Section Five

Affected Environment / Environmental Consequences

The existing environment and potential impacts of the Master Plan are complex. For each environmental topic, information on existing conditions and potential environmental consequences have been merged into one subsection to eliminate repetition of material, and for the convenience of the reader.

The proposed action is a Master Plan or long range guidance document, and no physical development will actually occur under the proposed action. No direct impacts or consequences will occur as a result of the proposed action. Environmental consequences are conditional, and dependent on the extent to which proposed projects are actually implemented or built. This EIS presents an overview of the cumulative environmental consequences that would occur if all the proposed facilities were to be built. Actual cumulative impacts may range anywhere between those for the No Action Alternative and the Master Plan Alternative.

5.1 SOCIOECONOMIC/LAND USE

5.1.1 Overview

The National Institutes of Health main campus is located in Montgomery County, Maryland, one of the largest jurisdictions in the Washington, D.C. region. As a result of expansion of the urbanized area, cross-commuting patterns, and other economic interrelationships, the federal Government recently designated a broader Consolidated Metropolitan Statistical Area for this region. This new CMSA encompasses both the Baltimore and Washington metropolitan areas, incorporating an area of nearly 9,600 square miles circumscribed by a 75 mile radius around downtown Washington, D.C. The limits of the CMSA extend from the Pennsylvania border to the edge of metropolitan Richmond, Virginia. On an east-west axis, the CMSA stretches from Queen Anne's County, Maryland, on the eastern shore of the Chesapeake Bay to Berkeley and Jefferson Counties, in the West Virginia panhandle (Population of Metropolitan Areas and Component Geography: 1980 and 1990 (6/30/93 definition), 1990 CPH-L-145, U.S. Bureau of the Census, 1993.

The region is growing at a very rapid rate, with communities and employment spreading over an ever-widening geographic area. This spread is reflected in the residential location patterns of NIH employees and the broad area affected by NIH's "local" procurement.

The population of the Washington-Baltimore CMSA in 2000 was 7.6 million, making it the fourth largest in the nation out of 280 designated CMSAs. It is also one of the most rapidly growing of the larger urbanized areas, with a population increase of 13 percent between 1990 and 2000. The MD-VA-DC Metropolitan Washington Area portion had 5.3 million people in 2000, an increase of 26 percent over 1990.

Montgomery County is the second largest jurisdiction within the Washington-Baltimore region. With 873,000 people in 2000, it is second only to Fairfax County, Virginia, which has a population of 970,000. Baltimore County ranked third, with 754,000. Montgomery County's population represents about 16 percent of the total MD-DC-VA Metropolitan Area population, and about 11 percent of total CMSA population.

Montgomery County has been one of the most rapidly growing of the larger jurisdictions in the region over the past decade. Population increased by nearly 116,000 between 1990 and 2000, or 15 percent. Only Fairfax County experienced a larger absolute growth with a 152,000 population increase during the same period.

Projections call for Montgomery County to continue to grow, albeit at a somewhat slower rate than over the past decade. Between 2000 and 2020, Montgomery County is expected to increase by about 145,000 people, bringing its total population to 1,018,000 (Preliminary Population Projections for Maryland's Jurisdictions, Maryland Department of Planning, 2001.

The County's land area is approximately 495 square miles, or about 320,000 acres. Between 1960 and 1991, the amount of developed land in the County more than tripled. As of 1960, about 49,000 acres, or 15 percent, of the County's land area had been developed; by 1991 a total of about 155,000 acres, or 48 percent, was urbanized. Residential land uses have grown most rapidly, with single family dwellings occupying the largest portion of the expanded urbanized area. In 1960, 23,000 acres, or 7.2 percent of the land area, was in single-family use, and by 1991, single family residential areas had increased to 86,800 acres, or about 27 percent of the County's land area. Multi-family residential land use has been clustered in a relatively few locations, utilizing far less land - 700 acres in 1960 and 6,700 acres in 1991, the latter scarcely over 2 percent of the County's land (General Plan Refinement Goals & Objectives: Then & Now, Supplemental Fact Sheets, Montgomery County Planning Department, January 1993). One of the largest concentrations of multi-family housing in the County is in Bethesda.

Including local and federal government, land use devoted to institutional uses also increased, from 10,600 acres in 1960, to 22,800 acres in 1991. The National Institutes of Health main campus with its 310 acres is counted in this institutional category of land uses.

Montgomery County had a total of nearly 296,000 housing units in 1990, having added over 8,000 dwellings a year in the two decades since 1970. The number of housing units nearly doubled during this period, exceeding the 56 percent growth rate experienced in the metropolitan region as a whole. During this period of rapid growth, the County's housing stock also changed significantly. Single family detached housing declined in share of the market from 68 percent to 52 percent, while townhouses increased from just 1 percent in 1970 to 17 percent (50,000 units) in 1990 (ibid). Multi-family units remained relatively constant with a 30 percent share of the mix. Montgomery County housing units increased to 334,000 in 2000.

Growth in housing supply has basically followed the patterns established in the County's General Plan, known as Wedges and Corridors. That plan sought to avoid suburban "sprawl" by channeling growth into the County's radial transportation corridors - particularly I-270 and U.S. 29 - and into the more densely developed down-County area nearest the District of Columbia, known as the urban ring, while preserving the wedges in between the corridors for rural land use and open space. Bethesda and NIH are in the urban ring. Residential zoning under the General Plan has been "pegged" to growth projections for the year 2000. Undeveloped residential land under densities projected in the Plan could accommodate 144,300 new dwellings. At County absorption rates of the past 20 years, this would be an 18-year supply. Less than 10 percent of the total future residential development areas are within walking distance of Metrorail stations in the County.

5.1.2 Land Use and Regional Planning

Montgomery County is divided into 37 planning areas. Master plans for each planning area provide a comprehensive set of recommendations and guidelines for growth and development while protecting existing land uses, community facilities and needs, and environmental and historic resources, and maintaining the transportation network. The area master plans are combined to form a general plan for the County, which in turn, is an element in regional planning for the Washington metropolitan area.

Sector plans are prepared for local communities and heavily developed areas within the planning areas.

Master area and sector plans are prepared by the Maryland-National Capital Park and Planning Commission (M-NCPPC) and pass through several stages of development before adoption: preliminary draft, final draft, and adopted plan.

The NIH Bethesda campus is located in the Mid-Bethesda sector of Bethesda-Chevy Chase, Montgomery County Planning Area 35, the southernmost in the County (Figure 5-1). The applicable planning document for the area is the Bethesda-Chevy Chase Master Plan, M-NCPPC, 1990, which was approved and adopted by M-NCPPC in April, 1990. The purpose of the plan is to establish a policy framework that will guide the direction of Bethesda-Chevy Chase for the next 20 years.

Bethesda was a suburban village until the 1950s, a focal point for shopping and community services on a limited scale. Now, it is the "downtown" or Central Business District (CBD) of the planning area with the greatest concentration of commercial and office development within the Bethesda Chevy Chase planning area. Planning for the Bethesda CBD is conducted in much greater detail, nearly on a parcel by parcel basis, in the Bethesda CBD Sector Plan. Planning for the two areas is coordinated and complementary. From 1990 to 1992, M-NCPPC undertook research and elaboration of preliminary proposals that were presented to the Montgomery County Planning Board in July 1993. A Citizen Advisory Committee, including representation from senior NIH staff, participated in formulating the Draft. After public review in hearings and work sessions, the Comprehensive Amendment to the Bethesda CBD Sector Plan was adopted by the County Council in 1994.

The area master and sector plans are tied to County planning through the Annual Growth Policy (AGP) for Montgomery County (FY 00 Annual Growth Policy, Montgomery County Planning Board, 1999), which is updated each year. This document provides guidelines that translate needs indicated in local plans into capital improvements, not only for a specific area, but also County-wide.

5.1.2.1 Bethesda-Chevy Chase Master Plan

The Bethesda-Chevy Chase (BCC) Master Plan establishes seven goals and objectives for the planning area:

- Perpetuate and enhance the high quality of life which exists in the BCC Planning Area.
- Achieve a level of future employment development that is in balance with a high quality of life and the transportation capacity of the Planning Area.
- Provide for a balanced housing supply so that persons of varying income levels, ages, backgrounds, and household characteristics may find suitable housing appropriate to their needs.
- Protect the high quality residential communities throughout the Planning Area as well as the services and environmental qualities that enhance the area.
- Achieve a significant shift of new travel from auto to transit and other mobility alternatives.
- Protect the natural resources and environmental qualities of the Planning Area.
- Contribute to a strong sense of community and help reinforce community cohesion.

The plan recommends reconfirmation of the existing residential character and zoning of the planning area. Three levels of future development were assessed assuming a set of moderate improvements to the road system. The plan endorses a moderate level of development in terms of employment and housing,

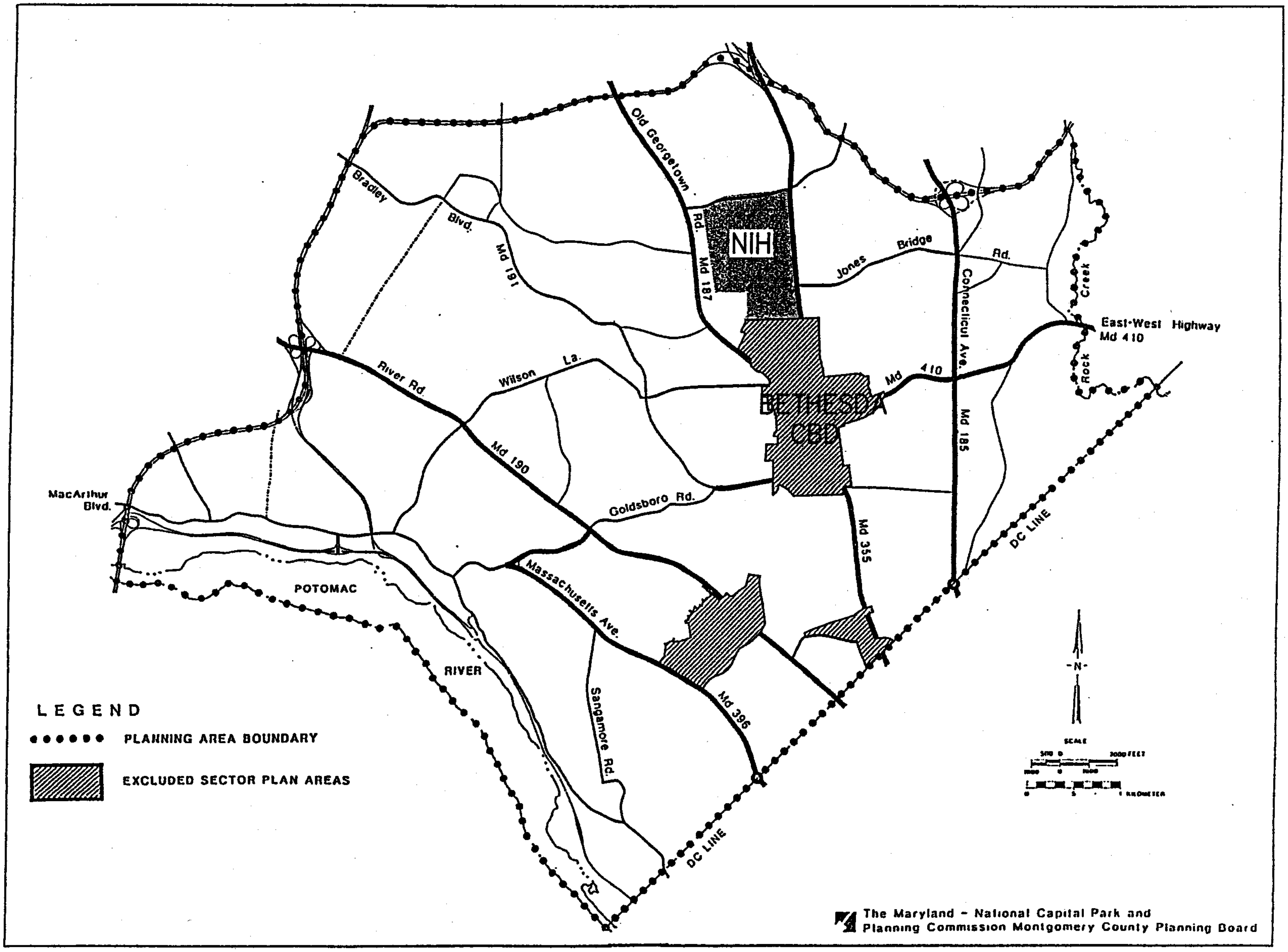


FIGURE 5-1 BETHESDA CHEVY CHASE PLANNING AREA.

provided that a balance is maintained with the overall transportation capacity of the area. This proposed level of development can be implemented through the following recommendations:

1. Maintain the relative level of households compared to jobs to reduce the pressures on commuting into the area.

2. Share new employment development between the Sector Plans and the federal employment centers.

3. Locate new employment and residential development in existing centers near Metro stations.

4. Continue to recognize the importance of biomedical and medically-oriented development in the area, but place less emphasis on large-scale office projects.

5. Support existing businesses, including those that meet community retail and service needs.

6. Support increased housing density and types in Sector Plan areas and where compatible with nearby properties.

Transportation improvements are assumed to be limited to moderate ones applied to the existing highway system, coupled with a strong effort to increase use of public transit and other alternatives.

5.1.2.2 The Bethesda CBD Sector Plan

The Bethesda Central Business District (CBD) adjoins the southern boundary of the NIH campus. It covers 405 acres, an area about one-third larger than the NIH campus. In 1990, the CBD contributed 5% of Montgomery County property tax revenues and 15% of the yield for commercial properties (BCC Chamber of Commerce, Statement Regarding Bethesda Central Business District Plan, Nov. 1991).

Unlike most suburban commercial core areas that are predominantly office complexes, the CBD contains a wide variety of retail space, restaurants, and many apartments and hotels (Figures 5-2 and 5-3). The core of development is concentrated around the Bethesda Metro subway station at Wisconsin Avenue and East-West Highway. This is surrounded by lower density commercial development that transitions gradually to surrounding residential areas. A feature of Bethesda is the presence of more than 170 restaurants. Many of these are located in the Woodmont Triangle, the area in the northern part of the Bethesda Central Business District CBD between Old Georgetown Road and Wisconsin Avenue. The area immediately to the south of NIH is occupied by mid and high rise apartment complexes that front on Battery Lane.

While the Sector Plan recommends a wide range of densities for the various components of the business district, it concentrates the highest densities in the Metro Core centered on the Metrorail Station and the intersection of Wisconsin Avenue with Old Georgetown Road and East-West Highway. It calls for gradually decreasing densities between the core and the CBD fringe and both establishment and maintenance of buffers between the CBD and residential and institutional uses abutting the CBD fringe.

In the immediate vicinity of the NIH campus, land use to the east of NIH and north of Jones Bridge Road is institutional with the National Naval Medical Command and the Uniformed Services University of the Health Sciences occupying a large block of land extending to Rock Creek. The Stone Ridge School of the Sacred Heart lies between the Naval Medical Center and Cedar Lane, although this property is zoned for single family residential. All remaining frontage surrounding NIH is zoned residential except for a commercial area between Woodmont Avenue and Wisconsin Avenue to the southeast of the campus.

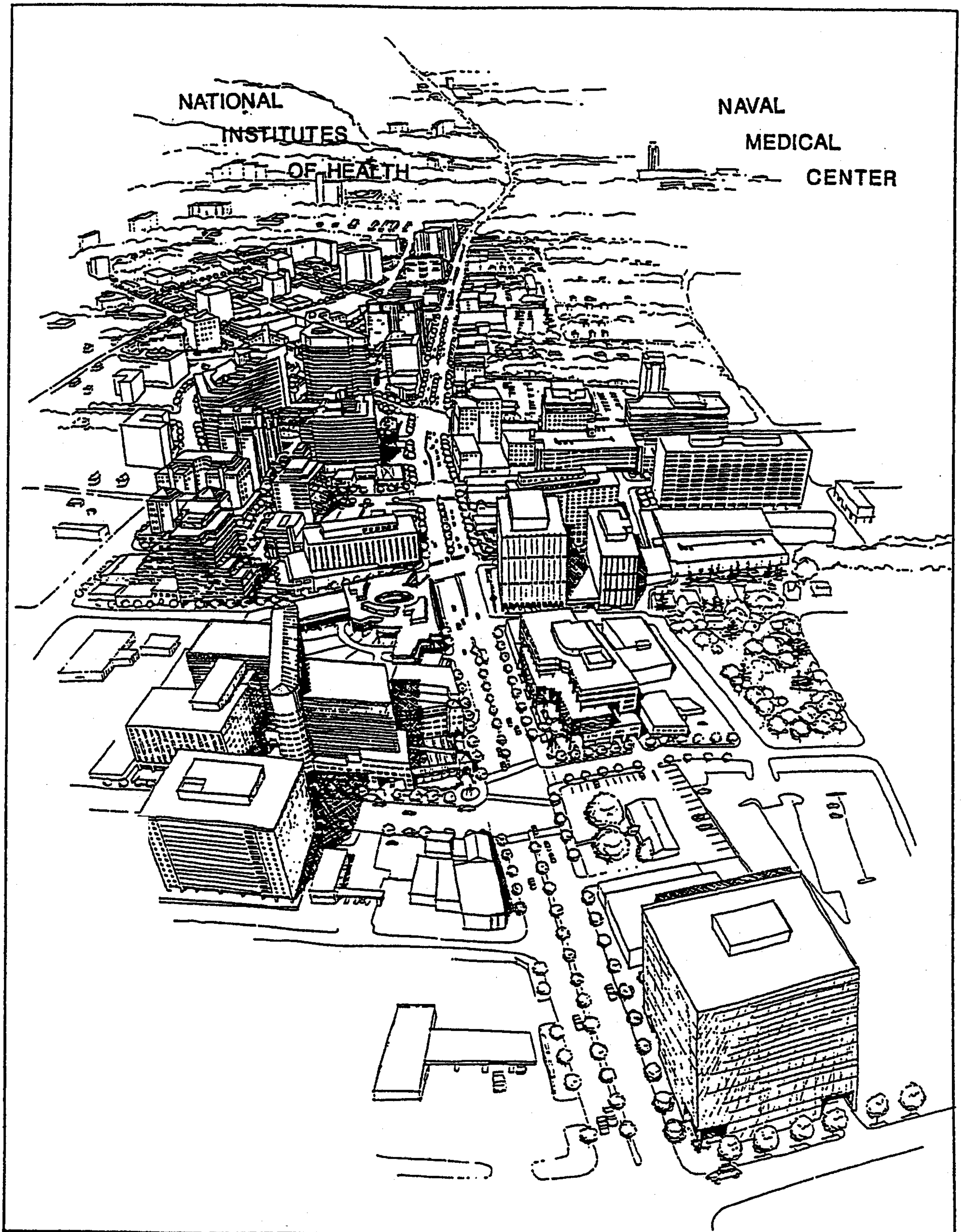


FIGURE 5-2 THE BETHESDA CENTRAL BUSINESS DISTRICT (CBD).

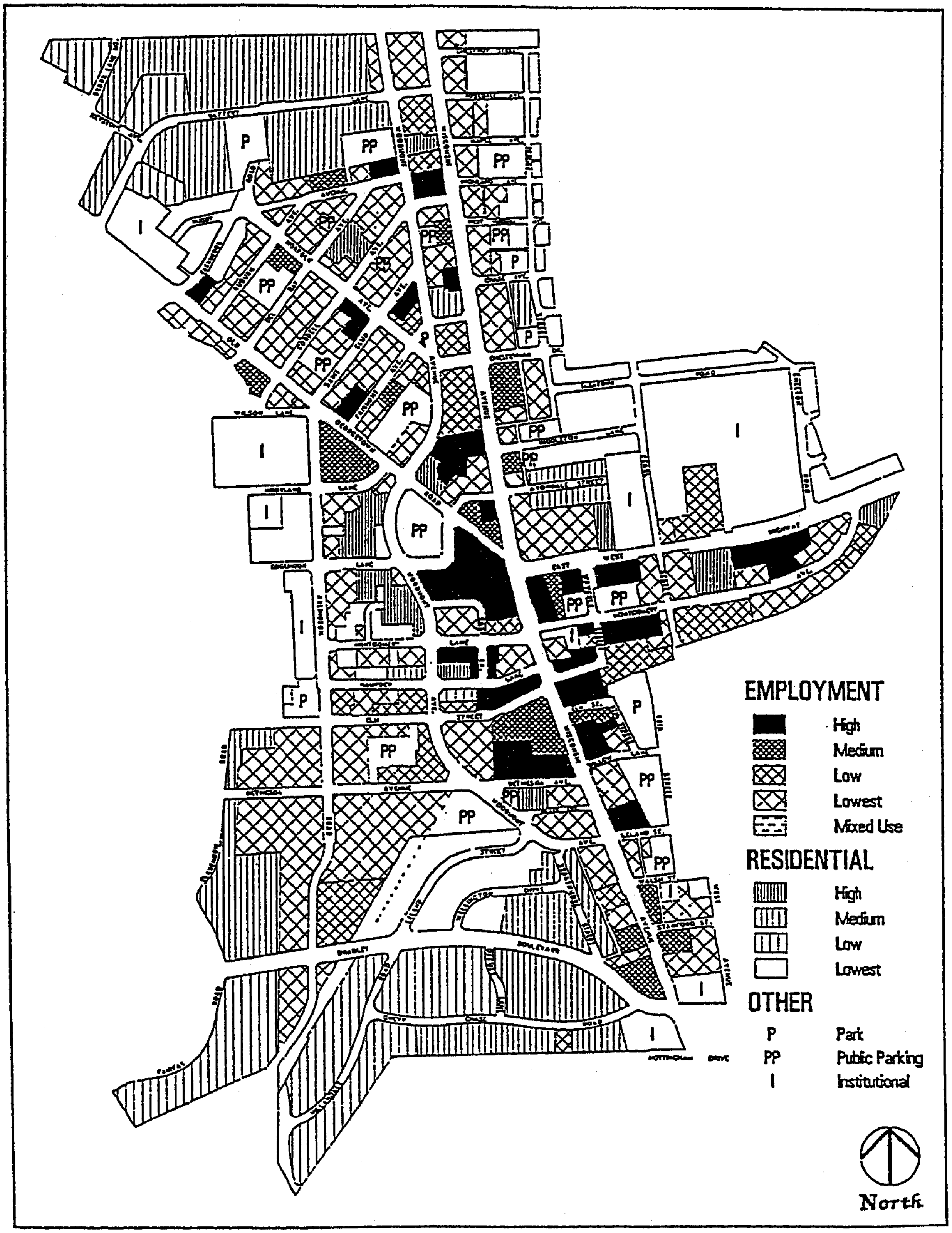


FIGURE 5-3 EXISTING LAND USE IN BETHESDA CBD

All residential areas are zoned R-60, single family residential, except for the area in the Bethesda CBD where the zoning is R-10 or RT-12.5 for multifamily high density residential use. Land use generally conforms to zoning. Special zoning exceptions have been granted to schools, churches, Suburban Hospital, professional offices, and community oriented associations along Rockville Pike, West Cedar Lane, and Old Georgetown Road.

In the future, the Bethesda-Chevy Chase Master Plan recommends that the existing zoning surrounding the NIH campus remain unchanged. It does not recommend redevelopment, but does recognize that large lots and special exception sites may be developed in the next 20 years. For Old Georgetown Road and adjacent communities, the objective is to maintain the residential character, preserve neighborhood stability, and discourage further special zoning or land use exceptions, except for those that serve the community (Figure 5-4). If development of large lots and special exception sites should occur in the future, the plan recommends that the new land use be residential. If this residential development should occur, then there is the potential for construction of 193 dwelling units around the periphery of the NIH campus (Table 5-1). Development of the Goodwill property would add another 25 dwelling units.

The Master Plan and No Action Alternatives are compatible with the land use recommendations of the Bethesda-Chevy Chase Master Plan. Neither requires or applies pressures to change existing and future recommended land use and zoning. The NIH campus provides a buffer between the Bethesda CBD and residential communities to the north and west of the campus. Its presence reduces pressures to extend the CBD along Old Georgetown Road and Rockville Pike, which would occur if the property were privately held. Both alternatives are compatible with the Bethesda-Chevy Chase Master Plan and Bethesda CBD Sector Plan, which propose continuing R-60, RT-12.5 and R-10 land uses around the periphery of the campus, offering opportunities for non-vehicle home-work trips between NIH and the surrounding community.

The NIH Master Plan Alternative would not create planning or land use changes in the immediate environs of the campus.

5.1.3 Employment/Economic

Montgomery County is a major employment center for the metropolitan region and the State of Maryland. In 1999, there were 580,000 jobs in the County, exclusive of military employment (At-Place Employment Services, Maryland Department of Economic and Employment Development, 2001), a significant increase from 368,000 in 1991. Close to 60 percent of the County's employed residents work in Montgomery County. No other jurisdiction in the region employs so large a share of its own residents. Nevertheless, commuters from surrounding jurisdictions fill 42% of all jobs in the County. The County has 15% of all the jobs in Maryland and a similar share in the Washington metropolitan area (ibid.). The total number of jobs and number of private sector jobs in the County are larger than that for any other jurisdiction in Maryland.

Federal government employment continues to be an important component of the County's economic base. In 1990, about one in ten employees in the County worked for the federal Government. By 1997, this had decreased to a little over one in six. Nineteen federal agencies are located in the County. Because of Montgomery County's significance in the regional and State economic picture, important components of the local economic base are also important to the region and State.

Bethesda-Chevy Chase is an established but growing employment center. In 1988, the number of jobs in Bethesda-Chevy Chase (77,200) including the Bethesda CBD, exceeded the number of households (34,050). Many of these jobs were concentrated in the Bethesda CBD. The number of jobs in the

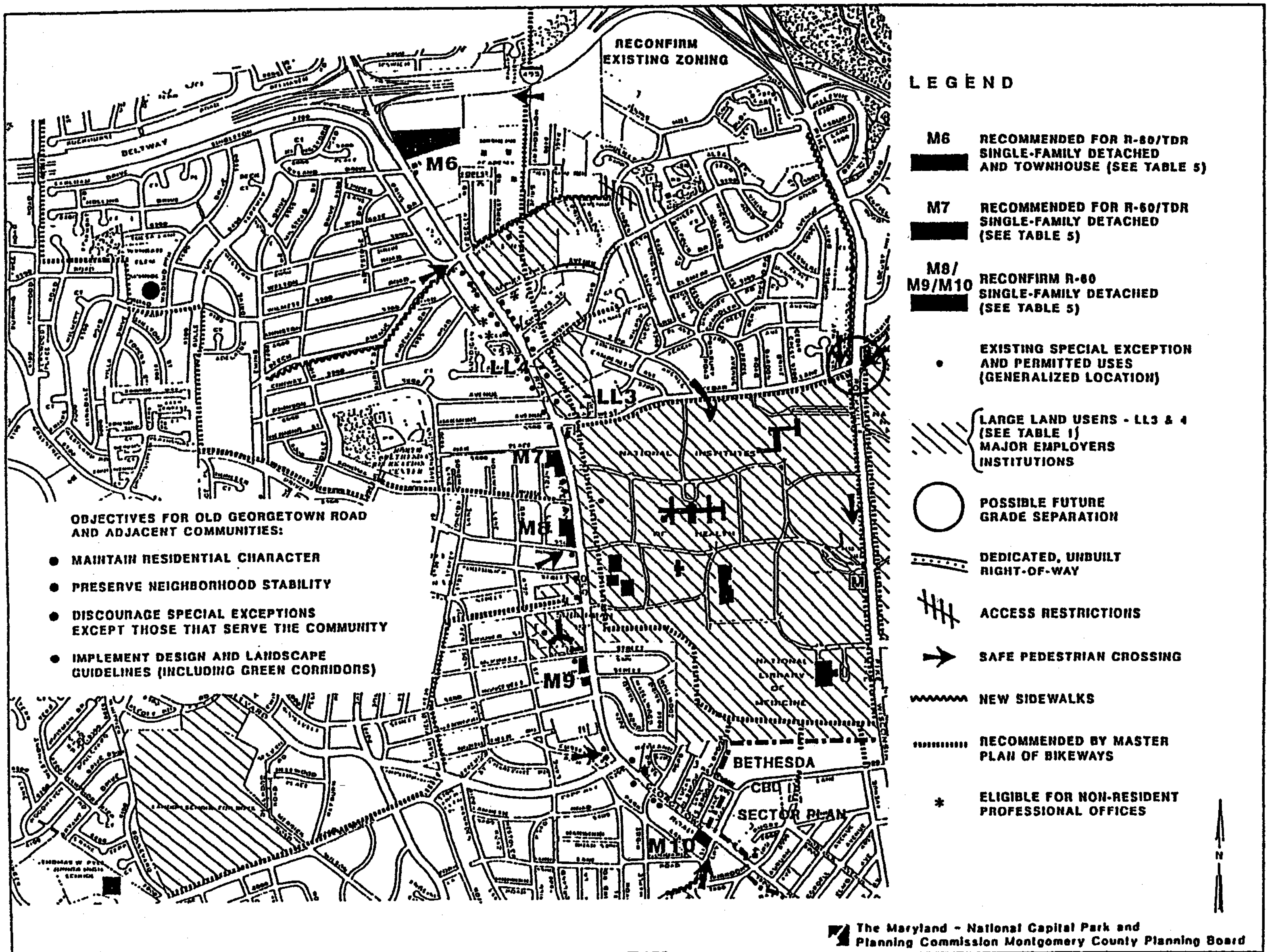


FIGURE 5-4 BCC MASTER PLAN RECOMMENDATIONS FOR OLD GEORGETOWN ROAD.

BCC Master Plan Site	Location	Size (acres)	Existing Use	Potential Use
—	Rockville Pike - Goodwill Property	---	Institutional	25 dwelling units
LL2a	Rockville Pike - Cedar Lane	34.6	Private School	111 dwelling units
LL3	Old Georgetown Road - Cedar Lane	3.9	FAES, Knights of Columbus	15 dwelling units
M1, a,b	Cedar Lane - Cypress Avenue	1.3	Vacant	5 dwelling units
M2	Cedar Lane - Cypress Avenue	2.1	Vacant	8 dwelling units
M3	Alta Vista Road - Locust Avenue	4.0	Farmhouse	16 dwelling units
M4, a,b	Alta Vista Road - Linden Avenue	5.8	Two houses	23 dwelling units
M7	Old Georgetown Road - Oak Place	1.7	3 houses and vacant lots	7 dwelling units
M8	Old Georgetown Road - Greentree Road	1.4	1 house, vacant lots	5 dwelling units
M9	Old Georgetown Road - McKinley Street	0.9	1 house, 3 vacant lots	3 dwelling units
			TOTAL	218 potential units

*Note: Currently in the development approval process for 40 to 50 townhouses.
Source: Bethesda-Chevy Chase Master Plan, M-NCPPC, 1990

TABLE 5-1 POTENTIAL DEVELOPMENT SITES NEAR NIH CAMPUS.

Bethesda-Chevy Chase planning area in 2000 was 97,688. In 2000, NIH and the Naval Medical Center constitute the second largest employment center in Bethesda-Chevy Chase with a combined 24,350 employees.

The "moderate growth" scenario in the Master Plan for the Bethesda-Chevy Chase planning area envisioned 18,800 additional jobs by the year 2010. This includes 8,800 jobs in private developments already approved when the plan was adopted, leaving a potential for 10,000 additional jobs in the planning area. The plan states that such expansion should remain within the constraints of BCC transportation capacity.

Future job growth in the planning area is expected to be primarily shared among the three Sector Plan areas (Bethesda CBD, Friendship Heights, and Westbard) and the federal employment centers (NIH and National Naval Medical Center), with a small amount of additional job growth elsewhere. The 10,000 job level endorsed by the Plan contemplates only "moderate expansion" of federal facilities in the area. Much of the commercial development projected in the planning documents for the Bethesda-Chevy Chase planning area and its Sector areas has already occurred, but growth is expected to continue. The County FY 2003 Annual Growth Policy (AGP) tracks job growth attributable to projects currently in the development process pipeline. A total of 10,529 jobs of this type were given for Bethesda-Chevy Chase the Bethesda CBD, and Friendship Heights. An additional 12,300 such jobs were anticipated for pipeline developments in North Bethesda and White Flint.

Apart from stating that the largest concentration of employment in the Planning Area should continue to be the Bethesda Central Business District, the BCC Plan does not specify how new jobs are to be distributed among the three planning area employment centers. Instead, it anticipates that levels of job growth will be established through amendments to the Annual Growth Policy and to the three respective Sector Plans, based on considerations of community impacts and regional and local transportation capacity.

To support the overall level of employment growth anticipated, the plan calls for the County to take three key actions:

- Provide both significant expansion of transit and mobility services to BCC employment centers and moderate improvements to the highway system, especially in the more congested eastern part of the Planning Area.

- Stage the approval of new development to the availability of transportation capacity through the Annual Growth Policy.

- Locate new employment within existing employment centers and in areas with good transit service.

The Plan endorses two specific employment development objectives to maintain the BCC area contribution to the positive economic image of Montgomery County:

- Support the continuation of existing businesses within the Planning Area, including those that meet community retail and service needs.

- Recognize the importance of employment in the biomedical, medically related, and high technology areas.

In this way, the Plan acknowledges the key contribution made by NIH and the Naval Medical Command to the Bethesda economic structure, as well as to the County's economy. It supports "some additional development to allow operational flexibility." The following provisions of the Plan are particularly relevant:

- The Central Business District should share any future traffic capacity for new development with the National Institutes of Health (NIH) and Naval Medical Command.

- NIH and NMC should share future BCC development with the Bethesda Business District. The largest additional development is likely to occur at the National Institutes of Health.

- Development levels must remain within the transportation system capacity constraints of the Bethesda-Chevy Chase area. More capacity could be achieved through a program of traffic reduction measures.

In the Bethesda CBD, the new Sector Plan recommends an overall development capacity envelope that would permit facilities for nearly 19,000 new jobs above the 1991 figure of 37,000, and up to 3,000 new housing units, largely apartments by 2010. Some of the parcels designated for employment are of substantial size and could accommodate office buildings of 100,000 sq. ft. or more. The Sector Plan is based on capacity and does not project employment or residential growth, which are totally contingent on market demand.

Federal Government employment in Montgomery County was 77,740 in 1997, amounting to 16.8 percent of all jobs in the County. NIH, with its work force of over 24,600 in the County, comprised somewhat over 31 percent of the federal total. Other health related agencies of the U.S. Public Health Service (the Food and Drug Administration, Health Resources & Services Administration, and Substance Abuse and Mental Health Services Administration) employed another 5,500 workers in the County. Seven different groups under the Department of Defense (including the Uniformed Services University of the Health Sciences and the National Naval Medical Center) employed 8,500; the Department of Commerce, 5,500; the Nuclear Regulatory Commission and the Department of Energy, together, somewhat fewer than 4,000. In 2001, NIH stood out as the largest single employer, public or private, in this community, where there are few large private employers.

NIH provides direct economic benefits to Maryland and Montgomery County. Historically, about 80 percent of the NIH budget devoted to biomedical research is spent extramurally through grants to institutions, companies, and scientists outside NIH. In Fiscal Year 2000, NIH spent 14.79 billion dollars on extramural research and training. Maryland continually ranks fifth among the States in receiving extramural program funding.

In Fiscal Year 2000, the various Institutes and Centers that comprise NIH awarded $868.64 million to Maryland institutions and firms. Within this total $595.29 million was expended on research grants, $235.88 million on research and development contracts and $30.4 million on researcher education and training. About $19.4 million of the research grant funds were awarded through the NIH Small Business and Small Business Technology Transfer programs. The $235.88 million Maryland received through R&D contracts was 21 percent of the NIH total $1.123 billion awarded through the process. Most of the extramural expenditures went to three jurisdictions within the State; the City of Baltimore ($561 million), and Rockville ($130 million) and Bethesda ($74 million) in Montgomery County.

Moreover, the presence of NIH in Montgomery County, along with the National Naval Medical Center, help to create a critical mass of health-related interests and support groups that, together, attract additional organizations and enterprises. According to the Montgomery County Office of Economic Development, over 50 associations in the health, bioscience and related technical fields have located in Montgomery

County, as have other institutions, such as the Howard Hughes Medical Institute and the American College of Cardiology.

A survey completed in 1993 indicated 62 of 135 biotechnology/medical companies in Maryland were located in Montgomery County (BIOMED: A Directory of Maryland Biotechnologies/Medical Companies and Organizations, 1992-93, Md. Dept. of Economic & Employment Development). This does not include facilities associated with the University of Maryland and Johns Hopkins University. Another roster, published by Montgomery County's Office of Economic Development in early 1992, identified yet 64 more biological and medical science-related industries in the community that were not included in the State's directory.

In 2000, Maryland's concentration of biotech companies ranks as the third largest in the nation, surpassed by only California and Massachusetts. The volume of product sales was estimated at more than $4 billion. The number of biotechnology workers in these private companies is estimated at 5,000. Clearly, they produce for national and international markets, but NIH plays a role in attracting, training and stimulating the human resources so essential to the intellectual vitality of this health sector.

NIH staff and visitors are also an important component of the market for businesses in the Bethesda CBD. The several hotels host NIH-oriented conferences, visitors, Clinical Center patients and patients' families. Managers report a significant proportion of their room and conference business is NIH-related. Restaurants in the area rely on NIH-related business as a major source of patronage.

Discussion with NIH staff responsible for coordinating meetings and conferences indicates a sizeable number of such events involving large numbers of attendees. Many of these conference attendees are non-NIH employees from out-of-town who stay overnight in hotels, primarily those in the Bethesda area. In addition, both out-of-towners and local residents patronize area restaurants and convenience retailers in free time during these events, particularly when the conferences are held off-campus in area hotels.

Two of the Institutes furnished 1992 information on numbers of meetings and conferences, attendees, and estimates of numbers of hotel room nights used. The National Heart, Lung, and Blood Institute (NHLBI) held 36 meetings and conferences, typically lasting for one to three days during the year. A total of 1,000 people attended these meetings, an estimated half of them from out-of-town. NHLBI figures indicate approximately 1,000 hotel room nights were utilized as a result of these meetings.

The National Cancer Institute held 107 meetings and conferences, lasting from one to eight days, with most in the two-to-three-day range. Over 4,000 people attended these conferences, with an estimated 2,600 from out-of-town. NIH figures indicate approximately 3,800 hotel room nights were bought as the result of these meetings.

Under the 2003 Master Plan Update, the ability of NIH to administrate grants and awards will be more efficient. Since the sums are large, any small gain in capacity and efficiency would lead to indirect benefits to the State and County, which can be assumed to continue to receive their proportionate shares. The Master Plan Alternative would directly generate about a net 4,000 on-campus jobs over the next 20 years. While specialized researchers and clinical doctors are recruited nationally, most of these job opportunities will be filled from the regional work force.

The economic vitality of the Bethesda CBD and Bethesda-Chevy Chase planning area is essential. NIH influences the potential for economic growth in these areas through its traffic generation. NIH proposes mitigation measures in the Master Plan Alternative to control the levels of congestion at northern gateway intersections to the Bethesda CBD. NIH has set a goal of maintaining site generated AM and PM peak hour trips at May 1992 levels, adjusted for projects pre-approved at that time. These measures would maintain available capacity at intersections around the campus for economic and housing development proposed in the Bethesda CBD Sector Plan and BCC Master Plan. Congestion will increase at intersections around the campus, but it will be due to general traffic growth associated with outside development.

In general, any increase in campus employee population as proposed in the Master Plan 2003 Update would generate a larger potential market for Bethesda CBD businesses. The Master Plan Alternative would locate more employees within eight minutes walking distance of the Medical Center Metrorail station, making them less hesitant to patronize Bethesda restaurants and businesses during midday.

In November 1991, the Montgomery County Executive issued a Strategic Plan for Economic Development in the 1990's. The plan calls for efforts by the County to retain and attract federal research and regulatory agencies, and to focus County private sector promotional efforts on expansion of knowledge-based industries and institutions. County officials regard biomedical research as a desirable clean or non-polluting "basic industry". They recognize the importance of NIH, both for its direct payroll and expenditures for supplies and services, and its expected ability to attract and foster biotechnology and related companies that will locate in the County. Considerable County resources, for example, have been devoted to establishing a life sciences center at Shady Grove near Gaithersburg. The Gaithersburg/Rockville area in which the center is located had 87 biotechnology companies listed in the County directory in 1993. The Master Plan Alternative would support this policy thrust.

The flow of research dollars, not to mention the intellectual capital generated by NIH activity, will lead to increases in employment and investment in these companies, new construction, and growth in the County's revenue base. NIH expenditures for vendors in the County to support the NIH's own operations can be expected to increase as well. NIH also would act as a stabilizing factor in the County economy.

5.1.4 Community Facilities

Community facilities in the vicinity of NIH are shown in Figure 5-5 and listed in Table 5-2.

The Stone Ridge School of the Sacred Heart is a private Catholic school for girls located to the southeast of the Rockville Pike/Cedar Lane intersection. School buildings are set back about 500 feet from Rockville Pike and 300 feet from Cedar Lane on a knoll which rises 40 to 50 feet above each street. The Convent of the Sacred Heart is located on the west side of the school. School grounds are bounded on the south by the National Naval Medical Center, and on the east by the Elmherst Parkway Neighborhood Conservation Area. Access is via Cedar Lane or northbound Rockville Pike.

Primary access to Stone Ridge is via two entrances on Cedar Lane, one to a parking lot adjacent to Cedar Lane, the other to parking and areas behind the school buildings. Egress in and out of the school entrances to and from the westbound lanes of Cedar Lane is difficult during the morning rush hour. Traffic on Cedar Lane waiting for the Rockville Pike signal queues beyond the entrances, and outbound vehicles from the school may have to wait several light cycles before they can enter the westbound traffic flow.

On the west side of Rockville Pike, the same phenomenon occurs at the Boy Scouts of America office building on the northwest corner of the intersection and adjacent residences on the north side of West Cedar Lane to the west. Outbound movements from the entrances to the eastbound lanes of West Cedar Lane during the evening rush hour must be made by a quick move into waiting queues of vehicles.

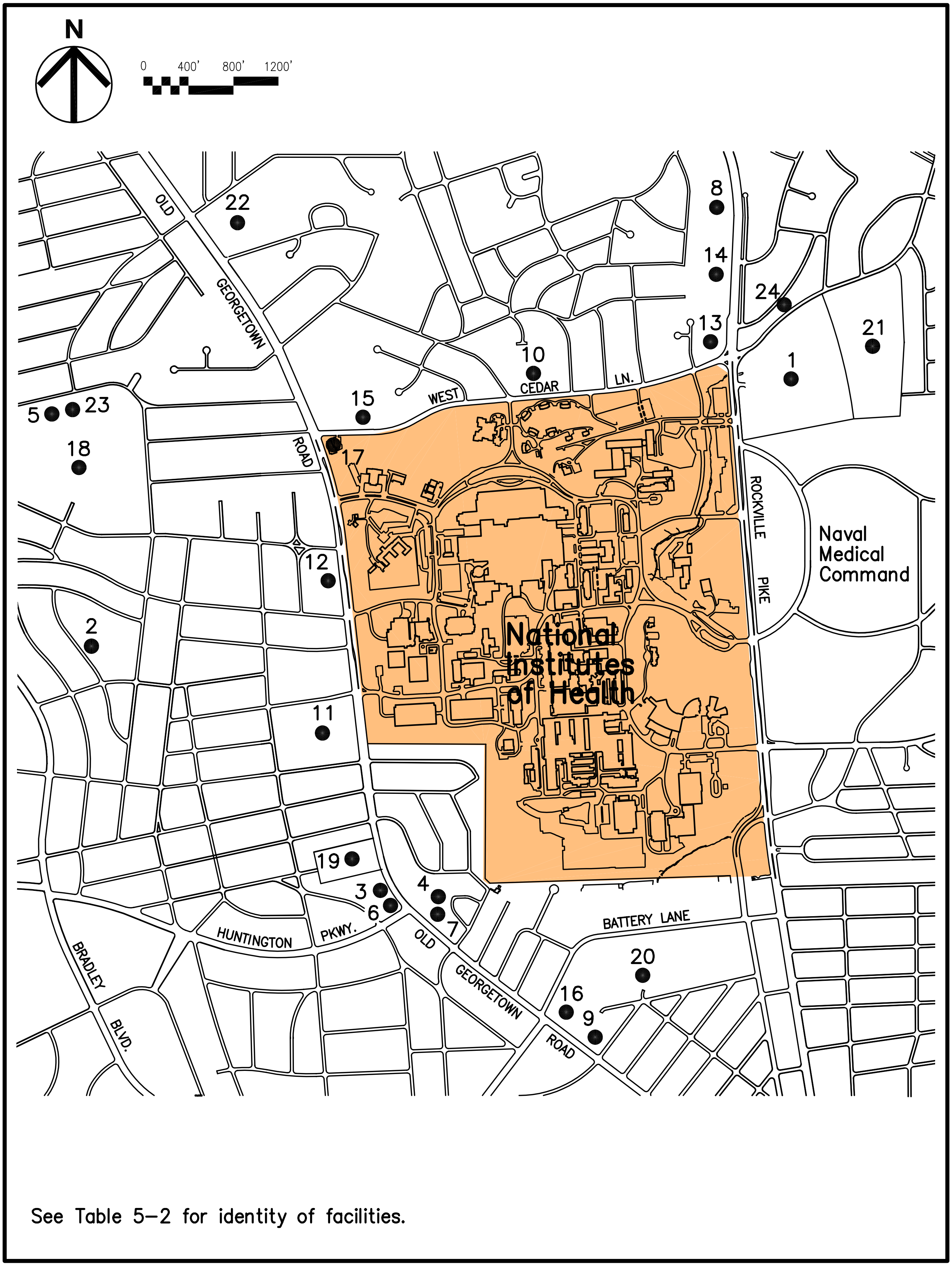


FIGURE 5-5 COMMUNITY FACILITIES.

School/Child Care Centers

1	Stone Ridge School and Convent of the Sacred Heart
2	Bradley Hills Elementary School
3	Wesley Nursery School
4	Congregation Beth El Day Care
5	Ayrlawn Day Care Center

Religious

6	Bethesda United Methodist Church
7	Beth El Temple
8	Temple Hill Baptist Church
9	Christ Lutheran Church

Health Care

10	Carriage Hill Nursing Center
11	Suburban Hospital

Community Organizations

12	Women's Club of Bethesda
13	Boy Scouts of America
14	Goodwill Industries
15	Knights of Columbus - Rock Creek Council

Emergency Response

16	BCC Rescue Squad
17	Bethesda Fire Company No. 20

Parks and Recreation

18	Arylawn Park
19	Greenwich Park
20	Battery Lane Park
21	Elmherst Parkway Neighborhood Conservation Area
22	Bethesda-Chevy Chase YMCA
23	Bethesda-Chevy Chase YMCA (Ayrlawn)
24	Rock Creek Park

TABLE 5-2 COMMUNITY FACILITIES.

Traffic movements in and out of the entrances to the Knights of Columbus and Foundation for Advanced Education in the Sciences (FAES) on West Cedar Lane just to the east of Old Georgetown Road are also difficult during the morning rush hour. However, most of the activities at these two facilities do not coincide with weekday morning peak period traffic conditions. Access to these facilities will continue to be difficult under traffic conditions generated by the Master Plan and No Action Alternatives.

The Bradley Hills Elementary School on Hartsdale Avenue is a Montgomery County public school serving the neighborhoods to the west of the NIH campus. Recreation facilities for local neighborhood use that are on the grounds of the school include tennis courts, play areas, and a ball field.

Child care centers in the area are incorporated within other community organizations. The Bethesda-Chevy Chase YMCA operates a child care facility on Oakmont Avenue in Ayrlawn. The Bethesda United Methodist Church and Beth El Temple are located at the intersection of Old Georgetown Road and Huntington Parkway to the southwest of the campus. Each has child care facilities, the Wesley Nursery School, and Beth El Day Care, respectively.

Child care center demand in the area is at a premium. For convenience, most parents seek child care facilities near their residence or work location. In the Master Plan Alternative, NIH proposes construction of two new centers, for NIH employee children. One would be in the Northwest Child Care Center, the other in renovated Building 34 (see Figure 4-2). Current child care center capacity on the campus is 183 children. The proposed Master Plan Alternative would increase the child care capacity to approximately 375 children.

The privately operated Phoenix Retirement Community occupies a high rise apartment building on Battery Lane on property abutting NIH's southern boundary. Suburban Hospital is a 310 bed regional general hospital with full emergency, diagnostic, and treatment facilities. The Carriage Hill Nursing Center is a 72 bed facility providing geriatric care for the elderly. None of these facilities are affiliated with NIH.

The R.A. Bloch International Cancer Information Center is located on the southwest corner of the Old Georgetown Road/West Cedar Lane intersection. The Center is part of the National Cancer Institute, and has the mission of preparing, publishing, and disseminating information on cancer detection and treatment. The building was built privately and purchased by NIH in 1982. Approximately 30 employees work in the building. The effects and impacts generated by the Center are included within the overall environmental analysis for the Bethesda campus.

NIH has attracted other private biomedically related organizations that have constructed facilities nearby. The Federation of American Societies for Experimental Biology occupies a large building on the west side of Rockville Pike about 0.4 mile to the north of the campus. The American College of Cardiology is located on the east side of Old Georgetown Road about one block north of NIH, and the American Association of Blood Banks is found two blocks south of the campus on Rugby Avenue in the Woodmont Triangle.

The Foundation for Advanced Education in the Sciences (FAES) maintains facilities on the northeast corner of the Old Georgetown Road/West Cedar Lane intersection. This is an independent private institution dedicated to education in the sciences, but many members are NIH staff. Each year, 3,000 students matriculate in the FAES School, which offers almost 200 courses. Most are in biomedical disciplines, but there is strong representation in the physical and behavioral sciences, English, and foreign languages.

Courses are at the undergraduate and graduate level and held in the evening. A majority of the faculty is composed of NIH personnel that share their special knowledge with a larger audience Although courses are primarily oriented toward NIH scientific staff at all levels, the school is open to the public at large. Postgraduate medical courses are offered for Medical Board examinations and continuing physician education. The school also has a "Frontiers in Biology" program that provides high school biology teachers with information and assistance in classroom and laboratory teaching. Cooperative advanced degree programs with Johns Hopkins University and the University of Maryland are offered.

The National Naval Medical Center (NNMC) is located to the east of NIH in 75 buildings on a 232 acre site. About 8,000 military and civilians work in medical research, patient care, and advanced medical education at NNMC. Of 14 tenant activities at NNMC, the Bethesda Naval Hospital is the largest. The primary mission of the hospital is medical care and treatment of active duty military personnel, dependents, and retired military on a space available basis. High level government officials such as the U.S. President and Vice President, their families, members of Congress, Supreme Court Justices, as well as foreign embassy personnel, are beneficiaries of medical service at the Naval Hospital. The Naval Hospital is a ten building complex with the most notable building being the original hospital tower that serves as a local landmark. The center hospital has over 427 beds and is expandable to 779 beds, if a local or regional catastrophe occurs. It has 50 clinics that treat more than 2,500 outpatients daily. More than 3,300 are employed at the hospital.

The Uniformed Service University of the Health Sciences (USUHS) provides a complete medical education to students, who obligate themselves to a fixed term of military service as medical doctors in return, and ongoing training of military service medical personnel. In addition to doctorates in medicine, the USUHS offers graduate level degrees in biochemistry, microbiology, pharmacology, and other biomedical sciences. The University is open to personnel from all the military services. A full range of university facilities is contained within the 500,000 square foot facility. It has 1,200 employees and students.

Other NNMC tenant activities include the Naval Medical Research Institute, which performs research on diseases and occupational health concerns of sailors and Marines; the Naval Dental Center, the Naval School of Health Sciences, the Armed Forces Radiobiology Research Institute, Naval Dosimetry Center, Naval Health Sciences Training Command, and the Naval Medical Research and Development Command.

The nearest Montgomery County Police station is located in the Bethesda CBD. NIH has its own campus police force, but its enforcement jurisdiction is limited to the NIH property.

Other County emergency response facilities in the vicinity of NIH are the Bethesda Fire Company No. 20 located at the northwest corner of the campus, and the BCC Rescue Squad at the intersection of Old Georgetown Road and Battery Lane. The NNMC also has a fire station. NIH maintains its own fire department and hazardous incident response unit, which have a fire truck, emergency response truck, and ambulance. They are the primary and first responders to incidents on the campus, and cooperate as second responders to the County and NNMC. Each year, the NIH Fire Department and Emergency Response Unit responds to about 200 calls from the County and NNMC.

The neighborhoods surrounding NIH are mature and stable. There is little room for additional housing. NIH employees who purchase or rent housing in the immediate vicinity will replace residents in existing housing, and not place new demands on community facilities. New housing proposed for the Bethesda CBD and Bethesda-Chevy Chase and North Bethesda planning areas will be built over the next 20 years regardless of NIH growth, because there is sufficient demand created by proposed job development in the above planning areas to sustain housing demand without NIH growth. NIH employees who move into new housing will be indistinguishable from the general resident population as far as community facility impacts are concerned. No impacts are expected on community facilities as a result of growth in campus population.

5.1.5 Housing/Population

Eight residential neighborhoods are located around the periphery of NIH (Figure 5-6). These include Maplewood, Ayrlawn, Sonoma, Huntington Terrace, Edgewood/Glenwood, East Bethesda, and Locust Hill as defined by citizen association boundaries. These neighborhoods are predominantly composed of single family detached homes on relatively compact lots of a quarter acre or less. The

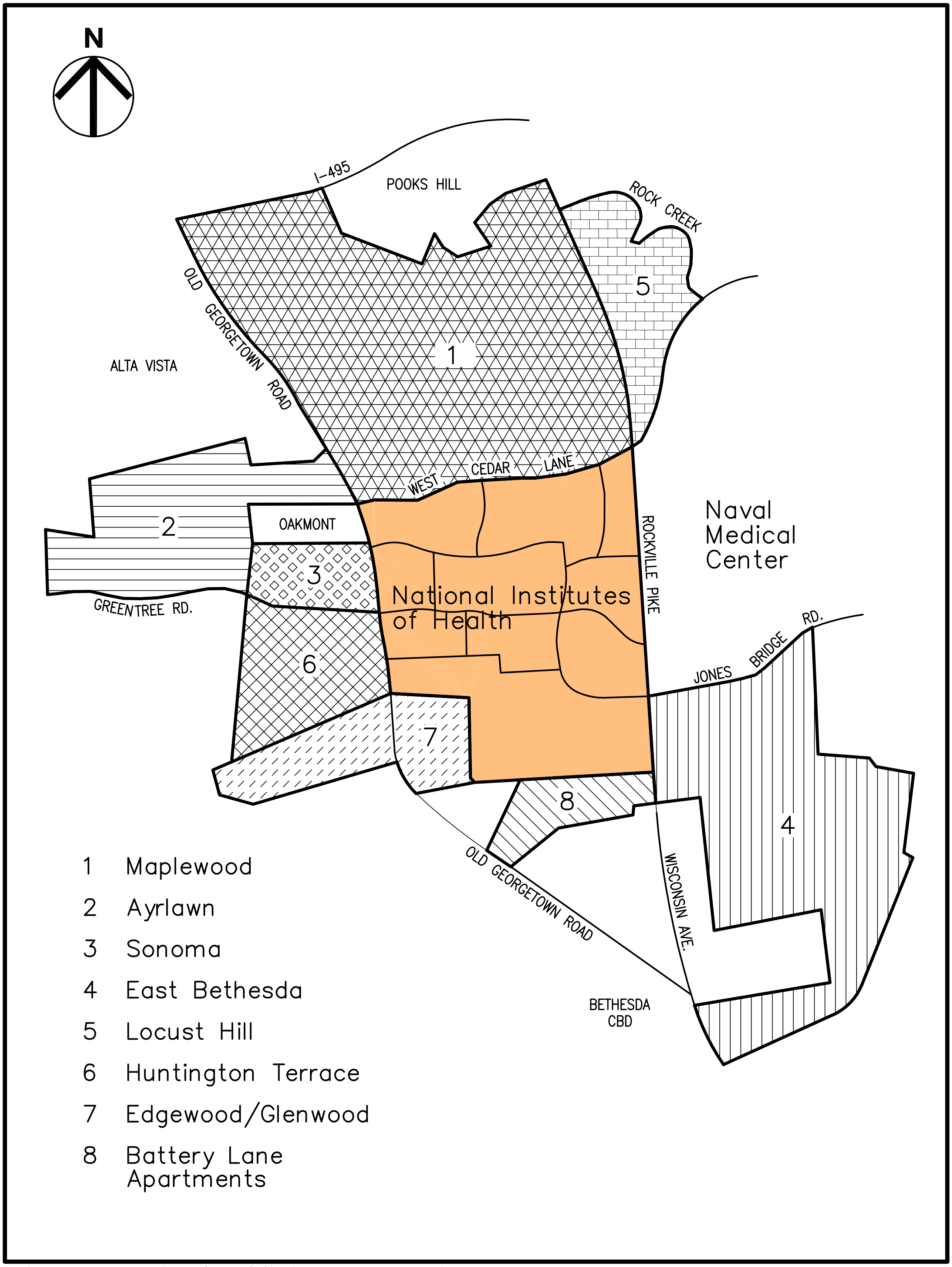


FIGURE 5-6 NEIGHBORHOODS IN THE NIH VICINTY.

eighth neighborhood, Battery Lane, is composed of high and midrise apartments and condominiums in the Bethesda CBD on the south side of the campus. Census tracts in which the neighborhoods lie are shown in Figure 5-7. Although the tracts cover larger areas, data is still indicative of neighborhood conditions.

Residential neighborhoods in the vicinity of NIH have been established for nearly half a century. The oldest homes not associated with the original farmsteads date from about 1900 when summer cottages were built in the area by District of Columbia residents (Table 5-3). A smattering of residences in Huntington Terrace and Alta Vista date from this period. The small neighborhood of Oakmont was once the site of a short-lived amusement park that was popular at the turn of the 20th century. These early homes were supplemented over the years by a varied assortment of homes. Among the single family neighborhoods, East Bethesda, with its convenient access to the Bethesda commercial area, was the earliest of the communities to develop fully. Most development occurred between the mid-1930s and mid-1950s. Development of NIH and the Naval Medical Center shortly before and after World War II triggered rapid growth in the neighborhoods to the north and west of NIH. The older homes were constructed around the NIH campus and on tracts adjacent to the major roadways where development was essentially complete by the 1960s. Later development within the tracts fanned out to the north and west.

The large number of units constructed in the 1970's in tract 44.02 is attributable to the Pooks Hill Apartments and other apartment and condominium construction on the north side of the tract. There are isolated pockets of new construction on undeveloped or recycled parcels such as a former school site, Trafton Place, in Ayrlawn.

The area of Bethesda surrounding NIH was not subject to large tract construction with only a few home models as seen in much of suburbia. It is filled with an eclectic assortment of housing styles and sizes set on narrow, tree lined streets. These varied houses, with their convenient location to employment areas, shopping, amenities, and excellent schools, command sales prices in the upper price ranges for their respective size and categories (Table 5-4). Although the average single family home value ranges from $250,000 to $500,000 in respective neighborhoods, the homes tend to sell quickly when they come on the market. New homes built singly or as a few units sell for more than $600,000.

About two thirds of the detached residences are family occupied with the remainder occupied by one or more individuals without children. About two-thirds of the detached units are owner occupied. Demand created by NIH employees in large part support available rental properties. Vacancy rates were reported at less than 4% in the 2000 census. Future growth in housing is expected to be low, less than 2 to 3% of the existing stock.

Tract 48.01 to the south of NIH differs significantly from the other neighborhood areas. Here, rental apartments predominate. Mid and high rise apartment complexes line both sides of Battery Lane for its entire length between Woodmont Avenue and Old Georgetown Road. Older mid-rise units built after World War II are found in the eastern sector. They include the Glen Lane, The Glendorra, The Glenmont, The Glenbrook, Glenwood, and the Glen Aldon that are operated under one central management company. Other complexes include Camelot Mews, Cambridge Square, the Battery Lane apartments, and the newer high rise Madison Park, Whitehall Condominium and Middlebrook complexes. Over 875 units are located in the 12 complexes along Battery Lane, providing a major source of affordable housing in Bethesda. In contrast to the single family neighborhoods, nine out of 10 properties in Tract 48.01 are rented, and nearly three-fourths of the units are non-family occupied.

Population characteristics reflect the neighborhood development patterns (Table 5-5). Many residents moved to the area when it developed 40 to 50 years ago, and are now in their seventies. There was also a large influx of families into the area 25 to 30 years ago when the area became more urban oriented. Their

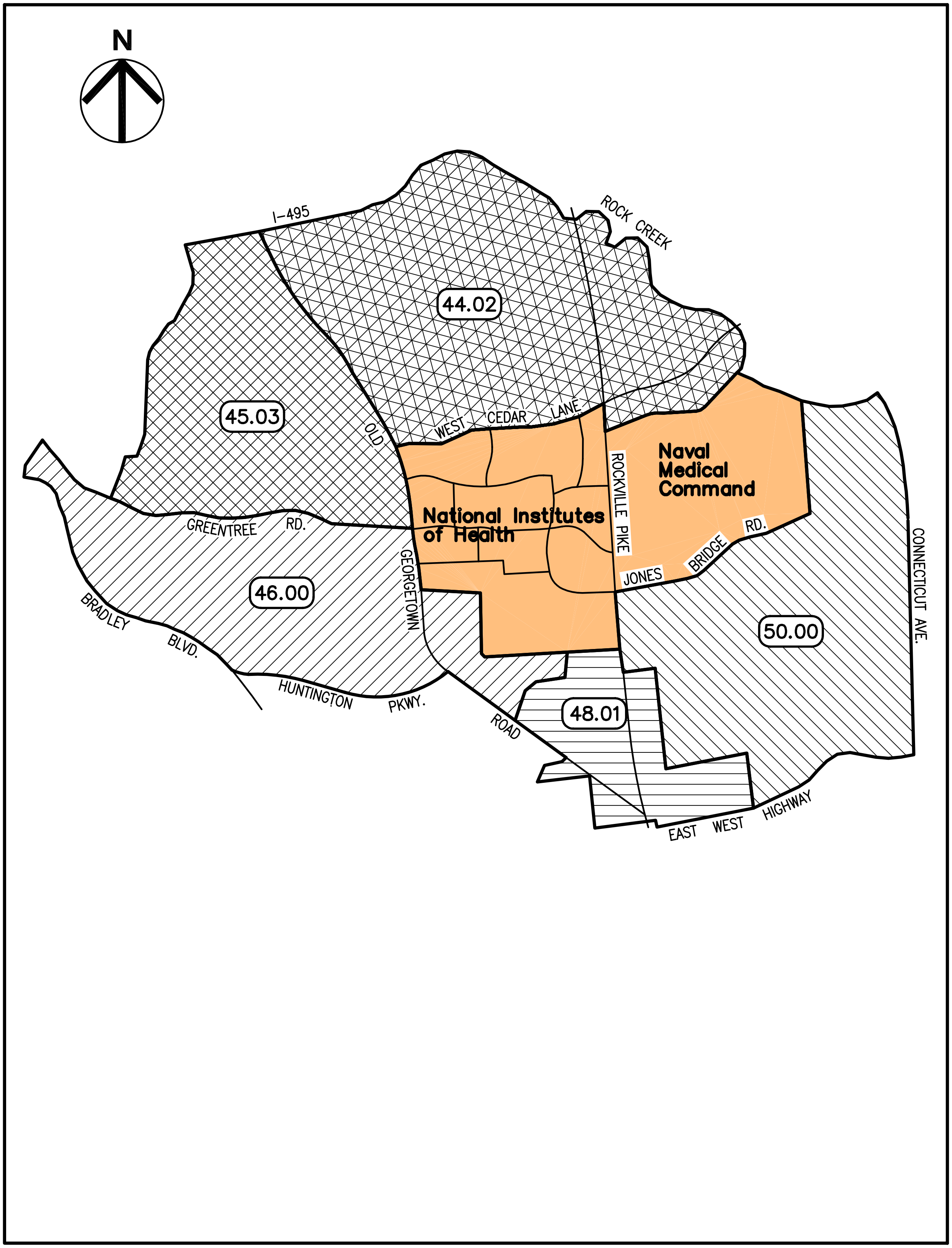


FIGURE 5-7 U.S. CENSUS TRACTS.

Housing Units Years Built	Montgomery County	Census Tracts					Total Vicinity
		44.02	45.03	46.00	48.01	50.00	
1999-March 2000	6,863	7	8	0	13	30	58
1990-1998	42,064	522	35	26	628	292	1,503
1980-1989	77,758	419	18	89	171	87	784
1970-1979	62,152	925	27	102	325	130	1,509
1960-1969	61,402	384	127	532	602	199	1,844
1950-1959	46,801	826	592	672	344	250	2,684
1940-1949	21,002	224	433	492	189	462	1,800
pre-1939	16,590	76	135	271	66	418	966
Total	334,632	3,383	1,375	2,184	2,338	1,868	11,148
Source: 2000 U.S. Census							

TABLE 5-3 AREA HOUSING UNITS AND PERIOD BUILT.

children have reached adulthood and gravitated elsewhere resulting in fewer children under 18 in the neighborhoods than in the County as a whole. There is a significantly higher proportion of residents over 65 than in Montgomery County as a whole, particularly in Tracts 44.02 and 50.00 to the north and east of the campus. Data for Tract 44.02 is influenced by the Carriage Hill Nursing Home.

Increasingly, however, the older residents are being replaced by younger professional couples, often childless or with one child. These younger couples frequently make substantial renovations and alterations to the older and smaller homes. Turnover and renovations have recently increased as the original owner cohort ages. This phenomenon is most evident in the East Bethesda neighborhood (Tract 50.0), which shows a significant decline in the elderly, but only the initial phases of growth in those under 18.

Population characteristics along Battery Lane are quite different. Forty-nine percent of the population lives in high rise apartments and condominiums, 38 percent in garden apartments. More than sixty percent of the population lives alone, and families occupy only 23 percent of the units. About 60 percent of the population is female and many of these are elderly.

The resident population is extraordinarily well educated with 27.8 percent holding bachelor's degrees and an additional 36.8 percent earning advanced graduate or professional degrees. NIH scientists and physicians among this resident population have a significant influence on these percentages.

Among all counties in the U.S., Montgomery County has consistently ranked in the top 10 in terms of median household or per capita income on a national basis. In 1999, the median household income in the

	Montgomery County	PCT.	Census Tract									
			44.02	PCT.	45.03	PCT.	46.00	PCT.	48.01	PCT.	50.00	PCT.
Housing Units												
Total	334,632	100.0%	3,383	100.0%	1,375	100.0%	2,184	100.0%	2,338	100.0%	1,868	100.0%
										96.0%		
Occupied	324,565	68.7%	3,283	97.0%	1,338	97.3%	2,123	97.2%	2,246	12.6%	1,829	97.9%
Owner Occupied	223,017	31.3%	2,220	67.6%	1,140	85.2%	1,513	71.3%	284	87.4%	1,143	62.5%
Renter Occupied	101,548	68.7%	1,063	32.4%	198	14.8%	610	28.7%	1,962		686	37.5%
										24.9%		
Family Occupied	225,193	69.4%	1,600	48.7%	995	74.4%	1,327	62.5%	559	75.1%	944	51.6%
Non-family Occupied	99,372	30.6%	1,683	51.3%	343	25.6%	796	37.5%	1,687		885	48.4%
Household Composition												
	79,298	24.4%	1,420	43.2%	277	20.7%	641	30.2%	1,416	63.0%	708	38.7%
1 Person	102,141	31.5%	1,113	33.9%	478	35.7%	712	33.5%	662	29.5%	598	32.7%
2 Person	54,999	17.0%	317	9.7%	265	19.8%	353	16.7%	102	4.5%	246	13.4%
3 Person	51,112	15.7%	268	8.2%	223	16.7%	280	13.2%	58	2.6%	175	9.6%
4 Person	23,088	7.1%	115	3.5%	72	5.4%	113	5.3%	8	0.4%	75	4.1%
5 Person	13,927	4.3%	50	1.5%	23	1.7%	24	1.1%	0	0.0%	27	1.5%
6+ Person												
Owner Occupied Housing Unit												
Value	$158,900		$263,500		$249,300$		$280,600		$310,700		$239,000	
Lower	$221,800		$327,900		294,500		$335,700		$364,300		$296,000	
Quartile	$336,400		$404,700		$371,600		$387,900		$438,500		$370,100	
Median Value												
Upper Quartile												
Contract Rent (Monthly)												
	$711		$847		$1,046		$859		$788		$1,246	
Lower Quartile	$856		$1,069		$1,303		$1,097		$941		$1,972	
Median Value	$1,054		$1,403		$1,573		$1,675		$1,262		$2,000*	
Upper Quartile												

* $2,000 is upper limit recorded by U.S. Census. Actual value exceeds this limit by undetermined amount.

Source: U.S. Census, 2000

TABLE 5-4 HOUSEHOLD CHARACTERISTICS.

	Montgomery County	PCT.	CENSUS TRACT									
			44.02	PCT.	45.03	PCT.	46.00	PCT.	48.01	PCT.	50.00	PCT.
Population	873,341		6,638		3,491		4,987		3,417		4,616	
Race												
White	565,719	64.8%	5,563	83.8%	3,068	87.9%	4,320	86.6%	2,627	76.9%	4,008	86.8%
Black	132,256	15.1%	159	2.4%	98	2.8%	93	1.9%	177	5.2%	218	4.7%
American Indian	2,544	0.3%	11	0.2%	13	0.4%	9	0.2%	8	0.2%	6	0.1%
Asian	98,651	11.3%	583	8.8%	225	6.4%	445	8.9%	400	11.7%	182	3.9%
Hispanic Origin	100,604	11.5%	366	5.5%	165	4.7%	255	5.1%	252	7.4%	331	7.2%
Other or 2 or more	74,589	8.5%	322	4.9%	87	2.5%	120	2.4%	205	6.0%	202	4.4%
Age												
Median	36.8		43.4		38.3		39.4		34.6		38.5	
Under 5	60,173	6.9%	312	4.7%	280	8.0%	355	7.1%	80	2.3%	289	6.3%
Under 18	221,758	25.4%	1,079	16.3%	851	24.4%	1,118	22.4%	252	7.4%	634	13.7%
65 & Over	98,157	11.2%	1,533	23.1%	458	13.1%	752	15.1%	450	13.2%	995	21.6%
Median Household Income*	$71,551		$84,161		$109,765		$92,754		$53,667		$83,179	

* 1999 Census Data
Source: U.S. Census, 2000

TABLE 5-5 POPULATION CHARACTERISTICS.

County was $77,551. This was double the national median income of $35,500. The single family neighborhoods around the campus are consistently higher than this County figure despite the comparatively high proportion of retired persons. Many households have two wage earners. The 1996 median household income for the Bethesda-Chevy Chase planning area was $95,480 with 47.7 percent of households having incomes greater than $100,000.

The Bethesda-Chevy Chase Master Plan proposes 4,010 additional housing units by the year 2010 including 2,675 units that were already approved when the plan was adopted in 1990. The Bethesda CBD Sector Plan estimates that there is capacity for an additional 3,000 units in the CBD. Most of these are apartments. It is estimated that 375-500 units could be phased-in annually. Areas adjacent to the NIH campus have a potential capacity for 218 dwelling units, if developed (see Table 5-1). The County does not encourage development of these sites but would permit residential development on them.

North of the Beltway, the North Bethesda planning area anticipates construction of several thousand dwelling units, primarily apartments and townhouses, in the 1990-2010 period, including some 1,250 apartment and townhouse units projected for Rock Spring Park near Montgomery Mall. Many of the units proposed for North Bethesda are near Metrorail stations such as Grosvenor, White Flint, and Twinbrook.

NIH has about 17,500 employees on the Bethesda campus and about 10,400 of them live in Montgomery County. About 11 percent of them live in Bethesda, Chevy Chase, Cabin John and Kensington, and 850 reside in Gaithersburg and Germantown. Housing demand created by routine employee turnover and retirement is an important element in sustaining housing demand in Montgomery County, and this effect increases as one gets closer to the campus.

Under the Master Plan Alternative, the campus employee population would increase to about 22,000 by 2023. No noticeable impacts on housing demand or prices are expected from implementation of the Master Plan. Except for recruited clinicians and scientists, it is probable that many new employees would come from the Washington regional work force. Many of the new hires would be looking for residences in the area. With the passage of time, they would become part of the regular NIH work force, increasing the annual volume of employee turnover and retirements, and adding to the local housing demand.

About 1,000 of the NIH employees at the Bethesda campus are researchers in training and visiting scientists assigned temporarily to NIH. These groups stay at NIH Bethesda for periods ranging from a few weeks to several years. Proximity of residence to NIH is desirable for these personnel. If regional transportation management measures are implemented over the next decade, then shorter distances between work and home, and residential locations near Metrorail, become more desirable.

The turnover from such a large transient work force at NIH, coupled with the reduced work-home travel distance, will contribute to sustaining the strong rental housing market in the areas surrounding the Bethesda campus and in the Red Line corridor in both the Master Plan and No Action Alternatives.

At the same time, houses in the Bethesda area are among the higher priced in a high price housing area. As turnover continues, housing and rental values will likely continue to be maintained or increase. The neighborhoods surrounding the campus have few vacant sites for new single family housing of more modest value. Professional salaries are sufficiently high to bring these units within reach of many staff members, but affordability of housing in the immediate vicinity may become an increasing problem for junior and non-professional personnel. NIH employees generally earn less than their counterparts in the private sector. It is expected that the housing market in Bethesda and North Bethesda will become even more competitive as the number of jobs in the private sector along the Red Line corridor increases, and regional transportation management measures take effect.

5.1.6 Economic Analysis

Costs associated with master plans are indeterminate for three reasons. First, master plans are conceptual by nature and do not give specificity to dimensions and materials needed to determine costs. This permits flexibility for future planners and designers. Second, master plans are long term. The NIH Bethesda campus Master Plan covers a twenty year period, and estimates of implementation costs beyond currently budgeted items would be speculative. And third, the Master Plan is presented as an envelope for development, and all projects may not be implemented. The benefit of modernizing NIH facilities to improve research efficiency and capability on campus, and to improve efficiency in administering off campus or extramural research, and thus improve the health and quality of life of the American people is undeniable, but unquantifiable.

Implementation of the Master Plan Alternative will be of overall benefit to the Montgomery County economy. Through its Transportation Management Plan (TMP) goal of maintaining NIH generated peak hour trips at May 1992 levels, NIH reserves traffic capacity for development in the Bethesda Central Business District and Rockville Pike corridor. Development proposed in the Bethesda-Chevy Chase Master Plan and Bethesda CBD Sector Plan can continue unabated by NIH Master Plan facilities and growth. The rate of growth proposed at NIH is less than that for the Bethesda CBD.

NIH creates significant direct and indirect benefits throughout the U.S. and in Maryland (The Economic Impact of the NIH in Maryland and the U.S., Maryland Dept. of Economics and Employment Development, 1994). Among the States, Maryland is the principal beneficiary of NIH due to receiving the bulk of NIH direct intramural program expenditures (Table 5-6). In Fiscal Year 1993, NIH contributed about $1.7 billion directly to the Maryland economy. About two thirds of this amount was attributable to employee salaries and fellowships and intramural program service contracts awarded to Maryland firms. NIH also expended near $550 million in Fiscal Year 1993 in support of extramural research in Maryland by others outside NIH. Maryland ranked fourth in the nation behind California, New York, and Massachusetts in total research grants and expenditures awarded by NIH in FY 1993. The Johns Hopkins University in Baltimore was the largest single recipient of NIH extramural research grants and contracts in the U.S. In FY 1993, the university received over $259 million (ibid).

Direct expenditures by NIH in its intramural and extramural programs lead to secondary and tertiary indirect economic benefits as funds received directly are subsequently paid to other parties. The total or overall annual economic impact of NIH in Maryland is estimated to be $36 billion in gross sales, $1.9 billion in employee income, and about 62,900 jobs when these indirect effects are taken into account. The intramural program represents about 60 to 65 percent of this economic benefit (ibid).

It is estimated that, in FY 1993, NIH spending generated a total of $70 million in personal income tax receipts, $35 million in local County personal income taxes, and $17 million in State retail sales tax receipts in Maryland. The combined State and local tax receipts from direct and indirect NIH activities in Maryland were estimated at $122 million (ibid).

NIH on-campus growth will have positive economic benefits for commercial enterprises in Bethesda by providing a larger concentrated potential market. The Master Plan and TMP implementation will make NIH employees less hesitant to patronize Bethesda restaurants and businesses during midday by locating more employees within five minutes walking distance of the Medical Center Metrorail station, where there are now less than 1,000 on the campus in that situation. NIH creates a high demand for overnight accommodations through the large number of technical meetings and conferences held on the campus. NIH's effect on residential property values cannot be estimated with precision, but NIH has a positive effect. In Montgomery County, the most important factors in determining property values are location

Intramural		
Business Services	$80.4	
Equipment Rental and Leasing	47.5	
Construction	45.4	
Scientific Instruments	40.9	
Chemicals and Allied Products	25.5	
Transportation, Communications Utilities	24.7	
Computer and Data Processing Services	21.4	
Wholesale and Retail Trade	19.9	
Printing and Publishing	19.7	
Miscellaneous Office Machines	13.7	
Other Services	15.2	
Miscellaneous Obligations	12.1	
Total Intramural Contracts		$366.5
Salaries and Fellowships		$785.0
Total Intramural Program		$1,151.5
Extramural		
Colleges, Universities, Biomedical Industry	$460.2	
Computers and Data Processing Services	37.5	
Management and Consulting	30.0	
Other Services	16.6	
Miscellaneous Obligations	5.4	
Total Extramural Program		$549.7
Total Direct Maryland Expenditures		$1,701.2

Source: The Economic Impact of the National Institutes of Health in Maryland and the U.S., Maryland Dept. of Economic and Employment Development, 1994.

TABLE 5-6 NIH DIRECT ECONOMIC IMPACT IN MARYLAND IN FISCAL YEAR 1993 (in millions of 1993 dollars).

and school district. Neighborhoods in the vicinity of NIH rank high in both categories. About 1,600 of the 17,500 NIH employees live in Bethesda, Chevy Chase, and Kensington. Housing demand created by routine NIH employee turnover and retirement is an element in sustaining housing demand and prices in these areas, and this effect increases as one approaches the campus based on a distribution analysis of employee population.

Americans move on the average of once every five years. NIH has long term permanent employees, but about 20% are transient research trainees and visiting scientists assigned to NIH for only a few months or years. Conservatively, if it is assumed that NIH employees move residences once every ten years, and the distribution of employee residences are similar to current ones, then NIH employees constitute a market for about 970 residences per year in Montgomery County, and 180 residences per year in Bethesda, Chevy Chase, and Kensington. Increases in campus population would increase proportionately the NIH employee demand for housing in the immediate area. Other factors will increase the pressure to make residential proximity to the campus more desirable for NIH employees. Regional and NIH transportation management will discourage single occupant vehicle use. Increasing long term regional traffic congestion will place greater emphasis on living closer to work.

Growth has been relatively continuous at NIH for nearly 50 years. The Montgomery County property tax records for the neighboring communities were searched to determine if there was any decrease in property values as one drew closer to the campus or as a result of these projects. Comparisons between neighborhoods cannot be made because of differing housing types and lot sizes, but within neighborhoods comparisons of 1992 and 1994 records indicated no evidence of decreasing land, improvement, or assessed property values as the distance to the campus decreased. Property values abutting the campus had little variance from those one or two blocks from the campus. Generally, properties abutting the campus had higher values.

The quality of life on the NIH campus is important to NIH as well as the surrounding neighborhoods. NIH must compete with other institutions for researchers, and government salaries are generally less than in the private sector. A high quality campus setting is an important factor in attracting researchers and highly qualified technical support personnel. One of the fundamental purposes and goals of the Master Plan is to enhance the quality of life and character of the campus. This fundamental tenet influences all aspects of the plan from the broad scope of functional layout of buildings and quadrangles, to the minor details of landscaping, signing, and lighting. The internal quality and character of the campus cannot be separated from the character of the campus as perceived and experienced from the surrounding neighborhoods. The Master Plan has incorporated a number of mitigation measures to maintain or enhance the quality of life in surrounding neighborhoods. These include measures to maintain NIH generated traffic at May 1992 levels, maintain and enhance the buffer zone around the campus, reduce construction, lighting, noise, and air quality impacts.

5.1.7 Environmental Justice

Presidential Executive Order 12898, issued on February 11, 1994, requires federal agencies to identify and address those impacts generated in the undertaking of its activities which have disproportionately high and adverse human health or environmental effects on minority or low income populations to the greatest extent practicable.

Based on the data given in Sections 5.1.4 and 5.1.5, the project area contains no identifiable minority or low income communities or neighborhoods composed of predominantly minority or low income populations, and no environmental justice impacts are expected.

5.2 PARKS AND RECREATION

Four parks owned and operated by M-NCPPC, Montgomery County Department of Parks, are located in the vicinity of the NIH campus.

- Rock Creek Park

In Maryland, Rock Creek Park is a regional Montgomery County park that serves County-wide outdoor recreation needs, and conserves national resources. It protects Rock Creek watershed stream valleys, floodplains, and wetlands. It is the second largest park in the County system, encompassing 1,795 acres. Arms of the park follow branches of the creek into numerous residential neighborhoods. For nearly 10 miles, the park follows the meanders of Rock Creek from the District of Columbia boundary to Route 28 east of Rockville. It continues above Route 28 to the headwaters of Rock Creek as the Upper Rock Creek Regional Park. The park continues southward from Montgomery County through the District of Columbia to the Potomac River. The section within the District is owned and operated by the U.S. National Park Service.

The park is a critical element within the County park system. Large areas remain undeveloped. Active recreation facilities in the form of ball fields, picnic areas, tennis and basketball courts, and lakes are interspersed throughout the park. All are linked by a trail and bike path system.

The closest point of approach for the main stem of the park to NIH is about 0.6 miles from the northeast corner of the campus. However, a small tongue or spur of the park extends through the Locust Hill Estates to the northwest corner of the Rockville Pike/West Cedar Lane intersection. This spur is an important access route between Bethesda and the main stem of Rock Creek Park. The NIH Stream flows through this section of the park after it leaves the campus.

The Elmhurst Parkway Neighborhood Conservation Area is located on the east side of Stone Ridge School. It is a natural area dedicated to watershed protection and open space preservation with no recreation facilities. Local residents use it for walking and nature study. The 22.7-acre property is included in the Rock Creek park system by the M-NCPPC Department of Parks.

- Battery Lane Urban Park

This park is a small 2-acre green oasis located amid the urban high rise and garden apartment complexes on Battery Lane. It is 600 feet long and from 50 to 200 feet in width, extending from the intersection of Norfolk and Rugby Avenues at its south end to Battery Lane. It has a tennis court, a basketball court, and a tot lot or child play area. A bike path or trail courses the length of the park. This path extends to the south side of the NIH campus through a narrow right-of-way between the Glen Lane and Phoenix apartments. It serves as a popular pedestrian access route between the NIH campus and the Bethesda CBD via the Woodmont Triangle.

The Bethesda CBD Sector Plan recommends an increase in recreational uses at this park by installing improvements to increase park access and visibility. Landscaping and seating could be added to serve workers from the Woodmont Triangle and adjacent residents. The trail through the park would be extended along Glenbrook Parkway to tie into the regional CBD bike path system.

- Ayrlawn Park

Ayrlawn Park is a 20.4-acre park located two blocks to the west of the Old Georgetown Road/West Cedar Lane intersection. It is classified as a local park that provides facilities for programmed or organized recreation. Facilities include an adjunct to the Bethesda YMCA Program Center with community meeting rooms, child care and gymnastics centers; fenced and unfenced play areas, four tennis courts, and soccer, softball, and regulation and Little League baseball fields.

- Greenwich Park

This 2.8-acre neighborhood park is located on the west side of Old Georgetown Road about three blocks south of the campus. It has facilities for informal leisure activities. Two tennis courts, a basketball court, gazebo, play area, benches, and picnic table can be found in the eastern half of the park. The western half is covered by well maintained open woods and lawn. The rear yards of residences on Glenwood and Custer Roads overlook the park to the north and south.

In addition to M-NCPPC Department of Parks facilities, two other recreational facilities are present.

- YMCA

The Bethesda-Chevy Chase YMCA is located four blocks to the north of the campus on Old Georgetown Road. Facilities include tennis courts, swimming pool, soccer field, outdoor track and a recreation center.

The Master Plan and No Action Alternatives would not create significant direct or indirect negative impacts on M-NCPPC park facilities, the YMCA, or their respective recreational values.

5.3 TRANSPORTATION

5.3.1 Road Network/NIH Access

Rockville Pike (Maryland Route 355), Old Georgetown Road (Maryland Route 187), Jones Bridge Road and West Cedar Lane are the primary access routes to the NIH Bethesda campus. Rockville Pike is identified as Wisconsin Avenue to the south of Woodmont Avenue in the Bethesda CBD. The I-495 Capital Beltway passes about 0.7 miles to the north of the campus and has interchanges with Rockville Pike and Old Georgetown Road. A spur of I-270, which passes through Montgomery County to the northwest, joins the Capital Beltway at the Rockville Pike interchange.

Rockville Pike is a six-lane divided roadway providing access to the study area from I-270, the Capital Beltway, and a heavily developed Montgomery County corridor from Rockville to Gaithersburg to the north. To the south, Rockville Pike is the main road through the Bethesda CBD before it reaches the District of Columbia. Rockville Pike forms the eastern boundary of NIH. There are signalized intersections with Cedar Lane/West Cedar Lane, Jones Bridge Road/Center Drive, and Woodmont Avenue in the vicinity of NIH. In addition to the NIH entrance at Center Drive, there are entrances at North, Wilson, and South Drives (Figure 5-8). One of the two NNMC entrances is at South Drive; the other is just south of North Drive. All NIH entrances are signalized except for North Drive, which is stop sign controlled. Left turn lanes are present on Rockville Pike in the northbound direction at Center Drive, South Drive, Wilson Drive, and West Cedar Lane. The posted speed limit on Rockville Pike is 35 mph.

Old Georgetown Road is a six-lane divided roadway providing access to NIH from the Capital Beltway, I-270, and parts of Montgomery County to the north and west, and the Bethesda CBD to the south. Old Georgetown Road runs parallel to Rockville Pike in an arc to the west terminating at Rockville Pike about four miles to the north of NIH, and at Wisconsin Avenue in the Bethesda CBD. Within the vicinity of NIH, West Cedar Lane, the three NIH entrances at Center, South, and Lincoln Drives, and Huntington Parkway intersections are signalized. Southbound left turn lanes exist at all of the above intersections except Huntington Parkway. The posted speed limit is 40 mph.

Jones Bridge Road is a four lane roadway providing access between NIH and Chevy Chase to the east. Westbound Jones Bridge Road widens at the Rockville Pike intersection to accommodate a right turn lane and an exclusive left turn lane. The posted speed limit is 40 mph.

Cedar Lane is a four lane undivided road providing access between Kensington to the northeast of NIH and Rockville Pike. It continues along the northern boundary of NIH as West Cedar Lane to Old Georgetown Road. Although West Cedar Lane is wide enough for four lanes, it operates as a two lane facility with parking on both sides except for the approaches to Rockville Pike and Old Georgetown Road. NIH previously had four entrances along West Cedar Lane but only West Drive, which is signaled, remains. West Drive is currently closed to traffic. The posted speed limit on West Cedar Lane is 30 mph. Center Drive is the primary circulation road within the NIH campus and is an extension of Jones Bridge Road at Rockville Pike. The posted campus speed limit is 25 mph.

Until September 2001, NIH had 11 two-way or bidirectional vehicle access entrances around the periphery of the campus with the exception of South Drive at Old Georgetown Road. In response to directives for increased federal facility security, NIH has established a new permanent fenced perimeter

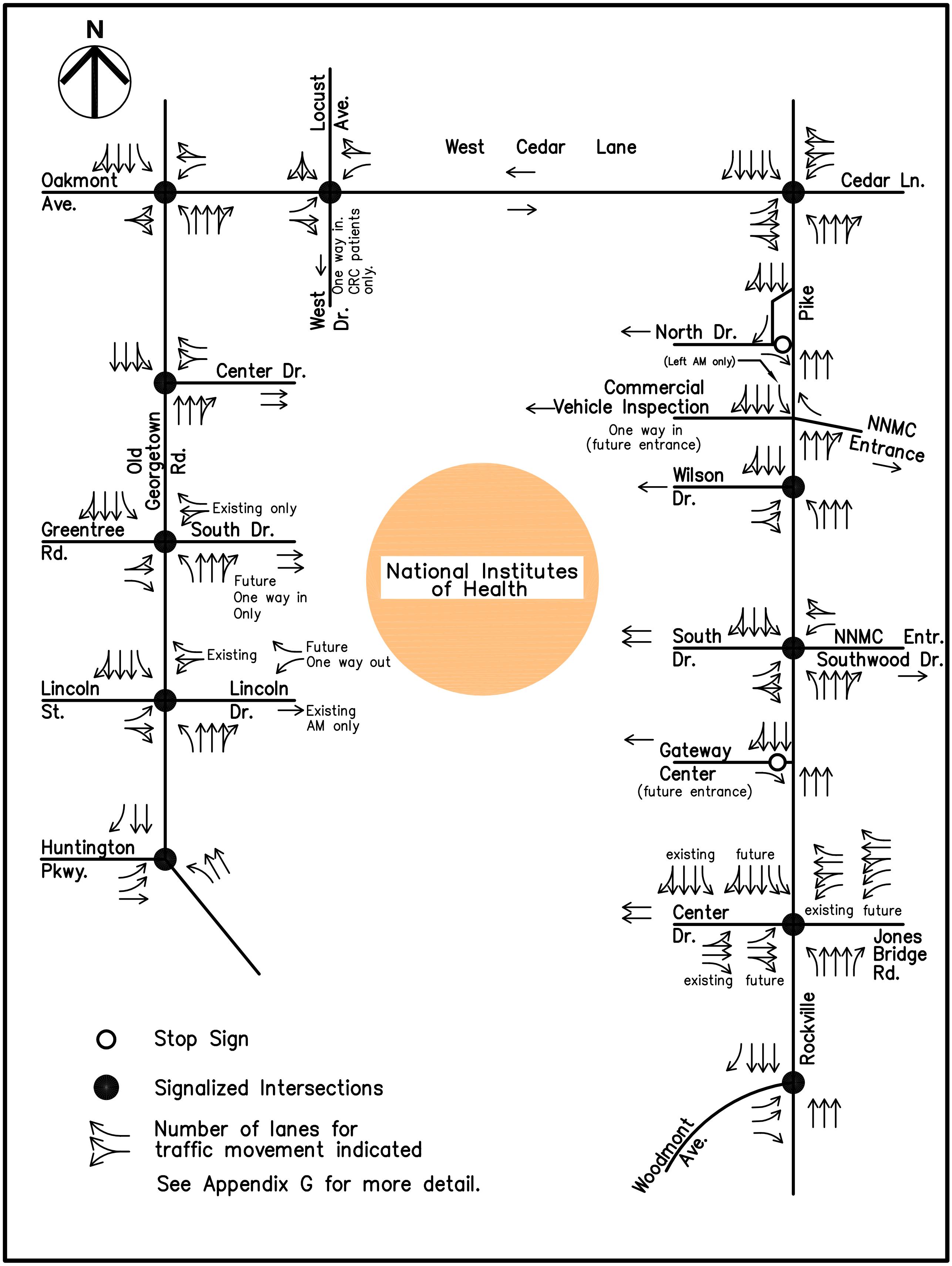


FIGURE 5-8 NIH ROAD ENTRANCES AND ADJACENT INTERSECTIONS.

and controlled access to the campus. A number of changes have been implemented, but access is in a transitional state.

On an interim basis, the number of vehicle entrances has been reduced to eight, but the West Drive entrance is closed to traffic under everyday operations. Employees can enter the campus at seven locations, three on Old Georgetown Road, and four on Rockville Pike. Commercial vehicle and general visitor traffic, which includes all non-NIH vehicles, are limited to entry at two points; South Drive on Rockville Pike, and Center Drive on Old Georgetown Road.

Change to the ultimate vehicle and pedestrian/bicycle access configuration will be the same under the Master Plan and No Action Alternatives (Table 5-7). This will occur as soon as the Commercial Vehicle Inspection Facility and Gateway Visitor Center complex are in service. There will then be ten vehicle portals through the security perimeter, (North Drive counting as one portal), and five additional gates, for exclusive biker and pedestrian use.

NIH employee traffic will be separated from other traffic entering the campus. This will permit a comparatively free flow of employee traffic with minimum queue lengths, while the non-NIH employee traffic that requires longer inspection times is routed to facilities designed for that purpose. The seven NIH employee portals are:

Old Georgetown Road
- Lincoln Drive (one way out)
- South Drive (one way in)
- Center Drive

Rockville Pike
- Center Drive
- South Drive
- Wilson Drive
- North Drive

Although NIH employee entrances will be manned for security, nearly all NIH employee vehicles will be processed electronically. This could take the form of a Smart Card system similar to that now used on area toll roads, permitting a comparatively free flow of vehicles with minimal stoppages.

In the future, Lincoln and South Drives on Old Georgetown Road will operate as a one-way pair of roadways that, in effect, reduces the employee entry and exit points to six locations. Any of the portal roadways, however, could be used for employee egress into and out of the campus should circumstances dictate, e.g. an accident blocks a campus portal road. A slip ramp into an employee vehicle inspection queueing area is provided to the north of North Drive to minimize, when necessary, entering vehicle queues at other entrance locations. Vehicles would pass through the campus security perimeter on North Drive. North Drive would operate as a right turn out only exit. The Master Plan does not propose any employee entrances on West Cedar Lane.

Commercial vehicles, including all campus construction related traffic, will be routed to a new inspection facility along Rockville Pike. The facility entrance will be just to the south of North Drive, and will operate as right turn in only, i.e. no left turns from northbound Rockville Pike. Vehicles that pass inspection will enter the interior campus through the perimeter security fence via a new capacity bridge across the NIH Stream.

The remainder of inbound traffic is composed of general visitor vehicles. These visitors can be split into two components; inpatients and outpatients traveling to the Clinical Research Center for admissions and

ENTRANCE	BICYCLE/ PEDESTRIAN ACCESS	PEDESTRIAN ACCESS TYPE	VEHICLE ACCESS	VEHICLE ENTRANCE TYPE	MASTER PLAN VEHICLE DIRECTION OF FLOW	CURRENT LANES NIH PROPERTY LINE (1)	INTERNAL LANES NIH CAMPUS	NOTES
Old Georgetown Road								
Lincoln Drive	Yes	employee only (3)	Yes	employee only	out only	3	2	Currently vehicle two way No movement to Lincoln St.
South Drive	Yes	employee only (3)	Yes	employee only	in only	4	2	Currently vehicle two way
Center Drive	Yes	employee only (3)	Yes	employee only	two way	4	4	
Fire Station	Yes	employee only (3)	No		none			
West Cedar Lane								
West Drive	Yes	employee only	Yes	CRC patients/ CRC visitors only	in only	1	2	Currently closed to vehicles
Cedar Crest Drive	Yes	employee only	No		none			
Rockville Pike								
North Drive slip ramp	No		Yes	employee only	in only	1	2	
North Drive	Yes	employee only	Yes	employee only	two way	2	2	future - vehicle out only
CVIF	No		Yes	see note	in only	1	1	Commercial vehicle entrance
Wilson Drive	Yes	employee only	Yes	employee only	two way	3	2	
South Drive	Yes	employees/ visitors	Yes	employee only	two way	4	2	vehicles-employee only, but all pedestrian types (2)
Natcher Path	Yes	employee only	No		none			gate at Metro station
Gateway/Visitor Cen.	No		Yes	visitor only	two way	2	2	campus access via Bldg 45 road exit-Visitor Center garage only
Center Drive	Yes	employee only	Yes	employee only	two way	3	2	
South Side								
Battery Park	Yes	employee only	No	employee only	none			4 access points through NIH property line fence south side
Glenwood/Southwest	Yes	employee only	No	employee only	none			

Notes: (1) Includes turning lanes.
(2) All types of access at the property line.
(3) Potential future visitor access with pass at one of these entrances.

TABLE 5-7 CAMPUS ACCESS SUMMARY.

clinical trials, respectively, and all others. West Drive on West Cedar Lane will serve as an exclusive entry point for the inpatients and outpatients. It will operate one way inbound. All other general visitors will enter the campus at a new entrance at the Gateway Center on Rockville Pike. It will operate as a right turn in - right turn out only entrance. These visitors may either park in the Visitor Center garage, which is outside the security perimeter, or continue on to the campus through a security check point and a connecting road between the Visitor Center area and Center Drive.

Vehicles of all types will be able to depart the campus at any portal that accommodates outbound traffic. All of the employee entrances except South Drive on Rockville Pike would be closed during the evening hours and on weekends.

5.3.2 Regional Transportation Planning

The Transportation Plan section of the Bethesda-Chevy Chase Master Plan assumes increasing use of transit services and a moderate level of road improvements to maintain the quality of life in the planning area (Bethesda-Chevy Chase Master Plan, M-NCPPC, 1990). The basic transportation strategy in the plan is to encourage the use of mass transit, carpooling, walking, and bicycling to reduce the demand for new roadway facilities. Use of such services is necessary, the plan notes, because it is difficult to expand the capacity of the area roads and these measures are needed to accommodate increased through traffic and the recommended level of development in Bethesda and Chevy Chase.

Improved transit and mobility services proposed in the Transportation Plan include:

- Increase the level of feeder bus services, particularly in the eastern half of the planning area.
- Provide park and ride lots for 750 vehicles at locations that would intercept vehicles destined to employment centers such as the Bethesda CBD, NIH, and the Naval Medical Center. Recommended potential locations were at I-495 and Kensington Parkway (250 spaces), and on River Road west of the Cabin John Fire Station No. 10 to the west of Seven Locks Road (500 spaces).
- Implement comprehensive ride share programs serving both employment and residential centers.
- Require new development to participate in traffic reduction programs.
- Expand the pedestrian and bike path system.

A moderate level of highway improvements as defined in the plan is:

- Completion of currently programmed projects.
- Endorsement of safety and sight distance improvements.
- Provide intersection capacity improvements at locations that currently operate with a Critical Lane Volume (CLV) of 1,650 or greater, or are likely to reach this CLV, over the next ten years. Improvements may include added turn lanes, lane widenings, and signal changes.
- Possibly endorse improvements to intersections to facilitate smoother traffic flow, even if they do not always achieve a fully acceptable Level of Service.
- Possibly require new development to participate in construction of improvements identified in the plan.
- Endorse reductions in through traffic on secondary and residential streets and, where possible, on primary streets and major highways.

The BCC Transportation Plan recognizes that Rockville Pike intersections at Pooks Hill Road, Cedar Lane, and Jones Bridge Road are operating at high peak hour levels of service. Traffic flow is characterized as very heavy between the Beltway and Jones Bridge Road, but not exceeding the capacity of Rockville Pike. The plan recommends that the six lane facility be retained from the Beltway to Woodmont Avenue. Widening of the road between the Beltway and Cedar lane is undesirable due to high potential property impacts. In the long term, after 2010, Rockville Pike could be widened to eight lanes between Cedar Lane and Jones Bridge Road, if it were necessary to accommodate federal facility and Bethesda CBD growth, and the project included HOV lanes for peak traffic period use. This would be conditional on endorsement by the Montgomery County Council as an amendment or future revision to the Bethesda-Chevy Chase Master Plan. The plan also recommends that a possible grade separated interchange at Rockville Pike and Cedar Lane be retained as a possible project after the year 2010. The 2004 Constrained Long Range Transportation Plan (National Capital Region Transportation Planning Board, Metropolitan Washington Council of Governments (CLRP) (MWCOG), 2004), which has a planning horizon through 2030, does not include it.

Improvements are considered for the Pooks Hill Road and Cedar Lane intersections. Implementation of improvements would be dependent on the findings of studies by MD DOT and MC DOT, and further information on projected traffic growth as indicated in the Bethesda CBD Sector Plan and NIH Master Plan. At Cedar Lane, the following would be considered to reduce the critical lane volume:

- add a right turn lane to eastbound Cedar Lane
- add a through lane to westbound Cedar Lane
- add a right turn lane to northbound Rockville Pike

At the Jones Bridge Road intersection, the northbound Wisconsin Avenue right turn improvement recommended in the BCC Transportation Plan and included in the Capital Improvement Plan (CIP) has already been built. Further improvements currently planned include adding a left turn lane to westbound Jones Bridge Road and to southbound Rockville Pike.

The BCC Transportation Plan recommends retaining the existing width of Old Georgetown Road between the Beltway and Huntington Parkway. After 2010, a single HOV lane addition would be considered if it was necessary to reduce severe congestion and community impacts. The only recommended intersection improvement along this section of Old Georgetown Road is the addition of a short right turn lane on eastbound Greentree Road. The BCC Transportation Plan recommends no changes to Cedar Lane or Jones Bridge Road.

Many measures are proposed in transportation planning to reduce single occupant vehicle trips to and from the Bethesda CBD (Bethesda CBD Sector Plan, M-NCPPC, 1993). As in the BCC Master Plan, the Bethesda CBD Sector Plan recommends measures to increase transit use, car and vanpooling, walking, and biking. These include expansion of the Ride-On bus service and the CBD trail system, and consideration of incentives and disincentives to encourage non-automobile modes of travel.

To achieve the goal of gaining a significant shift from driving alone to alternate modes of travel, the Bethesda CBD Transportation Plan in the Sector Plan proposes the formation of a Transportation Management District (TMD) modelled on the Silver Spring TMD. In 2002, the number of CBD workers who did not drive to work is 27 percent. The objective is to increase this to 32 percent before actual Stage I development proposed in the CBD Sector Plan is complete.

For road system improvements, the CBD Transportation Plan used the mid- and long-term improvements identified in the 1990 Bethesda-Chevy Chase Master Plan as a starting point for its recommendations. The CBD Transportation Plan does not recommend any major widening of the existing road network. The Sector Plan identifies a future need to implement a peak period reversible lane on Old Georgetown Road from Woodmont Avenue northward to Huntington Parkway, and subsequently extend it from Huntington Parkway to north of West Cedar Lane when traffic conditions warrant it. The plan notes that installation of the lane would require the removal of the existing median but otherwise could be done within the current right-of-way. The Sector Plan would accelerate the schedule for construction of the reversible lane over that proposed in the BCC Transportation Plan.

The CBD Transportation Plan also recognizes a possible future need for converting Wisconsin (northbound) and Woodmont (southbound) Avenues into one way pairs through the CBD. While the concept resolves many traffic flow problems, there are concerns about retail accessibility and visibility, and pedestrian safety. At the Wisconsin Avenue/Woodmont Avenue intersection, congestion is projected as growth occurs in the Woodmont Triangle and traffic increases along Wisconsin Avenue/Rockville Pike. The CBD Sector Plan proposes turning lane improvements to increase intersection capacity.

At Rockville Pike and Cedar Lane, the CBD Transportation Plan noted the improvements proposed in the BCC Master Plan. The CBD Sector Plan, however, sees the need for additional north and south through lanes on Rockville Pike at the intersection rather than additional turning lanes proposed in the BCC Plan. The Sector Plan notes that the actual improvements needed are dependent on a good projection of NIH generated traffic as well as that travelling to and from the CBD. The CBD plan also recommends maintaining the possibility of a future grade separation at this location. The grade separation could allow direct access to the NIH campus, reducing congestion at many other entrances to NIH along Rockville Pike.

On a regional scale in the Washington metropolitan area, transportation planning is taking a significant change of course as a result of recent federal legislation. These changes may have a significant effect on how individuals commute to work and travel through the area.

The regional Constrained Long Range Transportation Plan outlines improvements, actions, strategies, and studies needed by the region to comply with Clean Air Act Amendments of 1990 (CAAA) (42 U.S. C.§ 7407(d)) and the Transportation Efficiency Act for the 21st Century (TEA-21) regulations. The plan conforms to the CAAA requirements in that ground level ozone, volatile organic compounds, and nitrogen oxide regional emissions will be lower than they would be if the plan were not implemented. The plan has a 25 year planning horizon. It is constrained in that it may include only those transportation projects for which revenues can be “reasonably expected to be available” as required by TEA-21 and by U.S. EPA classification of the Washington Metropolitan area as being in "severe” non-conformity for ground level ozone. It is subject to change in that the TEA-21 will undergo reauthorization in 2004. The plan is based on growth projected in the MWCOG Round 6.3 forecasts for regional population and employment. Regionally, the population is expected to increase from 4.55 million in 2000 to 5.82 million in 2020, and the number of jobs by 46 percent. The Montgomery County population is projected to increase from 873,000 in 2000 to 1.05 million in 2020. County vehicle registrations are forecast to increase from 671,000 to 995,000 in the same period.

There are three projects in the Constrained Long Range Plan that could influence NIH transportation conditions in the long term. The first is the Bi-County transitway that would connect Silver Spring and Bethesda with a light rail line following an abandoned railroad right of way for most of its length. Montgomery County has purchased the right-of-way, and the Bethesda CBD Plan suggests two alternatives for connecting the line to the Metrorail station in Bethesda. The Constrained Long Range Plan calls for implementation by 2012, but funding only for studies is programmed.

The other two projects are major long term Constrained Long Range Plan projects involving multimodal improvements in the I-270/US15 and the I-495 Capital Beltway transportation corridors. In the former project, US15 and I-270 would be widened between MD Route 26 north of Frederick, Maryland, and Shady Grove Road near Gaithersburg. US15 would be widened to six lanes. The number of lanes on I-270 would increase progressively as one proceeds southward to ultimately match the existing 12-lane I-270 at Shady Grove Road. HOV and Transportation Demand Management measures such as park and ride lots and bus transit will be included throughout.

Rail transit will not be present within the highway corridor but has been provided by an extension of MARC service from Point of Rocks, Maryland to Frederick using existing railroad lines. The Frederick service was initiated in 2002. Draft Environmental studies for the I-270/US15 corridor were completed in 2002.

The Capital Beltway Study is evaluating multimodal transportation alternatives for a wide circumferential corridor centered on I-495 through Montgomery and Prince George's Counties. Studies to date have determined that Beltway road widening will be limited to expansion to 10-lanes with two of the lanes devoted to HOV and express bus service.

5.3.3 Memorandum of Understanding

In May 1992, NIH executed a Memorandum of Understanding (MOU) with the NCPC and the Montgomery County Planning Board (MCPB) (see Appendix C). In the MOU, NIH committed itself to a best faith effort to implement Transportation Management Plan (TMP) strategies in order to achieve the following TMP goals:

- Improvement in the availability of parking spaces on campus for NIH personnel and visitors.
- Mitigation of traffic impacts created by further campus development on the roadways serving the campus such that the level of congestion along the roadways is made no worse than if such development did not occur.
- Maintain a "good neighbor" relationship with the surrounding community.

NIH also committed itself to a best faith effort to implement TMP short-and long-term strategies to achieve these goals. Strategies included measures for reducing or mitigating traffic generated by NIH, and control of campus parking.

Strategies in the TMP are:

- Establishment of an Employee Transportation Services Office to coordinate the TMP and promote non-single occupant travel modes by employees.
- Continuation of and emphasis on carpool and vanpool programs and placement of carpool, vanpool, handicapped and visitor parking in close proximity to user destinations.
- Implementation of transit discount programs for employees to the maximum tax free benefit allowable by law.
- Improvement of NIH shuttle bus service as demand warrants.
- Further promotion and publicizing of existing TMP measures.
- Implementation of an internal loop road circulation system within the NIH campus with two way traffic.
- Improvement of congested roadway intersections around NIH's perimeter through the addition of more turning lanes to selected intersections adjacent to the NIH campus to mitigate traffic congestion.
- Explore the feasibility of developing or leasing satellite parking areas near outlying Metrorail Red Line stations to serve NIH employees.

The three agencies agreed to meet periodically to discuss planning and transportation issues. NIH would monitor the results of the TMP by providing NCPC and MCPB with semiannual traffic counts and evaluations of the program.

One goal of the MOU is that the level of traffic congestion created by any development proposed by NIH on roadways and intersections near the campus should be no worse than if such NIH development did not occur. Congestion would increase from growth in traffic from sources outside NIH, regardless of NIH activities. However, if the congestion increased as a result of NIH activities, then mitigation measures would be taken by NIH.

A traffic frame of reference or measure of performance is needed to assess the effects of NIH generated traffic within the changing environment of overall traffic changes. If the MOU goal is to be met, then it is implied that development proposed in the Master Plan cannot generate more peak hour trips than were generated by NIH at the time of the MOU baseline surveys in 1992, when NIH generated 5,888 AM peak hour trips (4,925 inbound and 963 outbound) and 5,772 PM peak hour trips (1,322 inbound and 4,450 outbound).

Further, the contribution of NIH to congestion on road links and intersections surrounding the campus should be no worse than that associated with the 1992 MOU reference NIH generated traffic. Since the background level of traffic is continuously increasing, the MOU reference level of congestion increases with time, even though NIH may hold its trip generation at or less than 1992 MOU reference levels (Figure 5-9). Projected MOU reference traffic levels are equivalent to a 1992 No Action Alternative for assessing traffic impacts, i.e. conditions that would exist if NIH undertook no activities after the 1992 MOU baseline traffic survey was conducted.

The 1992 MOU reference traffic surveys counted traffic through the NIH entrances and on the campus perimeter roads, but did not include intersection congestion analysis. The May 1993 NIH traffic survey was the first to do so. The data from this survey are therefore given as a reference of conditions on the road network and intersections. However, the NIH peak period traffic contribution had already declined by ten percent by May 1993 due to initial TMP measures (Table 5-8). The 1993 reference traffic and congestion is therefore lower than what was present at the time of the execution of the MOU.

The baseline total MOU traffic volume advances or changes with time. It is equal to the 1992 MOU NIH contribution to traffic in the terms of trips through the campus entrances, plus the background or non-NIH traffic present when assessment of conformance or impacts is conducted. The 2003 total MOU traffic volumes are higher than those in 1992 or 1993 because of significant growth in background traffic.

The 1992 and 1993 reference surveys were based on the pre-September 2001 campus entrance configuration. Changes in the entrance configuration and use require adjustment to the NIH 1992 MOU reference contribution to the 2003 total MOU reference volume. This has been done by redistributing the 1992 NIH entrance traffic to the 2003 and proposed 2020+ Master Plan entrance configurations.

5.3.4 Existing NIH Transportation Management Program

In October 1991, the NIH created an Employee Transportation Services Office (ETSO), and staffed a position with the responsibility of carrying out its Transportation Management Plan efforts in a more coordinated manner. In general, it is the responsibility of the ETSO to work with other administrative staff to monitor the effectiveness of existing transportation management programs and adjust them to make them more effective. Also, the ETSO continues to research new programs, and test and implement them if they prove to be effective.

The NIH ETSO has effectively expanded and enhanced the NIH TMP since its inception. Most of the short term TMP strategies proposed in the original 1992 program have been implemented. Although the campus employee population has increased by seven percent between 1992 and 2003 (from 16,350 to 17,500), the total number of AM and PM peak hour trips into and out of the campus has decreased by 29 and 46 percent, respectively, from the reference MOU trips.

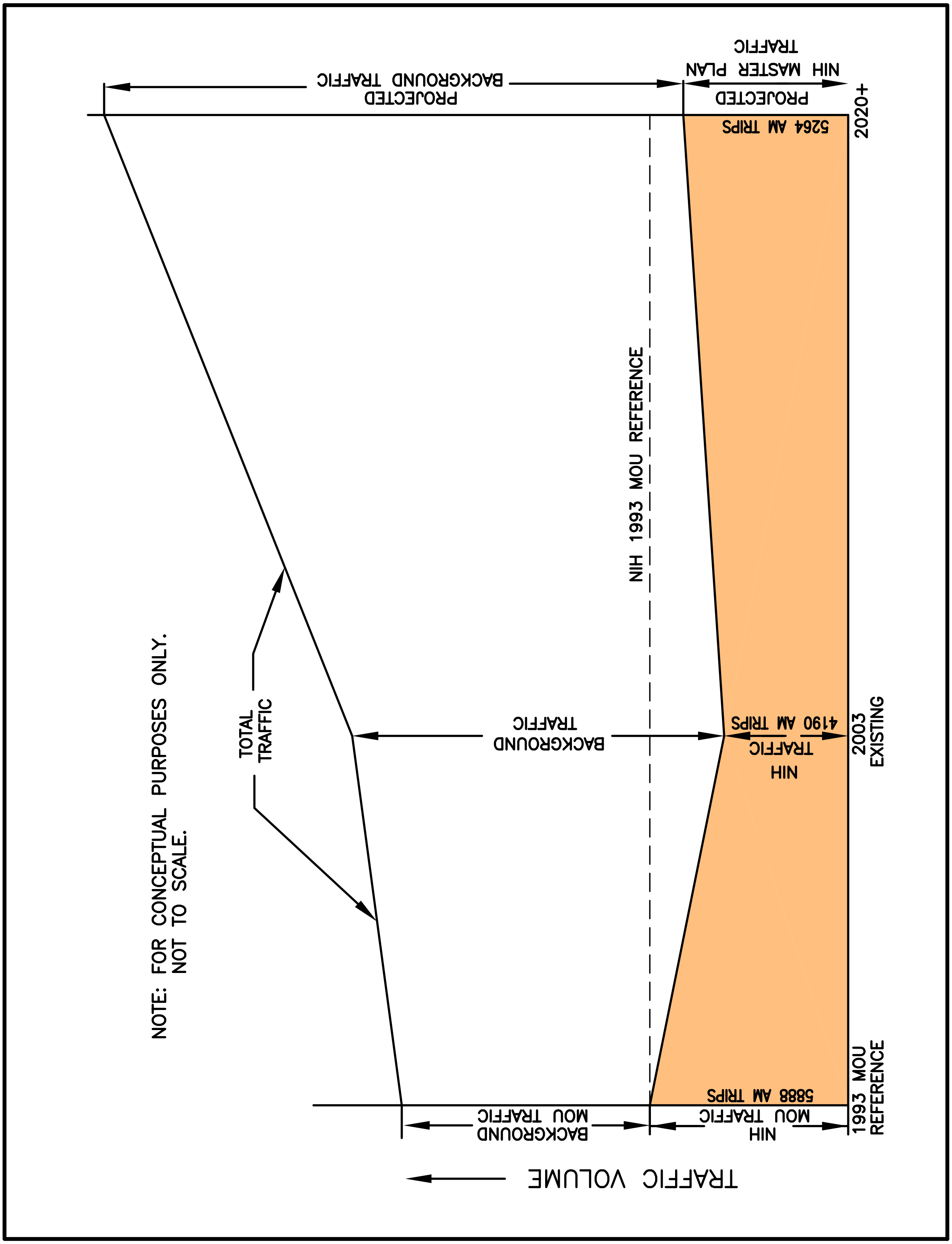


FIGURE 5-9 TRAFFIC IMPACT CONCEPTS.

	AM PEAK HOUR NIH TRIPS				PM PEAK HOUR NIH TRIPS			
SURVEY	IN	OUT	TOTAL	%(2)	IN	OUT	TOTAL	%(2)
1992 MOU	4,925	963	5,888	--	1,322	4,450	5,772	--
MAY 1993	4,384	858	5,242	10.9	1,177	3,961	5,138	11.0

SURVEY	AM PEAK PERIOD 6;30-9:30 AM NIH TRIPS IN	%(2)	PM PEAK PERIOD 3:30-6:30 PM NIH TRIPS OUT	%(2)
1992	10,978	--	10,815	--
MAY 1993	9,857	10.2	9,711	10.2

(1) Percentage reduction from May 1992 or MOU reference trips.

TABLE 5-8 COMPARISON OF NIH TRIP GENERATION BETWEEN 1992 AND 1993.

Current TMP measures include the following:

- TMP Coordination - The NIH ETSO maintains membership in other affiliated TMP groups participates in their activities, and shares information. The ETSO works cooperatively with the NIH/Naval Medical Center/Suburban Hospital/Montgomery County Transportation Management

- Organization, North Bethesda Transportation Management District (TMD) organizations, and Keep Montgomery County Moving.

- TMP Information - The ETSO Transportation Information Office provides NIH employees and visitors with website information on public transit routes and schedules, NIH shuttle routes and schedules, and visitor parking.

- TMP Promotion and Education - The ETSO actively stresses the importance of using transportation alternatives other than single occupancy vehicles to NIH employees. New employees are informed about NIH transportation conditions and commuting options through monthly orientation meetings. The ETSO also holds Commuter Transportation Fairs where many vendors associated with alternative commuting modes of travel (vanpool, carpool, transit, bicycling, express buses) can explain and provide information on their programs.

- NIH TRANSHARE Program - Currently, there are 3,971 employees participating in this program. NIH employees now receive up to $100.00 per month in transit subsidy funds.

- Carpool Program - There are currently 380 registered carpools accounting for over 760 NIH employees on the NIH campus. Carpool parking spaces are maintained in close-in parking lots and are reserved until 9:30 a.m. For individuals participating in vanpools, reserved parking spaces are set-aside in their lot of choice. Vanpoolers are eligible to participate in the NIH TRANSHARE Program to subsidize their commuting costs.

- Ridematching Program - employees are provided with a list of other people who are also looking to participate in the program, usually within two business days of their request. The NIH ETSO is very active in promoting and facilitating this program through the maintenance of an accurate database of all participants.

- Guaranteed Ride Home Program - NIH participates in this program, which is sponsored by the Metropolitan Washington Council of Governments. The program guarantees commuters, who regularly carpool, vanpool, bike, walk or take transit to work, a reliable ride home when they need to work overtime, or another unexpected reason to leave work arises. The ride, using a taxi or other transit, is free to the user.

- Alternative Work Schedule Program - NIH offers an alternative work schedule program, which allows some NIH employees the opportunity to work a four day schedule each week.

- Telecommuter Work Program - Some NIH employees are given the opportunity to work from home one day a week, maintaining contact with their office via fax machine, e-mail, and telephone.

- Campus Radio Station - A new radio station disseminates real time information about traffic conditions on, and in the vicinity of, the Bethesda campus.

- NIH Shuttle System - NIH has its own comprehensive shuttle system, which provides regular service to the whole campus and to most of its off-campus work locations.

- NIH Express Bus Routes - NIH has implemented several express bus routes which link the Bethesda campus directly to the Milestone Park & Ride Lot in Germantown, MD, the Lake Forest Park & Ride Lot in Gaitherburg, MD, and the New Carrollton Metro Station in Prince George's County, MD. These express buses operate during the morning and evening rush periods.

- Off-Campus Satellite Parking - There are currently 575 spaces available to NIH employees at off-campus, satellite locations. Employees can park for free at these locations and then either ride Metrorail or a free shuttle bus to the campus, depending upon the location.

- Managed Parking Facilities - For those employees who must drive to work, a parking management company has been utilized to assist in parking employees and visitors to the NIH campus. This allows for increased efficiency in the utilization of several parking facilities on campus. The managed parking also discourages illegal or lengthy parking and enhances the security of the parking areas.

- Paid Visitor Parking - NIH has implemented paid visitor parking on the Bethesda campus to discourage employees from parking in visitor parking spaces.

- Construction Contractor Employee Parking - Construction is underway at NIH on a nearly continuous basis. All construction contractor employees must either park on the campus in available visitor spaces or at off-campus lots. NIH maintains a satellite lot at Pooks Hill for the exclusive use of contractors.

- TMP Monitoring - The NIH ETSO monitors the effectiveness of existing TMP measures and activities on a continuing basis. Monitoring includes semiannual traffic counts at the NIH entrances to confirm continuing conformance to the MOU. ETSO also periodically surveys or maintains records on the usage of alternative travel modes such as public transit and the NIH shuttle.

5.3.5 Existing And Projected NIH Trip Generation

Additional information on existing and projected traffic and parking conditions at the NIH Bethesda campus are provided in Master Plan Transportation Report for the NIH Main Campus. Details are given for existing traffic surveys, NIH and background vehicle trip generation, intersection turning movements and Critical Lane Volume (CLV) methodology, and other analytical support materials. Analytical procedures for traffic projections follow the County Local Area Transportation Review (LATR) methodology.

Traffic is monitored semiannually at NIH to determine conformance with MOU conditions, assess the effectiveness of NIH TMP measures, and provide base information on traffic patterns at NIH entrances and within campus. Counts of traffic are made in the Spring (generally April or May) and Fall (generally September or October) as recommended in the Traffic Volume Control Station Report, Montgomery County Division of Traffic Engineering, 1990. Traffic volumes counted on a typical weekday during these periods are close to, or representative of, the average traffic volume for the year during the AM and PM peak hours.

The semiannual traffic survey monitors traffic at each NIH entrance and selected intersections around the campus periphery. Traffic is monitored continuously for up to seven days using 24-hour automatic machine counters at each entrance in operation. In addition, AM peak period (6:30 AM to 9:30 AM) and PM peak period (3:30 PM to 6:30 PM) traffic counts may be made visually at all NIH perimeter intersections when circumstances dictate. The visual survey monitors or counts all vehicle movements, i.e. through and left and right turns.

NIH trip generation is defined as the number of vehicles that pass through the campus entrances in both directions. All vehicles are counted regardless of whether they are driven by NIH employees or not. Data for trip generation is based on the automatic machine counts recorded in the semiannual traffic surveys. The AM and PM peak hour NIH trip generation is of primary interest as a measure for conformance to the 1992 MOU.

Data for past, present, and future NIH trip generation for the AM and PM peak hours are shown in Tables 5-9 and 5-10 respectively. Data shown in the Tables for 1992 MOU reflect conditions prior to implementation of NIH TMP measures and signing of the MOU. In January and March 1992, traffic volumes were counted at ten NIH entrances for the peak traffic hour (William N. Natcher Building, Site Access and Area Highway System Analysis, Barton-Aschman, Assoc. 1992). Additional survey counts were made in August to establish the baseline traffic conditions for implementation of the MOU (Traffic Monitoring Program Base Condition Surveys, Barton-Aschman, Assoc., 1992). Since the baseline survey was conducted in August, when many employees are on vacation, the data in for 1992 MOU conditions probably underestimated the baseline traffic flows.

Prior to September 2001, NIH had 11 entrances with bi-directional traffic. The 2003 MOU column in the tables reassigns the 1992 MOU trips to the post September 2001 entrance configuration. Further changes in the entrance configuration will occur with the construction of the Commercial Vehicle Inspection facility and Gateway Visitor Center. The 2020+ MOU data redistributes arriving commercial and visitor traffic to the ultimate Master Plan entrance configuration. The 2003 and 2020+ MOU reference trip generation is subsequently used in the intersection congestion traffic analysis (see Section 5.3.7).

Data from the November 2000 survey are given as a reference to show monitored conditions prior to September 2001. Until then, NIH still had eleven entrances with free access. Most of the decline in NIH entrance trips between 1992 and 2000 occurred along Old Georgetown Road. A lesser drop was

ENTRANCE		AM PEAK HOUR (7:30 - 8:30 AM)					
		1992 MOU	NOV 2000	OCT 2003	2003 MOU	2020+ MP	2020+ MOU
Rockville Pike entrances							
Center Drive	IN	1,068	604	852	1,026	785	833
	OUT	166	97	58	115	102	166
Gateway Center	IN	---	---	---	---	369	391
	OUT	---	---	---	---	45	72
South Drive	IN	324	255	335	710	530	550
	OUT	59	205	140	423	113	164
Wilson Drive	IN	450	471	564	987	701	745
	OUT	141	149	46	218	114	184
Commercial Vehicle	IN	--	--	--	--	91	97
	OUT	--	--	--	--	--	--
North Drive	IN	426	400	269	49	412	438
	OUT	42	29	5	9	5	9
Subtotal Rockville Pike		2,676	2,210	2,269	3,537	3,267	3,649
West Cedar Lane entrances							
East Drive	IN	180	261	63	--	--	--
	OUT	37	23	49	--	--	--
Garden Drive	IN	79	65	--	--	--	--
	OUT	32	13	--	--	--	--
Zelkova Drive	IN	56	34	--	--	--	--
	OUT	17	7	--	--	--	--
West Drive	IN	548	464	0	0	28	31
	OUT	86	146	0	0	0	0
Subtotal West Cedar Lane		1,035	1,013	112	0	28	31
Old Georgetown Road entrances							
Center Drive	IN	611	347	221	538	914	964
	OUT	81	139	0	0	125	202
South Drive	IN	204	136	898	685	827	876
	OUT	138	62	60	132	0	0
Lincoln Drive	IN	979	565	584	930	0	0
	OUT	164	100	46	66	103	166
Subtotal Old Georgetown Road		2,177	1,349	1,809	2,351	1,969	2,208
Total in		4,925	3,602	3,786	4,925	4,657	4,925
Total out		963	970	404	963	607	963
Total Peak Hour		5,888	4,572	4,190	5,888	5,264	5,888

TABLE 5-9 NIH AM PEAK HOUR TRIP GENERATION.

ENTRANCE		PM PEAK HOUR (4:45 - 5:45 PM)					
		1992 MOU	NOV 2000	OCT 2003	2003 MOU	2020+ MP	2020+ MOU
Rockville Pike entrances							
Center Drive	IN	246	154	75	114	71	187
	OUT	738	570	639	1,375	971	1,262
Gateway Center	IN	--	--	--	--	102	247
	OUT	--	--	--	--	59	78
South Drive	IN	183	176	190	648	99	168
	OUT	240	203	397	460	420	539
Wilson Drive	IN	138	90	41	140	63	168
	OUT	963	427	511	798	535	697
Commercial Vehicle	IN	--	--	--	--	8	20
	OUT	--	--	--	--	--	--
North Drive	IN	63	89	0	0	37	99
	OUT	168	104	126	133	33	44
Subtotal Rockville Pike		2,739	1,813	1,979	3,668	2,398	3,509
West Cedar Lane entrances							
East Drive	IN	18	94	2	--	--	--
	OUT	124	100	2	--	--	--
Garden Drive	IN	27	29	--	--	--	--
	OUT	123	103	--	--	--	--
Zelkova Drive	IN	16	34	--	--	--	--
	OUT	90	70	--	--	--	--
West Drive	IN	89	78	0	0	8	20
	OUT	314	326	0	0	0	0
Subtotal West Cedar Lane		801	834	4	0	8	20
Old Georgetown Road entrances							
Center Drive	IN	316	158	43	280	82	216
	OUT	653	356	0	443	770	1,002
South Drive	IN	100	50	79	140	75	197
	OUT	364	24	420	266	0	0
Lincoln Drive	IN	126	177	38	0	0	0
	OUT	673	512	596	975	636	828
Subtotal Old Georgetown Road		2,232	1,277	1,176	2,104	1,563	2,243
Total in		1,322	1,129	468	1,322	545	1,322
Total out		4,450	2,795	2,691	4,450	3,424	4,450
Total Peak Hour		5,772	3,924	3,159	5,772	3,969	5,772

TABLE 5-10 NIH PM PEAK HOUR TRIP GENERATION

experienced along Rockville Pike while trips through the portals along West Cedar Lane remained relatively constant. Overall, the number of AM peak hour trips declined from 5,888 in 1992 to 4,572 in 2000, or 22 percent. Similarly, the overall PM peak hour entrance trips dropped from 5,772 to 3,924, or 32 percent. The principal TMP measure leading to the reductions has been the TRANSHARE program, which provides subsidies to employee participants to partially offset fare costs.

The October 2003 survey data represent a new existing baseline under the new access conditions. As expected, the 2003 survey shows a significant transfer of portal trips from closed entrances on West Cedar Lane to Rockville Pike and Old Georgetown Road. Overall, peak hour trips continued to decline between November 2000 and October 2003, particularly in the minority or reverse peak direction movements, outbound in the morning, inbound in the afternoon. The total 2003 AM and PM peak hour volumes fell to 4,190 and 3,159, respectively. About half of the minority direction peak hour trips in 2003 were identified as non-employee trips, i.e. visitors, buses, trucks, and NIH shuttle. Since 1992, NIH trip generation rates have declined at a greater rate than the absolute trip counts because of an increase in campus population as noted below:

	TRIPS	EMPLOYEES	TRIP/EMPLOYEE
AM PEAK HOUR			
1992 MOU	5,888	16,325	0.36
Nov 2000	4,572	17,600	0.26
Oct 2003	4,190	17,511	0.24
PM PEAK HOUR			
1992 MOU	5,772	16,325	0.35
Nov 2000	3,924	17,600	0.22
Oct 2003	3,159	17,511	0.18

Past studies have revealed that the times for peak NIH trip generation are not concurrent with those for the NNMC, and Bethesda CBD or general background traffic, and this was true in October 2003. The 2003 AM and PM peak hours for NIH traffic were 7:30 - 8:30 AM and 4:45 - 5:45 PM, respectively. The corresponding peak hours for overall system or background traffic were 8:00 - 9:00 AM and 5:00 - 6:00 PM, respectively.

The values in Tables 5-9 and 5-10 show peak NIH trip generation, and are greater than those experienced during the peak system hours. For example, the AM and PM peak hour NIH trip generation for the hours starting at 8:00 AM and 5:00 PM are 3,175 and 2,984, respectively. The latter are used in traffic and intersection analysis shown in subsequent sections to meet M-NCPPC Local Area Transportation Review criteria and guidelines for traffic analysis.

The NIH AM peak hour trip generation is higher than the PM peak hour because arrivals are more concentrated over time than departures. A great majority of employees start work at either 8:00 AM or 8:30 AM. Separate studies indicate that visitor arrivals are high at this time. Departures are dispersed over a greater interval with counts between 1,500 and 2,000 as late as 6:30 PM to 7:30 PM.

Projected Master Plan NIH generated trips were estimated by applying October 2003 trip generation per employee rates to a projected campus population of 22,000. This assumes that the TMP would continue at the same rate of effectiveness. Adjustments were made to reflect changes in access. The West Drive entrance would be converted to a one-way inbound entry point for the exclusive use of clinical center patients and their visitors. On Old Georgetown Road, South and Lincoln Drives would operate as one-way pairs. On Rockville Pike, two new entrances, one for a commercial vehicle inspection facility and one for the visitor center, would be added to the existing portals. Departures for this traffic would be via any of the other available entrances.

Under Master Plan conditions with a campus employee population of 22,000, the total AM and PM peak hour portal trips are projected to be 5,266 and 3,975, respectively. Both volumes are less than the 1992 MOU trip counts. Under the No Action Alternative, the total number of NIH AM and PM peak hour vehicle trips would increase to an estimated 4,274 and 3,222, respectively.

NIH would therefore meet the MOU criteria for holding peak hour trip generation below 1992 levels. It should be noted that NIH can meet the MOU peak hour trip generation criteria with 22,000 employees as long as the AM peak hour trip generation rate is 0.268 (5,888/22,000) or less, and the PM peak hour rate is 0.262 (5,772/22,000).

The direction from which NIH generated traffic approaches the campus during the AM peak period is shown in (Table 5-11. Slightly more than half the vehicles approach the campus from the north via Rockville Pike and Old Georgetown Road. It is inferred from information about employee home zip codes that a large percentage of these drivers are using I-270 or the Beltway to reach the campus from upper Montgomery County and counties to the north as well as Prince George's County and Virginia. Analysis of the data indicates NIH employees choose the most efficient route to their ultimate campus destination. Route decisions are made some distance from the campus and the access route in the vicinity of the campus is the most direct to a desired parking area. Few employees traverse two sides of the campus on their approach route.

Comparison of data for 1992 and 2003 shows no substantive difference in the direction employees approach the campus. Since the absolute number of trips decreased between 1992 and 2003, all of the percentage values for the latter year represent decreases in approach volumes, except for Cedar Lane. The Cedar Lane increase is probably attributable to those employees who are traveling westbound on the Beltway to the campus from points to the east. They are leaving the Beltway at Connecticut Avenue, one exit early, instead of the Rockville Pike interchange to avoid congestion at the latter. The percentage as well as absolute declines in the number of drivers approaching from the south on Rockville Pike and Old Georgetown Road are most likely due to a high proportion of them switching to transit, particularly the Red Line.

Campus census data for 2000 indicated that 630 NIH employees live in zip code area 20817. The zip code area generally covers an area west of the campus that is inside the Beltway, although it extends to Bradley Boulevard beyond the Beltway on the west side. These employees account for nearly all the NIH generated traffic traveling to and from the west of the campus via Lincoln Street, Greentree Road, and Oakmont Avenue. The estimated NIH generated peak hour traffic on these three streets combined is about 140 to 155 vehicles. The total combined AM and PM peak hour traffic volumes on these streets in the October 2003 traffic survey were 1,236 and 1,090, respectively.

5.3.5.1 Commercial Vehicle Traffic

Commercial vehicle arrivals were counted at the visitor vehicle inspections over a three day period between 7:00 AM and 7:00 PM in July 2003. A total of 1,418 vehicles, or an average of 473 per day, were inspected. They represented 65 different service companies or organizations that arrived during the monitoring period (Table 5-12). The peak recorded hourly volume during the three day survey was 83, which occurred between 9:15 AM and 10:15 AM. Commercial vehicles arrive as early as 5:00 AM. Arrival volumes were evenly split between the Old Georgetown Road and Rockville Pike visitor entrances.

Location and Approach Direction	Percentage of Drivers Using Approach Direction	
	1992	2003
Rockville Pike - southbound at Cedar Lane	27	28
Old Georgetown Road - southbound at Cedar Lane	24	23
Old Georgetown Road - northbound at Lincoln Drive	13	7
Jones Bridge Road - westbound at Rockville Pike	12	12
Cedar Lane - westbound at Rockville Pike	10	18
Rockville Pike - northbound at Jones Bridge Road	10	7
Lincoln Drive - eastbound at Old Georgetown Road	2	0.2
Greentree Road - eastbound at Old Georgetown Road	1	4
Oakmont Avenue - eastbound at Old Georgetown Road	1	0.8
Total	100	100

TABLE 5-11 NIH EMPLOYEE VEHICLE ROUTES TO BETHESDA CAMPUS.

Commercial vehicle traffic includes that related to construction. Construction traffic can vary from no or a few vehicles on a given day to short term heavy volumes. Examples of periodic high volume construction traffic include transport of earth excavation or fill material, and delivery of concrete, masonry and steel during building construction. Construction traffic accounted for 180 of the commercial vehicle arrivals, or nearly 13 percent. Of these, 66 were trucks carrying asphalt for a maintenance paving project.

Cars, SUVs, as well as small vans, panel trucks, and pickup trucks comprise 45 percent of the commercial traffic. The remainder are larger, two to four axle vans and trucks, but four axle trucks, semis and flat beds, account for less than three percent of the total traffic. The Building 10 Clinical Research Center complex was the destination for more than one third of the general commercial traffic. Nearly 10 percent were making multiple stops or providing services throughout the campus.

Most of the commercial traffic makes a single daily, weekly, or monthly trip to the campus. The 1,209 vehicles counted during the three day survey represented 650 different business organizations. Only a

HOUR BEGINNING	COMMERCIAL VEHICLES	HOUR BEGINNING	COMMERCIAL VEHICLES
7:00 AM	48	1:00 PM	51
8:00 AM	54	2:00 PM	36
9:00 AM	73	3:00 PM	26
10:00 AM	59	4:00 PM	11
11:00 AM	54	5:00 PM	6
Noon	51	6:00 PM	3

TABLE 5-12 AVERAGE HOURLY COMMERCIALVEHICLE ARRIVALS IN 2003.

small proportion of the general commercial traffic makes multiple visits to the campus on a daily or frequently repeated basis. Five services account for about 18 percent of the average daily general commercial volume of 473 vehicles, as follows:

- Express and courier service 49
- Cafeteria/catering supply 11
- Computer/communications maintenance/service 9
- Trash and recycled material collection 8
- Government moving vans 7

It is estimated that most of the cafeteria food supply arrives prior to 7:00 AM.

5.3.5.2 Visitor Vehicle Traffic

A three day count of general visitor traffic undergoing arrival inspections was made in July 2003. An average of 2,357 such visitors arrived per day between 7:00 AM and 7:00 PM (Table 5-13). The peak arrival hour occurred between 8:00 AM and 9:00 AM when the average number of arriving vehicles was 305. Hourly arrival volumes in the morning hours are relatively constant with the exception of the peak hour. Volumes decline steadily in the afternoon as the day progresses. The visitor vehicle mix is composed of light duty vehicles (cars, SUVs, passenger vans, and pickup trucks) exclusively. About 60 percent entered the campus at South Drive on Rockville Pike with the remainder entering at Center Drive from Old Georgetown Road. Visitors may depart by any available exit.

The counted visitor traffic does not include NIH employee visitors who work at off campus locations and visit the campus on business. The general visitor mix has many components. Three types of visitors are travelling to the Clinical Research Center. In 2002, there were 74,364 outpatient visits for one day clinical tests. If it is assumed that all arrive by vehicle, then this is an average of 295 per work day. There were also 7,494 inpatient hospital admissions, or an average of nearly 30 per work day. Based on an average stay of 7.6 days there were 225 inpatients in the hospital at any one time. The third type of CRC-related traffic is family and friends visiting inpatients.

5.3.5.3 Average Passenger Occupancy and Modal Split

Average Passenger Occupancy (APO) and Modal Split are transportation analysis parameters. APO is the average number of occupants per vehicle. Various modal means of transportation such as car, bus, rail transit, bicycle, and walking are available. A modal split is the proportion of a population that uses each transportation mode. The existing NIH Bethesda APO and modal splits were derived or estimated for the AM site entrance traffic peak hour because the best data were available for this period from various field surveys and data records.

HOUR BEGINNING	VISITOR VEHICLES	HOUR BEGINNING	VISITOR VEHICLES
7:00 AM	263	1:00 PM	199
8:00 AM	305	2:00 PM	165
9:00 AM	263	3:00 PM	128
10:00 AM	261	4:00 PM	112
11:00 AM	268	5:00 PM	104
Noon	213	6:00 PM	76

TABLE 5-13 AVERAGE HOURLY VISITOR ARRIVALS IN 2003.

The campus traffic survey completed in October 2003 counted the number of vehicles entering or inbound to the campus for various periods as shown below:

Time	Vehicles
AM Peak Hour (7:45 AM - 8:45 AM)	3,786
AM Peak Period (6:30 AM - 9:30 AM)	10,052
Daily (6:30 AM - 7:30 PM)	17,050

The number of vehicles arriving before 6:30 AM or after 7:30 PM is relatively small. The counts include all vehicles: employee vehicles, commercial vehicles, NIH shuttles, and visitors. AM peak hour traffic comprises about 38 percent of the AM peak period traffic, and about 22 percent of the daily inbound traffic. The computed APO for vehicles entering the campus through entrance checkpoints is 1.09 based on the following:

Mode	Number of Vehicles	Average Occupancy	Occupants
Single Occupant Vehicle (SOV)	3,690	1	3,690
High Occupancy Vehicle (HOV)	75	2	152
Vanpool	5	10	50
NIH Shuttle	15	16.1	242
	3,786		4,134

HOV and vanpool volumes were derived from the number of employee parking permits and registered participants for these vehicles. It was assumed that 38 percent of them would arrive during the peak hour following the overall campus inbound trip pattern. NIH shuttle trip counts were obtained directly from published schedules. Only those shuttles that had routes external to the campus were included. SOV volumes were determined by subtracting the other three mode volumes from the peak hour total. Shuttle occupancy was derived from monthly ridership data, and assumed that 22 percent of the arriving workday riders on each route came during the peak hour.

The computed APO is an underestimate in that it is assumed all non-employee traffic is in single occupant vehicles, that HOV vehicles have minimum occupancy, and that there are additional employees who Rideshare, but do not necessarily park in HOV assigned spaces.

The modal split covers all transportation modes, and is determined on a population rather than vehicle basis. The computation for the NIH modal split carries the APO estimates forward, and adds those who use non-vehicle modes. The estimated peak hour modal split is:

	Peak Hour Arrivals	Percent by Mode
Single Occupant Vehicle (SOV)	3,690	61.9
Transit	1,497	25.1
NIH Shuttle	242	4.1
High Occupancy Vehicle (HOV)	202	3.4
Pedestrian	189	3.2
Bicycle	54	0.9
Vanpool	50	0.8
Kiss and Ride	34	0.6
	5,958	100.0

Transit share is based on the percentage of the campus population that is enrolled in the campus TRANSHARE program. It represents both bus and Metrorail use, but may be an underestimate, since WMATA ridership surveys indicate the AM peak hour passenger exits from the Metrorail station alone are about 1,800. Pedestrian and bicycle arrivals are based on a one-time survey that extended from 7:30 AM to 9:30 AM.

5.3.6 Existing and Projected Traffic

Tables 5-14 and 5-15 show 1993, existing, and projected AM and PM peak hour traffic volumes, respectively. Data for 1993 is shown. More detailed information on turning movements and intersection configurations are given in Appendix G.

The existing volumes are those counted by intersection turning movement surveys taken in January 2004. Traffic was monitored throughout the AM and PM peak periods over a three day period with different intersections covered each day. The raw counts were aggregated into 15 minute totals, and the four highest consecutive totals summed to determine the peak hour. The surveys reveal complex peak period traffic patterns. The NNMC, NIH, and Bethesda CBD each produce peak hourly traffic at separate times within the overall three hour long peak period. Peak overall (NIH & background) hourly traffic volumes and subsequent congestion, occur at different times at different road links and intersections. The overall system AM or PM peak traffic hours are 8:00 AM to 9:00 AM, and 5:00 PM to 6:00 PM, respectively. These times are not concurrent with the NIH AM or PM peak hour traffic generation.

Comparison of 1993 and 2004 traffic indicates a decrease in traffic volumes on many roads links, but it should be noted that traffic volumes on Rockville Pike and Old Georgetown Road were 20 to 30 percent higher in the intervening years. This fluctuation is attributable to changes in background traffic, since the NIH trip generation semiannual surveys show declines from survey to survey. The changes in traffic flow on West Cedar Lane reflect the closing of the NIH entrances on that street after September 2001.

The 2003 MOU traffic volumes represent conditions that would currently exist if NIH had maintained its 1992 trip generation, and had not reduced trips through its TMP program. The 2003 MOU traffic volumes are equal to the 1992 NIH generated peak hour traffic (5,888 vehicles in AM peak hour; 5,772 vehicles in PM peak hour) superimposed on existing 2003 background or non-NIH traffic. The 1992 NIH traffic has been redistributed among the campus entrances to account for recent access changes. The 1992 MOU and 2003 MOU columns in Table 5-8 show the redistribution. NIH generated trips were redistributed on the peripheral road network in a corresponding manner. Traffic survey conditions are compared to the MOU reference conditions to determine potential impacts.

Analysis for future traffic projections was based on M-NCPPC Local Area Transportation Review (LATR) procedural guidelines. Projections include both NIH and background traffic. Projections for future growth in background traffic were generated from information, provided by M-NCPPC staff, that is based on potential commercial and residential projects to the north of the campus and to the south in the Bethesda CBD. The estimated future background trip generation accounts for the traffic generated by the future addition of 3.37 million square feet of commercial and office space and 3,746 dwelling units planned for the Bethesda CBD. Only the estimated proportion of this traffic that will use the Rockville Pike and Old Georgetown Road corridors was included in the analysis. Similarly, the analysis accounts for a 90,000 sf expansion of Federation of American Science for Experimental Biology facility and 99 dwelling units in the area between the campus and the I-495 Beltway to the north. The background traffic projections assume all this development growth will occur, but no specific year is assigned to the projection. It was assumed that the National Naval Medical Center would maintain its current trip generation level.

Link		1993 Counts	2003 MOU REF	Jan 2004 Count	2020+ MOU REF	2020+ MP ALT	2020+ NA ALT
Rockville Pike (North of Cedar Lane.)	NB SB	1232 2973	1821 3396	1552 2662	2029 4231	1847 3689	1808 3452
Rockville Pike (South of Cedar Lane.)	NB SB	1237 3321	1771 4477	1467 3627	2088 5819	1882 5173	1846 4889
Rockville Pike (N. of Jones Bridge Road.)	NB SB	1273 2007	1225 2433	1102 2486	1849 3725	1690 3565	1634 3515
Rockville Pike (S. of Jones Bridge Road)	NB SB	1466 2414	1287 2873	1170 2754	1797 3898	1687 3105	1642 3093
Wisconsin Avenue (S. of Woodmont Avenue)	NB SB	1142 1679	1285 1755	1199 1654	1797 2742	1700 2715	1662 2710
Cedar Lane (East of Rockville Pike)	EB WB	214 1194	333 1307	298 1181	467 1789	442 1716	438 1684
West Cedar Lane (West of Rockville Pike)	EB WB	164 801	475 318	475 318	607 400	571 394	555 392
West Cedar Lane (E. of Old Georgetown Rd)	EB WB	532 398	432 393	432 393	567 393	546 393	509 393
Old Georgetown Rd. (N. of West Cedar Lane.)	NB SB	1139 3114	1088 3346	1000 2695	1531 4075	1393 3702	1370 3510
Old Georgetown Rd. (North of South Drive)	NB SB	1281 3018	1202 3451	1114 2800	1722 4106	1567 3737	1537 3575
Old Georgetown Road (South of Lincoln Drive)	NB SB	1297 2679	1205 1907	1033 1889	1607 2752	1469 2704	1411 2696
Old Georgetown Rd. (S. of Huntington Pkwy)	NB SB	847 2182	968 1984	894 1970	1377 2794	1295 2770	1262 2766
Greentree Road (W. of Old Georgetown Rd)	EB WB	512 205	648 225	535 214	595 244	538 223	512 221
Huntington Pkwy. (W. of Old Georgetown Rd)	EB WB	434 270	523 209	425 205	519 247	461 227	436 217
Jones Bridge Road (E. of Rockville. Pike)	EB WB	556 1401	482 1287	424 1022	519 1278	457 1104	448 1028
Woodmont Avenue (W. of Wisconsin Avenue)	SB NB	1214 359	1119 419	1101 388	1156 418	1122 404	1116 397

EB = eastbound NB = northbound MP ALT = Master Plan Alternative
WB = westbound SB = southbound NA ALT = No action Alternative

TABLE 5-14 1993, EXISTING, AND PROJECTED <u>AM</u> PEAK HOUR TRAFFIC ON ROADS SERVING NIH BETHESDA.

Link		1993 Counts	2003 MOU REF	Jan 2004 Count	2020+ MOU REF	2020+ MP ALT	2020+ NA ALT
Rockville Pike (North of Cedar Lane.)	NB SB	3811 1315	3862 2056	3270 1732	4381 2543	4057 2236	3906 2199
Rockville Pike (South of Cedar Lane.)	NB SB	4130 1428	4391 2212	3731 1842	5400 2998	5010 2612	4829 2566
Rockville Pike (N. of Jones Bridge Road)	NB SB	2913 1399	2876 2433	2756 1524	4157 2533	3983 2389	3927 2339
Rockville Pike (S. of Jones Bridge Road)	NB SB	2623 1452	2418 1781	2241 1695	3501 2638	3433 2543	3422 2498
Wisconsin Avenue (S. of Woodmont Avenue)	NB SB	2035 802	1834 1081	1682 1031	2942 1879	2828 1813	2872 1782
Cedar Lane (E. of Rockville Pike)	EB WB	1207 332	1219 344	1151 298	1790 613	1726 572	1696 567
West Cedar Lane (W. of Rockville Pike)	EB WB	1040 371	817 315	817 315	953 340	910 333	905 331
West Cedar Lane (E. of Old Georgetown. Rd)	EB WB	468 580	734 456	734 456	878 470	837 470	824 470
Old Georgetown Rd. (N. of West Cedar Lane.)	NB SB	2674 1509	2688 1440	2178 1300	3631 2086	3276 1883	3310 1851
Old Georgetown Rd. (North of South Drive.)	NB SB	2882 1581	2909 1376	2399 1236	3944 1984	3572 1805	3404 1784
Old Georgetown Rd. (South of Lincoln Drive)	NB SB	2294 1632	1871 1552	1740 1397	2670 2184	2598 2058	2587 2000
Old Georgetown Rd. (S. of Huntington Parkway)	NB SB	2062 1234	1854 1324	1785 1258	2695 1915	2654 1852	2647 1823
Greentree Road (W. of Old Georgetown. Rd.)	EB WB	246 522	279 560	263 508	304 604	272 553	268 529
Huntington Pkwy. (W. of Old Georgetown. Rd.)	EB WB	471 531	319 530	257 441	280 574	248 510	244 481
Jones Bridge Road (E. of Rockville Pike)	EB WB	1127 1067	1529 609	1066 558	1476 683	1198 587	1068 576
Woodmont Avenue (W. of Wisconsin Avenue)	SB NB	724 677	700 589	669 564	760 564	730 555	716 555
EB = eastbound WB = westbound	NB = northbound SB = southbound			MP ALT = Master Plan Alternative NA ALT = No action Alternative			

TABLE 5-15 1993, EXISTING AND PROJECTED PM PEAK HOUR TRAFFIC ON ROADS SERVING NIH BETHESDA.

Three future NIH traffic projections were analyzed: the Master Plan and No Action Alternative, and the future MOU reference case. All three were superimposed on the same background traffic. The Master Plan Alternative projections add and disperse the traffic generated by a campus population of 22,000 using the January 2004 trip per employee generation rate. This assumes that future NIH TMP would continue with the same efficiency as in 2003.

The No Action Alternative is based on two percent growth in NIH campus population and related traffic. Comparison of Master Plan and No Action Alternative traffic data is indicative of potential traffic impacts associated with Bethesda campus population growth from 17,900 under the No Action Alternative to the 22,000 under the Master Plan Alternative. The MOU reference traffic volumes are those that would be present if NIH had not adopted its Transportation Management Program.

Most of the growth in future traffic volumes will be due to background traffic growth. This can be seen by comparing the 2003 and 2020+ MOU reference traffic volumes, which differ only in background volumes.

Once one is beyond the periphery of the campus, Master Plan Alternative link volumes are less than the MOU reference traffic levels on all roadways radiating away from the campus. The effects of maintaining NIH traffic generation below 1992 MOU levels, therefore, does not extend to roads and intersections beyond the area studied.

5.3.7 Intersections/Congestion

The level of congestion at an intersection is related to traffic volumes, signal phasing, number of lanes, and traffic movements permitted on each approach lane. Congestion increases as the volume of traffic approaches capacity. One widely used methodology for evaluating congestion is the Critical Lane Volume (CLV) method (Highway Capacity Manual, National Academy of Engineering Transportation Research Board, 2000). This method analyzes the intersection variables to establish a single number representative of the relative level of congestion.

The Montgomery County Annual Growth Policy (AGP) divides the County into some 25 transportation policy areas when independent cities are included. NIH Bethesda and all the intersections studied are located within the Bethesda-Chevy Chase policy area, which is coincident with the B-CC planning area. The Bethesda CBD policy area is located immediately to the south of the campus, and the Old Georgetown Road and Rockville Pike intersections with Battery Lane are in this area. The AGP establishes acceptable levels of congestion in each policy area in terms of intersection CLV. The CLV standards that have been adopted in the FY 2003 AGP for the Bethesda-Chevy Chase and Bethesda CBD policy areas are 1,600 and 1,800, respectively.

One of the goals of the MOU is that, as NIH undergoes further campus development, the level of congestion on roadways and at intersections serving NIH should be no worse than if the development did not occur. Intersection congestion will increase even if NIH maintains a constant number of site generated trips because of growth in background traffic. A comparative measure of congestion is needed to reflect this condition that changes with time. An "MOU intersection congestion impact" is defined as occurring if :

- The Critical Lane Volume of an intersection during either the AM or PM peak hour is higher for the Master Plan Alternative than the concomitant MOU reference condition and

- The Master Plan Alternative Critical Lane Volume is higher than the Montgomery County threshold value of 1,600 for acceptable congestion in the Bethesda-Chevy Chase area.

An intersection congestion and capacity analysis was conducted for each intersection around the NIH Bethesda campus, using the County LATR CLV methodology. Since NIH will maintain peak hour trip counts at or less than the MOU reference level of 1992, only those intersections adjacent to the campus can potentially be MOU intersections. They may be impacted by redistribution of NIH generated trips among the NIH entrances due to redistribution of internal campus parking. All intersections beyond the periphery of the campus will have contributions from NIH traffic less than or equal to that contributed by NIH in the 1992 MOU traffic surveys.

Computed critical lane volumes for intersections in the vicinity of the campus are shown in Table 5-16 and Appendix G. The analysis for existing conditions was completed using traffic counts and turning movements as monitored in the January 2004 traffic survey as well as the existing intersection configuration.

The analysis for future conditions incorporates anticipated near term NIH and County changes in intersection operations or improvements. They include:

- Lincoln Drive/Old Georgetown Road - Change the NIH Lincoln Drive entrance from two lane, two way operation to two lanes, one way outbound at the intersection.
- South Drive/Old Georgetown Road - Change South Drive from two lanes outbound, one lane inbound operation to two lanes inbound at the intersection.
- West Drive/West Cedar Lane - Change West Drive from normally closed to one lane one way inbound.
- North Drive/Rockville Pike - Change North Drive outbound lane from left turn - right turn operations to right turn out only. Eliminate the left turn movement from northbound Rockville Pike into North Drive.
- Commercial Vehicle Inspection Facility/Rockville Pike - Add new right turn in only entrance on southbound Rockville Pike opposite to the NNMC north entrance between North Drive and Wilson Drive.
- Jones Bridge Road/Rockville Pike - After consultation with the Montgomery County DPW&T, County proposed second exclusive left turn lanes were added to southbound Rockville Pike, and to westbound Jones Bridge Road.

In general, overall existing congestion at intersections around the periphery of NIH is less than what was in 1993. The Critical Lane Volume exceeded 1,600 at six intersections in 1993 during at least one peak hour. In 2004, only one intersection, Rockville Pike at Cedar Lane, had a CLV above 1,600. Since background traffic has increased, the reduction in congestion over the interim decade is attributable to a reduction of over 2,000 AM peak hour and over 2,300 PM peak hour NIH generated trips during the LATR study times.

Traffic volumes and congestion will increase on all roads around the campus over the next 20 years, even if NIH trip generation remains unchanged. This is indicated in Table 5-16 by a comparison of 2004 and future MOU reference conditions, where NIH trip generation is held constant. The increased congestion is due to growth in background or non-NIH traffic. Projects that would add about 10,000 jobs and 2,000 residential units to the Bethesda CBD and Friendship Heights were in the development process pipeline in 2002 (County FY 2003 Annual Growth Policy). Similarly, pipeline projects in the North Bethesda and White Flint policy areas were expected to add another 10,000 jobs and more than 2,300 residential units.

The No Action Alternative CLV values indicate the effects of future background traffic growth. Under this alternative, NIH generated traffic is increased by only two percent from existing levels, and while some minor shifting of NIH commercial and visitor traffic from Old Georgetown Road to Rockville Pike

INTERSECTION	1993	2004 MOU REF	EXISTING JAN 20004	FUTURE MOU REF	FUTURE MASTER PLAN	FUTURE NO ACTION
Old Georgetown Road @ West Cedar Lane	1611/1690	1538/1591	1298/1402	1835/2026	1698/1864	1638/1795
Old Georgetown Road @ Center Drive	1266/1421	1114/1355	947/988	1469/1892	1197/1560	1172/1452
Old Georgetown Road @ South Drive/Greentree Road	1651/1383	1398/1280	1162/998	1447/1417	1370/1227	1342/1189
Old Georgetown Road @ Lincoln Drive	1211/1430	1157/1417	820/1065	1299/1592	1272/1406	1417/1233
Old Georgetown Road @ Huntington Parkway	1417/1227	1256/1183	1209/1068	1704/1501	1646/1416	1637/1383
Rockville Pike @ Cedar Lane	1683/2154	1947/2054	1614/1973	2540/2592	2283/2404	2169/2339
Rockville Pike @ North Drive*	1380/1776	1616/1498	1299/1223	2106/1828	1864/1643	1759/1597
Rockville Pike @ Commercial Vehicle Insp.* NNMC Entrance	--	---	1104/1386	1806/2079	1614/1934	1531/1867
Rockville Pike @ Wilson Drive	1105/1579	1626/1551	1200/1266	1951/1957	1693/1776	1595/1692
Rockville Pike @ South Drive	1005/1642	1586/1645	1218/1446	1980/2132	1730/1989	1638/1925
Rockville Pike @ Gateway Center*	--	--	--	1424/1617	1340/1529	1318/1498
Rockville Pike @ Center Drive/Jones Bridge	1901/2589	1498/1879	1230/1480	1804/2020	1632/1811	1570/1717
Wisconsin Avenue @ Woodmont Avenue	938/1182	871/988	817/919	1236/1385	1218/1358	1213/1354
West Cedar Lane @ West Drive/Locust Avenue	887/705	CLOSED	CLOSED	537/868	498/813	CLOSED

* Unsignalized
1000/1000 = Critical Lane Volumes (AM Peak Hour/PM Peak Hour)

TABLE 5-16 INTERSECTION CRITICAL LANE VOLUMES.

occurs, most of the increase in future CLV levels is attributable to background traffic. The number of intersections with Critical Lane Volumes above 1600 in at least one peak hour would increase to eight. Six of these intersections are in the Rockville Pike corridor.

The NIH Commercial Vehicle Inspection Facility (CVIF) entrance will be located opposite the north entrance to the National Naval Medical Center (NNMC). Vehicle movements at the CVIF will be limited to right turn inbound. The relatively high CLV at this unsignalized intersection is due to traffic entering and leaving the NNMC. It was assumed that NNMC traffic volumes would remain constant.

The Master Plan Alternative does not add any intersections with Critical Lane Volume greater than 1600 to the No Action total. However, the AM CLV would increase from below 1600 in the No Action case to above 1600 in the Master Plan case at three intersections on Rockville Pike (CVIF, Wilson Drive, and Center Drive/Jones Bridge Road). The CLV is higher during the PM peak hour at each of these intersections. A similar situation would occur at the Rockville Pike/North Drive intersection during the PM peak hour, even though NIH traffic will be limited to right turn in-right turn out at this intersection. The Master Plan Alternative CLV levels assume a 22,000 employee population and full build out of the campus. Actual CLV levels would be intermediate between the No Action and Master Plan values depending on the extent of campus population growth.

The Master Plan CLVs are less than the future MOU reference levels in all cases, and the no MOU intersection congestion impacts are anticipated.

5.3.8 NIH Parking

The number of parking spaces at NIH Bethesda fluctuates continually. Ongoing construction of buildings and utilities adds and deletes spaces or removes access to spaces, on a permanent or temporary basis. The last formal survey of campus parking completed in September 2002, counted 9,700 spaces. The data shown in Table 5-17 advances the baseline conditions to 2003, and accounts for space adjustments due to ongoing construction at the Family Lodge, the new Hatfield Clinical Research Center, and at Building 6.

Employee parking at NIH Bethesda is controlled by several parking space classifications designated by permit. For each classification, NIH employees receive rear view mirror parking tags of a certain color.. All NIH employee spaces are not necessarily available to the entire campus employee population. Preferential employee spaces are set aside for high level administrative and technical personnel whose jobs require immediate space availability particularly during the midday when spaces are at a premium. Reserved spaces are used by fire, police, and emergency response personnel, by official vehicles travelling daily between NIH Bethesda and NIH facilities in Poolesville, Frederick, and Baltimore, and by contractor vehicles. Other spaces are designated for carpools and vanpools, and the handicapped. Remaining NIH employee spaces can be used by NIH employees with general parking permits. Additional spaces are set aside for government interagency carpools, residents who live on the north side of the campus, as well as the many visitors to the campus.

Of 9,356 parking spaces on campus in 2003, only 8,149 were allocated to NIH employees. Of these, only 6,163 were available for general employee use. There were an additional 575 parking spaces reserved for NIH employees at satellite lots. The Mid Pike Plaza lot is connected to the campus by NIH shuttles. Spaces at the Shady Grove and New Carrollton Metro stations are available only for employee transit users. If satellite and on-campus parking are combined, about 8,700 spaces were available to NIH employees in early 2003.

In contrast to many federal facilities, NIH Bethesda attracts a large number of visitors to the campus. This is attributable to the Clinical Center hospital and outpatient facilities, and the dispersion of NIH extramural research administration facilities elsewhere in Montgomery County. Activities lead to an estimated 5,000 daily visits to the campus, when trips to the campus by NIH employees working elsewhere are included. Campus visitor parking has been consolidated at four locations: Lot 4A on the south side of Building 31, MLP-8, Building 45, and under Building 10. Operations have been shifted to managed and pay parking.

Campus parking is continually reported as saturated by periodic parking occupancy surveys dating back to 1989. Parking remains saturated as indicated in the following, which summarizes an occupancy survey that was conducted in April, 2001:

Space Type	Occupancy
General NIH Employee	108.2%
Preferential NIH Employee	98.4
Reserved NIH Employee	70.0
NIH Carpool/Vanpool	99.5
Handicapped	82.6
Visitor/Patient	99.0
Government Vehicle	48.7
Overall	102.0%

Occupancy greater than 100% is achieved through attendant parking, parking in lot aisles, or drivers waiting for an available space.

			Spaces
A. NIH BETHESDA CAMPUS PARKING SPACES BY ASSIGNMENT			
NIH Employee Parking by Permit			
General NIH Employee		6,163	
Preferential NIH Employee		919	
Reserved NIH Employee		238	
NIH Carpool/Vanpool		542	
NIH Handicapped		287	
	Total Employee		8,149
Loading Dock/Service		138	
Government Vehicle, On-Campus Residents, Special Purpose		358	
			496
NIH Visitor			
General Visitor		447	
Patient/Patient Visitor (Clinical Center P3 Lot)		264	
	Total Visitor		711
	Total NIH Bethesda		9,356
B. OFF CAMPUS PARKING			
Mid Pike Plaza (North Bethesda)		400	
Shady Grove Metro (Shady Grove)		150	
New Carrollton Metro (Prince George's County)		25	
	Total NIH Off Campus		575
C. CONSTRUCTION CONTRACTOR PARKING			
Pooks Hill		150	
	Total Employee		150
	Total		10,881

TABLE 5-17 NIH PARKING DATA.

NIH has no authority over employee actions beyond the campus limits. If campus parking demand exceeds supply, the pressure to park off campus in adjacent neighborhoods increases. Reductions in the employee parking ratio must be done cautiously to maintain a balance between employee campus requirements, and County and Federal objectives to control parking on federal sites.

Since 1993, NIH has conducted a vigorous employee awareness program through the campus newspaper. about the importance of avoiding parking in adjacent residential neighborhoods. New employees learn about the situation at monthly TMP orientation meetings, where TMP alternatives such as transit and satellite parking are identified. NIH limits construction contractor parking spaces on the campus, but maintains 150 spaces dedicated to contractor use at Pooks Hill. The current employee parking ratio at NIH Bethesda is 0.47 spaces per employee (8,149/17,511), down from 0.54 in 1995.

In August 2004, just prior to publication of the Draft Master Plan 2003 Update and EIS, NCPC adopted a revised Comprehensive Plan for the National Capital: Federal Elements, that updated the 1989 Comprehensive Plan. The Comprehensive Plan update revised federal facility parking goals and policies in response to regional transportation and air quality conditions. The new policies are influenced by the overall quality of transit services, proximity and cost of commercial parking, guidelines established by local zoning ordinances, and walking conditions. The policies are generalized and based on federal agencies with office functions. The Comprehensive Plan update notes that special consideration will be given to facilities with non-office functions such as laboratories or those employing multiple shifts.

Parking policy in the Comprehensive Plan is given in terms of parking space per employee ratios. The ratios are intended as goals for agencies. A new category for application of parking ratios was established in the Comprehensive Plan Update: Federal facilities in suburban areas within 2,000 feet of a Metrorail station. If a federal building is located within a federal campus or enclave, the applied distance will be that measured between the nearest Metrorail station entrance and the campus or enclave perimeter. The NIH Bethesda campus falls within this category. The applicable parking ratio for the new category is one parking space for every three employees (0.33), down from the old 0.50 ratio that was previously applicable to all suburban federal facilities. Parking for agency visitors, government vehicles, loading, police, emergency vehicles, and other special uses is not subject to the standard.

The updated Comprehensive Plan also notes that, while the agency TMP should be oriented toward attaining the Comprehensive Plan parking ratio goals, the goal for individual agencies will be evaluated independently by NCPC. A final determination of an appropriate ratio goal will be based on the circumstances specific to the facility operational characteristics, site location, and local transportation conditions. The appropriate parking ratio goal should be determined and justified by a detailed analysis and Transportation Management Plan (TMP). The analysis would include an assessment of local transportation system impacts resulting from the vehicle and transit trip generation at the proposed ratio goal.

Montgomery County has taken a different approach for traffic mitigation. Management goals are based on vehicle trip generation. Mitigation is applicable to certain new private commercial development where traffic mitigation agreements are required. The percentage of employee non-driver trips made during the peak traffic period must not be lower than 15 percent, or the percentage of home-based work trips using transit, whichever is greater. The percentage also must not be higher than 55 percent (Montgomery County Growth Policy Resolution for FY 2005, adopted by the County Council in October, 2003). The percentage of non-driver trips applicable to a particular development is determined by its location, availability of transit, available parking, commuting pattern census data, and other factors.

Parameters for traffic management are set by transportation policy area with more stringent criteria in

Central Business Districts, and lesser ones in rural areas. NIH is located in the Bethesda-Chevy Chase policy area outside of the Bethesda CBD policy area.

The Draft Master Plan 2003 Update and its potential impacts in the Draft EIS were based on an 0.50 employee parking space ratio, and the continuation of existing reduced employee vehicle trip generation, which assumes continuation of the current TMP effectiveness. Reduction in the parking ratio goal from 0.50 to 0.33 has a significant effect. It changes Master Plan premises and the assessment of transportation related impacts. For example, the reduction would reduce the number of existing campus employee parking spaces by nearly 3,000 (8,756 at an 0.50 ratio vs. 5,775 at 0.33), when applied to the existing campus population of 17,511. The reduction would not only change the Master Plan itself, but also require reanalysis of projected or future transportation conditions, and consequent traffic noise and air quality impacts. Based on experience gained with the existing NIH Bethesda TMP, a parking ratio goal of 0.33 may not be achievable. Nevertheless, NIH has agreed to work with NCPC and M-NCPPC to complete a revised TMP and determine an appropriate campus employee parking ratio goal.

The projected Master Plan Alternative parking conditions discussed in the following are based on the 0.50 parking ratio in the Draft Master Plan 2003 Update. They have been retained unchanged as a reference point for evaluating future Master Plan and revised TMP conditions and impacts. The values will change depending on the new employee parking space ratio goal that will be established in the revised TMP.

NIH is committed to updating its Master Plan every five years. Revisions to the plan resulting from a new parking ratio goal will be accounted for in the next Master Plan Update. Traffic impacts related to the goal change will be assessed as part of the revised TMP as required by NCPC. Since a lower parking ratio implies a lower employee vehicle trip generation rate, the related future noise and air quality impacts with a parking ratio less than 0.50 will be less than shown in EIS Sections 5.5.2 and 5.6.2.1. These impacts can be reassessed in the updated EIS that will accompany the next Master Plan Update.

Currently, 4,888 of the 9,356 campus spaces are in surface lots and 4,468 are in MLPs or other structure parking, primarily Building 10. Under the Master Plan, the number of surface spaces would be reduced to 1,508, mostly through buffer area removal, while the total number of spaces would increase to 12,249. Of these, about 10,512 would be for employees, for a parking ratio of 0.48. Parking in structures would increase from 4,468 to 10,741 with the construction of all proposed MLPs and structural parking.

The projected number of 2020 Master Plan visitor spaces is 1,237. Of these 350 would be located in a garage at the Visitor Center along Rockville Pike. An additional 160 visitor spaces would be added at MLP-9. The 264 patient visitor spaces under the Clinical Center would be retained. The remainder of the visitor spaces would be interspersed throughout the campus. Government vehicle and loading dock spaces would remain at around 500.

Under the No Action Alternative, future campus parking would be maintained using the criteria of 0.50 spaces per employee based on an ultimate No Action employee population of 18,400, plus six percent of employee spaces for visitors, plus 500 spaces for government and other vehicles, or about 10,000 total spaces. The No Action Alternative includes construction of MLP-9, MLP-10, and the Visitor Center garage, which are either under design or construction. These projects will provide 2,500 additional parking spaces in structure, permitting a concomitant number of surface space removal.

Off campus spaces would vary under both Alternatives as TMP circumstances dictate.

The NIH parking strategy for the future will include a full spectrum of parking options, transportation management measures, and long term solutions. Options for adding spaces when needed are increased stacked parking, temporary surface lots, and new multilevel parking structures (MLPs). These would be implemented in conjunction with increased use of satellite lots, and offset by the gamut of TMP measures such as TRANSHARE, express bus service, carpool/vanpool, and bicycling to maintain alternative mode of travel usage at existing levels.

The pace of reduction in the NIH employee parking ratio is dependent on many factors, some of which are beyond the control of NIH. The NIH has already significantly reduced the number of employee peak period vehicle trips through its TMP program. The NIH TMP program has already achieved the "easy" trip reductions from the 1992 MOU reference traffic levels. A significant portion of the NIH employees who live along the Red Line west leg corridor already use Metrorail and participate in TRANSHARE. About 23 percent of the employees are in the TRANSHARE program.

Achieving and maintaining these ratios is dependent on implementation and enhancement of regional Washington and suburban Maryland facilities and programs, such as HOV lanes on I-495and I-270, new transit facilities such as the "purple line" and the Georgetown trolley, park and ride lots, NIH daily operational exigencies, and availability of Congressional funding for campus parking projects and TMP measures. Under the Master Plan Alternative, no new employee parking spaces would be added to the buffer, and those now in the buffer would be removed. The Visitor Center parking garage will be located in the buffer because it must be outside the security perimeter.

The parking ratio may increase temporarily under several circumstances. New MLPs proposed in the Master Plan range from 350 to 1,520 spaces (MLP-D). A sharp jump in the campus parking ratio will occur in the interval between the MLP opening for service, and the demolition of surface spaces. An MLP of 1,000 spaces, for example, would increase the existing ratio by 0.057 (1,000 spaces/17,511 employees) on the day it opened. The ratio would return to levels below 0.50 with the removal of parking that the MLP replaces, in whole or in part. Funding for parking projects can be difficult to obtain. Proposed MLPs generally replace several surface lots. These lots may not be removed in conjunction with the new MLP because of funding. They also may not be removed simultaneously, but in sequence as funding is obtained. Although the Master Plan calls for MLP construction at sequenced intervals, it is possible that two may be built at the same time. In such a case, the ratio may be affected temporarily by 10 percent or more.

5.3.9 Transit

NIH is located on the Washington Metropolitan Area Transit Authority (WMATA) Red Line of the Washington Metrorail rapid transit system. The line passes NIH in a tunnel and is accessed via the Medical Center station on the east side of the campus on Rockville Pike at South Drive. The station is located underground between South Drive and Jones Bridge Road just to the east of Rockville Pike. On average, approximately 8,200 Metrorail riders board or alight at the station each day based on WMATA ridership surveys. Between 5:30 AM and 9:30 AM, 2,844 riders use the station. Of these, 62 percent or 1,777 arrive at the station on work destination trips (1992 Metrorail Passenger Survey, WMATA Planning Dept., 2000). The Medical Center station ranks 45th out of 70 stations in passenger counts, and has a comparatively high use for a station with no associated dedicated parking. Except for the Shady Grove station, ridership exceeds that of all Metrorail stations to the north of NIH on the west leg of the Red Line.

The Medical Center station has a bus transit transfer station on the surface. WMATA Metrobus and Montgomery County Ride-On both operate buses to and through this station (Figure 5-10). Transit service at the station has undergone a transformation over the last two years. Seven bus routes that passed through the campus prior to September 2001, now make circuits around the periphery.

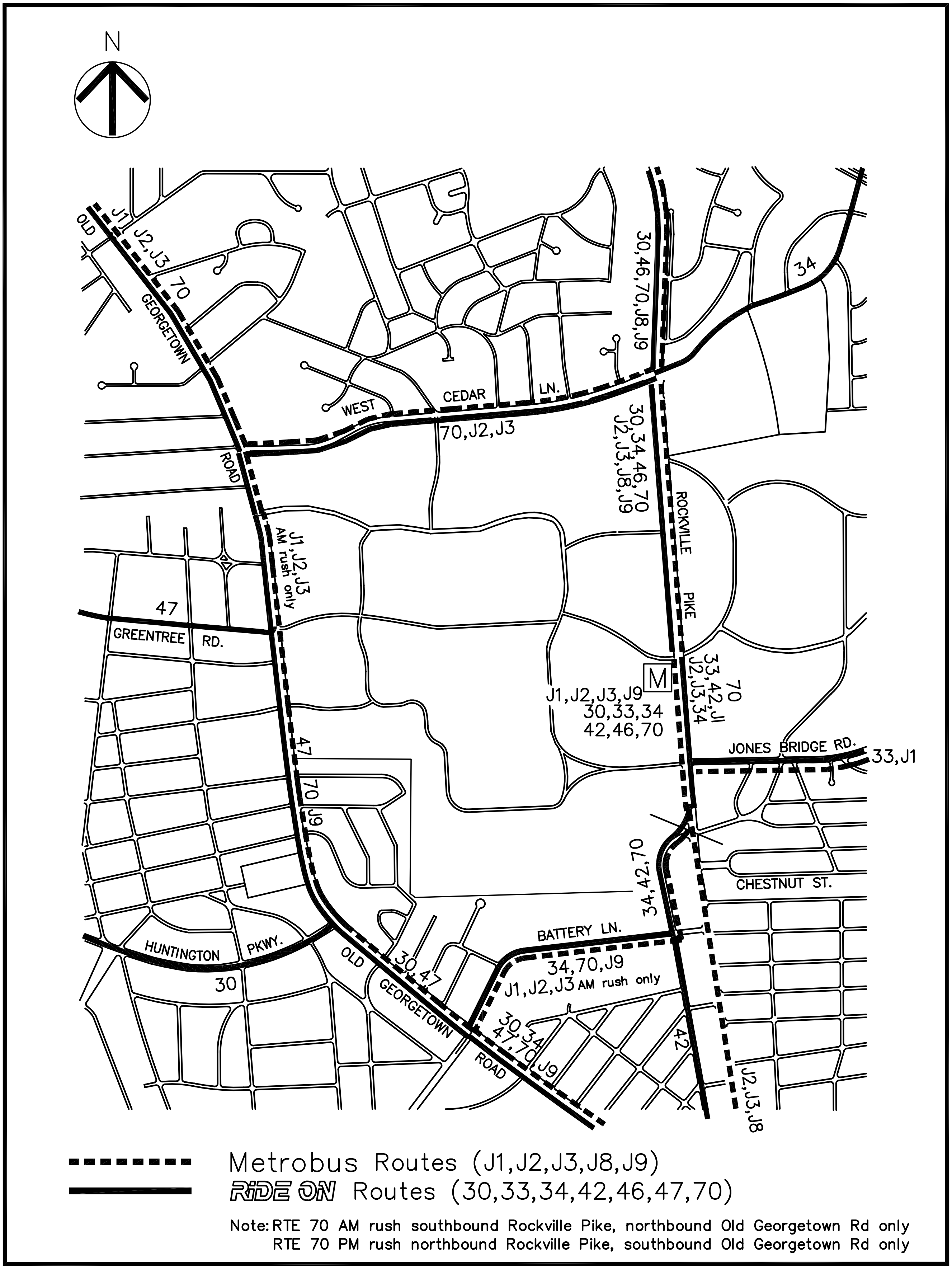


FIGURE 5–10 BUS TRANSIT SERVICE AT NIH.

Metrobus has four routes serving the campus. The J1 route provides rush hour only service between the Metrorail station in Silver Spring and the NIH campus via Jones Bridge Road on 30 minute headways. Scheduled trip time to Silver Spring is 20 minutes. The J2 and J3 routes offer through service between the Silver Spring Metrorail station and Montgomery Mall with intermediate stops in the Bethesda CBD and at the Medical Center station. Headways are 7 minutes during rush hours and 20 minutes at other times. Trip times are 24 to 28 minutes to Silver Spring and 18 to 22 minutes to Montgomery Mall. These bus routes have a ridership of about 7,000 passengers per day. About 4,000 of these passengers have origins and destinations at the Medical Center station.

New Metrobus service includes the J8 and J9 routes. The J9 is one of two lines that comprise the "I-270 Express". It runs between the Lake Forest Transit Center in Gaithersburg and the Bethesda Metro station. An intermediate stop is made inbound or southbound, at the Medical Center station in the morning rush period, and outbound in the evening. The companion J8, I-270 Express, line passes NIH on Rockville Pike but makes no intermediate stops between its route end terminals

Montgomery County operates the local Ride-On Bus system. Seven Ride-On routes serve the campus. All but one, Route 47, stop at the NIH Medical Center transfer station. Route 30 is a local collector route that circles through neighborhoods to the north, west, and south of the campus before terminating at the Bethesda Metrorail station. Routes 33 and 34 provide rush hour only service to Wheaton Plaza via separate routes. Route 42 provides service to Friendship Heights via Woodmont and Wisconsin Avenues. Route 46 connects NIH with Rockville via Rockville Pike on 20 minute headways and primarily serves as a feeder to Metrorail stations along this route. Route 47 runs between the Rockville and Bethesda Metro stations via Montgomery Mall, and passes the campus on Old Georgetown Road northbound. Route 70 is a new express service running between the Germantown Milestone park and ride lot and Bethesda. The route follows Rockville Pike northbound, but returns via Old Georgetown Road, West Cedar Lane and Rockville Pike. These Ride-On bus routes collectively carry about 7,600 passengers per day (MC DOT Office of Planning and Project Development).

Heavy rail commuter service is available via the Maryland Rail Commuter (MARC) "Brunswick" line. Trains originate in Martinsburg, West Virginia, or Brunswick and Frederick in Maryland, and travel to Union Station in Washington, D.C in the AM hours with reverse movements occurring in the evening. MARC currently operates nine trains inbound to Washington in the morning and ten outbound in the evening. All stop in Rockville about six miles to the north of NIH Bethesda, where a connection can be made to the Metrorail Red Line.

The NIH TRANSHARE program provides subsidies to NIH employees to offset transit costs. To participate in the program, members must yield their employee parking tags. Only full-time employees are eligible. The current subsidy is as much as $100 per month.

Employee transit use has grown steadily under the NIH TMP TRANSHARE program since 1995, when 2,000 employees participated. Participation has increased with 3,971 employees enrolled in 2003, despite the severance of public bus routes through the campus. Actual transit use is higher. Employees not enrolled in the program use transit occasionally. Several hundred summer student intern researchers may not park on the campus and, as a condition of employment, although they are eligible for TRANSHARE. Most use transit to reach the campus.

Under the Master Plan Alternative, the existing transit mode share for home-work trips is assumed to continue at the same proportionate rate. If this occurs, the number of TRANSHARE program participants would increase to about 5,400 when the employee population grows to 22,000. Further increases in the percentage of employees using transit are limited unless outside plans and proposals such as the circumferential "Purple" transit line are implemented.

5.3.10 NIH Shuttle Service

NIH operates several shuttle bus services under contract that link the campus internally and provide free service to off-campus NIH facilities and parking. The NIH shuttle bus fleet includes eight 20-passenger buses, eleven 15-passenger vans, and two lift-equipped 14-16 passenger vans for those confined to wheelchairs. For special events and deliveries, there are two lift equipped 24-passenger buses. Lift equipped vans connected to this service are also available to the handicapped on advance request. A phone is available at the NIH information kiosk at the entrance to the Medical Center Metrorail transfer station to permit handicapped transit riders to call for handicap equipped NIH vehicles. Most of the shuttle routes do not run on holidays or weekends.

NIH shuttles carried about 800,000 passengers in 2003. The NIH internal campus shuttle carried 302,814 riders during this period, or an average of about 1,226 per operating day. It runs on a ten minute headway. The four stops with the highest ridership in the order of number of boardings were: the Metrorail station, Building 31, Building 10, and Building 36. NIH initiated a second internal campus route, the NIH Campus Express, in September 2003. It follows a similar route to the campus shuttle, but bypasses the Metrorail station to provide faster service between campus buildings. It operates on 15 minute headways. Ridership increased from 115 per operating day under initial operations to 310 in December. A separately funded shuttle extends service between the Metrorail station and Clinical Center via Building 31 until 8:00 PM. A shuttle also provides service for patients and family members between the Children's Inn and Clinical Center. These two internal routes carried an additional 46,763 riders during 2003. On call campus shuttle service is also available until 12:30 AM.

Six off-campus routes and patient shuttle service are also available. Five of these off-campus routes connect the Bethesda campus to NIH satellite facilities and primarily transport NIH employees among them. The first of these travels between the campus and NIH facilities in the Gateway Building in the Bethesda CBD. The second, the Executive Plaza shuttle operates between NIH and four buildings with NIH offices in the Executive Plaza complex about four miles to the north of the campus. Other intrafacility shuttles travel between NIH and facilities on Rockledge Drive to the east of Montgomery Mall, and to the US FDA Parklawn offices. Services on all these external routes run from approximately 6:30 AM to 6:30 PM on work days. Headways of 15 to 20 minutes are maintained during the morning and evening rush hours, and 30 minutes during midday. The last external shuttle of this type runs four times a day to Fort Detrick in Frederick, Maryland, about 25 miles to the north. These external employee shuttles had a combined ridership of over 245,000 in 2003. The sixth external shuttle carries employees to and from satellite parking at Mid-Pike Plaza. Ridership was 141,164, or 572 per operating day.
In addition to these shuttle services, other on-call shuttles transport Clinical Center and Children's Inn patients and family members between the campus, and Reagan National, Dulles, and BWI Airports, as well as local hotels in Bethesda. Ridership was over 43,000 in 2003.

It is estimated that all the external shuttles combined eliminate about 1,540 vehicle trips to the campus each day. This cuts the average daily traffic flow through the campus entrances by about four percent.

All of the shuttle services would be retained under the Master Plan and No Action Alternatives with route and stop alterations made as circumstances and ridership dictate. The existing internal campus route generally follows the path of the future Loop Road, but temporarily diverges to service Building 10 on the south side, while the new Hatfield CRC is under construction, and the south parking lot. Route changes will occur when construction of the Hatfield CRC is completed around 2004 (Figure 5-11). Under both Alternatives, campus security requirements will separate internal and external campus shuttle routes with neither crossing the security perimeter. All external shuttles will be routed to a campus shuttle loop at the South Drive entrance on Rockville Pike where and riders will transfer between shuttles.

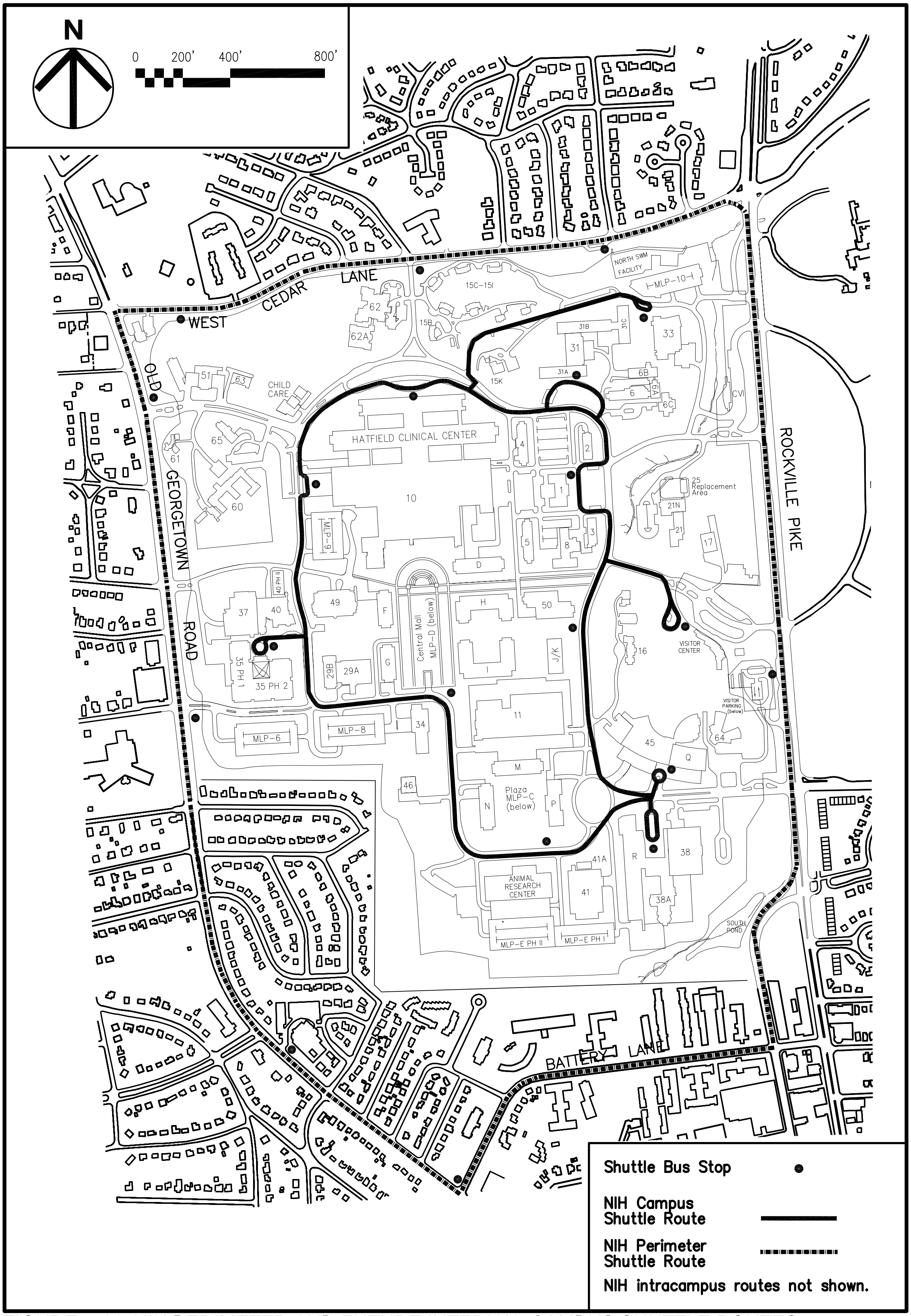


FIGURE 5-11 NIH PERIMETER AND FUTURE INTERNAL CAMPUS SHUTTLE ROUTES.

Campus shuttles will have increasing functional importance under both Alternatives. More employees will use transit even if the proportion doing so remains the same. General visitors will be directed to the Gateway Center on the periphery. The internal campus shuttle will take on increasing importance in the dispersal and collection of transit station and Gateway Center arrivals throughout the campus.

In November 2003, NIH introduced a new local area external shuttle route, which is available to both employees and the general public. The route makes a clockwise circuit around the periphery of the campus via Rockville Pike, Battery Lane, Old Georgetown Road, and West Cedar Lane with a 20 minute headway. Eight stops are located along the route. Residents along the route can use this perimeter shuttle to travel to and from the Medical Center Metrorail station.

5.3.11 Pedestrian/Bicycle Access

The Bethesda-Chevy Chase Master Plan endorses the expansion of pedestrian paths and bikeways to form a network linking residential neighborhoods with public facilities. Such an expansion is an important step that generates opportunities to reduce automobile use and provide transportation alternatives. The Plan recommends that a vigorous program be pursued to implement the County <u>Master Plan of Bikeways</u> within the Bethesda-Chevy Chase planning area.

The Bethesda CBD Sector Plan proposes a more formal bikeway connection to the southern boundary of the NIH campus near Stony Creek. The existing path through Battery Park would be extended to right-of-way on Norfolk Avenue in the Woodmont Triangle to reach the center of Bethesda and other points in the Bethesda CBD. Connections would be made to the Capital Crescent Trail that follows the old CSX Georgetown Branch right-of-way, linking the Silver Spring and Bethesda CBDs, the C&O Canal, and Georgetown.

The County <u>Master Plan of Bikeways</u> proposes bicycle routes along Rockville Pike, Old Georgetown Road, Cedar Lane, Greentree Road, and Sonoma Road. In most cases existing sidewalks would be used. The Bethesda-Chevy Chase Master Plan notes that it is important that NIH provide the bicycle path segments around the perimeter of the campus as shown in the <u>Master Plan of Bikeways</u>.

An existing pedestrian/bicycle path follows the NIH Stream through the Locust Hills neighborhood. It connects the northeast corner of NIH to the main bikeway and hiking path in Rock Creek Park about half a mile to the northeast. This is a popular access route between Bethesda and the park for recreational users. The County is in the process of creating the North Bethesda Trail through construction interconnecting existing segments.

In the past, the Bethesda campus was freely accessible at any point along its perimeter to pedestrians and bicyclists except for fencing its fenced southern boundary. However, a new perimeter fence was installed in 2003 in response to new security requirements. Foot access is currently limited to 13 entry points through the security perimeter, nine of which will accommodate cyclists (Figure 5-12). Eight of the entry points are at vehicle entry locations. The remaining five, including two in the south side buffer, will be for pedestrians and bikers only. A publicly accessible NIH pedestrian trail running the length of the south side buffer between Old Georgetown Road, and across Woodmont Avenue to Rockville Pike, has been constructed as part of the security perimeter fence installation.

Both alternatives encourage and allow for County trails around the perimeter of the campus. Internal campus walkways or bike paths tie to the County system. The thirteen pedestrian entryways are still available to the general public to transit the campus. However, in the future, with one exception, access at the entry points will be limited to NIH employees via an electronic card system. Campus visitor

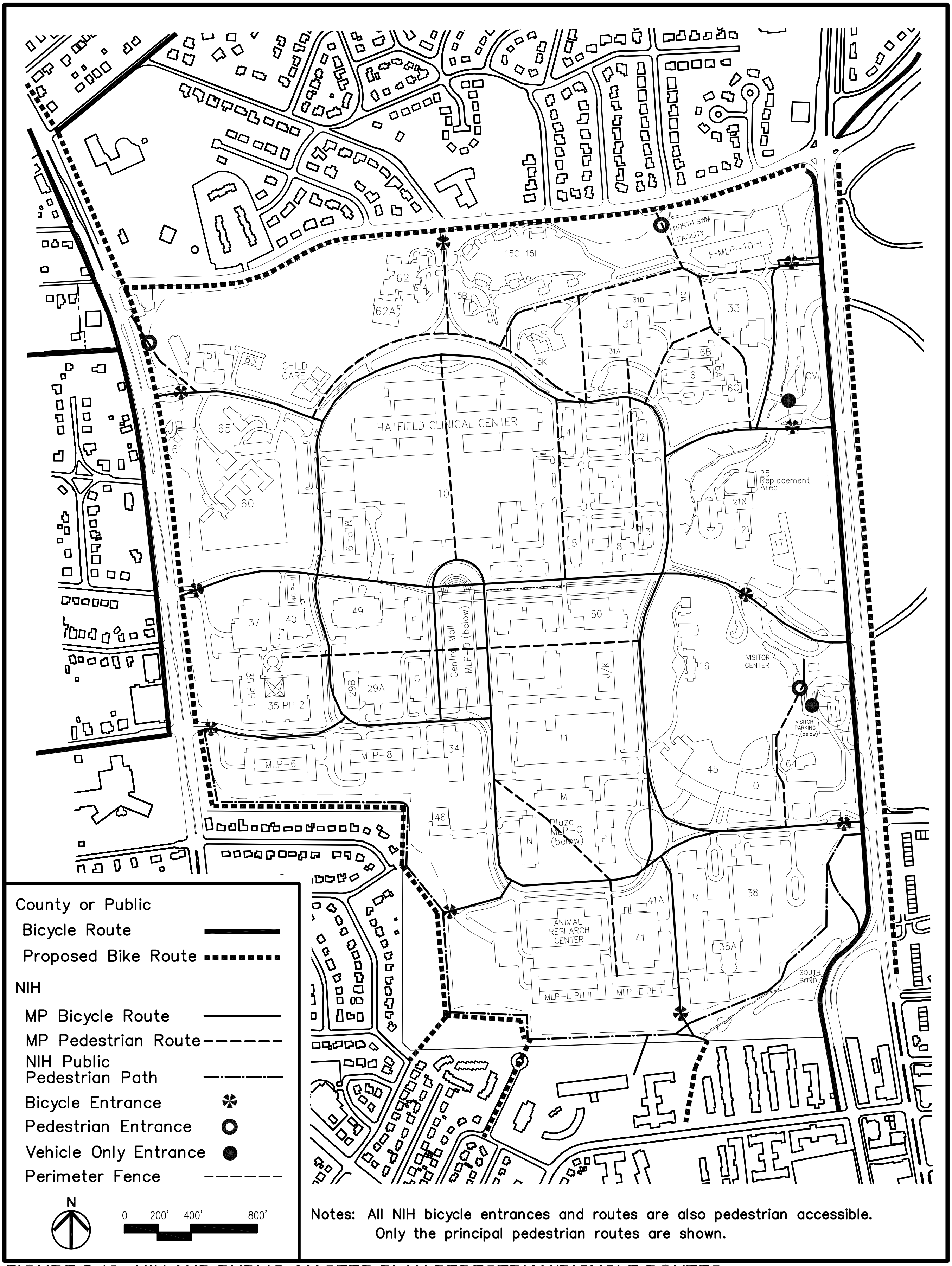


FIGURE 5-12 NIH AND PUBLIC MASTER PLAN PEDESTRIAN/BICYCLE ROUTES.

pedestrian and biker traffic will be limited to the Gateway Center entrance on Rockville Pike at South Drive to pass through a security checkpoint. Those arriving by Metro or surface transit will also enter the campus at this point. Visitor pedestrian or biker departures could be by any entry point. In the future, and within security constraints, pedestrian/bicycle access may be provided to the general public to permit access between the Metrorail station and the areas to the west of the campus. A screening/pass system applicable to each transit of the campus would be needed. One of the gate entrances on Old Georgetown Road would be selected as the western portal.

NIH Bethesda now has about 600 securable bicycle spaces in racks and lockers around the campus. An important feature of the Master Plan Alternative is greater emphasis on pedestrian travel internally around the campus. Except for emergency and a few service vehicles, automobile and truck access will be limited in the central core of the campus inside the Loop Road, an area equivalent to about sixteen city blocks. Organization of the campus into landscaped quads and malls, with interconnecting paths and walkways will encourage more pedestrian activity. In the Master Plan Alternative, the number of employees who would work within 1,500 feet of the Metrorail station entrance or eight minutes walking distance from the station would be increased from about 4,100 to 7,200.

NIH will cooperate with the County on resolving trail issues. Montgomery County has included funding for design and construction of the North Bethesda Trail, formerly identified as the Tenallytown Trolley Trail in its Capital Improvement Program. Completion of the trail is scheduled for 2004. The trail passes through Maplewood to the north of NIH, then down Old Georgetown Road to Lincoln Drive. The County Master Plan of Bikeways proposes that it follow the NIH buffer across the southwest corner of the campus to link to the Woodmont Triangle. NIH has built a public pedestrian trail along the south buffer. Upgrading the path to a bike trail conforming to County standards would be the responsibility of the County.

5.3.12 Future NIH Transportation Management Program

A primary goal of the NIH TMP is to mitigate NIH generated traffic impacts such that the contribution of NIH to the level of congestion on public roads is no worse than it was in 1992 when the Memorandum of understanding (MOU) establishing the program was signed. Over the intervening decade, TMP activities have aggressively pursued the reduction in employee single occupant vehicle traffic. These include public transportation programs, ridesharing, and development of off-site parking facilities.

One measure of conformance is the rate of vehicle trip generation per employee that is reflected by campus entrance trip counts. NIH is committed to generating no more peak hour trips than were prevailing at the time the MOU was signed in 1992. On this basis, a site limitation of 5,888 AM peak hour and 5,772 PM peak hour trips was established.

The success of the NIH TMP is revealed by the October 2003 monitoring survey. The total recorded AM peak hour entrance traffic volume was 4,190, while the PM peak hour value was 3,159. These figures represent reductions of 29 and 45 percent from 1992 counts, respectively. The reductions were realized despite a campus population increase from 16,350 to 17,500 at the time of the respective monitoring surveys. Another measure of TMP effectiveness is TRANSHARE participation, which has increased from about 1,000 employees in 1992, to about 2,000 in 1995, to over 3,700 in 2003.

The decline experienced in vehicle trips through the entrances more than offsets the number of trips that would be added by an employee population increase from 17,500 to 22,000 as proposed in the Master Plan.

NIH is committed to continuing and enhancing its TMP measures to control vehicle trip generation and parking. Future TMP measures would be applicable to the Master Plan and the No Action Alternatives. For analytical purposes, it is assumed that TMP will continue at the same rate of effectiveness, i.e. trips per employee, as the existing TMP. (See Section 5.3.4 for existing TMP summary). The program undergoes periodic monitoring and review in the context of evolving regional and campus transportation conditions. Future measures are also explored, and evaluated for feasibility, cost, and effectiveness at NIH Bethesda. as they are developed

Some measures currently in place or under consideration are:

- Electronic signs at campus shuttle stops that provide “real time” arrival information. WMATA is installing such a system at some Metrorail stations.
- Federal agency shared parking program.

This concept is intended as a measure to reduce regional vehicle pollutant emissions. Under the program, the employees of a federal agency would be encouraged and allowed to park at the facilities of a second agency closer to their home. They would then use transit to continue their trip to work. For example, an NIH employee would be allowed to park at the Suitland Federal Center in Prince George’s Maryland, and vice versa. The program would reduce regional vehicle miles traveled. Emphasis in the program is placed on reducing traffic on the I-495 Beltway. Each agency would maintain a bank of parking spaces, and trade spaces with other agencies so that there would be no net change in facility portal trips.

- Managed Parking Expansion

Managed parking increases space use efficiency, discourages illegal parking, and enhances security around garages and lots.

- Transit Promotion and Marketing Enhancement

NIH continues to look for ways to increase transit use. Since 1995, NIH has worked cooperatively with local jurisdictions and transit agencies to establish four new express bus routes serving the campus. Other opportunities and routes are evaluated as they develop. NIH is evaluating how promotional measures employed by Transportation Management Associations around the region may be applied at NIH. An example is merchant or restaurant discounts for TRANSHARE program members.

- Increased Employee Carpools

Regional transportation improvements will increase the attractiveness and potential use of HOV. The widening of I-270 will extend HOV to Frederick and include the construction of park and ride lots within the corridor. The I-495 Beltway widening, now in the study stage, will add bidirectional HOV lanes while the number of general travel lanes will remain the same.

- Employee Education

NIH will continue to expand the ETSO educational effort. Providing information on bicycle trails in the vicinity of NIH on the ETSO website is currently being evaluated.

5.4 UTILITIES

Extensive infrastructure such as roads, utilities, and support facilities are needed for campus operations.

Planned improvements to infrastructure are guided by the NIH Infrastructure Modernization Program (IMP). The IMP covers infrastructure modernization needed to upgrade facilities to meet current conditions as well as Master Plan growth. Many of the improvements are necessary in the No Action Alternative. The NIH Bethesda Master Utilities Plan (MUP) is a part of the IMP which provides a planned program for improvements to central utilities, including central heating and cooling generation and distribution. Secondary utilities, which include water, sanitary sewer, storm drains, electric power and gas, are also covered by the IMP. In the interim, since 1995, many of the central plant and utility infrastructure projects proposed in the IMP and MUP have been implemented or are underway.

Similarly, several major research laboratories and the Clinical Research Center replacement have been built or are underway. Some Master Plan planning premises such as campus population and space allocation by type of use have been revised. The original 1992 MUP has been updated to reflect these changes (Master Utility Plan: 2000 Update, Mueller Associates II, Inc./TA Engineering, Inc., 2000). The updated Master Plan is referred to as the UMUP herein.

Future No Action Alternative utility demand projections assume implementation of the projects shown in Table 4-3. The listed projects are "committed" projects in that they are either in the design or construction phase, or they will be required by known exigencies (e.g. the Gateway Center and Research Building 33).

Projected demands are based on existing utility consumption or demand rates. They do not account for energy conservation measures, such as those given in Section 5.11 that may be implemented over the next 20 years. Utility loads, as generally defined in plumbing, mechanical, and electrical codes, are the sum required capacity of all components in a building connected to a utility system. Demand is always less than the load. For example, the electrical load for a building accounts for every electrical outlet installed. Demand accounts for only those in use at any one time.

5.4.1 Central Heating and Cooling

5.4.1.1 Buildings 11 and 34

When a large site has sufficient building density of buildings on site, central heating and cooling is more economical, energy efficient, and service reliable than utilities supplied by outside entities. For these reasons, many large government installations and university campuses use central heating and cooling. Examples around the area include the Federal Triangle, the Navy Yard, the University of Maryland, and George Mason University. Heating and cooling of NIH campus buildings is done through a central heating and cooling system. Steam is generated in Building 11, and chilled water is processed in Buildings 11 and 34, and distributed to buildings around the campus by a pipe network located in tunnels or by direct burial.

Building 11 has a floor footprint of about 76,000 sf and a total building gross area of 232,400 sf. Five boilers that supply steam to the campus occupy the north side of the building. The height of the building on the boiler side is approximately 90 feet. Chillers, which generate chilled water, occupy the south half of the building at ground level. Each chiller has a set of two cooling towers located on the roof, which is about 30 feet above ground level on the south side of the building.

A Master Utility Plan (MUP) competed in 1992 indicated the need for a major modernization and expansion of the central heating and cooling plant (Master Utility Plan, Task 4.0, Volume 1, Ross, Murphy, Finkelstein, Inc., 1992). Planning for plant, and the steam and chilled water distribution systems, was reviewed and updated in 2000 (Master Utility Plan 2000- Update (UMUP), Mueller Associates II, Inc., et al., 2000).

The 1992 MUP recommended completion of plant modernization in three phases, and NIH has completed the first two. The major elements that have been completed are:

- Installation of Boiler 5.
- Overhaul of Boilers 1 to 4 with retrofit of equipment to reduce emissions.
- The raising of boiler stack height, and the consolidation of the stacks into a single unit.
- In conjunction with PEPCO, the installation of a cogeneration (COGEN) unit that supplies both steam and electric power. The unit also has a Heat Recovery Steam Generator (HRSG).
- Expansion of the plant on the south side to accommodate ten new chillers and their associated cooling towers. These new chillers replace the original 10 smaller units originally located in Building 11, increasing total plant capacity from 37,750 to 68,000 tons. The new chilled water system uses about 35 percent less energy to generate a ton of refrigeration.
- Installation of a noise attenuation screen to reduce noise from cooling towers on the roof of Building 11.
- Installation of new energy saving equipment and controls that have advanced since 1992.
- Replacement or overhaul of supporting mechanical and electrical equipment to increase plant reliability.

The chiller and boiler plants operate throughout the year. They not only cool and heat buildings but also supply chilled water and steam for process use. Examples of process steam use include building humidity control, laboratory bench supply, animal cage cleaning, and sterilization of laboratory and hospital equipment.

Under certain circumstances steam and chilled water may be supplied to an individual building at different times throughout the day or to separate areas within a building at the same time to meet heating, cooling, and humidification requirements. Steam is also supplied to laboratory benches in research spaces. NIH and AAALAC standards for rooms holding individual animal species range from 61° F to 84° F. These individual space or room temperatures must be maintained within a tolerance of +/- 1.8° F. Heating and cooling of animal spaces within a building may be required if the outdoor temperature is intermediate between the extremes required for individual species. Temperatures in laboratories containing biological materials must also be maintained at lesser but close tolerances, and animal spaces and laboratories have relatively small tolerances for humidity levels.

NIH, therefore, requires a very high service reliability for steam and chilled water production, even when outdoor temperatures range to record levels, and as a result, there are two applicable definitions for boiler and chilled water plant capacities. The first is production plant capacity, which is the sum of all equipment nominal, or nameplate capacities. Capacity is also defined in terms of "firm" plant capacity. Firm plant capacity is the plant production capacity less the capacity of the largest generating boiler or chiller unit and interrelated support equipment. Firm capacity indicates that one boiler or chiller may be out of service for maintenance or repairs at any given time including periods of peak demand.

5.4.1.2 Steam

Data for existing steam demands, and those projected for the No Action and Master Plan Alternatives are shown in Tables 5-18, and 5-19 for various operating conditions. The data for existing conditions are derived from plant steam production records for 2003. Plant operators record the total pounds of steam generated each day, and the daily peak production in lbs/hour. Peak demands are important in establishing necessary plant and fuel supply capacities. Total seasonal and annual production is important in estimating annual boiler stack pollutant emissions. Operating permit emission limits are set on an annual basis.

OPERATION CONDITION	2003 EXISTING CONDITON (lb/hr)	NO ACTION ALTERNATIVE (lb/hr)	2020+ MASTER PLAN (lb/hr)
Estimated Potential Peak Steam Demand at 0ºF Minimum Daily Temperature	585,000	776,000	968,000
Average Steam 20 Coldest Days	403,000	535,000	668,000
Winter Average (Dec-Feb)	340,000	451,000	563,000
Spring/Fall Average (Mar-May, Sep-Nov)	190,000	252,000	314,000
Summer Average (Jun-Aug)	155,000	206,000	256,000
Annual Average	217,750	---	---
Annual Average (with COGEN)	225,330	299,000	373,000

YEAR	ESTIMATED PEAK DEMAND OF 0º F MINIMUM TEMP. (lb/hr)	PLANT CAPACITY		REMARKS
		TOTAL (lb/hr)	FIRM (lb/hr)	
2003	585,000	800,000	600,000	
2005	774,000	980,000	780,000	COGEN in service.
2009	738,000	980,000	780,000	First Phase.
2011	773,000	1,180,000	980,000	Boiler 7 in service.
2015	878,000	1,180,000	980,000	Second Phase.
2020	913,000	1,180,000	980,000	Third Phase.
2020+	968,000	1,180,000	980,000	Last Phase.

TABLE 5-18 EXISTING AND PROJECTED STEAM GENERATION.

Steam demand at NIH Bethesda has two primary components: steam used to heat buildings, and "process" steam that is used for all other purposes such as cleaning animal facilities, sterilization of research and medical equipment, building humidity control, and at the laboratory bench. Steam demands vary daily and by season. Heating steam demand fluctuates with outdoor temperature. Analysis indicates that, on the average during the heating season, NIH needs an additional 6,300 lb/hr of steam for each Fahrenheit degree drop in temperature.

The annual average steam generated in 2003 by existing Boilers 1 through 5 was 217,750 lb/hr (1.907 billion pounds per year). The COGEN unit was operated periodically during this time as part of an acceptance testing program. It is estimated that the annual average steam production was 225,330 lb/hr with the COGEN operations included.

Seasonal variation is shown for the months indicated in Table 5-18. Production is concentrated in the winter months, so that production is less than the annual average for more than nine months of the year. The summer average, 155,000 lbs/hr, is indicative of the process steam demand, i.e. no heating requirement. Demand has increased as the campus has developed. An all-time peak demand of 532,000 lb/hr was recorded on January 27, 2003. The overall average generation for this day was 475,000 lb/hr. Peak demands of 521,000 and 511,000 lb/hr were recorded on January 28 and 30, respectively. The

DAY	2003 RECORDED DAILY PEAK (1000 lb/hr)	CURTAILMENT	2008 NO ACTION ESTIMATED DAILY PEAK (1000 lb/hr)	2020+ MASTER PLAN ESTIMATED DAILY PEAK (1000 lb/hr)
ESTIMATED at 0°F	585		776	968
1	532	X	705	880
2	521	X	691	862
3	511	X	677	845
4	492	X	652	814
5	491	X	651	812
6	490	X	649	810
7	481	X	638	795
8	478	X	634	790
9	474	X	628	784
10	472	X	626	781
11	470	X	623	777
12	464	X*T	615	767
13	456	X*T	604	754
14	454	X	602	751
15	451	X	598	746
16	450	X	596	744
17	448	X	594	741
18	448	X	594	741
19	445	X*T	590	736
20	435		577	719
21	434		575	718
22	433	X	574	716
23	426		565	704
24	424	X	562	701
25	422		559	698
26	421	X	558	696
27	416	X	551	688
28	416	X	551	688
29	413	X	547	683
30	413	X*T	547	683
31	411	X	545	680
32	411		545	680
33	407	X	539	673
34	407	X	539	673
35	405	X	537	670
36	404		535	668
37	404	X	535	668
38	401	X	531	663
39	399	X	529	660
40	399		529	660
41	394	X	522	651
42	391	X	518	646
43	390		517	645
44	387		513	640
45	385	X	510	637
46	384		509	635
47	384		509	635
48	382		506	632
49	379	X*T	502	627
50	379		502	627
51	378		501	625
52	378		501	625
53	377		500	623
54	373		494	617
55	371		492	613
56	368		488	608
57	366		485	605
58	365	X	484	603
59	365		484	603
60	364		482	602
61	359		476	594
62	357		473	590
63	356		472	589
64	356		472	589
65	356		472	589
66	355		470	587
67	354		469	585
68	354		469	585
69	353		468	584
70	353		468	584
71	352		466	582
72	351	X	465	580
73	351	X*T	465	580
74	348		461	575
75	348		461	575
76	345		457	570
77	343		454	567
78	341		452	564
79	339		449	560
80	338		448	559
81	337		447	557
82	332		440	549
83	331		439	547
84	330		437	546
85	328		435	542
86	321		425	531
87	319		423	527
88	298		395	493
89	293		388	484
90	281		372	464

NOTES

(1) DAILY PEAK STEAM DEMANDS DURING JANUARY, FEBRUARY, AND DECEMBER SORTED IN DESCENDING ORDER.

(2) 2003 DATA BASED ON PLANT RECORDS. FUTURE PEAKS BASED ON PROJECTED GROWTH IN DEMAND.

(3) DAILY PEAKS at 0°F EXTRAPOLATED FROM:

Y = -.00008(T^3) + .0696(T^2) -10.915(T) + 580

WHERE Y = STEAM IN 1000 LB/HR
T = TEMPERATURE IN DEGREES °F.

X = UNDER CURTAILMENT IN 2003, OIL USED AS FUEL
X*T = OIL TO GAS OR GAS TO OIL TRANSITION

(4) 2003 - top 20-day average peak 473,150 lb/hr

(5) 2003 - top 35-day average peak 449,200 lb/hr

TABLE 5-19 DISTRIBUTION OF NIH DAILY PEAK STEAM DURING WINTER OF 2003.

average amount of steam produced on the 20 coldest days was 403,000 lbs/hr. January, February, and December 2003 were slightly colder, average temperature 34.63º F, than the normal of record 37.48º F as recorded at Reagan Airport in Washington, D.C. The daily peak steam generation or demand for these three months are shown in Table 5-19 along with projects for future No Action and Master Plan Alternative conditions. The daily peaks have been sorted in descending order of value to indicate the typical winter distribution of demands. The days in 2003 when natural gas was curtailed are indicated.

Plant capacity must meet anticipated peak steam demands. The potential existing peak demand for planning purposes is estimated to be 585,000 lbs/hr. This corresponds to a daily minimum temperature of 0ºF, and an average daily temperature of about 8º F.

Campus steam demands do not increase steadily. They increase or decrease in steps as new buildings are brought on line, or existing buildings are demolished or taken out of service for renovation. Short term demand peaks occur when a new replacement building and its associated building to be demolished are on line at the same time. Projections of future steam demands were based on factors for potential peak demand developed in the Master Utility Plan and its 2000 Update. These are 0.12963 lb/hr of steam per gross square foot (gsf) for laboratory research and animal holding spaces, and 0.1285 lb/hr per gsf for office, child care, and other non-research space. In a few cases, information was available and used for individual buildings. The factors were applied to the projected square footage of each type and accumulated into totals for the campus as a whole. Seasonal demands were determined by multiplying the 2003 demand by the ratio of the resultant future potential peak to the 2003 potential peak demand.

The Gateway Visitor Center, Commercial Vehicle Inspection Facility, and the Children's Inn Addition are relatively small and on the periphery of the campus. Each will be heated by independent building systems rather than connected to the central plant, and are not included in projected central plant demands.

The No Action Alternative steam demand projections are based on implementation of the "committed" projections shown in Table 4-3. The Master Plan Alternative projections assume full buildout or implementation of Master Plan projects, and demand will increase by an estimated 65 percent under these conditions.

Steam demands will increase sharply in the next two years when new buildings, now under construction, are occupied. The potential peak steam demand will increase to an estimated 774,000 lb/hr when the Hatfield Clinical Research Center, the Neuroscience Research Center, Phase I, and Building 33 are on line. Subsequently, the demands would decrease when Building 36 is demolished for NRC, Phase II, and portions of the Clinical Center Complex in Building 10 are taken out of service for renovation .

Building 11 houses five boilers and auxiliary equipment for generating steam and recovery of spent condensate. Boilers 1 through 4 each have a nominal capacity of 150,000 pounds per hour (PPH) of saturated steam. Boiler 5 has a nominal capacity of 200,000 PPH. Total plant capacity is 800,000 PPH and firm capacity is 600,000 PPH with Boiler 5 out of service. Boilers 1, 2, and 3 were installed in 1952. Boilers 4 and 5 went into service in 1969 and 1997, respectively. All the units supply steam at 165 psig.

Boilers 1 through 4 were overhauled between 1995 and 1997 as part of the central plant infrastructure modernization program. Earlier renovations included general refurbishment, installation of dual No. 2 fuel oil and natural gas feed, new state-of-the-art low nitrogen oxides (NOx) emission burners, and flue gas recirculation (FGR) for greater operating efficiency. Boiler 5 was installed incorporating the new features.

The central heating plant was in transition during 2003 with the completion of installation of a

PEPCO/NIH Cogeneration (COGEN) facility. A COGEN facility generates both electric power and steam. The COGEN facility is located in the northwest corner of Building 11. Performance and acceptance testing was underway in 2003, and the facility contributed to the annual steam generation in this way. Full service operations are expected to begin in 2004. Additional information on the COGEN unit is given in Section 5.4.2.

Boiler 6 would serve as a heat recovery steam generator downstream from the turbine. Hot exhaust gases from the turbine would pass through the boiler to generate 108,000 PPH of steam. Supplemental dual oil/natural gas fired turbine exhaust duct burners in the boiler would permit generation of additional steam, increasing the overall COGEN facility capacity to 180,000 lb/hr.

As a condition of the contract between NIH and PEPCO, steam from Boiler 6 must be available to NIH for campus use for a minimum of 94 percent of the time each year. To meet this condition, PEPCO must provide alternative steam capacity, if it is necessary to meet the 94 percent availability requirement. This would be accomplished by installing two or three temporary boilers on the west side of Building 11, and space must be available for them through the duration of the contract.

The virtually continuous availability of Boiler 6 will change central plant operational patterns. Boiler 6 will operate at 108,000 PPH virtually throughout the year and satisfy base campus loads and demands up to this level. Other boilers will be used only to supplement Boiler 6 as daily demands exceed its capacity. Boiler 6 is therefore a substitute for the remaining boilers, which would normally be rotated in service when demands are less than capacity. The application for a permit to construct the COGEN/Boiler 6 unit assumes that additional supplemental firing capacity in Boiler 6 would be 720 hours of operation per year. Operation times for supplemental firing will depend on the plant's day to day status in relation to permissible annual emission limits.

On the cooling side, Chillers 21 through 23 have been equipped with dual steam and electric power drives. Each has a 5,000 ton capacity. If they are steam driven, each requires 47,000 PPH of steam when operating at capacity, assuming 70 percent efficiency. The NIH boilers could be used to supply chiller steam during the warmer or summer months when campus demand is comparatively low.

Boilers 7 which would be needed for the Master Plan Alternative, but not for the No Action Alternative, is proposed as a 200,000 PPH capacity operating unit. It is estimated that Boiler 7 will be needed around 2011 or 2012. Boiler 7 would be located on the east side of the COGEN unit in an extension on the north side of Building 11.

5.4.1.3 Chilled Water

The 1992 Master Utility Plan (MUP) proposed a three phase program to completely modernize and expand the NIH Bethesda central refrigeration plants as follows:

- Phase I - Replace the original small Chillers 1 through 9 in Refrigeration Plant No. 1 in Building 11 with six larger high efficiency units, Chillers 16 through 21.

- Phase II - Increase plant capacity by constructing a building extension along the length at the south side of Building 11 for four additional Chillers, units 22 through 25.

- Phase III - Consolidate all facilities in Building 11 and provide for further expansion of capacity by construction of an extension on the east side of Building 11 for chillers beyond unit 25, as needed and decommission Refrigeration Plant No. 2 with Chillers 10 through 15 in Building 34, as circumstances permit.

NIH completed installation of Chillers 24 and 25 in early 2003 and building space has been provided for units 26 and 27. The plant now is composed of ten chillers, each with a 5,000 ton capacity in Building 11, and six chillers with unit capacities of 3,000 tons in Building 34. The overall total and firm plant capacities are 68,000 and 63,000 tons, respectively.

All of the chillers have electric drive. Chillers 21 through 23 have dual steam-electric drive with the steam supplied by NIH boilers. Auxiliary equipment is all electric and supportable by diesel generators under emergency conditions. NIH can provide 15,000 tons of cooling for critical demands completely independent of outside power sources.

NIH also has four 2,500 ton "free cooling" flat plate heat exchangers in Building 11 that can meet all or most of this demand. Free cooling takes advantage of cold outdoor winter temperatures. Condenser water is circulated between a cooling tower, where it is exposed to cold air, and the heat exchanger. The chilled water returning from buildings bypasses the chiller compressors but passes through the heat exchanger. It is cooled by direct contact with the condenser water across the inner surfaces of the exchanger. The operation is thermodynamically efficient when outdoor temperatures are 38^{o} F or less. Total nominal and firm free cooling capacities are 10,000 and 7,500 tons, respectively. The heat exchangers may be operated in parallel or series with chillers. When in parallel, they substitute as conventional chillers; when in series, they precool chilled water return increasing chiller efficiency. Since the exchangers are not available during the summer months, their capacity is not included in the plant total.

Each chiller in the central chilled water plant has an associated cooling tower located on the roof above. Each cooling tower for 5,000 ton chillers has two cells, which are 36 feet square. One side of each cell is an air intake side and must face outward. The cells may be arranged side by side, or one behind the other. In the latter case, the front to back dimension is increased to about 120 feet to ensure adequate fresh air flow to the rear unit.

The average annual chilled water demand is about 18,000 tons. In 2003, the average demand in July and August was 38,000. An all-time plant average daily peak demand of 51,112 tons was recorded on July 5, when the maximum average, and minimum daily temperatures were 94, 84, and 73º F, respectively (Table 5-20). The second highest daily average occurred on August 21, when demand for the day reached 50,061 tons.

The average winter demand, indicative of campus usage other than for cooling, was 7,700 tons in 2003. Future peak chilled water demands were estimated by using factors developed in the MUP and UMUP in a manner similar to that for steam. Hospital, animal, and research spaces would require chilled water at a 117 gross square feet (gsf)/ton rate, other types of space at a 382 gsf/ton rate. The former is based on 15 building air changes per hour. No reductions for energy conservation measures are included in either category for two reasons: to produce a conservatively high estimated demand, and to provide a reference for measuring future conservation.

The Children's Inn addition, Gateway Visitor Center, and the Commercial Vehicle Inspection facility would be cooled by individual building air conditioning systems, and not connected to the central plant.

Under the No Action Alternative average daily peak chilled water demand would increase to approximately 66,700 tons. An additional 5,000 ton chiller unit would be required.

Capacity for the Master Plan Alternative would be achieved by implementing Phase III of the MUP modernization and expansion program. Six additional 5,000 ton chillers, units 26 through 31 would be

PERIOD ENDING	PEAK CHILLED WATER DEMAND (tons)	PLANT CAPACITY	
		TOTAL (tons)	FIRM (tons)
2003 Existing	51,112	68,000	63,000
No Action Alternative	66,700	73,000	68,000
Master Plan Alternative			
First Phase	62,700	78,000	73,000
Second Phase	71,000	80,000	75,000
Third Phase	47,900	80,000	75,000
Final Phase	76,900	80,000	75,000

TABLE 5-20 PROJECTED MASTER PLAN CHILLED WATER DEMANDS AND PLANT CAPACITY.

installed with the first two going into existing space in Building 11. Units 28 through 31 would be installed in an extension of Building 11 on its east side. The six 3,000 ton chillers in Building 34 would be retired, and Building 34 converted to a Campus Center with amenities for employees. It is estimated that this will occur during the Second Phase of the Master Plan.

Ultimately, the central chilled water plant would have 16 chillers with a total capacity of 80,000 tons and a firm capacity of 75,000 tons. Although the estimated peak demand for ultimate buildout of the Final

Phase of the Master Plan is slightly higher than this firm capacity, 76,500 tons, it is anticipated that an acceptable level of reliable service will be achieved through implementation of energy conservation measures, which have been ignored in estimating future chilled water demands.

Specific thermal storage facilities have not been included in the Master Plan 2003 Update due to the apparent space constraints in the vicinity of Building 11. Nevertheless, the concept is retained. Implementation on a smaller scale or in individual buildings may be feasible in the future.

Under the No Action Alternative, the peak demand would increase to an estimated 62,000 tons by 2007 due to implementation of "committed" building projects. Chillers through unit 27 would be installed, but only four Building 34 chillers would be retired.

5.4.1.4 Steam and Chilled Water Distribution

The Master Utility Plan and Master Plan Alternative propose the conceptual formation of utility corridors in which campus support utilities would be concentrated (Figure 5-13). These corridors would be developed under both the Master Plan and No Action Alternatives. In general, the corridors follow existing utility concentrations, but many collection and distribution lines other than individual building services crisscross development blocks. The concept formalizes long term planning for the transfer or relocation of these lines to the corridors. Utilities would be relocated to the corridors as Loop Road improvements are made, individual building sites are developed, or as the existing utility tunnel system is expanded.

The general concept for steam and chilled water is to create a grid of distribution and return lines along and inside the Loop Road. This would permit distribution and return by two paths to the point where individual building service drops connect to the grid, even those outside the Loop Road. Major steam and

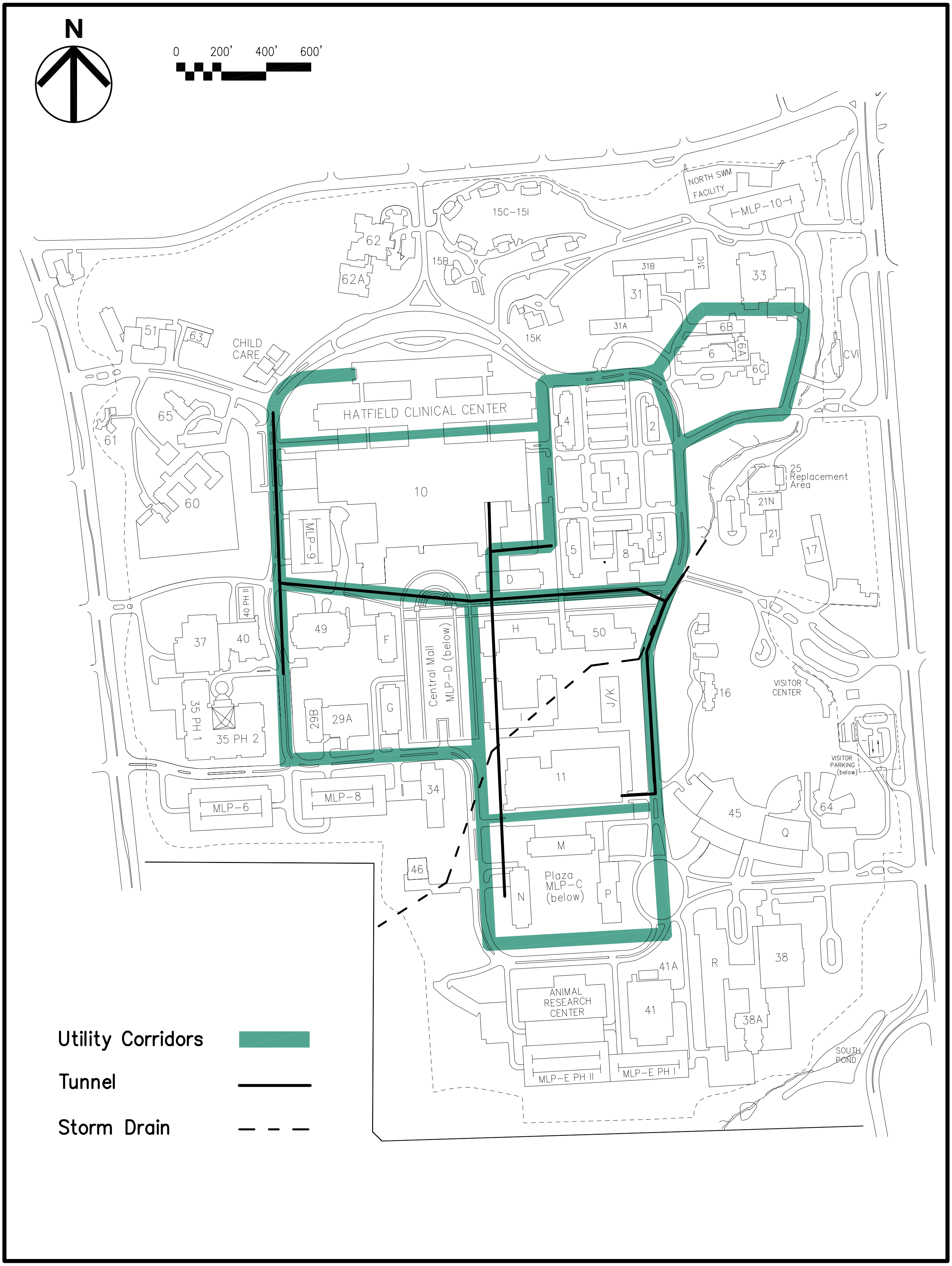


FIGURE 5-13 UTILITY CORRIDORS.

chilled water lines on the campus are located in tunnels, or concrete-encased utility trenches. Minor lines and most building services are buried directly. Lines in tunnels are accessible for direct inspection, maintenance, and repair. Utility trenches generally are only wide and deep enough to contain the distribution and return lines. Access is available at interspersed vaults or inspection points. The main existing tunnel runs north-south between Building 11 and the Clinical Center. This tunnel extends southward to service Building 14. The Master Utility Plan recommended an east-west header tunnel through the core of the campus. The first segment or phase of this east-west tunnel was constructed between Center Drive and the main tunnel in 1994, and extended to Convent Drive in 1997. A tunnel would also be constructed eastward from Building 11 to Center Drive and thence northward to connect to the east-west tunnel to form a distribution loop.

Steam and chilled water service for the South Quad and other facilities to the south of Building 11 would be provided in a utility trench prior to the construction of the Animal Research Center. Service to Buildings 31 and 33 in the northeast campus sector would also be accommodated through a utility trench loop system.

Other significant distribution system needs identified in the MUP 2000 Update include:

- Replacement of the steam main in the tunnel between Building 11 and Building 10/Clinical Research Center with one of sufficient size to handle projected demand increases.

- Metering of the steam and chilled water distribution systems to provide more detailed information on building demands and system operational characteristics. NIH installed water submeters in Building 11 to measure usage by the steam and chilled water generation systems. The monitored water does not go to the sanitary sewer system; it is released to the NIH Stream or campus storm drains, lost in system distribution, or evaporated to the atmosphere. The metering will permit deduction of these uses from the sewer component on WSSC water bills with concomitant savings on sewer charges.

- Modernization and expansion of the campus Supervisory Control and Data Acquisition (SCADA) system that monitors campus utility and alarm systems electronically. The existing SCADA system predates personal computer developments that have occurred over the last decade, and it does not cover all the utilities on the campus. The MUP Update further recommends that the SCADA command center be relocated to a dedicated secure space that would be manned on a 24 hour basis

Hydraulic analysis of the campus chilled water distribution system completed in the MUP Update indicates that it is critically important that the operating temperature differential between chilled water supply and return at the plant be increased from the current 10º F to 18º F as recommended in the original Master Utility Plan. This is essential if the existing distribution system is to be used to meet future increases in demand. The increase can be gradually achieved by installing new and retrofitting existing individual building air handling units capable of operating at the 18º F temperature differential.

5.4.2 Electric Power

Power is supplied to the campus by the Potomac Electric Power Company (PEPCO) via three PEPCO substations. PEPCO Substation 80 is located in Building 17 to the northwest of the Rockville Pike/South Drive intersection. Primary distribution to the substation is via four 35 kilovolt (KV) lines from Rockville Pike. PEPCO equipment in the substation includes one 30,000 kilovolt-amp (KVA) transformer, two 20,000 KVA transformers, one 10,000 KVA transformer, and related switchgear. PEPCO Substation 167 is located in Building 46 on the southwest side of the campus. It is served by three 35 KV lines, extending from Old Georgetown Road, that supply three 20,000 KVA transformers.

Construction of the third substation, NIH North substation in Building 63, was completed in 2002, and equipment installed in 2003. This substation is wholly owned and operated by NIH. The purpose of the station is to not only provide needed additional capacity, but also increase service reliability. The substation will have space for three 30,000 KVA, 35/13.8 KV transformers. Only two of the transformers will be installed initially. They will be dedicated to NIH service. The 60,000 KVA additional capacity will increase the total capacity of the three campus substations to 200,000 KVA, and the allocated NIH capacity to approximately169,000 KVA. The installation includes a new satellite switching station in Building 59. The substation is scheduled to go into service in 2005.

The total capacities of Substations 80 and 167 are 80,000 KVA and 60,000 KVA, respectively for a combined capacity of 140,000 KVA. Capacity is shared with customers other than NIH. Substation 80 supplies power to the Naval Medical Center and one non-government outgoing 15 KV feeder to the Bethesda area. Substation 167 supplies the Uniformed Services University of the Health Sciences and the Medical Center subway station as well as NIH. The capacities available to NIH, 70,000 KVA at Substation 80 (Building 17) and 39,000 KVA at Substation 167 (Building 46), are set by a NIH-PEPCO service contract.

Buildings 17 and 46 are joint PEPCO-NIH use substations. PEPCO owns the buildings, the 20,000 KVA transformers and some related 15 KV switchgear. NIH owns and operates 15 KV main breakers, tie breakers, and feeder breakers that protect the internal campus 15 KV cable distribution system that feeds spot networks in different NIH buildings. Both substations have an interior wall that separates PEPCO switchgear and facilities from NIH switchgear and facilities. The interconnecting electric bus through the common wall belongs to PEPCO.

NIH identifies their facilities in Building 17 as the East NIH Substation, and those in Building 46 as the West NIH Substation. NIH has extended the East NIH Substation switchgear to a satellite station in Building 45 (NIH East Satellite Substation) via a cable extension from the East NIH Substation switchgear bus.

The East and West NIH substations in Buildings 17 and 46 are fed by PEPCO Substation 121 via PEPCO Substation 6, although one feeder to Building 46 is routed directly from Substation 121. The Substation 121 itself is fed by three independent power sources interconnected to four distribution busses, and it is considered to have a high operational reliability. However, the existing lines between the station and NIH through Bethesda are overhead and subject to potential storm damage. The North Substation is fed underground directly from PEPCO Substation 121 by a route totally separate from existing routes providing redundancy.

PEPCO Energy Services Inc. and NIH have signed a contract for installation of a electric power cogeneration (COGEN) unit in Building 11. The COGEN unit is composed of a turbine, boiler, and auxiliary support equipment. The natural gas fired turbine has a nominal capacity of 23 MW (23,000 KW), and will generate about 19.6 MW of electric power, when operational efficiency is accounted for. The hot exhaust gases from the turbine will pass through Boiler 6 to recover heat prior to release in the plant stack. The heat recovered will generate 108,000 PPH of steam. The turbine and boiler will operate in an on-off mode. Supplemental direct firing of Boiler 6 will provide a capability to produce an additional 72,000 PPH of steam.

PEPCO Energy Service, Inc. will finance and build the COGEN unit, and operate it for ten years. NIH will purchase the electricity produced during this period. Power produced will be sent via 15 KV underground cable to the West NIH Substation in Building 46. NIH payments for the electricity produced will be credited toward the purchase of the COGEN plant. The plant has been undergoing performance testing in 2003, and it is anticipated that it will be in service in 2004, and NIH takeover is projected to occur in 2014. Economic analysis completed for the project indicates that it will save NIH, when it owns the unit, about $5.5 million annually in power cost.

Utility deregulation, and corporate actions are leading to a rapidly evolving electric power environment. PEPCO received approval of its merger with Conectiv in September 2001. PEPCO has expressed its intent to concentrate on power distribution and sell all its generation plants. PEPCO and Connectiv are members of the PJM wholesale electric power market in the Mid-Atlantic region. Power generation and distribution are shared across the PJM area, which covers New Jersey, Pennsylvania, Delaware, and Maryland. With deregulation, PEPCO/Connective will still deliver power to NIH Bethesda, but it may be purchased elsewhere. The PJM market area appears to have sufficient reserve capacity for the next 10 to 15 years. However, experience with deregulation in Pennsylvania within the market indicates that greater volatility in short term prices can be expected. The NIH COGEN plant will provide NIH with opportunities and flexibility in a deregulated power market.

The East NIH Substation serves 43 buildings in a service area north of South Drive and east of Service Drive West. At the East NIH Substation, all PEPCO and NIH switchgear was replaced in 1991 with new 750 MVA rated vacuum breakers. The West NIH Substation covers 12 buildings in the southwest sector of the campus. Both substations provide power to the Magnuson Clinical Center Complex. Power is fed to clusters of buildings directly or via satellite switching substations. The East NIH Substation supplies the power plant, Building 11. Three transformers in Building 11 convert 13.8 KV to 2.4 KV for large motor loads. Other transformers convert 13.8 KV to 480Y/277 volt or 208Y/120 volt to operate auxiliary and pumping equipment and for house current. Building 34, the Auxiliary Chiller Plant, is served from the West NIH Substation. A few small buildings around the campus receive power directly from the PEPCO system, rather than through the campus substations.

All internal campus distribution lines and electrical equipment are owned by NIH and operated by its personnel. Primary distribution is made at 13.8 KV direct to all campus buildings, where it is converted to the building utilization voltage, which may be either 277Y/480 or 120Y/208 volts, three phase, four wire systems. This primary campus distribution system, consisting of 21 miles of 13.8 KV cables, 150 manholes and interconnecting underground duct, and six electrical equipment vaults, is judged to be in good to excellent condition.

NIH is subject to load curtailments during periods of high regional electric power usage. For example, NIH experienced three curtailments in the summer of 1999. In return for reducing campus loads temporarily on request from PEPCO, NIH receives a discount on purchase costs.

NIH Bethesda power usage is shown in Table 5-21. Data is based on PEPCO billings for power delivered to the NIH East and West substations combined. Four other accounts, including those for Buildings 60 and 62, are metered separately. The combined annual usage of the separately metered lines is about 2.65 million KWHR per year.

NIH demand increases in the summer due to power requirements to drive the chillers in the Central Refrigeration Plant (0.86 KW/ton). Chilled water generation accounts for 50 to 60 percent of the total campus demand when the outdoor temperature is 90° F or above. Overall campus electric power demands increased steadily by 32 percent between 1992 and 2003.

Maximum demand for each month is recorded on PEPCO billings. The campuswide recorded maximum demand was about 74,500 kilowatts (KW) in June 2002. The annual maximum power demand generally corresponds with maximum or peak chilled water production. While there are wide diurnal fluctuations in demands, it is estimated that building demands are relatively consistent from work day to work day.

Month	2003 Power Demand Buildings 17 & 46 KWHR	2003 Power Demand Other Sources KWHR	2002 Maximum Demand (1) KW	2003 Maximum Demand (1) KW
January	32,000,000	218,000	56,036	51,786
February	29,996,000	192,000	54,339	39,483
March	31,164,000	220,000	55,215	44,112
April	28,948,000	214,000	64,099	43,766
May	33,213,000	224,000	64,283	43,405
June	34,275,000	239,000	74,486	54,540
July	38,944,000	240,000	72,663	49,525
August	40,570,000	245,000	71,201	50,477
September	40,978,000	195,000	70,977	53,261
October	31,328,000	212,000	52,038	36,433
November	34,840,000	216,000	48,971	36,929
December	32,886,000	230,000	50,966	37,916
Total	409,144,000	2,645,000		

	Annual Usage (KWH	Maximum Demand (KW)
1992	305,800,000	53,350 (July)
1996	311,200,000	63,424 (July)
1998	342,800,000	69,608 (May)
2000	358,800,000	67,613 (August)
2002	402,800,000	74,486 (June)
2003	411,800,000	74,000 est. (June)

Notes: (1) For Building 17 and 46 combined.
Source: PEPCO billings.

TABLE 5-21 NIH ELECTRIC POWER USAGE.

The estimated peak or maximum demand for all facilities on the campus other than the chilled water plant is roughly estimated to be about 32,000 KW.

Comparison of 2002 and 2003 billing dated for maximum or peak usage shows the effects of the COGEN unit. The unit was operated periodically in 2003 while undergoing performance acceptance testing. It generates about 19,600 KW of power on a continuous basis, when operating. Although undifferentiated, the KW HRS produced by the unit are included in the billing totals for Building 17 and 46. The billed maximum KW demand for 2003, however, includes only the peak demand on the outside PEPCO system serving the campus substations.

Projected Master Plan Alternative maximum electric power demands are shown in Table 5-22. Master

Year	Maximum Demand (KVA)
2003	78,400
2005	106,500
2009 End First Phase	105,000
2015 End Second Phase	121,200
2020 End Third Phase	124,500
2020+ End Final Phase	131,800

Substation	NIH Demand KVA)	NIH Capacity KVA)	Total Capacity (KVA)
East (Bldg. 17)	51,000	70,000	80,000
West (Bldg. 46)	30,000	39,000	60,000
North (Bldg. 63)	50,800	60,000*	60,000*
Total	131,800	169,000	200,000

* Space provided for 90,000 KVA.

TABLE 5-22 PROJECTED MASTER PLAN MAXIMUM ELECTRIC POWER DEMANDS AND SUBSTATION CAPACITY.

Plan Alternative demands are projected to increase to about 132,000 KVA if all Master Plan Alternative projects are implemented. About half of the projected growth in demand will occur over the next two years as the Hatfield CRC, NRC Phase I, and Building 33 come on line. Projected demands are based on peak power demand needed by the chilled water plant. The projected higher power demand increase in relation to building space increase is created by higher unit demands. Most of the Master Plan growth proposed will be research and animal space which use significant more power in terms of watts per square foot than office or general space (7 w/gsf vs. 4 w/gsf). Indirectly, the disparity is even greater. Laboratories and animal space require 7.53 w/gsf to produce the necessary chilled water under peak demand conditions. Offices and general spaces similarly require only 2.25 w/gsf for air conditioning. The projected demand estimates include multiple level parking structure lighting at 2 w/gsf. General site or outdoor lighting is included in the 2003 billings, and it is assumed that it will remain constant in the future.

Under the No Action Alternative, maximum electric power demands are projected to increase to about 107,000 KVA.

Chillers 21 through 23 will have dual steam/electric drive. They will have a combined capacity of 15,000 tons. Switching to steam drive during the summer months when demand is highest eliminates 0.6 KW/ton of chiller demand. Some electric power is needed to run the cooling towers, but the net reduction when producing 15,000 tons of chilled water would be about 8,850 KW or 9,300 KVA.

NIH began a cable replacement program for its primary 13.8 KV (15 KV) cable campus distribution system in 1992. Approximately half of the cable has been replaced. With completion of the North Substation, NIH will begin a program to redistribute campus electrical loads among the three substations, and satellite substations. The campus will be divided into nine service zones, seven of which will have satellite substations (Figure 5-14). The distribution system will be converted to a loop network so that

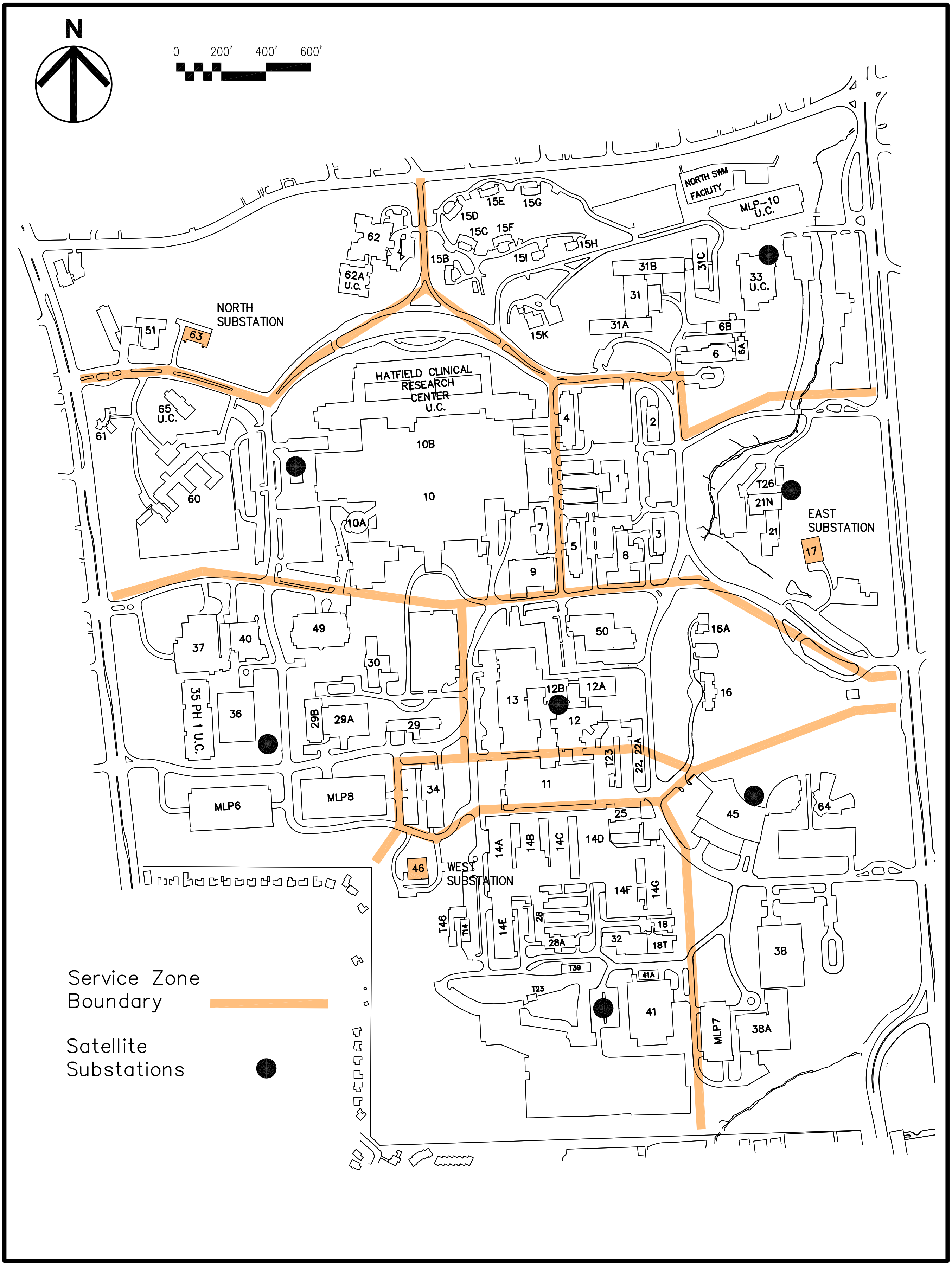


FIGURE 5-14 NIH ELECTRIC POWER SERVICE ZONES AND SUBSTATIONS.

critical or important loads can be met, even if power is lost at one of the substation. The estimated potential distribution of demand among the substations under Master Plan buildout condition is shown in Table 5-22. Campus power distribution will change with the connection of the North Substation to the campus network. The electrical load will be redistributed among Buildings 17, 46, and 63. The seven satellite switching substations will provide greater system reliability and flexibility.

5.4.2.1 Emergency Electric Power

Emergency power is defined as backup electric power that is needed quickly when the normal means of supply is interrupted or lost. Emergency power requirements are divided into two general levels.

Level 1 service requires replacement of electric power with an alternate source within ten seconds of loss. It is divided into two categories: life support and critical. Examples of demands within Level 1 service include fire alarms, firewater pumps, emergency lighting, hospital patient care and support such as life support equipment, surgery room power and lighting, intensive care spaces, and critical laboratory equipment. Alternate source power at Level 2 service can be replaced within intervals greater than ten seconds. Examples include heating, ventilation, and restart of refrigerators or freezers holding temperature sensitive biomaterial or stored MPW awaiting pickup and disposal.

Currently, there are 48 emergency diesel generator units on the campus ranging from 60 KW to 1,825 KW in size. Seven units are 700 KW or larger. Total nominal capacity is 16,005 KW. Analysis completed in the 1992 Master Utility Plan indicated that about two-thirds of the emergency power load was Level 1 service.

Three 1,500 KW units were installed recently in a “central” emergency generator plant in Building 59A replacing two smaller units in Building 11. They supply power to Building 10, and the central steam and chilled water plants in Building 11. Five additional generators at Building 10 with a combined capacity of 2,635 KW supplement the Building 59A facility and serve individual functions within Buildings 10 and 10A. Emergency power generators at the Building 14/28 animal care complex support the entire building demand (2,005 KW or about seven watts per gross square foot (w/gsf)).

In older buildings on the campus, backup or emergency power is generally limited to critical loads. Emergency power at Buildings 31 and 38 support only emergency lighting (0.25 w/gsf). Supported loads or demands in older laboratories varies considerably from building to building, but averages about four watts per gross square foot.

Recently developed emergency power design criteria for hospital and research space account for increased loads per unit of space. Demands have increased with increased use of electronic equipment and personal computers. Industry trends indicate these demands will grow further over the next decade. Recent construction at NIH reflects this trend. Backup or emergency power is supplied for greater portions of or the entire building load or demand. Building 45, an office building, has a 1,000 KW generator capable of supplying emergency power at four w/gsf. Laboratory Building 49 and 50 are serviced at six w/gsf, and Building 40 will be serviced at 5.5 w/gsf when Phase II is built.

Projected campus emergency power requirements for the Master Plan Alternative are shown in Table 5-23, assuming the implementation schedule shown in Table 4-2. The No Action Alternative requirements would rise to about 21,000 KW in 2007 and remain at that level.

The loads shown in Table 5-23 are net values accounting for new buildings and demolition. Service requirements for new buildings were determined by type of space at the rates shown in the table. Existing

Year	Total Load (KW)	Space Type	Rate (w/gsf)
2003	16,005	Clinical Research	10
End First Phase	20,300	Animal Care	7
End Second Phase	24,400	Laboratory	6
End Third Phase	26,400	Building 13/Service	5
End Final Phase	29,600	Office	4
		Existing Building 10	2
		Other	0.5

TABLE 5-23 PROJECTED MASTER PLAN EMERGENCY POWER REQUIREMENTS.

units servicing individual buildings were deducted, if the building is to be demolished. In practice, these units could be relocated. It was assumed that renovated Building 10 would be laboratory space.

5.4.3 Water

Water is supplied to NIH by the Washington Suburban Sanitary Commission (WSSC). The WSSC transmission and distribution grid surrounds NIH. WSSC maintains 12" and 24" diameter mains under Old Georgetown Road and a 24" main under West Cedar Lane. The water main along Rockville Pike is 12" in diameter between West Cedar Lane and South Drive, and 8" in diameter to the south. Service pressures in the area are established at the Alta Vista standpipe and tank located on the north side of West Cedar Lane about 300 feet to the east of Old Georgetown Road and across the street from NIH. The system head or pressure elevation is 495 feet. Area mains are fed by water from the WSSC Patuxent and Potomac Water Filtration Plants.

NIH receives water at seven metered locations around the campus:

- An 8"-line at Rockville Pike and Woodmont Avenue
- An 8"-line north of South Drive at Rockville Pike
- A 12"-line at West Cedar Lane and Crest Drive
- A 12"-line at West Cedar Lane and West Drive
- A 10"-line at West Cedar Lane and West Drive
- A 16"-line at Old Georgetown Road and South Drive
- A 10"-line via Roosevelt Street in Edgewood/Glenwood

Internally, a grid network of 10" water mains owned and operated by NIH serves the campus. The grid forms 14 separate squares or loops which surround individual clusters or blocks of buildings. An 8" main serves the southern periphery of the campus and a 6" diameter main services the residential area on the north side of the campus. Service lines to all buildings except the residences range from 4 to 8 inches in diameter.

Since 1995, NIH has cleaned and restored the campus distribution system, returning it to the original capacity. Building service lines have been upgraded or increased in size. And a new 16"-main through the center of the campus and 12"-main around the west and north sides of the new Clinical Research Center have been added to greatly enhance general service and provide adequate fire flows.

Based on WSSC meter readings at the seven water service entrances to the campus, the average water usage at NIH Bethesda in 2003 was approximately 2.141million gallons per day (MGD) (Table 5-24). In 1993, the average daily use was 1.846 MGD. The relatively low increase in demand compared to campus growth over the intervening period is attributable to water efficient plumbing installed in new facilities such as Buildings 40 and 50 in the intervening period. Seasonally, average daily usage is higher in the summer months, when a large amount of makeup water for the chilled water system is needed. Typically, water usage during the peak month, generally July or August, averages about 3.0 MGD, while average low monthly use is about 1.5 MGD. The 3.03 MGD average demand in July 2003 was unusually high, and a record use for a given month.

The Master Plan Alternative average daily water usage on an annual basis is projected to increase as follows:

Year	Average Daily Usage (MGD)
2003	2.141
2005	4.629
End First Phase	4.924
End Second Phase	5.820
End Third Phase	5.994
End Final Phase	6.376

NIH water use can be divided into three categories, general domestic or building use, water needed for makeup of steam, and water used in the chilled water plant. Estimates of diurnal building water usage patterns can be inferred from a sanitary flow monitoring program conducted by ADS Environmental Services, Inc. from December 1992 to June 1993. Flows were monitored continuously at individual buildings as well as at NIH sanitary Manholes 4 and 23. They are the last two manholes in the campus sanitary system draining to West Cedar Lane. Daily averages, minimums, and maximums were recorded. Building water usage was estimated by correcting for NIH buildings that send sanitary flow elsewhere, and for non-NIH sanitary flows at Manholes 4 and 23 (See Section 5.4.4). Comparison of NIH monthly water bills with sanitary flows at the time of monitoring, and after correction for steam and chilled water use, indicate that the building sanitary flow is about 93.5 percent of the building water demand.

Water usage at NIH fluctuates during a given day (Figure 5-15). Analysis of the 1992 monitoring data indicates that NIH has two distinctive building water use patterns, one applicable to work week days between 7:00 AM to 5:00 PM, and the other for the remainder of the time. The average building water use during the non- work hours was about 750 gpm. The average daily minimum was 508 gpm, although daily minimums fall to as low as 150 gpm on occasion. Building water usage increased sharply between 7:00 AM and 5:00 PM on work days. The average building demand was about 1,750 gpm during this period. The average work day maximum flow was 1,942 gpm, although daily maximum flows exceeded 2,100 gpm several times a month. The estimated 2003 maximum building water demand is 2,197 gpm. This is equivalent to 0.00030 gpm/gsf.

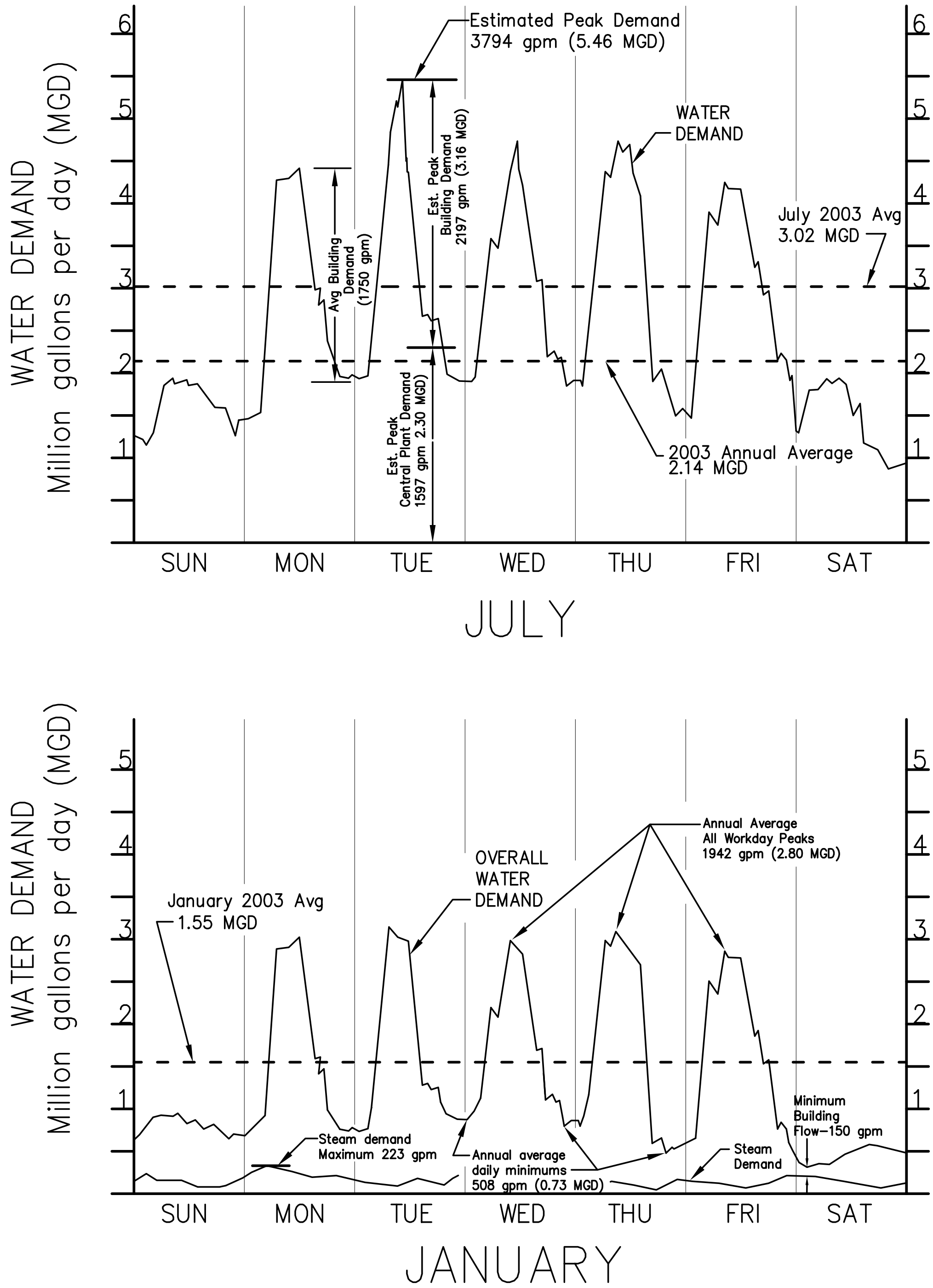
Existing and projected Master Plan maximum water demands are shown in Table 5-25. Water demands for chilled water (0.0279 gpm/ton) and steam generation are superimposed on building demand. Chilled water production requires far more water per unit than steam. Maximum total water demands therefore occur during the summer months as reflected by the monthly billings.

Building water demands per unit of space will also increase. Laboratories and animal spaces use much greater amounts of water than offices and general use space (0.00054 gpm/gsf vs. 0.00024 gpm/gsf).

Month	Vault #1 (Roosevelt)	Vault #2 (Old Georgetown)	Vault #3 (W. Cedar Lane-West)	Vault #4 (W. Cedar Lane-East)	Vault #5 (Rockville Pike-North)	Vault #6 Rockville Pike-South)	Vault #7 W. Cedar Lane	Total Campus Flow
JAN	150.7	331.4	129.5	46.6	20.6	0.0 [(3)]	868.8	1547.7
FEB	148.3	376.5	127.2	153.4	6.3	0.0 [(3)]	856.0	1667.7
MAR	150.8	369.3	126.5	154.1	18.2	0.0 [(3)]	854.0	1672.9
APR	140.9	347.6	122.6	149.8	24.8	199.3	827.7	1812.6
MAY	140.4	349.7	118.3	152.0	21.2	268.8	842.6	1893.0
JUN	171.8	438.1	158.2	184.6	40.9	395.4	1089.1	2478.2
JUL	189.6	533.5	177.4	208.5	48.5	637.3	1230.1	3025.1
AUG	188.1	538.6	179.3	213.7	38.1	627.8	1225.6	3011.2
SEP	141.1	361.7	144.5	165.2	23.6	622.6	963.4	2422.0
OCT	126.8	353.9	124.9	151.8	15.7	803.7	881.0	2457.7
NOV	143.6	403.2	119.8	147.0	19.5	416.5	852.7	2102.3
DEC	141.0	322.0	107.8	141.3	11.9	76.9	802.7	1603.5
AVG	152.8	393.8	136.3	155.7	24.1	337.4	941.1	2141.2

Note:
1. Data taken from utility billings.
2. Average flow based on number of days in billing period. The length of billing period varies from meter to meter.
3. Out of service for all or portions of the month.

TABLE 5-24 NIH AVERAGE DAILY WATER CONSUMPTION IN 2003 SUMMARY (in thousands of gallons day).



Notes: 1 MGD = 694.4 gpm
Derived from continuously monitored sanitary flows and WSSC billings

FIGURE 5-15 TYPICAL NIH BETHESDA WATER USE PATTERNS.

Year	Direct Building Use	Chilled Water Makeup	Summer Steam Makeup	Total
2003	2,197	1,531	66	3,794
2005	2,781	1,769	79	4,629
End Of First Phase	3,003	1,838	83	4,924
End of Second Phase	3,596	2,125	99	5,820
End of Third Phase	3,709	2,182	103	5,994
End of Final Phase	3,968	2,299	109	6,376

TABLE 5-25 EXISTING AND PROJECTED MASTER PLAN MAXIMUM WATER DEMAND (in gallons per minute).

Most of the new space proposed in the Master Plan Alternative is of the former type. The overall average building water usage factor per unit of space is projected to increase to 0.00037 gpm/gsf.

The Master Plan total maximum water demand, which includes central plant consumption, would increase

to about 6,400 gpm. Under the No Action Alternative, total maximum water demands would increase to an estimated 5,100 gpm by 2007.

Fire flows at NIH are 1,250 gpm for buildings with an additional 500 gpm for site building density in accordance with the National Fire Protection Association Code.

In its review of the Draft EIS for the 1995 Master Plan, WSSC indicated that there was sufficient WSSC transmission and distribution capacity to meet NIH and surrounding community needs.

5.4.4 Sanitary Sewer

NIH is in the Washington Suburban Sanitary Commission (WSSC) sanitary sewer service area. WSSC maintains an 8 to 12-inch diameter sanitary main under Old Georgetown Road that ultimately connects to a collection system to the west of the campus. An 8-inch main runs under most of the length of West Cedar Lane on the north side of the campus. This line carries an estimated 80,000 gallons per day of sanitary waste from sources outside NIH, primarily the Maplewood residential neighborhood. There are no sanitary lines along Rockville Pike on the east side of the campus.

WSSC also operates and maintains short sections of sanitary mains within the NIH campus at four locations. The first of these is in the northeast corner of the campus where the main NIH sanitary system serving all but a few buildings connects to WSSC and NIH manholes 4 and 23 (Figure 5-16). WSSC maintains two short sections of main between the NIH manholes and WSSC lines under Cedar Lane. The WSSC system expands to two parallel mains, 15 and 18-inches in diameter downstream from the NIH outfall. These mains combine with one another on the east of Rockville Pike to form a main that follows the NIH Stream to a connection with the Rock Creek Trunk sewer.

The WSSC 15 and 18-inch lines are not interconnected. Flows from NIH are roughly equalized between the two WSSC mains by separate connections to each, and an interconnection between NIH manholes 2 and 4. Manhole 2 is located on a separate 8-inch main serving the National Naval Medical Center (NNMC).

The second WSSC main crosses the southeast corner of the campus following the Stony Creek valley. It

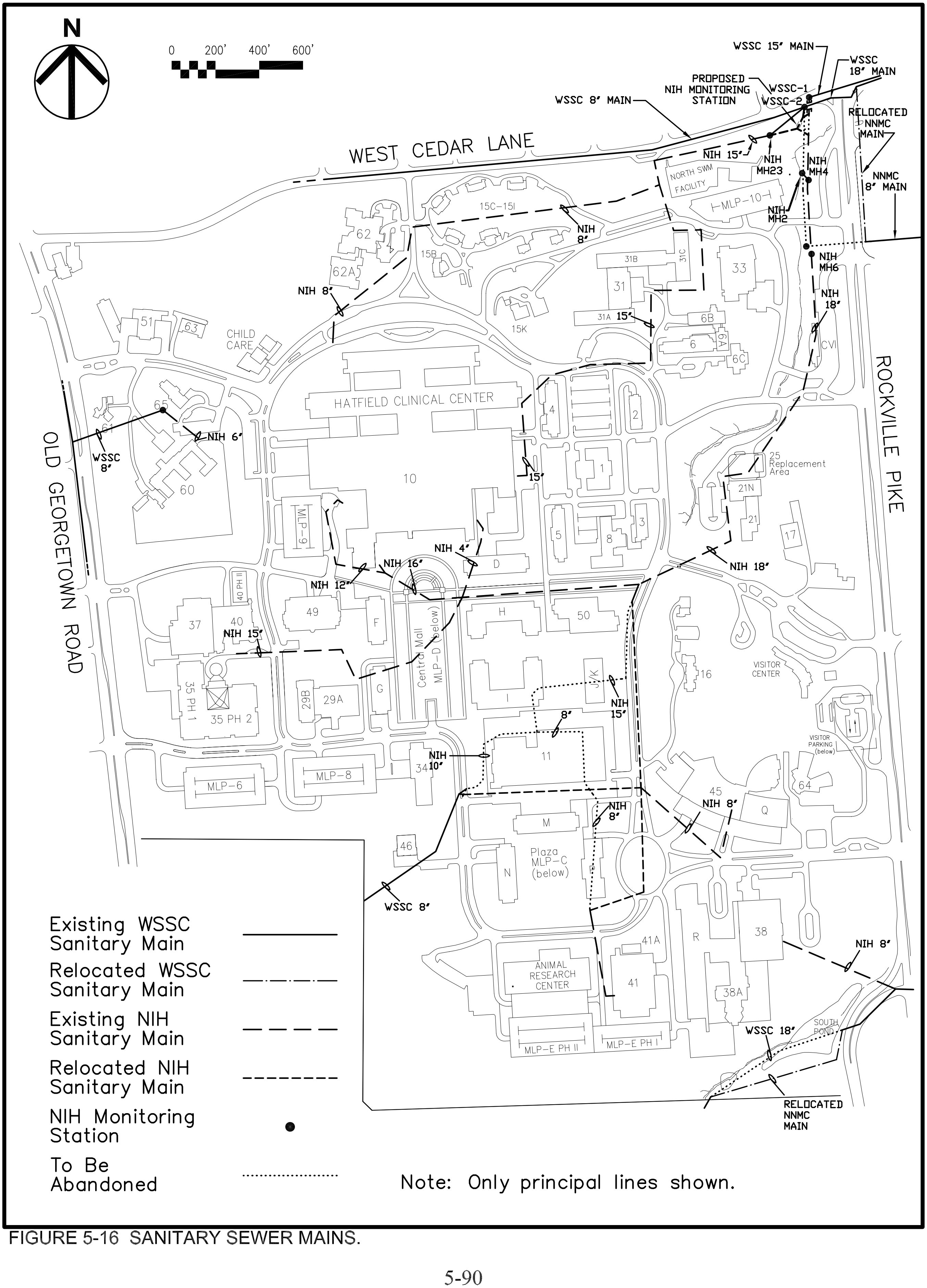


FIGURE 5-16 SANITARY SEWER MAINS.

is 18-inches in diameter as it crosses the campus, but increases to 21 inches in size at Woodmont Avenue.

This main serves most of the Woodmont Triangle of the Bethesda CBD as well as residential areas to the southwest of Old Georgetown Road before entering the campus. It proceeds to the east after crossing Woodmont Avenue, collecting sanitary waste from the bulk of the NNMC as well as the Uniformed Services University of the Health Sciences and East Bethesda. The WSSC main paralleling Stony Creek follows that stream to Rock Creek about 0.5 mile to the east of the campus.

The third WSSC line on campus drains the Glenwood neighborhood to the southwest. It enters the campus at the east end of Roosevelt Street as an 8-inch main. The main connects to the NIH system near the southwest corner of Building 11. The last WSSC main on campus is a short section serving the Cloisters, Building 60, which connects to a WSSC Line under Old Georgetown Road.

The main NIH sanitary system can be divided, in general, into two separate collection networks that join one another in the northeast corner of the campus. The north network drains most of the old and new Clinical Centers and all the campus buildings north of Center Drive and the administrative area. The southern branch of this northern network is 15 inches in diameter between Building 10 and West Cedar Lane, and the northern branch primarily serves non-research type buildings (Building 15A-K, fire station and the Children's Inn).

The south network drains most of the remainder of the campus and divides into three principal branches. One serves the laboratories on the west side of the campus; the second follows the original course of the NIH Stream valley to Edgewood/Glenwood, while the third extends south to Building 41. An 8-inch sanitary main from the National Naval Medical Center joins the south network near East Drive. Buildings 38, 38A, and 46 are serviced separately by short, direct, and independent connections to surrounding WSSC mains that flow to the Stony Creek main. Buildings 1 through 9 are serviced by a small lateral system that connects to the southern network.

Sanitary flows were monitored continuously from December 1992 until June 4, 1993 at selected locations to provide checkpoint data for a hydraulic analysis of the NIH sanitary system (Utility System Analysis and Planning, Task 3.0, Volume II, Ross Murphy Finkelstein, Inc., 1994). Survey results provide information on daily flow patterns, and indirectly, water usage. Average monitored daily flows for the northern and southern networks combined were 1.425 MGD. However, NIH exhibits two distinct usage patterns, one applicable to the work weekday between 8 AM and 4 PM, the other applicable to all other times. Average daily weekday flows were 1.581 MGD, while on weekends the average was 1.077 MGD. From 8 AM to 4 PM, the average flow was 2.538 MGD. The peak dry weather flow was at a rate equivalent to 2,020 gallons per minute (gpm) (2.910 MGD).

Flows are generally equally divided between the north and south collection networks. The Building 10 outfall to the north network contributed about one third of the total flow at all times. Flows from the WSSC Glenwood main (0.049 MGD) and the NNMC (0.117 MGD) are included in the above averages. Sanitary wastes from both areas flow into the southern network. The NNMC volume is only a partial flow from that facility. It is estimated that the dry weather groundwater infiltration from six miles of campus sanitary lines is about 0.035 MGD. Infiltration from the Edgewood/Glenwood and NNMC systems is estimated to be double this volume.

Existing and projected maximum dry weather Master Plan Alternative sanitary flows are shown in Table 5-26. The large differences between maximum water demand and maximum sanitary flows are due to water evaporation in the central plant chilled water cooling towers. Cooling tower evaporation can account for 60 percent of total site water demand when temperatures are above 90E F. The tower makeup water is submetered and deducted from NIH sanitary sewer billings.

YEAR	NIH BUILDING SANITARY TO CEDAR LANE (A)	NIH BOILER[1] TO CEDAR LANE (B)	NIH SANITARY TO OTHER WSSC MAINS (C)[2]	TOTAL NIH SANITARY (D) = A+B+C	EDGEWOOD/ GLENWOOD TO CEDAR LANE (E)	NNMC TO CEDAR LANE (F)	TOTAL SANITARY TO CEDAR LANE G = (A+B+E+F)
2003	2,059	203	118	2,380	34	81	2,377
2005	2,600	243	118	2,961	34	81	2,958
2009	2,807	256	118	3,181	34	81	3,178
2015	3,362	305	204	3,871	34	0	3,601
2020	3,467	317	204	3,988	34	0	3,818
2020+	3,710	336	246	4,292	34	0	4,081

(1) For boilers operating at peak winter demand.
(2) Buildings 38, 60 and 64. Assumed to include the National Library of Medicine addition and Building Q in the future.

TABLE 5-26 EXISTING AND PROJECTED DRY WEATHER MAXIMUM WEEKDAY SANITARY FLOWS (in gpm).

Peak campus sanitary flows will increase from 2,262 an estimated 2,380 gpm in 2003 to nearly 4,000 gpm by 2020 under the Master Plan Alternative. The portion to Cedar Lane would increase from 2,262 gpm to 3,784 gpm. When the contributions of Edgewood/Glenwood and NNMC are added to the NIH flows to Cedar Lane, it is estimated that the total maximum flow at the NIH Cedar Lane outfalls to WSSC will be over 4,000 gpm if the Master Plan Alternative is fully built out. Data in Table 5-26 is for the NIH Cedar Lane outfall. Using WSSC procedures, it is estimated that the residential community of Maplewood adds an additional 49 gpm to the WSSC main flow before it passes under Rockville Pike. Under the No Action Alternative, peak sanitary flows at the NIH Cedar Lane outfall would increase to an estimated 3,100 gpm.

The existing NIH sanitary collection system generally has adequate capacity to handle all development proposed in the Master Plan. A computer hydraulic analysis was made using existing peak flow conditions which were 2.70 cfs for the north network and 3.94 cfs for the south network) conditions. Based on the analysis, the south network is operating at 22 to 33 percent capacity with the exception of the segment of the main stem north of Building 21, which operates at 45 percent capacity under peak flow conditions. The north network flows at 37 percent capacity or less, except for one section in Center Drive between NIH manholes 39 and 40 that is now at 84 percent capacity. The north network has an estimated capacity of 1,700 gpm, and the south network, a 3,900 gpm capacity.

The two WSSC mains under Cedar Lane have an estimated combined capacity sufficient to handle projected NIH and other off-site flows based on a minimum slope of 0.54% in the WSSC mains between NIH and the Rock Creek trunk sewer paralleling that stream. The estimated capacity of the WSSC main downstream from NIH is about 4,700 gpm.

Wastewater in the Rock Creek trunk sewer is ultimately routed to the Blue Plains Wastewater Treatment Plant operated by the D.C. Water and Sewer Authority. The Blue Plains plant treats approximately 350 million gallons of wastewater per day. Discharges from the plant to the Potomac River must meet the National Pollutant Discharge Elimination System (NPDES) permit requirements established by the U.S. EPA. Treatment removes 90 to 100 percent of specific contaminants. Approximately one billion gallons per day of wastewater are treated by jurisdictions in the Washington Metropolitan area and discharged to the Potomac River. The average flow of the Potomac River at Washington, D.C. is 6.97 billion gallons per day (6,970 MGD) (Water Resources Report, Maryland & Delaware, USGS, annual).

NIH wastewater discharges must meet the pollutant concentration limits established by WSSC Discharge Authorization Permit No. 05967 (Table 5-27). The limits are those for a standard industrial discharger modified to meet more stringent criteria for discharges to the Blue Plains Wastewater Treatment Plant. Sanitary effluent is sampled once every four days at the NIH sanitary system discharge points with results reported to WSSC semiannually as is applicable for all industrial discharges under the NPDES program.

The effluent sampling points monitor sanitary discharges from all campus sources such as Building 11 and 21, the Clinical Center, and all laboratories as well as normal human waste. Most laboratories have separate acid waste drains to holding tanks. These wastes are not sent to the sanitary system; but disposed of in containers through the hazwaste collection and treatment system (See Section 5.7.2.3).

The total toxic organic (TTO) permit limit is a cumulative one, i.e. the combined concentration of about 125 U.S. EPA designated priority chemicals cannot exceed 2.13 mg/l. Over the years, monitored concentration, have been consistently far below permit limits. In 1999, NIH implemented a toxic Organic Management Plan (TOMP) to further reduce releases of TTOs to the sanitary system. WSSC has exempted NIH from reporting TTO monitoring results unless monitored TTO concentrations exceed 1.07 mg/l, and it has not been necessary to do so since 1999.

Pollutant	Daily Max (mg/l)	NIH Self-Monitoring Required
Cadmium (total)	0.07	yes, Blue Plains limit
Chromium (total)	7.0	yes
Copper (total)	1.9	yes, Blue Plains limit
Cyanide (total)	1.3	yes
Lead (total)	0.7	yes
Mercury (total)	(---)*	no
Nickel (total)	4.1	yes
Silver (total)	1.2	yes
Zinc (total)	4.2	yes
Total Toxic Organics	2.13	yes, but see text
Dissolved Solids	1,500	no
Suspended Solids	400	no
Total Solids	1,900	no
Biological Oxygen Demand	300	no
Fats, Oils, Grease	100	no
pH	6.0-10.0 units	yes
Chemical Oxygen Demand	500	no
Temperature	150EF	no
* WSSC monitors for presence.		

TABLE 5-27 WSSC DISCHARGE LIMITS FOR NIH SANITARY WASTEWATER.

As part of the campus utility infrastructure modernization program, NIH would construct a sanitary wastewater monitoring station in the northeast corner of the campus (See Figure 5-16). The station would be a small underground structure that would facilitate access for obtaining monitoring samples. Sanitary lines in the vicinity would be relocated to combine the north and south networks for monitoring. Departing campus flows would be split between the WSSC 15-inch and 18-inch mains under West Cedar Lane to separate NNMC contributions from the NIH monitored flow. The NNMC sewer main would be disconnected from the NIH system, and the line relocated within the Rockville Pike right-of-way to the WSSC main.

5.4.5 Storm Drainage

With the exception of a 32 acre area in the southeast corner and a five acre area along Old Georgetown Road, all of NIH drains to the northeast toward the West Cedar Lane/Rockville Pike intersection (Figure 5-17). The drainage area upstream from this point is 455 acres including 57 acres in the Edgewood/Glenwood neighborhood to the southwest of the campus, 55 acres north of West Cedar Lane in Maplewood, and 25 acres east of NIH along Rockville Pike and on the Naval Medical Center property. (See Table 5-46 for estimated site drainage areas).

All storm drainage systems on the campus are owned and maintained by NIH. The main collection system has a trunk line interceptor that follows the original NIH Stream course. It enters the campus at the east end of Roosevelt Street after draining Edgewood/Glenwood as a 42" line and crosses the campus in a northeasterly direction, passing under existing Buildings 12B and 13, for a distance of approximately 2,350 feet. It progressively increases in diameter until it exits to daylight to the northeast of the South Drive/Center Drive intersection as a 96" pipe. It carries the flow of the NIH Stream during wet weather. Three other tributary drainage networks connect to the interceptor as it crosses the campus. A 12" to 36" line drains the southern area of the campus; an 18" to 36" line follows Lincoln Drive in the southwestern area; and a 12" to 48" line drains the laboratory area on the western side of the campus.

The second drainage area covers the northern sector of the campus. The dry channel of the North Branch of the NIH Stream is the main drainage stem for this area. Flows occur in the branch only during wet weather. The branch flows in a 48-inch diameter culvert under the residential area between West and Zelkova Drives. Elsewhere it is confined to a concrete-lined channel as it crosses the campus. Campus drainage occurs via overland flow, and through small individual collection networks serving building roofs and street and parking lot inlets. Stormwater drainage from West Cedar Lane and the western two-thirds of Maplewood also flows to the channel by direct pipe connections.

The third drainageshed is independent of the other two, covering the southeast corner of the campus. Most drainage is overland. A small storm drain network collects flows from the vicinity of Buildings 38, 38A, and MLP-7, and directs them to a small dry stormwater pond to the southeast of these structures.

In general, the campus storm drain systems are in good condition and adequately serve present conditions. In older areas of the campus developed prior to about 1965, drainage laterals from individual building downspouts and road inlets are often only 10 to 12 inches in diameter. This is sufficient to carry the 10- year design flows, but modern criteria are minimum 15-inch diameter pipes to prevent blockages and clogging, and facilitate cleanout. These lateral connections can be replaced as individual sites are developed and road improvements are implemented. Based on a hydraulic analysis of the campus networks all existing storm drains 15-inches and over in size have adequate capacity for expected Master Plan development flows.

5.4.5.1 Stormwater Management

Regulatory management of stormwater has been delegated by the U.S. EPA to local jurisdictions, in this case the Maryland Department of the Environment (MDE). Federal projects must follow the requirements of the Maryland Stormwater Management Guidelines for State and Federal Projects, MDE, July 2001, and State regulations given in COMAR 26.17.02.

Under the State guidelines, management of stormwater is accomplished in terms of quantity and quality control. Quantity control is achieved through detention of a computed channel protection stormwater runoff volume (CPv) as identified in the revised 2001 management guidelines. Similarly, quality management is obtained by applying a number of potential measures to treat a computed Water Quality

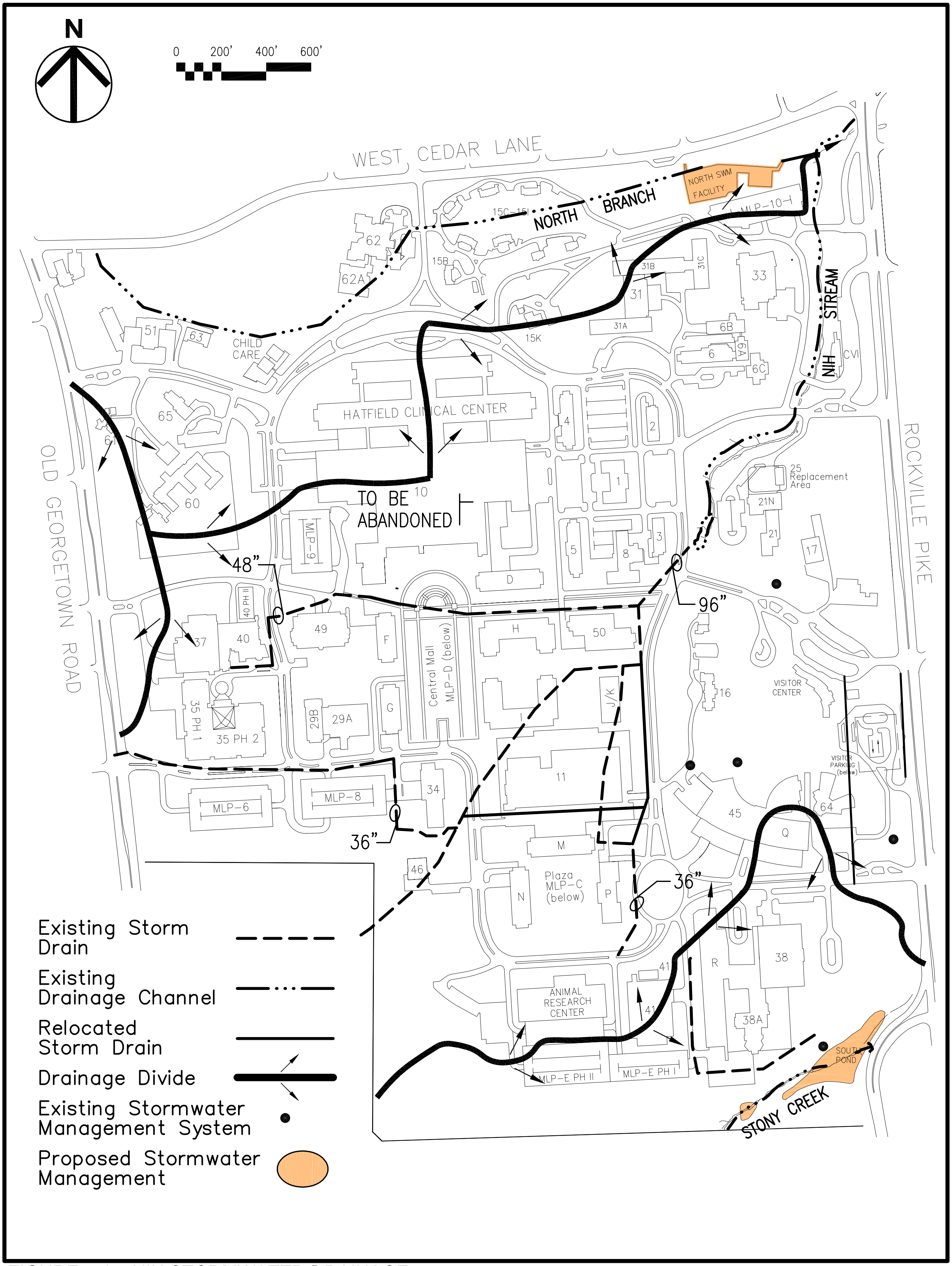


FIGURE 5-17 NIH STORMWATER DRAINAGE.

volume (WQv). One management measure such as stormwater ponds can provide both quantity and quality control depending on design details. The computed volumes are not necessarily equal to the physical volume of the management facility, and combined may exceed it.

For Stormwater management purposes, pervious surfaces are those covered by natural vegetation; impervious surfaces are those covered by paving and buildings. For quality control, MDE has different requirements for "new" development and "redevelopment" sites that are already largely impervious. New development requires treatment of 100 percent of the computed MDE WQv. Under "redevelopment" the impervious project area must be reduced by 20 percent, or 20 percent of the MDE WQv must be treated, or an equivalent condition achieved by a combination of these measures.

The MDE guidelines give authority to the MDE Administrator to grant waivers for stormwater quantity, or channel protection, volume control to sites with an approved Institutional Stormwater Management Plan (ISMP), or projects that solely involve redevelopment of a site.

Management of stormwater at NIH Bethesda presents complex issues. Factors impacting potential management include four separate stream watersheds, storm drain and stream hydraulics, limited space available for potential stormwater management (SWM) facilities, and concentration of development in the NIH Stream watershed. NIH Bethesda is also different from normal residential and commercial development. It is dynamic with construction and demolition almost continuously underway, and this results in continually changing management requirements.

Discussions between NIH and MDE have concluded that NIH can meet the MDE SWM requirements through development and implementation of a NIH Bethesda Institutional Stormwater Management Plan (ISMP). NIH has prepared a Draft ISMP, which has been submitted, to MDE for review. The ISMP has been developed on stormwater management on a campuswide or "regional" basis. This offers several advantages. It significantly reduces the complexity of the factors involved. Sitewide facilities are more cost effective than smaller facilities serving individual buildings. Sitewide evaluation of impacts and management is more realistic. It permits increases in imperviousness in one area to be balanced or offset by decreases in imperviousness in another. The ISMP is applicable to the Master Plan and No Action Alternatives.

For the purpose of stormwater management in the ISMP, "existing" campus conditions are defined as those present just prior to the start of construction of the Hatfield Clinical Research Center. This baseline status was established at the design level for a proposed 1995 Master Plan Site SWM Facility that was included as an element in the Hatfield CRC project. The Hatfield SWM facility has been subsequently superceded by ISMP proposals. The "existing" campus impervious area is calculated as 129.2 acres, or 41.8 percent of the total campus (Table 5-28).

Future campus impervious surface area cannot be calculated with precision because the Master Plan is conceptual or schematic. Actual impervious cover will be dependent on the design layout of buildings, parking, roads, and sidewalks. Although the Master Plan would add over 3.3 million gsf of floor space under full buildout conditions, approximate computations indicate there would be little or no net change in site imperviousness. This occurs for two reasons. For the most part, existing one to three story facilities, such as Buildings 12, 13, and 14, will be replaced by five to seven story structures. Also, while parking will increase, more than 5,800 surface parking spaces will be consolidated into multilevel parking structures. It is estimated that the overall site imperviousness will be reduced to approximately 102 acres or 33 percent of the campus under full buildout Master Plan conditions.

Although the actual campus impervious area is projected to decrease under Master Plan and No Action Alternative development, the ISMP impervious area for computation of Stormwater management

	North Branch	NIH Stream	Booze Creek	Stony Creek	NIH Total
Existing Site Areas by Drainage Basin	61.4	212.4	5.2	31.5	310.5
Baseline Buildings	4.5	39.0	0.1	4.0	47.6
Baseline Roadways/Parking	15.8	48.2	0.3	9.9	74.2
Baseline Sidewalks	1.6	4.8	0.0	1.0	7.4
Total Existing Baseline Impervious	21.9	92.0	0.4	14.9	129.2
Additional ISMP Build out Development	9.0	27.0	2.0	5.0	43.0
Total Ultimate ISMP Impervious	31.1*	118.6	2.4	19.5	171.7
*includes adjustment for post-CRC conditions.					

TABLE 5-28 NIH IMPERVIOUS SURFACE INVENTORY AND PROJECTED ULTIMATE CONDITIONS (in acres).

requirements will increase. This occurs because "redevelopment" of existing sites requires runoff quality control management and most of the projects listed in the Master Plan are presently occupied by buildings and parking lots. For example, Building 14 has a footprint extending over a little more than 10 acres. Redevelopment of the site with 10 acres of building and paving would result in no change in physical impervious area. However, the MDE requirement for a 20 percent reduction or treatment in Stormwater runoff in this case, computationally increases the ISMP has been based on a conservative increase of 43.0 acres accruing in this way to adequate management facility capacity.

Many types of structural facilities are available for stormwater management. They include water quality chambers, subsurface storage, surface ponds with permanent pools, dry basins, filtration, infiltration and bioretention facilities, or any combination of these. Some facilities provide both quantity and quality control, others one or the other. If a facility does both, the computed quantity (CPv) and quality (WQv) volumes for a given facility may not be equal. The ISMP proposes management with two facilities: the North SWM facility, and the South Pond. The North SWM facility is a “Channel Protection” facility for quantity control; the South Pond would be a quality control facility. Each would be a campuswide facility and satisfy MDE requirements for the site.

Quantity Control

The recently constructed North SWM Facility replaces a pond proposed in the 1995 Master Plan for the northeast corner of the campus. It is located on the North Branch. The facility is composed of three underground or buried fields of large diameter pipe laid side by side in rows. Pipe lengths range from 50 to 100 feet. The fields are connected in series, and arranged so that each is filled in sequence. The facility is “bottomless” in that the pipes are perforated and laid on a stone base, so that stored water can percolate into the underlying subsurface. Release of stored water is controlled through a single, small diameter outlet pipe at each buried field. The facility is scheduled for service in 2004.

The required quantity control storage volume (CPv) criteria is 3.14 acre-feet, equivalent to that approved for the original pond by MDE in 2000 (MDE No. 99-SF-0150). Under one year, 24 hour storm runoff conditions, the actual detained volume will be 3.30 acre-feet. The MDE channel protection objectives are achieved by extended detention that exceeds the minimum 24-hours required by MDE guidelines. Design detention times range from 30 hours, when the soil is dry, to 56 hours when the soil is saturated. Under dry weather conditions, the facility has the potential for up to 1.57 acre-feet of groundwater recharge.

Quality Control

Determination of necessary Master Plan sitewide quality control volumes is complex. In agreement with MDE, an assumption is made in the ISMP to simplify calculations, ensure sufficient capacity for intermediate campus conditions and contingencies, and avoid uncertainties about details at the future project level. Although the impervious ground cover at NIH Bethesda with full Master Plan development is expected to remain relatively constant in practice, it was assumed for the purposes of computing required SWM quality control volumes only, that 43 acres of the campus would be converted from pervious to impervious surface to ensure adequate management facilities are provided, and cover unforeseen contingencies. Although these 43 acres were apportioned among the campus drainagesheds, they are not associated with any specific site locations or projects. All development in the Master Plan in impervious areas, as defined by pre-Hatfield CRC conditions, is considered as "redevelopment" for determining individual project SWM requirements. The assumptions produce very conservative estimates of quality control requirements.

MDE has indicated that their quality control requirements would be met by treating 20 percent of the site Water Quality Volume (WQv). In addition, NIH proposes treatment of 100 percent of the WQv generated by the hypothetical 43 acre increase in impervious area. The computed or estimated WQv for the 43 acres is 3.4 acre-feet, and for redevelopment, 2.2 acre-feet. The required total campus wide WQv is 5.6 acre-feet.

NIH quality control requirements would be met by the South Pond. Most of the Bethesda CBD and resident areas south of NIH were developed prior to enactment of sediment control and stormwater management (SWM) regulations. There are few potential locations for retroactive installation of management facilities within the CBD. Stony Creek, which courses through the southeast corner of the NIH campus after emerging from the upstream storm runoff collection system, drains this area. The 1995 Master Plan and EIS identified the area where it flows through the campus as a potential storm water management facility site, although a number of issues would have to be resolved before implementation.

The Montgomery County Department of Environmental Protection (MCDEP) has conducted a study of the Stony Creek watershed to assess conditions and make recommendations for returning Stony Creek flows to predevelopment conditions (Regional SWM Facility, Continuation of SWM Study for NNMC, A. Morton Thomas and Associates, Inc., 1998). The study determined that existing management facilities upstream in the Woodmont Triangle, and downstream on NNMC, were in good condition, but they provided only partial quantity control. Downstream facilities on NNMC could provide suitable quality control. The most beneficial SWM best management practice for the watershed would be a regional facility in the southeast corner of the campus.

NIH and the County have signed a Memorandum of Understanding (MOU) wherein NIH will grant an easement for the project, provided that certain conditions are met and issues are satisfactorily resolved. MCDEP will complete concept and preliminary designs to a level that would give better definition to proposed facilities, conditions, and issues.

Construction of a SWM facility at the site would involve the relocation of electric power, natural gas, and a WSSC sanitary sewer line. Under the provisions of the MOU, the County would be responsible for all construction cost and coordination including resolution of utility issues. NIH would review landscaping and public safety features. Monitoring and maintenance of the facility once it is built would be the responsibility of the County. Response to emergencies such as upstream pollutant spills would be handled jointly by the County and NIH through procedures to be given further definition as the project progresses.

The County Stormwater Management Facility, or South Pond, will have four elements (See Figure 5-15 and Figure 5-26). The first is an underground screening facility to trap trash and sediments. Access would be provided through the roof for clean out and maintenance. Runoff would then flow into a small forebay water pool, about 60 feet in diameter, where settlement of suspended material would occur. Outfall from the forebay pool would then flow into the main pool, which would be one acre in extent under dry weather conditions. A second trash collection facility would be located at the Woodmont Avenue outfall. The South Pond is scheduled for construction in 2005.

The pools would have water depths up to 5 or 6 feet in the center. The main pool would have a 12-foot wide "bench" around the perimeter, where water depths would be less than a foot, for planting hydrophilic species. Montgomery County requires fencing around all wet ponds greater than two feet in depth.

The total drainage area upstream from Woodmont Avenue is 219 acres. For County purposes, the facility will serve as a quantity control facility. For example, it will reduce the one-year recurrence interval storm peak outflows through the twin 66-inch culverts under Woodmont Avenue from 219.5 cfs to an estimated 45 cfs (NIH South Pond Preliminary Design, A. Morton Thomas Assoc., 2002), and provide a channel protection storage volume of 5.52 acre-feet. The Pond will be capable of storing a six month storm, and quantitative management for 68 percent of the flow in a one year storm.

The facility will also provide 4.61 acre-feet of WQv storage for NIH. The wet pool of the main pond will contain 2.98 acre-feet of WQv at a water surface elevation of 300 feet. The remaining 1.63 acre-feet of water quality storage is achieved by Extended Detention of the one year storm runoff between the 300.0 and 301.5 pool elevations.

Restoration of the NIH Stream to its "natural condition" along the full length of exposure in the northeast sector of the campus is underway. Work includes bank stabilization, placement of rocks and riprap in a natural way, creation of micropools, and planting of native species within and alongside the stream. Flow velocity attenuators will be installed on storm drains outfalling directly to the stream.

The NIH Stream restoration project will also include the installation of six stormwater runoff quality treatment or storage facilities at strategic locations around the campus. Either bioretention or sand filter facilities will be installed. The estimated MDE WQv for these facilities combined is 0.96 acre-feet. This WQv is not included in the campus stormwater management total.

The MDE encourages non-structural Best Management Practices (BMP) for stormwater management. Additional CPv and WQv credits can be gained through their adoption. Examples of non-structural BMPs include disconnection of roof top drainage, open channels or swales with natural vegetation, and possibly vegetated building roofs. NIH will seek opportunities to implement innovative nonstructural stormwater management on a project by project basis for additional WQv credits.

The Bethesda campus is dynamic. More than 50 construction, renovation, and demolition projects are listed in the Master Plan. Several projects involving these activities are generally underway on campus at any given time. Some projects will involve both "new" and "redevelopment" aspects. Some areas will undergo several changes in perviousness status over a few years time. For example, the Building 14/28 complex will be demolished to make way for a new South Quad. The replacement buildings and underground MLP parking will be built over a period of several years. Portions of the Building 14/28 site may temporarily be used for parking or be converted to lawn. And NIH needs to record credits obtained for removal of surface parking in the buffer to compensate for increased impervious that may be created by new parking structures located elsewhere on campus.

The situation will be covered by an ISMP SWM tracking or "banking" system. The system is a ledger or account book that shows the status of campus management at any given time. The overall campus 3.30 acre-feet of channel protection or quantity control volume at the North SWM Facility and the 4.61 acre-feet acre-feet of WQv establish "account" levels for the campus as a whole. Concomitant Cpv and WQv would be determined for individual projects as they are implemented. If the projects are "new" ones, or "redevelopment" projects that do not reduce project site impervious area by 20 percent, then the computed project quantity and quality volumes would be deducted from the account values current at the time of project implementation. Volumes for projects that eliminate impervious surface, or reduce it by more than 20 percent, would be credited and added to the account CPv and WQ values. The current status ledger would be submitted to MDE with project computations to satisfy individual project MDE stormwater management requirements. MDE has indicated that tracking of stormwater management status in terms of acres of site impervious area may be preferable.

Projects that will be completed prior to construction of the South Pond will have independent or individual water quality management facilities. These facilities will be "rolled over" into the banking system when the South Pond is in place.

A new Phase II National Pollution Discharge Elimination Systems (NPDES) permit for federal, state, and small municipal stormwater discharge systems went into effect in January, 2005. Requirements include six measures: (1) Public outreach and education, (2) Public involvement and education, (3) Illicit discharge detection and elimination, (4) Construction site runoff controls, (5) Post-construction runoff controls, and (6) Pollution prevention and good housekeeping. NIH has filed a Notice of Intent to obtain a Phase II NPDES permit for the Bethesda campus.

5.4.6 Communications

Outside communication lines reach NIH via Verizon subsurface lines in Rockville Pike. Internal lines on the campus are owned and maintained by NIH. Communication lines on campus are routed through a complex network of 4" diameter conduits. Conduits are generally located under or immediately adjacent to the existing street grid. Conduits also carry the NIH fire alarm, security, and internal campus communications networks. Master Plan implementation impacts are minor; additional conduits would be needed in a few locations, particularly around the Clinical Research Center. Only a few minor relocations are needed to service proposed individual buildings.

5.4.7 Natural Gas, Fuel Oil, and Gasoline

Natural gas is supplied to NIH by Washington Gas (WG) mains running under Old Georgetown Road and West Cedar Lane. Washington Gas maintains 8" and 12" high pressure (200 psig) mains in Old Georgetown Road. Two 8" service mains branch from these mains and enter NIH at a Washington Gas pressure regulating station in the southwest corner of the campus along Old Georgetown Road. One of these 8" service mains, installed in 1992, supplies 100 psig natural gas to the power plant for boiler fuel. The other 8" main closely follows the southern boundary of the campus along the buffer area to Rockville Pike, which it subsequently crosses to supply gas to the Naval Medical Center.

The 6" service main from West Cedar Lane supplies low pressure gas (15 psig) to 38 campus buildings through a distribution system ranging from 3/8 inch to six inch size lines. There are about 15,000 linear feet of gas lines on the campus. Two to four inch service lines branch from the mains to individual buildings. Gas lines on the campus are owned and operated by WG, although many smaller building service lines are owned and operated by NIH.

More than 99 percent of campus demand is for generation of steam in Building 11. Boilers 1 through 5 and the COGEN have dual natural gas - No. 2 distillate fuel oil burners. The estimated existing and projected Master Plan Alternative potential peak demands are given in Table 5-29. These correspond to the estimated potential peak steam demands that would occur when outdoor minimum daily temperatures reach 0º F. Assumptions include exclusive use of natural gas alone as the fuel supply, 85 percent plant efficiency, and 1,025 BTU per cubic foot of gas. The computed potential peak demands for future No Action and Master Plan conditions are shown for planning purposes. In practice, as noted below, NIH switches to oil during periods of high steam demands.

The existing potential peak natural gas demand is 684,000 CF/HR. This potential gas peak demand corresponds to an estimated potential peak steam demand of 585,000 lbs/hr at a minimum daily temperature of 0º F. The potential peak demand will increase sharply in the short term over the next few years as projects that are now under construction such as the Hatfield Clinical Research Center (135,000 CF/HR), COGEN turbine (126,000 CF/HR), and the Neuroscience Research Center, Phase I (34,000 CF/HR), Building 33 (19,500 CF/HR) are connected to the steam distribution system. Peak potential demand is expected to increase to more than 1,000,000 CF/HR by 2005. Cubic foot per hour natural gas demand or usage for generating steam at times other than the potential peak can be roughly approximated by multiplying the pounds per hour of steam demand given in Table 5-17 by 1.15.

The existing NIH line between the Washington Gas system and Building 11 to the campus is capable of delivering approximately 700,000 CF/HR. Estimated potential peak natural gas demand will exceed this physical capacity in the short term under both the Master Plan and No Action Alternatives. The estimated ultimate No Action Alternative peak potential demand is 1,033,000 CF/HR.

NIH is one of many customers served by the Washington Gas distribution mains outside the campus. Since NIH can use oil as an alternative fuel supply, natural gas service to NIH is curtailable by Washington Gas. During the winter, when Washington Gas demands are high, NIH may have to reduce or eliminate its use of natural gas. Curtailment is the prerogative of Washington Gas under the service contract, and generally occurs when the average daily temperature is below about 27º F. NIH operated exclusively on oil during three periods totaling 38 days while under curtailment in January and February 2003. Therefore, as a practical matter, natural gas delivery to NIH is usually curtailed before the 700,000 cf/hr campus line capacity is reached.

Maximization of natural gas as a boiler fuel is important to NIH in controlling boiler stack emissions and maintaining operations within operating permit limits. Burning fuel oil generates more NOx emissions per pound of steam produced than natural gas. For example, Boilers 1 through 5 produce about 2.6 times more NOx than natural gas for a given amount of steam generation.

NOx are precursor compounds for generation of ground level ozone. The Washington metropolitan area Air Quality Control Region has been classified by the U.S. EPA as being in "severe" non-attainment for ozone, i.e. regional ozone levels do not meet the Federal Ambient Air Quality Standards. While regional measures for reaching NOx attainment have been identified, there is some uncertainty regarding whether these measures will be sufficient or not. If they are not, the potential for reduction of emissions from all sources, stationary and mobile, exists.

The Master Plans for Bethesda-Chevy Chase and Bethesda Central Business District forecast continuing residential and commercial growth. Continued growth implies increased natural gas demand by customers outside NIH. If the gas distribution capacity is not increased, then curtailment of NIH supply can be expected to occur more frequently and for longer periods during each occurrence, regardless of growth in campus demands.

Year	Maximum Demand (CF/HR)
2003	684,000
2005	1,032,000
End First Phase	1,011,000
End Second Phase	1,153,000
End Third Phase	1,229,000
End Final Phase	1,259,000

TABLE 5-29 PROJECTED MASTER PLAN PEAK NATURAL GAS DEMAND.

In May 2004, NIH signed an agreement with WG that guarantees a minimum supply of 380,000 cf/hr throughout the year, which would allow NIH to generate up to 325,000 lb/hr of steam at all times using natural gas. Additional steam demand during periods when the gas supply is curtailed to 380,000 cf/hr would continue to be generated using fuel oil, but the amount of steam produced using oil under the new agreement is markedly reduced. Assuming campus growth at the rate projected in the Master Plan 2003 Update, it is projected that NIH will be able to satisfy steam demands, natural gas demands, and Permit NOx limits under the new agreement provisions through the years 2011 or 2012.

In the event additional natural gas services is needed in the Bethesda area in the future (i.e., after 2011-2012) to serve NIH or others, NIH believes all affected parties within the affected service area, including Washington Gas, County officials other government agencies, local communities, as well as NIH, should be involved in discussions regarding this new or additional service.

NIH, as it has done in the past, will continue to reexamine its utility requirements on the campus on a regular basis and alert the appropriate utilities, as well as the community, if its requirements dramatically change. The master plan will continue to be updated on a regular basis, and if new proposals come forward that would introduce a new utility requirement, not identified in the Master Plan 2003 Update, these proposals will be reviewed, shared with the community, and go through the established environmental and other review processes with the federal and state authorities that presently oversee development on the Bethesda campus. In the future, if NIH would require a new natural gas line dedicated solely to NIH use, it will follow the NEPA process. If area natural gas demands, such as Bethesda CBD, NNMC, commercial and residential growth, etc., require expansion of the public system, NIH will follow or participate, as appropriate, in all applicable environmental review processes conducted by others.

NIH will continue to maintain facilities for the delivery and storage of No. 2 distillate oil as an alternative backup supply of fuel for the boilers. Fuel oil is now stored in two 90-foot diameter underground tanks on the east side of Building 34. Each tank holds 500,000 gallons. The tanks were inspected and brought into conformance with Underground Storage Tank regulations in 1995.

Relocation of fuel oil storage facilities would be necessary under the Master Plan Alternative. This would permit realignment of Lincoln Drive and Service Road West in the vicinity of their intersection to form the Loop Road in this area. Refueling facilities located immediately adjacent to the Loop Road would be unsuitable.

The Master Plan would replace the tanks with new ones on the south side of Building 11 in a service area between that building and Building M in the South Quad. The relocation cannot occur until demolition of Building 14. The new tanks would be smaller in diameter, but have the same or similar combined capacity as the existing ones.

Tanker trucks would follow a one way path between Service Road West and Center Drive. It is estimated that under maximum potential steam demand conditions (0º F outdoor temperature) and full implementation of the Master Plan, the tanks would hold a little more than a four day fuel supply, and that approximately 27 trucks per day would be needed to maintain supply. Under more typical winter conditions, the tanks would hold about a ten day supply, and on the average, a 20 day supply, and the respective number of daily truck deliveries would be about ten and five.

The NIH gasoline station , which supplies fuel for government vehicles and grounds maintenance equipment, has two storage tanks. Each has a 10,000 gallon capacity.

5.4.8 Strategic Central Plant Operating Program

Management of the NIH central plant steam, chilled water, and electric power generation operations is rapidly increasing in complexity. Recently, or soon to be, installed equipment create options for running the plant. However, these options introduce new relationships among the utilities as well as boiler plant stack emissions. The amount of stack pollutants emitted by the boiler plant on an annual basis is limited or constrained. An important consideration in choosing an operation option on a given day, or strategically for the next few months or remainder of the year, is the cumulative amount of pollutants that have been emitted when the decision is made compared to the annual emission limits.

Selecting an option is no longer straightforward. Many factors are involved. To illustrate, the following are some of the factors that must now be taken into account:

- Steam may be generated using either boilers or the COGEN unit.
- Chilled water may be generated using steam or electric power.
- Electric power can be obtained from the COGEN unit or outside sources.
- Either fuel oil or natural gas may be used to generate steam, and electric power in the COGEN unit.
- Generation of electric power in the COGEN unit requires burning additional fuel.
- The burning of oil and natural gas produces stack pollutant emissions.
- For each pollutant, the stack emission rate per pound of steam or kilowatt of electric power generated by oil or natural gas differ. For example, making one pound of steam using oil generates more nitrogen oxides than using natural gas.
- For a given fuel, the boiler and COGEN emission rates for each pollutant differ. Smaller variances, as determined by annual monitoring, exist among the boilers.
- Current or contract oil, natural gas, and electric power prices, and their relationship to one another.
- Projected oil, natural gas, and electric power prices as indicated by commodity markets.
- The availability of natural gas and outside electric power through local utilities, or by contract from other entities at various terms for quantity and price.
- When NIH owns the COGEN unit, whether to sell the power generated, or use it internally within NIH.
- The extent to which past or future steam, chilled water, and power generation is affected by unusually hot or cold weather.
- Anticipated changes in utility demands created by scheduled new buildings, demolitions, and space use changes.
- Contingencies, such as outside utility curtailments or loss, or unexpected demand changes.

The above factors become increasingly important during those periods when campus demands approach plant capacity, i.e. just before new chillers or boilers go into service, or when emissions approach annual limits.

To resolve the situation, the Master Plan recommends the development of a Strategic Central Plant Operating Program (SCPOP). It is visualized as a computer program that would give the status of plant operations and emissions over any selected period of time. Input would include information on steam, chilled water, and power production, fuel and utility usage, prices, and also estimated stack emissions based on monitoring data. The status information could be used for preparing reports to regulatory agencies and internal NIH records. The program could also be tied to plant or distribution system metering or monitoring.

However, to be of maximum value, the program should also be a tool for strategic planning of operations over a future period of time. This can be done by creating a computer model of the plant. The annual cycle of demands can be projected or synthesized on a daily basis from past records. Equipment fuel, and emission characteristics can be modelled mathematically. The program should also have the ability to test various potential future operating scenarios on a user interactive basis, i.e. the user should be able to change all the variables involved. For example, for a desired test scenario, the user should be able to turn equipment on or off, run chillers on steam or electric power, select type of fuel to be used, add an anticipated demand, or change the price of oil or gas, all for testing any given day or period.

Output would include the effects of the test scenarios on plant stack emissions, or on operating costs.

5.4.9 Compressed Air

Air is compressed to 125 psi in the central plant for subsequent delivery to the Clinical Center and laboratory buildings. It is distributed to the Clinical Center and laboratories north of the central plant via pipes in the steam/chilled water tunnel running between the power plant and the Clinical Center. This line extends to Building 6. A branch main and network services Building 34 and the laboratories on the west side of the campus. A second branch network services laboratories, animal care spaces and Building 38 to the south of the plant. Delivery pressures are approximately 110 psi.

Air is used primarily for laboratory experiments and processes. New individual laboratory building service laterals would be needed if the Master Plan Alternative is selected. NIH is currently doubling the compressed air generation capacity, and replacing the distribution system.

5.5 NOISE

5.5.1 Guidelines and Criteria

Noise levels vary continuously with time. Various measurable descriptions of noise are used to account for this variance with time. Leq is the average mean square sound level measured in decibels over a time period of consideration, usually one hour. Ldn is the 24-hour average sound level for the period from midnight to midnight obtained after adding a 10 decibel "penalty" to sound levels recorded or computed for the period from midnight to 7 AM and from 10 PM to midnight.

L_{10}, L_{50}, and L_{90} are sound pressure levels that are exceeded 10, 50, and 90% of the time, respectively.

Noise levels are measured in A-weighted decibels (dBA), which match the sensitivity of the human ear across the frequency spectrum. It is a logarithmic measurement. A 3 dBA increase is equivalent to a doubling of the sound pressure level or loudness. Conversely a 1 or 2 dBA increase is barely perceptible to the human ear.

Noise criteria have been established by different agencies depending on noise source and land use. Traffic noise impact criteria have been established by the Federal Highway Administration (Federal Aid Policy Guide, FHWA). Impacts are expected to occur if the peak hour Leq exterior noise level exceeds 67 dBA for activity areas such as residences, schools, churches, libraries, hospitals, hotels, motels, parks, playgrounds, and recreation areas, or if there is an increase of 5 dBA or more. Other federal agencies define noise criteria in terms of Ldn (Guidelines for Considering Noise in Land Use Planning and Control, Federal Interagency Committee on Urban Noise, 1980). U.S. Department of Housing and Urban Development, the U.S. Department of Transportation, and EPA recognize an Ldn of 55 dBA as a non-regulatory goal for outdoor residential areas.

The Guidelines indicate proposed activities are compatible with the following land uses provided the indicated Ldn is not exceeded:

Residential	65
Hospitals	65
Schools	65
Churches	65
Government Services	70
Parks, Recreational Areas	75

State noise level criteria are given in COMAR 26.02.03.03 and Montgomery County criteria are in the Montgomery County Noise Ordinance. The State and County have the same daytime and nighttime noise criteria, but apply them to different day and night hour intervals. The maximum allowable Leq or time averaged noise criteria for the State and County are:

	DAYTIME	NIGHTTIME
Commercial	67 dBA	62 dBA
Residential	65 dBA	55 dBA

The Maryland regulations define daytime hours as the period between 7 AM and 10 PM. The Montgomery County ordinance defines daytime as the period between 7 AM and 9 PM on weekdays, and 9 AM and 9 PM on weekends.

5.5.2 Traffic Noise

To characterize the existing noise environment in the surrounding neighborhoods, Leq noise levels were measured at eight representative receptor locations. Measurements were taken using a RION-N4 meter meeting ANSI Type 2 criteria. Leq, L_{10}, L_{50}, L_{90}, and Lmax values were measured using FHWA criteria for measuring traffic noise. Traffic data during measurement periods was recorded. It was determined that Leq noise levels on Rockville Pike and Old Georgetown Road were relatively constant throughout the day, i.e. Level of Service C traffic produced noise levels equivalent or close to those recorded during the peak hour. This is attributable to the frequent acceleration and deceleration of vehicles at the closely spaced signalized intersections, and a greater number of trucks in the traffic during the non-peak hours.

The dominant source of noise in the vicinity of NIH is produced by traffic on Rockville Pike and Old Georgetown Road. Time averaged noise levels adjacent to these two arterials are relatively constant between 6 AM and 9 PM on weekdays. Values may be only one or two dBA higher during short term peak noise periods. At the building line adjacent to these roads, Leq noise levels are generally 68 to 71 dBA (Table 5-30). Under Similar conditions, noise levels on Jones Bridge Road and West Cedar Lane are 66 and 64 dBA, respectively.

	Site	Time	L95	L90	L50	L10	L5	Lmax	Leq
1	Stone Ridge School	5:38-5:53 PM	58	58	61	63	63	66	61
2	Locust Hill Estates	8:20-8:35 AM 9:47-10:02 AM	61 60	62 61	66 68	71 74	72 74	91 83	68 69
3	Carriage Hill Elderly Care	10:10-10:25 AM	55	56	62	68	70	79	64
4	Alta Vista	9:30-9:45 AM 4:38-4:53 PM	57 59	60 60	67 68	73 72	74 73	82 105	69 69
5	Beth El Temple	10:44-10:59 AM	59	61	69	75	76	83	71
6	East Bethesda Wisconsin Avenue	3:22-3:37 PM 4:39-4:45 PM	58 58	60 60	68 69	73 74	74 75	82 81	70 70
7	East Bethesda Jones Bridge Road	2:50-3:05 PM	59	60	64	69	71	82	66
8	East Bethesda Windsor Lane	4:06-4:21 PM	55	56	59	64	65	75	61

TABLE 5-30 1993 Leq TRAFFIC NOISE MEASUREMENTS (in dBA).

Internally within the core area of the campus, numerous sources contribute to the overall noise environment. Noise from traffic exterior to the campus dominates noise levels on the campus for a distance extending 500 feet into the campus. Campus traffic is comparatively light, particularly during the middle of the day, and moves at low speeds. Noise from the passing of individual groups of vehicles can be recorded. Since campus traffic is not sufficiently high to create a noise continuum, other sources can be heard. These include human activities, mechanical equipment, and grounds maintenance. Measurements taken in 1987, 1992 and 1993 at many locations at various times of the day indicate that typical day time (Ld) noise levels range from 55 to 60 dBA throughout the core area. Construction is generally underway around the campus on a continuous basis at one location or another. Where this occurs, Leq noise levels are elevated 2 to 5 dBA locally. Night time (Ln) noise levels range from 45 to 55 dBA. Night time levels are about 5 dBA higher in the immediate vicinity of the Clinical Center. Leq noise levels in the 45 to 50 dBA range were recorded along the northern periphery of the site in areas beyond the direct influence of traffic noise from Rockville Pike and Old Georgetown Road in the early morning hours (1 AM to 4 AM)

Another minor source of periodic source of noise is two METRO subway fan shafts located near the station entrance. When operating, fans in the shafts produce a steady mechanical drone of 70 dBA. They operate automatically when tunnel or station ventilation is needed. The length of the operational period is variable depending on the number of trains and ambient weather. A single operating cycle may last for an hour or more followed by several hours of silence. Noise from the shafts is projected upward and has little influence on ambient levels at the ground level beyond a radius of about 50 feet.

Traffic noise predictions were determined by using the FHWA TNM 1.1 Traffic Noise computer model, which includes information on traffic volumes, mix and speeds, and roadway and receptor geometry as inputs. The model also accounts for vehicle deceleration and acceleration at signaled intersections. Existing and future Master Plan and No Action Alternative traffic volumes on roadway links around the campus used in the analysis are given in Section 5.3.6. Existing volumes are based on a field survey or count; future volumes are projected based on NIH and background or non-NIH growth in trip generation. Data for the peak PM hour was used. The vehicle mix (cars, medium and heavy trucks, and motorcycles) used in the analysis for Rockville Pike and Old Georgetown Road is based on data derived by the Metropolitan Washington Council of Governments (MWCOG) for Montgomery County arterial roadways. The vehicle mix for other roadways was determined by field survey.

Traffic generated by implementation of the Master Plan will not create noise impacts on the surrounding neighborhoods (Table 5-31). Noise levels will increase by 2 dBA or less regardless of whether the Master Plan or No Action Alternative is selected. One or two dBA differences are not readily discernable to the human ear. Traffic volumes must double or halve to produce a 3 dBA increase or decrease, respectively. Even with projected non-NIH growth in the Bethesda CBD and Rockville Pike corridor, traffic volumes are not expected to double..

Predicted noise levels are typical for urban arterials and collector-distributor roadways. Predicted levels are representative of those experienced at residences and buildings directly fronting the streets at 50 to 100 foot setbacks from the curb line. Residences screened by a row of houses will experience levels 5 dBA less than indicated. In those locations where traffic generated noise dominates or is the prime contributor to overall noise levels, future noise levels will remain unchanged. This includes all areas within about 600 feet of Rockville Pike, Old Georgetown Road, and Cedar Lane.

Vehicles associated with the Gateway Center garage and the Commercial Vehicle Inspection facility are included in the analysis. They have no impact on noise levels because they comprise only a small fraction of the total traffic.

	2003 Existing	No Action Alternative	Master Plan Alternative
Stone Ridge School And Convent Of The Sacred Heart	59	60	60
Locust Hill Estates Residences East Side Rockville Pike	68	69	70
Maplewood Carriage Hill Elderly Care Residences North Side Cedar Lane	66	66	67
Alta Vista Residences Either Side of Old Georgetown Road	68	70	70
Suburban Hospital	61	63	63
Greenwich Park at Old Georgetown Road End of Park	65	66	66
Edgewood/Glenwood Bethesda United Methodist Church Wesley Nursery School & Residences Facing Old Georgetown Road	66	67	68
Beth El Temple & Congregation Beth El Day Care	67	69	69
East Bethesda Residences Facing Wisconsin Avenue	68	68	70
East Bethesda Residences Facing Jones Bridge Road East Of Glenbrook Parkway	68	69	70

TABLE 5-31 EXISTING AND PROJECTED TRAFFIC Leq NOISE LEVELS (in dBA)

5.5.3 NIH Chilled Water Plant Noise

The NIH central refrigeration plant produces chilled water in two plants, No. 1 in Building 11 and No.2 in Building 34. Chilled water is generated through the combined use of chillers and cooling towers. Currently, there are ten chillers inside Building 11, and six in Building 34. Two cooling towers located on the roof of each building are associated with each chiller, i.e. 24 cooling tower cells.

The number of chillers and cooling towers that are operating fluctuates with the outdoor temperature. When the temperature exceeds 95 ^{o} F, all or nearly all of the units are in service, at lesser temperatures, fewer units are needed and typically one half of the units may be in service when downtime temperatures are around 75 ^{o} F. The plant operates throughout the year even on the coldest days in the winter to accommodate the campus base or process chilled water load. Operations also vary diurnally as daily temperatures rise and fall.

Noise levels were monitored on seven occasions for up to a week at Site A and along the southern NIH property line between 1987 and 1994 (Figure 5-18). The general Leq day time noise level at Site A was consistently 59 to 60 dBA unless the NIH chilled water plant was operating at near capacity. In July 1993, a one hour Leq of 62.4 dBA was recorded at Site A when the outdoor temperature was 95 ^{o} F. One week of continuous monitoring in August 1994 recorded the average day time Leq noise level at 61.9 dBA between 6:00 AM and 9:00 PM, and an average night time noise level of 60.0 dBA (9:00 PM to 6:00 AM).

A review of the noise data revealed a complex noise environment at Site A and at residences on the north side of McKinley Street in Glenwood. The composite or overall noise in the area has several components: background noise comprised of Old Georgetown Road traffic noise and other noise and noise produced by the NIH chilled water plant with facilities in Buildings 11 and 34 making separate contributions.

Noise generated by Old Georgetown Road traffic dominates and governs the overall ambient noise levels over an area extending about 600 feet to the east of the roadway. It is dominant in this area at all times of the day. The combination of vehicle volumes and speeds is such that noise generated by this traffic is relatively constant with a variance of only 1 to 2 dBA from 6 AM to 9 PM. Noise levels drop from 3 to 6 dBA during the remaining hours. Weekend noise levels, both day and night, are about the same as weekday levels.

Background noise includes noise not specifically accounted for. It includes working hour NIH campus traffic (48 dBA), NIH electrical and mechanical equipment, transformer hum from PEPCO facilities in Building 46, children playing at the NIH child care center, birds singing, insects, aircraft over flights, sirens on ambulances and fire engines, residential air conditioners, dogs barking, lawn mowers and leaf blowers, vehicles on McKinley Street, and many human activities including pedestrians passing Site A on nearby footpaths. None of these sources dominates the background levels individually or is continuous, but all contribute to it.

The principal sources of exterior noise are the cooling towers located on the roofs of the two buildings. The towers have three separate subsources of noise: tower fans and motors, water splashing in towers trays, and high velocity air passing through the tower and its fans (Figure 5-19). The fans and motors produce a steady drone. The splash of water in the trays generate tones similar to a waterfall. The air flow noise is similar to the moan produce by high winds.

The noise levels produced by a cooling tower unit are the logarithmic sum of these three subsources.

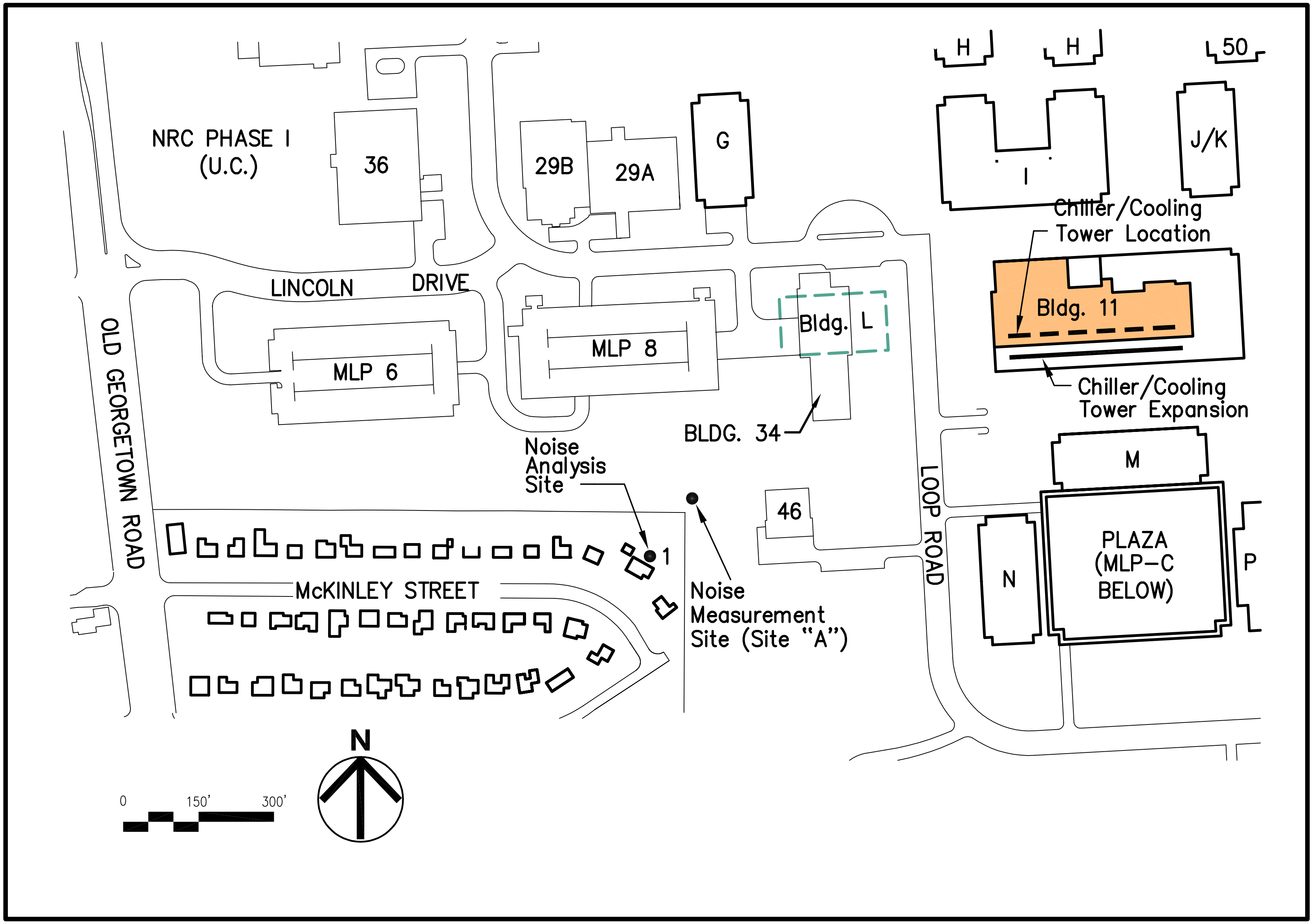


FIGURE 5-18 BUILDING 11 NOISE IMPACT SITE EVALUATED IN GLENWOOD.

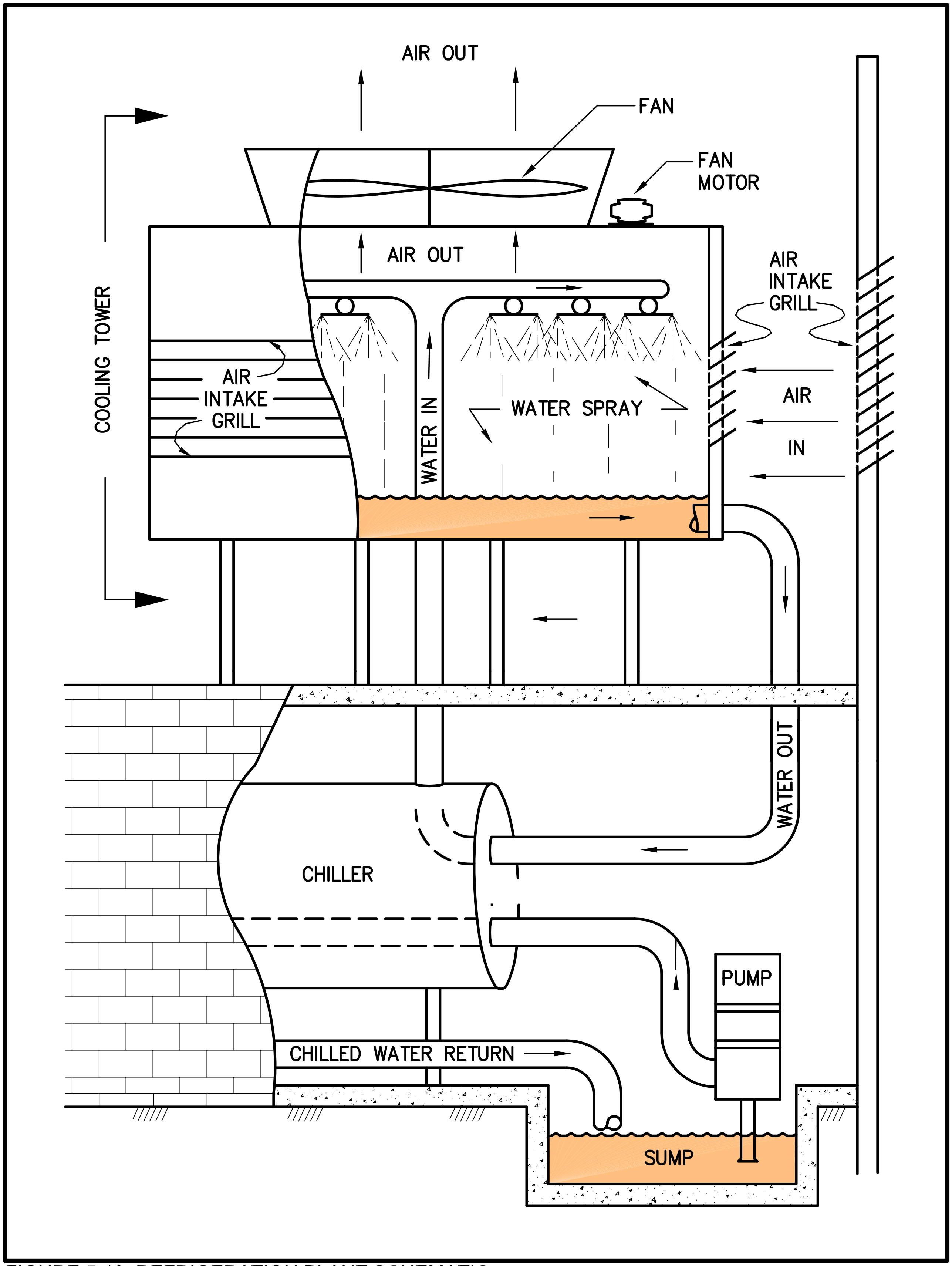


FIGURE 5-19 REFRIGERATION PLANT SCHEMATIC.

Total plant noise varies incrementally with the number of units in service. Reference Leq noise levels were obtained for NIH tower operations by recording levels when one, two, and three units were in operation.

Observation of the monitored noise levels and field conditions indicated that the NIH chilled water plant produced different noise impacts at different times. Except for summer, noise produced by the plant during the day time was submerged within the overall noise environment and the plant was not a primary contributor. During the summer months, when temperatures exceed 90 ^{o} F, plant noise increases as the number of units in service increase. During the day, plant noise is equivalent to all other noise sources combined in terms of loudness. It is during the summer night time (9:00 PM to 6:00 AM) when plant noise becomes most evident. Although the plant produces less noise during the night time hours than during the day, the noise from all other sources decreases to a greater extent, and plant noise becomes the dominant or loudest contributor to the overall noise environment.

In order to determine the relative merits of potential mitigation options for the plant, an analysis of the existing noise environment was conducted. The analysis was based on partitioning the week long day-night time Leq noise levels monitored at Site A into its contributing components (daytime 61.9 dBA, night time 60.0 dBA). The contributing components were cooling tower noise, Old Georgetown Road traffic noise, and other background noise. The first two can be determined by computer modelling, the last is what is unaccounted for.

This was done by using the FHWA STAMINA 2 noise prediction computer model, which is normally used to predict noise generated by traffic on roadways. Conditions were simulated by modelling Old Georgetown Road and its traffic conventionally, the residences in Glenwood, existing campus roads and buildings such as MLP-6, MLP-8, the PEPCO substation in Building 46, and topography in the vicinity of Site A.

Buildings 11 and 34 were also modelled. Cooling tower cells were modelled as individual line sources with a length equal to the cell width. The three tower noise subsources were modelled separately, so that each tower was represented by three line sources. The analysis included all chillers/towers through Unit 27. These units face to the south. Towers 28 through 32 would be located on the east side of the plant and face in that direction, and have no effect on noise to the south or west of the plant.

The model was then calibrated until the noise levels at Site A under a variety of operating conditions (peak, nonpeak, day, night) could be reproduced. Day and night time peak operating Leq noise levels, or maximum impact conditions, are shown in Table 5-32. The existing data represents conditions that were present at the time of the analysis. It shows that NIH chilled water plant noise becomes the dominant source in the night time on hot summer days. Day and night time plant noise levels during the non-summer seasons are 2 to 5 dBA less.

NIH incorporated noise attenuation in the design of the Building 11 expansion and installation of new equipment as mitigation in the 1995 Master Plan EIS. Phase I and II chilled water plant expansion has been completed. Chillers 22 through 25 went into service in 2002 and Chillers 26 and 27 are scheduled for service in 2004. The new cooling towers associated with these chillers operate more quietly that older towers. Each unit produces about 6 dBA less noise. A 60-foot high louvered acoustical screen running the length of the south side of Building 11 has also been installed as part of the project.

NIH retrofitted screening around the cooling towers on the roof of Building 34 in 1994. The screening reduces noise levels by about 2 dBA. The chillers in Building 34 will be operated less as the number of units in Building 11 increases. The Building 34 units will primarily operate as peak service units, or only during the day time on those days when peak campus demand approaches plant capacity. The six chillers

	EXISTING	MASTER PLAN
Peak Day Time (6 AM-9 PM)		
Background noise	57.6	57.6
Building 34	56.2	--
Building 11	57.2	49.6
Total CHW Plant	59.7	49.6
Plant and Background	61.9	58.2
Peak Night Time (9 PM-6 AM)		
Background noise		
Building 34	54.3	54.3
Building 11	50.9	--
Total CHW Plant	57.2	48.9
Plant and Background	58.1	48.9
	59.6	55.4

TABLE 5-32 EXISTING AND PROJECTED PEAK DAY AND NIGHT TIME Leq NOISE LEVELS AT GLENWOOD PROPERTY LINE (in dBA).

would eventually be decommissioned and removed, and Building 34 would be converted to a campus center.

The total net attenuation produced at Site A under peak or high outdoor temperature conditions by quieter operating towers and the acoustical screen will be about 10 dBA in plant noise. Day time plant noise would decrease from 59.7 to 49.6 dBA. Overall, however, only a 3 to 4 dBA improvement in the noise environment will be realized as unattenuated background noise begins to dominate the acoustical environment. However, noise generated by the plant will contribute significantly less to the overall or total noise environment. This mitigation would occur under both the Master Plan and No Action Alternatives.

It is only when all cooling tower units are running that the combined or cumulative noise produced becomes significant. Operationally, it will be relatively immaterial which of the towers are run to meet a less than capacity cooling load due to the distance between Building 11 and Glenwood. Noise levels decrease by 3 dBA for each successive doubling of distance between source and receiver (i.e. 100, 200, 400, 800 feet). The westernmost (Chiller 22) and easternmost (Chiller 27) ends of the plant, for example, are about 700 and 1,000 feet distant from Site A, respectively. The estimated unattenuated combined effect of Cooling Towers 22 and 23 at the west end would be to produce Leq noise levels of 52.2 dBA at Site A. Towers 26 and 27 at the east end generate 50.7 dBA, a barely discernable audible difference. Towers further east than unit 27 will be physically screened as viewed from Site A by other towers and buildings.

In contrast to Site A, Leq noise levels on the north side of Building 14 will be high, and operation of individual tower units does make a difference in the noise environment. Construction of the chilled water plant expansion reduces the wall to wall distance between Building 11 and 14 from 90 to 30 feet. The source-receiver distance is so small that the Leq noise level of any point along the north face of Building 14 is determined by the nearest operating tower cell.

The unattenuated Leq noise level at the center of the north face of Building 14 is estimated to be 84 dBA, if the plant were operating at capacity with all towers in service. The noise screen reduces the level to 76 dBA, which is only half as loud or intense as levels were prior to installation of the noise screen. However, at operations less than capacity, the Leq noise level at any point opposite the center of a single operating tower cell will be 72 dBA due to the distance factor. Similarly, if the point is centered on two or three adjacent operating tower cells, the resultant noise levels are 74 and 75 dBA, respectively.

This condition would continue permanently under the No Action Alternative. The Master Plan Alternative proposes replacing Building 14 with Building M. The north wall of Building M would be about 130 to 140 feet from Building 11. The projected maximum future Leq noise level at Building M is 65 dBA, an acceptable level in an urban environment. This would occur under high summer temperature conditions.

5.5.4 On Campus Noise

In general, the future campus noise environment for both alternatives will be similar to existing conditions, since no one source of noise dominates and no new significant noise source will be created. Traffic noise levels increase with vehicle volume and speed. A doubling of vehicle volume increases noise levels by 3 dBA, if all other factors are held constant. Gateway Center and Commercial Vehicle Inspection Facility traffic volumes are low in comparison to volumes on adjacent Rockville Pike and move at lower speeds. Noise levels in the Rockville Pike corridor are dominated by the set by Rockville Pike traffic. Noise levels in the east side buffer area will be the unchanged by these projects.

Typical Ld noise levels will continue to be in the 55-60 dBA range, and Ln levels in the 50-55 dBA range, in the core area of the campus away from the influence of the road network surrounding the campus.

Current and future peak hour traffic entering and leaving the campus is constrained by the MOU trip limits. Internal campus traffic volumes under the No Action and Master Plan Alternatives will be similar to existing conditions. Currently, most vehicles make short internal campus trips to the nearest peripheral surface parking. In the future, under the Master Plan the pattern will be similar except that the vehicles will proceed to structured parking along the Loop Road.

The estimated Loop Road peak hour traffic volume for the links and sections in the southwest quarter of the campus is about 1,100 vehicles per hour under the Master Plan buildout conditions. The predicted Leq noise levels generated by these vehicles at the property line nearest to the Loop Road on the east side of Edgewood/Glenwood is 49 dBA. This is significantly less than the combined day time noise levels produced by Old Georgetown Road, the chilled water plant, and background noise from all other sources (57 dBA).

Building exhaust fans and emergency diesel power generators are additional campus noise sources. Fans and generators maybe located on building roofs, at ground level, or in subsurface areaways or chambers. Individual exhaust fans generally produce Leq noise levels in the range of 73 to 76 dBA at a reference distance of 50 feet. While public road traffic is the dominant noise source between 6:00 AM and 9:00 PM around the campus periphery (see Table 5-30), fan noise, which has the character of a steady hum or tone with a few dominant resonant frequencies, can be annoying during the remaining hours. Individual diesel generator noise levels can range to 88 to 90 dBA at a reference distance of 50 feet. Noise emissions from generators are limited to a few occurrences when the public electric power supply is lost, or when the units undergo periodic test operations to ensure serviceability.

New NIH facilities should be designed to abate or mitigate excessive noise and vibration impacts to nearby NIH facilities, and the neighborhoods surrounding the campus. The potential impacts and necessary abatement must be evaluated on a case by case basis. Maximum building operational Leq noise levels should meet the Maryland or Montgomery County noise criteria given in Section 5.5.1. Mitigation can be achieved through physical shielding, equipment noise silencers, or project design configuration and layout.

5.6 AIR QUALITY

5.6.1 Regional Conditions

The Federal Clean Air Act of 1970 requires that air quality in designated Air Quality Control Areas (AQCA) meet the National Ambient Air Quality Standards (NAAQS) (42 U.S.C.§ 7407). NAAQS criteria pollutant standards are shown in Table 5-33. Primary standards are based on health effects, secondary standards on environmental effects. For several pollutants, these standards are the same. If the standards are not met, then the AQCA is in "non-attainment". The one hour ground level ozone (O3) standard applies to areas that are in non-attainment for ozone. The eight-hour standard, issued by U.S. EPA in 1997, was intended as a replacement for the one-hour standard in those areas where the one-hour standard is attained. Amendments to the Clean Air Act require the AQCA to develop an air quality State Implementation Plan (SIP) that indicates how the NAAQS will be "attained" (42 U.S.C.§ 7502). Non-attainment areas are classified as marginal, moderate, serious, severe, and extreme.

The Washington metropolitan area extending from Frederick County, Maryland to Stafford County, Virginia, and from Calvert County, Maryland to Loudoun County, Virginia comprises the National Capital Interstate (NCI) AQCA. Maryland, Virginia, and the District of Columbia each have AQCA's within the National Capital Interstate AQCA. NIH is located within Maryland AQCA IV, which covers Montgomery and Prince George's Counties. Since 1990, ozone concentrations in the National Capital Interstate AQCA have exceeded the NAAQS on an average of six days per year.

Since non-attainment involves all of the regional jurisdictions, a Metropolitan Washington Air Quality Committee (MWAQC) was formed by the governors of the two states and the Mayor of Washington, D.C. to develop a regional strategy to reach ozone attainment. Committee membership is composed of local jurisdictions within the regional AQCA as well as the air management agencies for each State and the District. The MWAQC recommendations are forwarded to the three State air quality agencies for approval. In Maryland, the Department of the Environment (MDE) is the controlling agency.

Ground level ozone is generated when nitrogen oxides (NOx) combine with volatile organic compounds (VOC) at times of persistent high temperature, abundant sunshine and prolonged periods of air stagnation. Ozone generation is therefore controlled indirectly through control of NOx and VOC emissions. In 1990, the NCI AQCA emitted an estimated 729 tons of NOx and 527 tons of VOC per day. Control measures to reduce VOC emissions were proposed in the Final State Implementation Plan (SIP) to Achieve a Fifteen Percent Reduction in VOC Emissions for the Washington Non-Attainment Area, MWCOG, 1994. This SIP is also know as the "15 percent Plan". Further NOx and VOC control measures were proposed in SIP Revision, Phase I. Target emission goals for 1999 for the SIP and SIP Revision Phase I were 615 and 380 tons per day for NOx and VOC, respectively.

Computer modelling indicated that these inventory emissions would result in regional ozone concentrations that met the NAAQS criteria. However, the MWAQC claimed that up to one-third of ozone pollution within the region arrives from upwind sources outside the NCI AQCA resulting in continuing non-attainment. The MWAQC prepared a plan for the outside sources (Washington SIP

Pollutant/ Averaging Time	Ambient Standard(s)****				Monitoring Data		
	Primary		Secondary		Maximum Concentration		Location Dist./Dir.*** (Year)
	(ug/m^3)	(ppm)	(ug/m^3)	(ppm)	(ug/m^3)	(ppm)	
Carbon Monoxide (CO)							
1-Hour*	40,000	35	---		3,900	3.3	McLean Gov't Ctr 6 mi/SW(2002)
8-Hour*	10,000	9	---		2,700	2.3	McLean Gov't Ctr 6 mi/SW(2002)
Sulfur Dioxide (SO2)							
3-Hour*	---		1,300	0.50	86	0.033	Balls Mill 7 mi/SW(2002)
24-Hour*	365	0.14	---		47	0.018	Balls Mill 7 mi/SW(2002)
Annual	80	0.03	---		18	0.007	Balls Mill 7 mi/SW(2002)
Nitrogen Dioxide (NO2)							
Annual	100	0.053	100	0.053	38	0.020	Balls Mill 7miSW(2002)
Ground Level Ozone (O3)							
1-Hour**	235	0.12	235	0.12	209	0.110	Rockville Env. Center
8-Hour**	157	0.08	157	0.08	188	0.099	8 mi/N(2002)
Particulate (PM10)							
24-Hour*	150		150		45	---	Chantilly 20 mi/SW(2002)
Annual	50		50		18	---	Chantilly 20 mi/SW(2002)
Particulate (PM2.5)							
24-Hour*	65		65		35	---	McLean Gov't Ctr 6mi/SW(2002)
Annual	15		15		14	---	McLean Gov't Ctr 6mi/SW(2001)
Lead (Pb)							
Quarterly	1.50		1.50		---	---	Not monitored regionally

Notes:
* short-term (1-hour, 3-hour, 8-hour and 24-hour) standards are not to be exceeded more than once per year. Therefore, second-highest annual values are compared to the standards rather than the highest.
** 3-year average of 4th highest annual concentration may not exceed standard. 1-hour standard applies to areas in ozone non-attainment; 8-hour standard to those meeting 1-hour standard.
*** Approximate distance and direction from NIH.
**** The State of Maryland has adopted the National Ambient Air Quality Standards (NAAQS) as the state standard.
(µg/m^3) = micrograms per cubic meter. (ppm) = parts per million

Source: Maryland and Virginia Annual Air Quality Data Reports

TABLE 5-33 AMBIENT AIR QUALITY STANDARDS AND EXISTING AIR QUALITY DATA.

Revision Phase II, Attainment Plan, MWCOG, 2000). The Phase II Plan projected “budget level” NOx and VOC emissions for the year 2005 were 418 and 355 tons per day, respectively, and attainment by that date.

The degree of ground level ozone pollution in a region is characterized by its ozone "design value". The ozone design value for an AQCA is defined as the highest of the fourth highest one-hour daily maximum ozone concentrations recorded over a given three year period at individual monitoring stations within the AQCA. An area is in ozone attainment if the design value is 0.12 parts per million (ppm) or less. In 1989, the design value for the Washington area was 0.165 ppm. The design values for 17 monitoring stations within the NCI AQCA for 1997 through 1999 ranged from 0.114 to 0.132 ppm.

In January 2003, while noting this regional progress in reducing ozone, levels, the U.S. EPA determined that the Washington area had failed to meet the one-hour NAAQS by the November 15, 1999 deadline prescribed by the Clean Air Act (CAA) for serious non-attainment areas. The Washington area was reclassified as being in "severe" non-attainment.

The effect of the reclassification to "severe" is to set a new attainment deadline of November 15, 2005. It also requires the preparation of a SIP revision that meets CAA provisions for severe ozone non-attainment area SIPs. These include development of a regional ozone attainment inventory, and specific control measures. The MWCOG Metropolitan Washington Air Quality Committee approved a revised "Plan to Improve Air Quality in the Washington, D.C.-MD-VA Region" ("Severe Area SIP") in February, 2004. Since MD AQCA IV and NCI AQCA are not in ozone attainment, federal actions involving new sources must demonstrate conformity with the non-attainment AQCA SIP for the pollutant, which is in non-attainment (CFR 40§ 93, 158). For ozone, this can be achieved by meeting any of the following:

- Direct or indirect emissions of the action are specifically identified and accounted for in the SIP or AQCA permit inventory.
- For ozone or NOx, the total direct or indirect emissions from the action must be fully offset within the non-attainment area so that there is no net increase in emissions.
- The State air management agency (MDE) determines or documents that emissions combined with all others would not exceed non-attainment budgets given in the SIP.

NIH is under the jurisdiction of the Maryland Department of the Environment (MDE) for air quality permitting and regulations. MDE maintains the SIP for the Maryland portion of the regional AQCA as well as the State NOx allowance banking (NATS) and NOx emissions tracking (NETS) systems. NIH stationary source emissions are identified and accounted for through the MDE permitting process.

Air quality data recorded at monitoring stations representative of conditions at NIH Bethesda are shown in Table 5-33. Maryland no longer monitors carbon dioxide, sulfur dioxide, nitrogen dioxide, or 2.5 micron particulate matter in the Washington region. The Chantilly, Balls Mill and McLean Government Center stations are in the Virginia monitoring network. These stations are located in Fairfax County, a mile or two inside the Washington Beltway. The mix of commercial and residential development in the vicinity of these stations is similar to that at NIH Bethesda. The location of the station in relation to prevailing winds crossing the NCI AQCA are also similar to NIH's position.

The ground level ozone monitoring station nearest NIH Bethesda is located in Rockville, Maryland. Although the region is in non-attainment, monitored one-hour ozone levels at this station are consistently below the NAAQS. The second highest maximum one-hour zone concentration of 209 micrograms per cubic meter is equivalent to a concentration of 0.11 ppm. The eight-hour maximum concentration is given for reference only as this NAAQS is not applicable to areas in non-attainment for ozone.
There are two primary emission sources at NIH:

- Traffic coming to and departing from the campus, which adds, exhaust emissions to the general traffic on arterial roadways.
- The central heating plant boilers which produce emissions from the combustion of oil and gas.

5.6.2 Mobile Source Air Quality

5.6.2.1 Traffic

Traffic related air quality impacts are considered on two scales; the mesoscale or regional level, and the microscale or local level. Regional impacts are generally assessed in the SIP in terms of total regional vehicle miles of travel producing tons of pollutants such as carbon monoxide (CO) and NOx per year. In urban areas, traffic generated by individual projects has little or no influence at the regional level.

Projects are therefore evaluated at the microscale level, and an analysis of CO is typically made to assess whether local violations of the NAAQS will occur. CO is used as the reference criteria pollutant for traffic microscale air quality analysis because it is the standard that will always be exceeded first as a result of vehicle emissions.

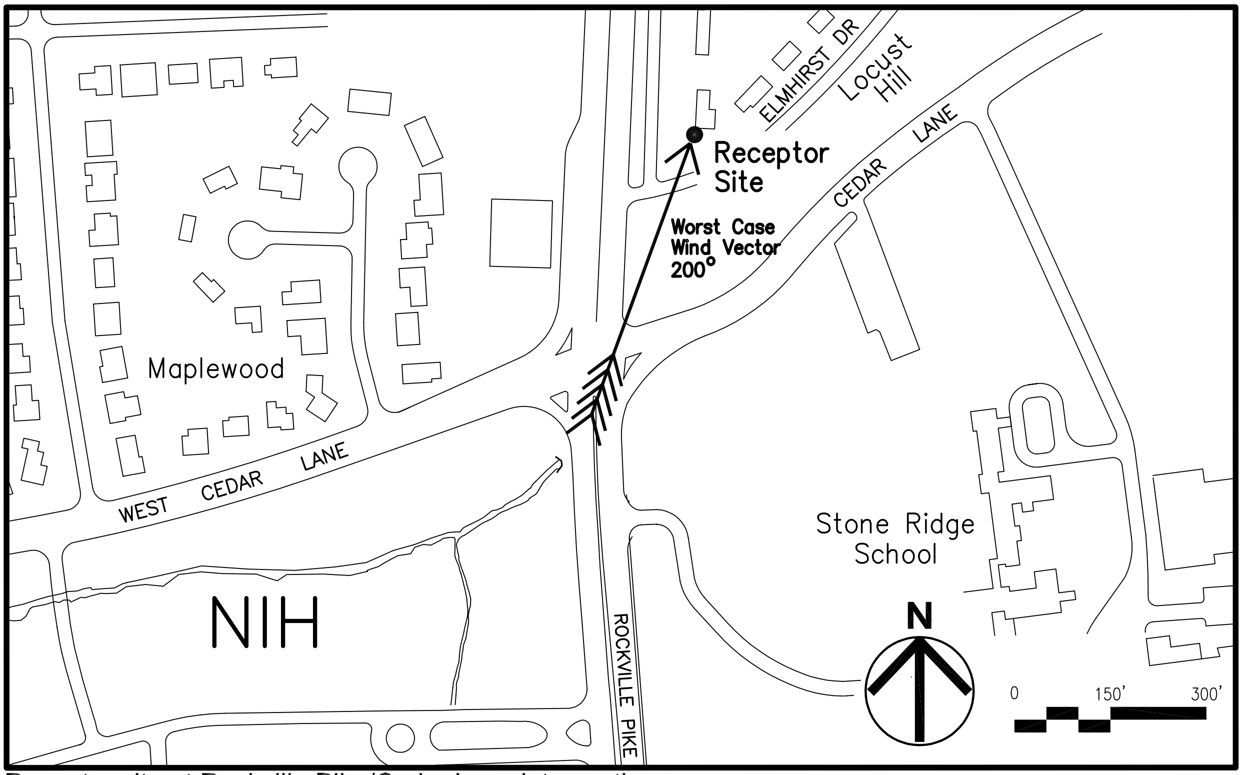
To assess traffic related air quality impacts associated with NIH, a "worst case" microscale analysis was conducted using EPA approved methodology and computer models. Eight potential study sites were evaluated on a preliminary basis. From these, two receptor sites with the highest potential CO concentrations were selected for more detailed study. The two sites are near intersections where they are subject to vehicle idling as well as running emissions. The first, Site 1, is a single family, detached residence on the north side of West Cedar Lane closest to the Rockville Pike/Cedar Lane intersection. The Rockville Pike/Cedar Lane intersection has the highest existing and future total and NIH-generated traffic volumes. The second site is a townhouse in a development to the southeast of the Rockville Pike/Jones Bridge/Center Drive intersection. The total and NIH traffic volumes at the Jones Bridge/Rockville Pike intersection are less than at the Cedar Lane intersection, but the townhouse is closer to the intersection travel lanes than the residence at Site 1. Site locations are shown in Figure 5-20.

CO concentrations were determined in a two step process: (1) determination of vehicle emission factors or rates in terms of grams per vehicle mile of travel using the EPA MOBILE6.2 Mobile Source Emission Factor Model computer program, (2) these emission rates were then inputted into the computer model, CALQ3HC Version 2.0, Traffic Pollutant Dispersion Model, along with traffic data, site geometry, and weather data. Both programs are approved by the U.S. FHWA and U.S. EPA for determining traffic related air quality impacts. Concentrations were determined for existing 2003 conditions, and for ultimate conditions in 2023.

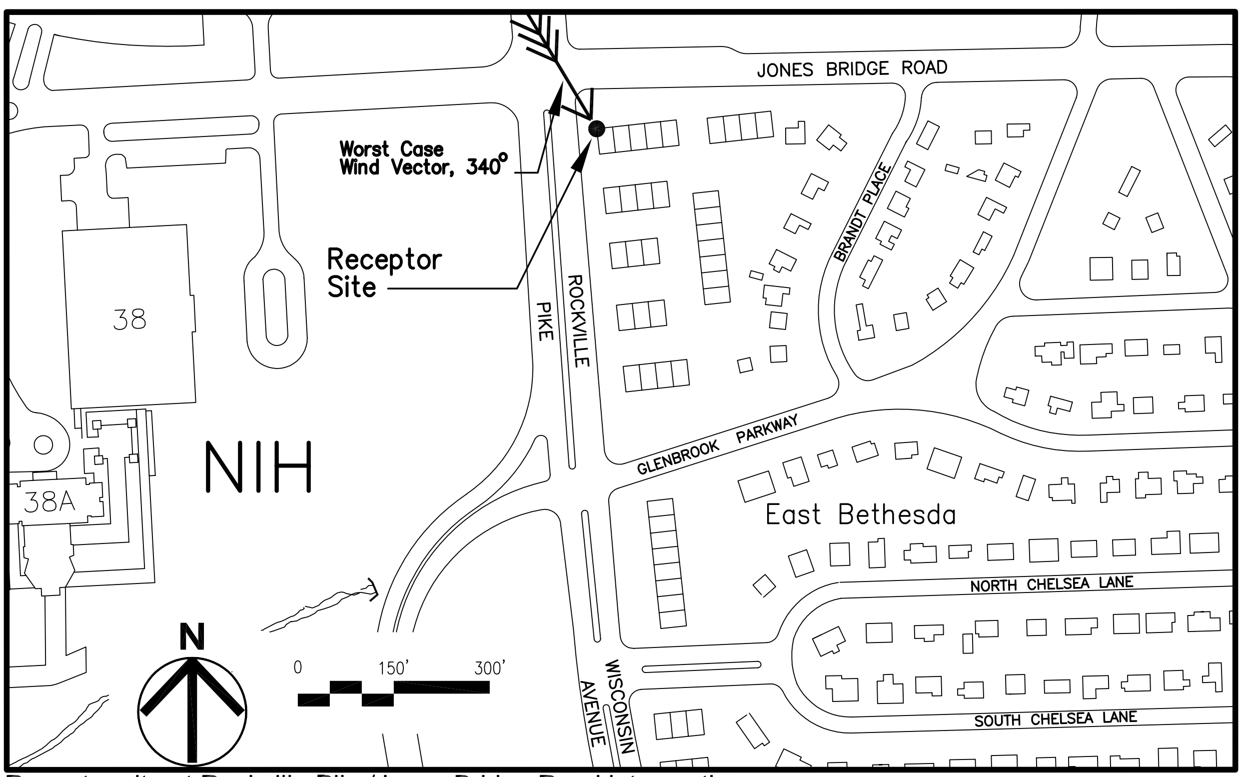
The sites were analyzed as an intersection with both moving and idling vehicles contributing to resultant concentrations.

Most of the data used in the MOBILE6.2 emission factor analysis was adopted directly from that used in the regional air quality conformity analysis "Severe Area SIP" (See "Plan to Improve Air Quality in the Washington, D.C.-MD-VA Region, Appendix B, MWCOG, 2004). Data used directly included:

- Southern reformulated gasoline program.
- Regional weekday vehicle trip length distribution.
- Maryland vehicle exhaust/evaporative Inspection/Maintenance program including Maryland IM240 outpoints.
- Maryland implementation schedule (from LEV to Tier 2 in 2004).
- Maryland anti-tampering program.
- Montgomery County vehicle registrations.
- Montgomery County diesel fractions.
- Fuel RVP at 7.8.



Receptor site at Rockville Pike/Cedar Lane intersection.



Receptor site at Rockville Pike/Jones Bridge Road intersection.

FIGURE 5-20 TRAFFIC AIR QUALITY ANALYSIS SITES.

- Soak distributions - The Appendix B procedure was used for background traffic. NIH traffic leaving the campus was assumed to be running five minutes after start up. The remaining parameters other than those given below were set at EPA default values.

The following were adjusted for local site conditions:

- Calendar years - 2003 and 2023.
- Temperature - 35º F.
- Vehicle speed – 2.5 mph emission factor for vehicles idling in traffic signal queues, and 25 mph for free flowing traffic. (See User's Guide to MOBILE6.1 and MOBILE6.2, EPA420-R-2-028, 2002)
- Vehicle mix - the MWCOG Appendix B vehicle mix for Montgomery County local analysis was used, but adjusted for site conditions. A field survey counting total traffic, heavy duty vehicles, school and transit buses, and motorcycles was conducted. The traffic mix on Rockville Pike was very close to the Appendix B mix , and the latter was used except for adjustment for the comparatively high volume of transit buses. In contrast, Cedar Lane and Jones Bridge Road have virtually no heavy duty truck traffic, and the vehicle mix using the MWCOG Appendix B mix as a base, was adjusted accordingly. Traffic departing NIH was 100 percent light duty vehicles.

Emission factors for individual road links accounting for soak distribution were computed in a post-modelling process. Vehicles on road links approaching the campus were assumed to have the MWCOG Appendix B or regional soak distribution. On those road links that contained both outgoing NIH and background traffic, a composite emission factor accounting for the proportions of NIH and Background traffic was computed.

In the CALQ3HC model, data and assumptions were:

- Applicable roadway and receptor coordinate geometry.
- Peak PM rush hour traffic from October 2003 surveys and 2023 projections for full Master Plan buildout conditions to determine the one-hour average CO concentrations.
- Existing intersection traffic signal cycle timing.
- The model was permitted to search for the wind direction that produces the highest CO concentration.
- Wind speed of 1 meter/sec.
- Atmospheric stability class D or 4.
- Maximum one and eight-hour CO concentrations (3.3 and 2.3 ppm, respectively) at the McLean Government Center monitoring station were used as background concentrations.
- Future background concentrations were estimated using the "rollback" technique, which accounts for reduction in vehicle emission rates and increase in regional vehicle miles of travel over time..
- Maximum eight hour concentrations were determined in a post process of the one hour modelling based on Appendix B data for regional hourly distribution of traffic on arterial roadways.

Predicted future "worst case" traffic generated CO concentrations are shown in Table 5-34. Predicted CO concentrations at both intersections are determined principally by emissions idling in queues at each signalized intersection. At the Cedar Lane intersection, all of the vehicle queues contribute to the total CO concentrations, although the northbound Rockville Pike queue is predominant.

At the Jones Bridge Road intersection, the worst case wind vector at this location also passes through the center of the intersection. Rockville Pike traffic contributes about two-thirds of the total CO in all cases due to higher traffic volumes.

Year/Case		Maximum CO Concentrations			
		Site 1		Site 2	
		One-hour Average	Eight-hour Average	One-hour Average	Eight-hour Average
2002 Existing	Traffic Background Total	1.8 3.3 5.1	1.4 2.3 3.7	1.2 3.3 4.5	0.7 2.3 3.0
2023 Master Plan	Traffic Background Total	3.0 2.0 5.0	2.4 1.4 3.8	1.8 2.0 3.8	1.4 1.4 2.8

TABLE 5-34 PREDICTED WORST CASE TRAFFIC CO CONCENTRATIONS.

Future traffic generated CO concentrations will be less than existing concentrations in all cases due to reduced vehicle emission rates. The one and eight-hour average NAAQS CO concentrations will not be exceeded and no impacts are expected.

5.6.2.2 Commercial Vehicle Inspection Facility

The proposed Commercial Vehicle Inspection Facility (CVIF) would be located on the east side of the campus adjacent to Rockville Pike between Wilson and North Drives. The peak number of vehicles arriving at the facility in the short term is expected to be 83 per hour based on a three day commercial traffic survey conducted at NIH in 2003. Peak volumes are projected to grow to about 105 vehicles per hour under full Master Plan buildout conditions.

The survey also classified arriving commercial vehicles into four categories: light vehicles, and heavy two, three, and four axle trucks. About 46 percent of the traffic is "light duty" vehicles for air quality analysis purposes with the remaining 54 percent classified as heavy duty vehicles, i.e. those with gross vehicle weights over 8,500 lbs.

Emission factors for the vehicles using the facility were determined by using the EPA MOBILE6.2, Mobile Source Emission Factor Computer Model. Base input assumptions were the same as those given in Section 5.6.2.1, except for vehicle mix. The Montgomery County local area vehicle mix distribution used in regional air quality conformity analysis was used as a basis for the facility vehicle mix distribution. The facility vehicle mix was determined by proportioning 45 percent of the facility traffic among the County light duty vehicle classes, and 54 percent of the facility traffic among the 16 County or MOBILE 6.2 heavy duty vehicle classifications. The latter include both diesel and gasoline fueled trucks.

The U.S. EPA CAL3QHC computer program for analysis of air quality at road intersections was used to model conditions in the vicinity of the CVIF. The program computes predicted carbon monoxide (CO) concentrations at specified receptor locations based on topographic, road, and receptor geometry traffic and its emission factors, and pollutant dispersion algorithms. The program has the capability of simulating emissions from vehicles idling in queues at signalized intersections.

The CVIF was simulated as a four lane approach road to a signalized intersection with the stop line at the front of the CVIF inspection area canopy. It was assumed that the fifth lane would be used only for a few vehicles pulled out of line for more thorough inspections. Each of the four lanes was modelled separately. The simulated "traffic signal" cycle for each lane was set to correspond with anticipated average inspection times. The red light time for light duty vehicles was set at 45 seconds, those for two heavy duty vehicle lanes at two minutes, and one heavy duty vehicle lane at four minutes. Green time for all lanes was set at five seconds, simulating the release of only one or two vehicles at a time. The resultant average queue lengths ranged between five and six vehicles. Vehicles not idling moved at five miles per hour within the facility. The adjacent Rockville Pike/Wilson Lane intersection with its idling vehicles was included in the model. Although they do not occur concurrently, the traffic volumes associated with CVIF and Rockville Pike peak hour conditions were used in the model.

Only calendar year 2003 was modelled. By 2023, or full Master Plan buildout, CVIF traffic volumes will increase by about 26%, but overall vehicle emission factors will decline by about 50 percent.

There are no sensitive receptors in the vicinity of the CVIF. The CVIF building itself, and NIH Building 6A, the next closest building to the inspection facility at 380 feet distance from the inspection lanes, were selected as analysis sites.

Predicted peak one hour CO concentrations at the receptor sites are influenced by traffic at the Rockville Pike/Wilson Lane intersection as well as CVIF traffic. The total CO concentration at the north end of the CVIF building occurs when the wind is from the southeast (azimuth 160 degrees). Under these circumstances, the estimated CO concentration is 1.2 ppm with Rockville Pike traffic and CVIF idling vehicles contributing equally or 0.6 and 0.6 ppm, respectively.

The maximum effect of CVIF vehicles occurs when the wind blows from the east across the vehicles at the front of the queues at the stop line. In this case, the peak one hour average CO concentration is 1.4 ppm. CVI vehicles contribute 1.1 ppm , and Rockville Pike traffic contributes 0.3 ppm. The 1.1 ppm contribution from CVIF idling vehicles is constant all along the west side of the inspection area as long as all four inspection lanes are occupied when the wind is blowing from the east. The predicted 2003 total CO concentrations under these circumstances with background ambient concentrations included are:

	2003 One-Hour Average	2003 Eight-Hour Average
CVIF contribution	1.1 ppm	1.1 ppm
Rockville/Wilson contribution	0.3	0.2
Background	3.3	2.3
Total	4.7 ppm	3.6 ppm

Both results are well below the 35 ppm one hour average and 9 ppm eight hour average national standards.

The maximum CVIF vehicle contribution to a receptor at NIH Building 6A is 0.1 ppm, and no impacts are expected.

5.6.2.3 Parking

A "worst case" microscale analysis was conducted to determine the highest potential carbon monoxide (CO) concentrations generated by campus parking. CO concentrations produced by parking facilities at a given receiver site are directly proportional to the facility capacity, assuming all parking spaces are occupied, but decrease exponentially with the distance between vehicle source and receiver site. Worst case conditions occur under a combination of high vehicle count coupled with short distance between source and receiver.

It was determined that this occurs at multiple level parking structures MLP-6 and MLP-8, in the southwest corner of the campus (Figure 5-21). The two structures concentrate a large number of vehicles in a relatively small area. Their combined capacity is 2,531 spaces, about 26 percent of the campus total. The distance between MLP-6 and MLP-8 and nearby residences is 250 feet. MLP-6 and MLP-8 are existing structures and would continue in service under both the Master Plan and No Action Alternatives.

All other parking lots have, or will have, less air quality impact. Existing surface lots now in the north and south perimeter buffer are closer to nearby residential areas, but they have less than half the combined capacity of MLP-6 and MLP-8. They would also be removed under the Master Plan Alternative. The Master Plan Alternative proposes two new parking structures, MLP-10 and MLP-E, near the campus periphery, but they would be located interior to the perimeter buffer. Each would have less capacity and be at a greater distance to potential residential receivers than MLP-6 and MLP-8. For MLP-10, these values are 1,250 spaces and 360 feet; for MLP-E, they are 1,116 spaces and 400 feet.

The parking air analysis was completed using the CAL3QHC dispersion model. Emission factors were determined using MOBILE 6.2.

Basic assumptions used in the analysis were:

- MLP-6 has 880 parking spaces on 4 levels. First level at elevation 345 feet, and levels 10 feet apart in elevation. Spaces divided equally between levels. Exits at Levels 1 and 4. Vehicles use shortest route to exit.
- MLP-8 has 1,651 parking spaces on 7 levels. First level at elevation 325 feet, and levels 10 feet apart in elevation. Spaces divided equally between levels. Exits at Levels 1, and 3. Vehicles use shortest route to exit. About 75 percent of the spaces on Level 7 at the top are visitor spaces, the remainder are for NIH employees.
- From parking surveys at NIH, daily space turnover ratio is 1.4. Therefore, 1,232 daily exits from MLP-6 and 2,311 exits from MLP-8 occur.
- Based on a traffic and parking lot survey, hourly exits beginning at 10 AM were assumed as follows:

Hour Beginning	MLP-6 Exits	MLP-8 Exits
10:00 AM	88	165
11:00 AM	88	165
12:00 PM	88	165
1:00 PM	88	165
2:00 PM	88	165
3:00 PM	249	468
4:00 PM (peak Hour)	293	550
5:00 PM	249	468

  Parking is saturated at NIH and the exit pattern is applicable for both 2002 and 2022.
- All departures from 10:00 AM to 3:00 PM start with an average 4-hour hot soak, those from 3:00 PM through 6:00 PM have an average 8-hour hot soak.
- All vehicles are light duty vehicles as defined in MOBILE 6-2, i.e. no heavy duty trucks. The vehicle mix among light duty vehicles was as defined by MWCOG for Montgomery County in the regional air quality conformity analysis.

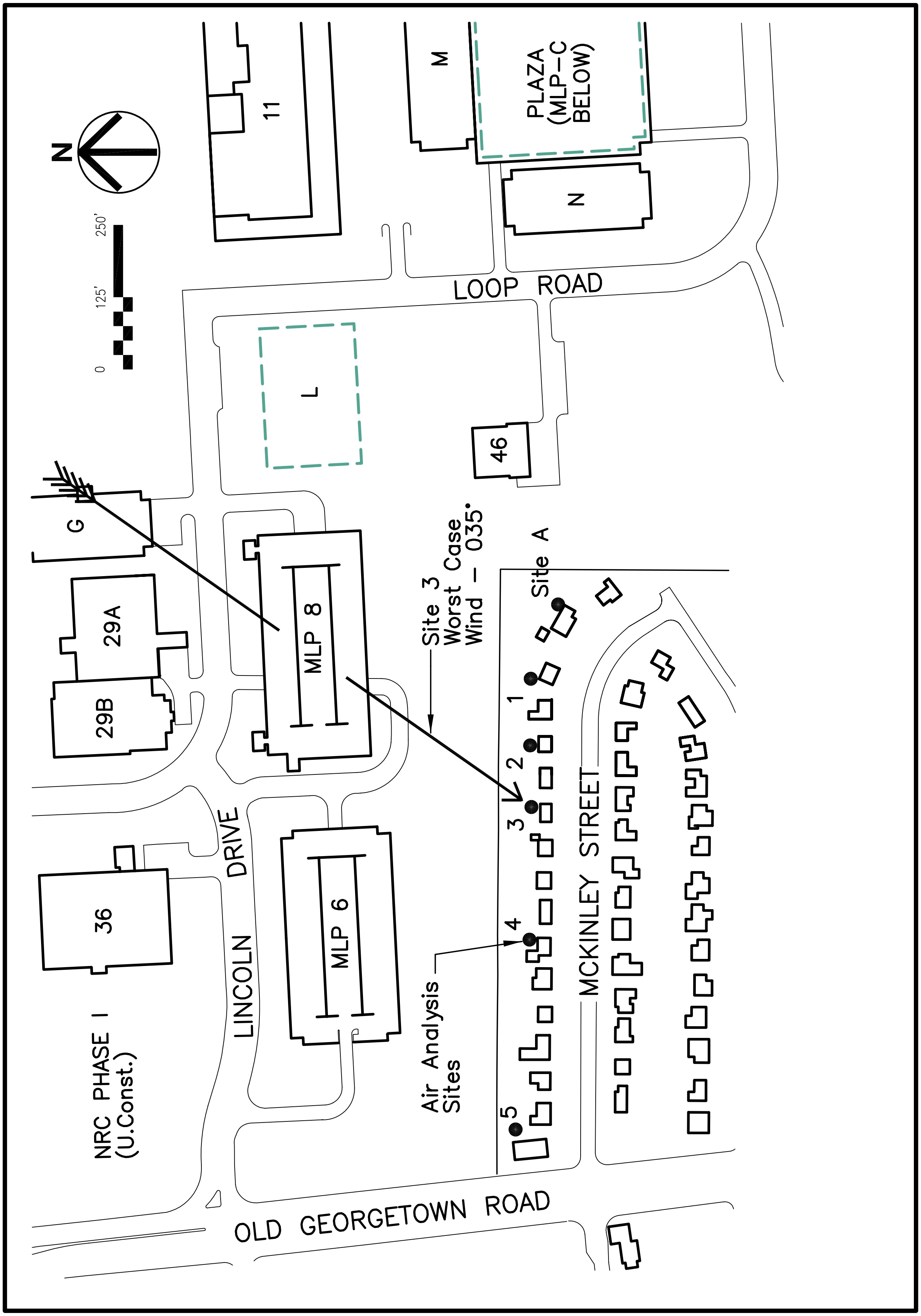


FIGURE 5-21 SITES FOR PARKING AIR QUALITY ANALSIS.

- Vehicle departures are divided equally among the parking levels.
- Vehicle speeds in the garage are 5 mph.
- Emission factors determined for each parking level in each structure.

Meteorology is the same as for the traffic air quality analysis. The model was permitted to find the "worst case" wind.

Five sites were analyzed in the 1995 Master Plan EIS for the maximum or "worst case" one-hour average CO concentrations. It was determined that Site 3 was subject to the highest overall concentrations, and this updated analysis evaluated only that site. For a given year, predicted concentrations and impacts are the same for both the Master Plan and No Action Alternatives because MLP-6 and MLP-8 would be present in both alternatives. Both would operate at capacity in both alternatives because of campus parking demand.

Resultant estimated CO concentrations are shown in Table 5-35. Each parking level was modelled separately, as vehicle volumes increase progressively from top Level 7 down to a maximum on level 3, which has an exit. Volumes on Levels 1 and 2 are intermediate, but follow different patterns within the garage. Levels 3 and 4 contribute virtually all of the CO concentration at the receptor since they have both the highest traffic volumes and the least elevation differential with the receptor.

Future vehicle volumes and physical parameters remain the same under the Master Plan and No Action Alternative conditions as the MLP operates at capacity conditions in all cases. However, future MLP-8 generated CO concentrations will decline. This is solely due to U.S. EPA projected reductions in individual vehicle emission rates over time that are included in the MOBILE-6 model.

5.6.3 Stationary Source Air Quality

5.6.3.1 Central Steam Plant

The main point or stationary source for emissions on the campus is the central heating plant in Building 11. Existing Boilers 1 through 4 each have a capacity to generate 150,000 lbs/hr of steam. Boiler 5, which has a 200,000 lbs/hr capacity went into service in 1996. Total plant capacity is 600,000 lb/hr.

Prior to 1994, No. 6 fuel oil was used as the primary fuel supply. The estimated annual 1993 sulfur dioxide and nitrogen oxides emissions using No. 6 fuel oil were 803 and 343 tons per year, respectively. In the mid-1990s, NIH implemented the first steps in the central heating and cooling plant modernization program. NIH retrofitted Boilers 1 through 4 for dual natural gas and No. 2 distillate fuel oil feed. Natural gas, which is a much cleaner burning fuel than oil, would be the primary fuel with No. 2 low sulfur content diesel oil used as a backup source. Boilers 1 through 4 were also retrofitted with low nitrogen oxides (NOx) burners, and flue gas recirculation emission controls to further cut nitrogen oxides emissions. Boiler 5 was installed with the new features. Emission reductions of 80 percent or more have been realized through the modernization program since 1993.

The PEPCO COGEN turbine and Heat Recovery Steam Generator (HRSG), Boiler 6, are expected to start service in 2004. The HRSG has a capacity of 108,000 lb/hr when it uses the exhaust heat from the turbine under standard daily operating conditions. An additional 72,000 lb/hr of steam can be produced through direct supplemental firing within the unit for a total capacity of 180,000 lb/hr.

Emissions from Boilers 1 through 5 are routed to a central stack, which encompasses the five individual stacks. Each individual stack is 40 inches in diameter. Stack height is 117 feet above ground level. The

	1-Hour Average	8-Hour Average
National/State Air Quality Standard	40,000	10,000
2002 EXISTING		
Parking	555	182
NIH Roads	400	275
Background	3,900	2,700
TOTAL	4,855	3,157
2023 MASTER PLAN and NO ACTION ALTERNATIVES		
Parking	166	85
NIH Roads	250	150
Background	2,350	1,625
TOTAL	2,766	1,860

EXISTING AND PROJECTED ONE AND EIGHT-HOUR AVERAGE CO CONCENTRATIONS AT SITE 3 (in µg/m^3).

TABLE 5-35 WORST CASE PARKING CO CONCENTRATIONS (in µg/m^3).

COGEN facility will have an independent 8-foot diameter stack that is 140 feet high.

Title V, Part 70, of the Clean Air Act Amendments of 1990 establishes a national program for permits for regulated air emission sources. For program purposes, NIH is classified as a major source because its overall emissions from fossil fuel fired equipment exceed regulatory threshold limits. NIH Title V permit 24-031-00324 describes all the regulated NIH emission sources, emission control equipment, operations, and compliance procedures. The Title V permit is applicable to Boilers 1 through 5, the COGEN facility, gasoline storage tanks, and emergency diesel generators with a capacity over 750 KW. The permit identifies applicable regulations for emissions, monitoring, and record keeping. As a permit condition, NIH conducts tests of stack emissions annually and files certification reports to MDE. The permit is renewable every five years. Although changes can occur in the interim, the permit is usually revised at renewal time to account for changes in conditions and regulations.

5.6.3.1.1 Annual NOx Emissions

The annual NOx emissions from the NIH central heating plant are limited to 55.6 tons for the COGEN unit and 81.7 tons for boilers 1 through 5, or a total 137.3 tons.

Heat is measured in British Thermal Units (BTU). When burned, natural gas and fuel oil release fixed amounts of heat, about 1,025 BTU/CF and 140,000 BTU/gallon, respectively. A fixed amount of heat is needed to generate a pound of steam. Compliance with the permit is ascertained by annual tests which determine a pollutant emission factor for each plant boiler in terms of pounds of pollutant per million BTU of fuel consumed (lb/mm BTU). This factor is multiplied by the annual fuel consumption of each type for each boiler as indicated in plant records to determine the aggregate or total plant pollution emissions for the year. The estimated NOx emissions in 2003 as derived by this method was 75.7 tons.

In practice, individual boiler pollutant emission factors vary from test to test, year to year. Emission factors, therefore, were computed using the procedures given in Compilation of Air Pollution Emission Factors, 5th Edition (US. EPA Publication AP-42), and 40 CFR 60, Appendix A (Table 5-36). Boilers 1

	Boilers 1-5		COGEN				Boiler 7	
			(1)		(2)			
	No. 2 Oil	Natural Gas	No. 2 Oil	Natural Gas	No. 2 Oil	Natural Gas	No. 2 Oil	Natural Gas
Carbon Monoxide (CO)	0.0779	0.0739	0.0248	0.0243	0.004	0.007	0.07796	0.0739
Sulfur Dioxide (SO_2)	0.0507	0.0006	0.054	0.00066	0.054	0.00066	0.051	0.0006
Particulate Matter (PM10)	0.0143	0.0062	0.040	0.021	0.015	0.007	0.00929	0.00745
Volatile Organic Compounds (VOC)	0.00143	0.00278	0.0014	0.0014	0.002	0.003	0.00446	0.00423
Nitrogen Oxides (NOx)	0.130	0.050	0.1632	0.0442	0.120	0.120	0.10243	0.02427

(1) At 108,000 lb/hr and no supplemental HSRG firing.
(2) At 180,000 lb/hr with supplemental HSRG firing.

TABLE 5-36 EMISSION FACTORS FOR ESTIMATING BOILER PLANT POLLUTANT EMISSIONS (in lb of pollutant/mmBTU).

through 5 share the same emission and control characteristics, and resultant factor. The values for the COGEN unit are those given in the application for a permit to construct the unit, except for NOx when operating at 108,000 lb/hr. These latter factors (0.0442 and 0.1632) are based on value obtained during performance tests in 2003. The factors for future Boiler 7 are estimated on the basis that it will be a 200,000 lb/hr boiler with Reasonable Available Control Technology (RACT) FOR NOx emissions.

The use of these pollutant emission factors produces conservatively high emission estimates. Actual plant emission factors, as indicated by annual stack tests for Boiler 1 through 5, are generally less than the computed values.

Since the units have different pollutant emission factors for each type of fuel, actual or estimated emissions depend on which unit is used, and the amount of steam produced by each unit using each fuel type. Compliance to Title V NOx emission limits under No Action and Master Plan Alternative build out conditions was assessed by development of simulated annual plant operations that would meet the projected steam demands given for each alternative in Section 5.4.1.2. Existing 2003 conditions were also simulated using the same procedures for comparison to actual operations and emissions.

Assumptions used in the operating scenarios are:

- Boilers 1 through 4 are interchangeable regarding pollutant emissions, i.e. any combination of these boilers may be used when the scenario indicates they are in service.
- Based on plant records, NIH generally operates the boilers between 50 and 75 percent of their capacity, except where peak demands dictate.
- Overall steam generation is split equally among the units within the previous parameter to meet demand.
- Plant efficiency for converting heat to steam is 85 percent.
- The COGEN unit is run 94 percent of the time (8,234 hours per year) based on the availability criteria in the NIH-PEPCO contract.
- For the Master Plan and No Action Alternatives, NIH will have a firm natural gas availability, not subject to curtailment, that will permit operation of the COGEN unit using this fuel throughout the year.
- Boiler 7 would not be installed under the No Action Alternative.

- Boilers 5 and 7 would be used equally on an annual basis in the Master Plan Alternative.
- That oil will be used in boilers for 20 days, or for 480 hours, per year due to curtailment under the No Action and Master Plan Alternatives, which are based on 2020 or later conditions.

The simulated annual plant operations for 2003 are summarized in the Table 5-37. Plant records were used to determine average seasonal steam demands. Natural gas is the preferential fuel because it produces less NOx and other pollutants per pound of steam generated. Oil is generally used when the gas supply is curtailed by Washington Gas, and demands outside NIH are high. Curtailment is also coincident with high campus steam demand. Gas was curtailed at least in part on 38 days (840 total hours) in 2003, and NIH used oil exclusively during these periods. Although oil was used for less than 10 percent of the year, nearly 17 percent of the annual steam production was generated using this fuel. The winter season was split into two parts when each type of fuel was used to account for this.

Boiler operating scenarios where developed for each seasonal condition. The short term peak condition is used in the analysis to estimate pollutant concentrations (see next section). The more complex future operating scenarios for the No Action and Master Plan Alternatives are shown in Tables 5-38, 5-39 and 5-40. The resultant existing and projected annual NOx emissions based on given assumptions and operating scenarios are given in Table 5-41. The key assumptions are exclusive use of natural gas to fuel the COGEN unit, oil use in other units for 20 days and equal use of Boilers 5 and 7 throughout the year in the Master Plan Alternative projection. NOx emissions would increase to an estimated 108.1 ton per year under the No Action Alternative, and to 123.9 tons per year under full build out Master Plan conditions. Master Plan emissions do not increase in proportion to steam demand because of the availability of Boiler 7. In this case, its NOx emission factor is lower than the other units. The Title V operating permit NOx limit would be met in both cases under the assumed conditions.

Actual emissions will vary from the projected estimates, either up or down, depending on several conditions. NIH will have some latitude in controlling overall annual emissions, particularly in the Master Plan case. Boiler 7 and the COGEN unit produce less NOx than Boilers 1 through 5 per pound of

Season	Demand PPH	Hours	Fuel
Short Term Peak	585,000	1	Oil
Winter Oil Average	380,000	840	Oil
Winter Gas Average	314,500	1,320	Gas
Spring/Fall Average	190,000	4,392	Gas
Summer/Average	155,000	2,208	Gas

Season	Boilers	% Capacity	MMBTU/hr
Short Term Peak	1,2,3*	73	690
Winter Oil Average	1,2,3,4	63	448
Winter Gas Average	1,2,5*	63	371
Spring/Fall Average	1,2*	63	224
Summer Average	1,2*	52	183

* May be any combination of Boilers 1 or 2 or 3 or 4 where individual units are listed.

TABLE 5-37 BOILER SCENARIO FOR 2003 EMISSION ANALYSIS.

SCENARIO	CAMPUS STEAM DEMAND (KPPH)	
	NO ACTION 2008	MASTER PLAN (full implementation)
Peak Hour	776	968
Winter Oil Average	535	668
Winter Gas Average	427	533
Fall/Spring Average	252	314
Summer Average	206	256

ANNUAL OPERATING SCENARIO					NO ACTION ALTERNATIVE		MASTER PLAN ALTERNATIVE	
Season	Fuel	COGEN Status (KPPH)	Oil Hours	Gas Hours	Total Demand (KPPH)	NONCOGEN Demand (KPPH)	Total Demand (KPPH)	NONCOGEN Demand (KPPH)
1 Winter	Oil	108	480		535	427	668	560
2 Winter	Gas	108		1,680	427	319	533	425
3 Fall/Spring	Gas	108		3,866	252	144	314	206
4 Fall/Spring	Gas	Off		526	252	252	314	314
5 Summer	Gas	108		2,208	206	98	256	148

Note: KPPH = 1,000 lbs/hr steam.

TABLE 5-38 STEAM DEMAND SCENARIOS.

Scenario (boiler fuel)	Boilers	Operation at % Capacity	Steam Per Unit (KPPH)	Fuel Consumption (mmBTU/hr)
Peak Hour (oil) (not evaluated)	--	--	--	--
Winter (oil)	1,2,3 5	67 63	100 125	353 151
Winter (gas)	1,2 5	64 64	96 128	226 151
Spring/Fall/COGEN On (gas)	5	72	144	170
Spring/Fall/COGEN OFF (gas)	1 5	72 72	108 144	127 170
Summer	1	65	99	116

TABLE 5-39 PROJECTED NO ACTION ALTERNATIVE ANNUAL BOILER SCENARIO.

Scenario (boiler fuel)	Boilers	Operation at % Capacity	Steam Per Unit (KPPH)	Fuel Consumption (mmBTU/hr)
Peak Hour (oil)	1,2,3,4 5 COGEN 7	88 88 -- 88	132 176 108 176	623 208 241 208
Winter 20 coldest days (oil)	1,2,3 5 COGEN 7	66 66 -- 66	99 132 108 132	467 156 241 156
Winter 70 warmest days (gas)	1,2,3 5 or 7 COGEN	66 63 --	99 126 108	467 149 241
Spring/Fall/COGEN On (gas)	1,2 COGEN	69 --	103.5 108	244 241
Spring/Fall/COGEN OFF (gas)	1,2 5 or 7	63 63	94.5 126 144	244 149
Summer (gas)	COGEN 5 or 7	-- 74	108 148	241 174

TABLE 5-40 PROJECTED MASTER PLAN ANNUAL BOILER SCENARIO.

Scenario	Boilers	COGEN	Total
2003 Existing Actual	75.6	---	75.6
2003 Existing Computed	71.4	---	71.4
No Action Alternative	58.2	49.9	108.1
Master Plan Alternative	74.1	49.9	123.9
Title V Permit Limit	81.7	55.6	137.3

TABLE 5-41 ESTIMATED EXISTING AND PROJECTED ANNUAL NITROGEN OXIDES EMISSIONS (in tons per year).

steam produced. Maximization of the amount of steam generated by these units over the year would lower the annual amount of NOx generated for a fixed steam demand.

Annual emissions are also dependent on the relative amounts of steam generated over the year using oil and gas. An analysis was made to determine the maximum number of days that oils could be used under Master Plan Alternative conditions. All the analytical assumptions and scenario conditions were maintained, except that fuel oil was used until the overall annual NOx emissions reached the permit limit.

It is estimated that NIH would remain within the NOx limit for an additional 15 days, or for the 35 coldest days of the year. This is based on 2003 outdoor temperature conditions. Additional oil use days could be accommodated by exclusive use of Boiler 7 with its lower NOx emission rate, when operating conditions require only one 200,000 lb/hr boiler in service to meet non-COGEN demand (See Table 5-36).

On the other hand, NIH now has three chillers with dual steam-electric drive. About 141,000 lb/hr of steam is required for all three units under steam operations. It is estimated that about 8.32 and 4.04 lb/hr of NOx would be generated by Boilers 5 and 7, respectively, if each unit was used exclusively to drive chillers. Steam chiller drive is not included in the Table 5-38 totals.

Steam drive would be most effective during the summer months. Since the overall summer campus chilled water demand is higher, the chiller steam load would be uniform over time. Operation at 15,000 tons would reduce electric power consumption by an 8,850 KW HRS or KW necessary for electrical drive.

Most of the power delivered to the campus is generated in commercial power plants fueled by coal or oil. When burned, coal and oil produce higher amounts of NOx than natural gas per BTU of heat generated.

Further, more than one kilowatt of power must be generated at the distant plant to delivery one kilowatt to the customer due to transmission line losses. NOx emissions factors using bituminous coal can range from about 0.20 to 0.85 lbs/mmBTU depending on combustion unit characteristics, and emission controls. The entire range of emission factors for coal is far above those for natural gas.

Generation of electric power in the COGEN unit in effect, substitutes natural gas for coal and oil as the power generation fuel. On a regional basis, NOx emissions are reduced by a factor of four or more for each KW generated by the NIH plant. Use of the power within NIH and the immediate neighborhood virtually eliminates distribution losses, and creates additional NOx reductions. Driving the chillers using steam generated by the plant boilers also reduces regional emissions.

5.6.3.1.2 Emission Pollutant Concentrations

Computer stack plume dispersion modelling is used to estimate the atmospheric dispersion and resultant concentrations of pollutants at selected receptors in the vicinity of emission sources. Such an analysis was conducted as part of the 1995 Master Plan EIS by using the detailed Industrial Source Complex Short Term (ISCST-2) computer model released by the U.S. EPA in 1992. The model revealed that there were no stack plume downwash problems created by proposed Master Plan buildings in quads located to the north and south of Building 11.

A screening level of approach using conservative assumptions and a "worst case" scenario was therefore used to update projections. The U.S. EPA recommended screening model, SCREEN 3, was employed. To conservatively calculate pollutant concentrations, a composite set of "worst case" conditions regarding meteorological conditions, aerodynamics, projected boiler emissions, and analytical assumptions were used.

U.S. EPA default options for meteorological conditions and building wake effects were used. The model uses a fixed internal set of meteorological parameters and computes potential receptor concentrations for 44 combinations of wind speed and atmospheric stability that may be experienced at any geographic location in the U.S. In some cases, the test cases are rare or are representative of very unusual meteorology that is not necessarily experienced throughout the U.S. Use of default values leads to conservatively high estimated concentrations.

The SCREEN 3 model also takes into account the potential influence of aerodynamic wake effects or downwash created by buildings in the vicinity of the stack source. Downwash tends to limit dispersion by drafting the plume to ground level at a point closer to the source before the effects of distance traveled are fully realized. The effects of Building 11 itself were modelled for potential downwash (90 feet. high, 400 feet long, 223 feet wide) for existing conditions, and: 90 feet high, 515 feet long, and 251 feet wide for Master Plan conditions.

The base of stacks was set at reference elevation zero. Three receptor locations were analyzed:

1. The location where the COGEN stack emission produced a maximum concentration. This occurs on the campus at a distance of 337 feet from the stack. The nearest residence in the Glenwood neighborhood (Site A in Figure 5-21). The site distance and relative elevation above the stack base are 850 and 33 feet, respectively.

2. The uppermost floor at the Whitehall Condominiums, a high rise apartment building on the south side of the campus. The receptor is 1,865 feet distant from the stack at a relative elevation of 85 feet.

The SCREEN3 program computers maximum one hour concentrations. To estimate short-term, less than 24-hour concentrations, plant operations during the existing (585,000 lb/hr) and Master Plan build out (968,000 lb/hr) potential peak hour were modelled (see Tables 5-37 and 5-40). The No Action Alternative was not modelled, but would have results intermediate between existing and No Action conditions. It was assumed that all boilers would oil fired during the potential peak hour, and the COGEN unit, which is present only in the Master Plan case, would be gas-fired.

Boiler 1 through 5 have stacks located adjacent to one another in a three by two matrix manifold. Boiler 7, when built, will use the sixth stack. Each stack is 117 feet high and 40 inches in diameter. The COGEN stack is 100 feet distant from the center of the boiler matrix. Its height and diameter are 141 and 8 feet, respectively.

The COGEN stack temperature was set at 279º F and stack velocity at 67 ft/sec based on a combustion analysis. Values for the boilers were computed similarly, not only for the potential peak hour, but also average seasonal conditions. The SCREEN3 model was run with a unit stack emission rate of one/gram per second to obtain microgram/cubic meter per gram/sec factor for each receptor. In a past modelling analysis, for each pollutant, and for each operating boiler and the COGEN unit in the scenario, gm/sec emissions were determined by multiplying the appropriate operating unit pollutant emission factor (lb/mmBTU) by the heat throughput for the unit (mmBTU/hr), assuming 85 percent plant efficiency, and making the appropriate engineering unit conversion. The resultant gm/sec values were multiplied by the SCREEN3 conversion factor to obtain µgm/cubic meter concentrations for each unit.

The U.S. EPA analytical procedure for merging stacks was modified to account for annual operations. The COGEN unit operates at a uniform rate throughout the year. As a result, only one or two boilers are operated during the non-heating season (March-November). The COGEN stack was used as the reference point. Boiler stacks were modelled as a single stack location with adjustments in distance made to the two residential sites. The contributions of each unit in service to the receptor site concentrations were summed to a cumulative total. This produces a conservative result that overestimates predicted pollutant concentrations, but ensures conformance to National Ambient Air Quality Standards (NAAQS).

U.S. EPA specified scaling factors were used to estimate short term pollutant concentrations applicable to longer NAAQS averaging periods. To obtain 3-hour, 8-hour, and 24-hour concentrations, the one hour model concentrations were multiplied by the EPA factors of 0.9, 0.7, and 0.4, respectively. Annual average pollutant concentrations were estimated by applying a factor of 0.1 to estimated concentrations derived by simulating plant operations over the entire year by season.

The resultant estimated receptor concentrations are shown in Table 5-42. Background concentrations are shown separately. Year 2022 Master Plan NOx background concentrations have been adjusted in proportion to trend lines in the MDE 2002 Maryland Air Quality Report. Carbon monoxide background. concentrations have been reduced using the “rollback” technique applied to traffic vehicle emission factors. The total existing and projected pollutant concentrations meet the NAAQS criteria in all cases.

5.6.3.2 Laboratory Emissions

In contrast to vehicles or the boiler plant where emissions are limited to a few combustion products, laboratory emissions can have a multitude of potential components. These components and their concentrations vary from day to day depending on the collective experimental protocols that are underway. The pollutant emission volumes of any one researcher are small, since the amount of chemicals or biological materials handled at any one time is small. Quantities handled at any time are generally contained with beakers, phials and Petri dishes. Biological materials are generally tissue, DNA, or body fluid samples that are kept in refrigerators when not in active use. Until recently, although they would be locked at the discretion of the researcher, Biosafety Level 1 and 2 laboratories were otherwise accessible to anyone because there are no significant hazards.

Safe air quality levels must be maintained not only for the general public, outside the laboratory, but also the workers and visitors within the building itself. This is accomplished through national building and mechanical codes that set ventilation requirements. These requirements are used for the design and construction of university student and research laboratories and biomedical research facilities in the private sector throughout the U.S.

Since the amount and character of potential pollutant generation is variant, the codes are based on the principle of massive dilution. For biomedical laboratories, they call for 12 to 20 air changes per hour throughout the building. Ventilation air is therefore resident in the building for three to five minutes. Air

POLLUTANT/ AVERAGING TIME		MAXIMUM			SITE A			APARTMENTS			NAAQS
		PLUME	BACK GROUND	TOTAL	PLUME	BACK GROUND	TOTAL	PLUME	BACK GROUND	TOTAL	
EXISTING											
CO	1-hour	312	3,900	4,212	152	3,900	4,052	202	3,900	4,102	40,000
	8-hour	218	2,700	2,918	107	2,700	2,807	141	2,700	2,841	10,000
SO_2	3-hour	183	86	269	89	86	175	118	86	204	1,300
	24-hour	81	47	128	40	47	87	52	47	98	365
	Annual	1.4	18	19.4	0.7	18	18.7	1.0	18	19	80
NO2 as NOx	Annual	10	38	48	5	38	43	7	38	45	100
PM10	24-hour	23	45	68	11	45	56	15	45	60	150
	Annual	1.2	18	19.2	0.6	18	18.6	0.9	18	18.9	50
2022 MASTER PLAN											
CO	1-hour	459	2,350	2,809	204	2,350	2,554	234	2,350	2,584	40,000
	8-hour	321	1,625	1,946	143	1,625	1,768	164	1,625	1,789	10,000
SO_2	3-hour	233	86	319	105	86	191	128	86	214	1,300
	24-hour	103	47	150	47	47	94	57	47	104	365
	Annual	1.3	18	19.3	0.6	18	18.6	0.8 8	18	18.8	80
NO2 as NOx	Annual	14	28	42	6	28	34		28	36	100
PM10	24-hour	35	45	80	15	45	60	17	48	62	150
	Annual	2.9	18	20.9	1.3	18	19.3	1.3	18	19.3	50

TABLE 5-42 EXISTING AND PROJECTED MASTER PLAN BOILER PLANT AIR QUALITYCONCENTRATIONS. (in micrograms per cubic meter)

is pulled through the building by large exhaust fans located in mechanical penthouses located on the roof and released to the atmosphere at that point.

To illustrate, new laboratory Building 50 has about 290,000 gsf of floor space. The floor to ceiling height in laboratory spaces is 12 feet. If the average number of air changes is 15 per hour, then about 52 million cubic feet or air is drawn through the building each hour.

Further dilution occurs once roof top emissions are released due to atmospheric dispersion in both the horizontal and vertical direction. The magnitude of this dispersion is several million fold. As a parallel example, it is estimated that traffic on Rockville Pike, Old Georgetown Road, and West Cedar Lane produces about six tons of carbon monoxide per day solely on those links adjacent to the campus. But the contribution of this traffic to the carbon monoxide at residences adjacent to the roadways is measured in terms of a few parts per million (ppm), or micrograms per cubic meter.

Further operational and ventilation requirements are set for Biosafety Level 3 and 4 laboratories. If necessary, experimental work is done in sealed chambers with built-in hand access that are within the laboratory room. Codes and standards require the laboratory room to be kept at a “negative” or lower air pressure in relation to the building as a whole to contain any release of material to the room itself. The codes also require all air exhausted from Biosafety Level 3 and 4 laboratories to pass through High Efficiency Particulate Arresting (HEPA) air filters before release. These special filters, originally developed by the military over 50 years ago, remove particles down to the 0.1 micron level. Materials removed include microdust, smoke, spores, bacteria, and viruses.

5.7 WASTE

Waste generated at NIH are classified by Federal and State regulations which define procedures for waste handling, treatment, storage, transport, and disposal. In some cases, NIH has defined classifications for management of waste within NIH to ensure that waste are handled within the Federal and State regulatory framework. Classifications of waste generated at NIH include solid or general waste, medical/pathological waste (MPW), radioactive waste, chemical waste, and multihazard/mixed waste.

5.7.1 Solid or General Waste

Solid waste is general waste as defined by 40 C.F.R. §243.101 and 40 C.F.R. §257.2. Solid waste consists of general trash, garbage, and refuse. At NIH, solid waste includes office waste; disposable paper products, plastic, glass and wood; animal bedding which is not contaminated; cafeteria or dining center waste; and a small amount of residential trash, all of which are classified as general waste.

Solid waste also includes yard waste and waste from campus maintenance and construction. As in private commercial spaces, interiors of buildings are renovated, refitted, and rearranged to suit the changing needs of occupants. These alterations are occurring around the campus on a continuing basis. Materials can include partitions, doors, glass, and office furniture.

General waste is collected by custodial staff and placed in about 60 dumpsters located throughout the campus. Yard and construction waste are handled separately. A private contractor collects the waste and hauls it to the Montgomery County Transfer Station where a tipping fee is paid to the County on a pass through basis. About 8 to 12 truckloads per weekday are hauled to the transfer station.

NIH is the largest federal employer in Montgomery County and the largest single source of solid waste from among the civilian federal agencies, which contribute less than 3% of the total waste generated in the County. In 2003, campus facilities generated 11,879 metric tons of solid waste (Table 5-43). More than half of the total campus general waste originates in the Clinical Center, or Building 10.

Recycling consists of recovering materials before they enter the waste stream, and diverting them from landfill disposal to reuse as raw materials for the manufacture of new products. For many years, NIH has participated in GSA surplus property programs to recycle paper, scrap metal and used furniture and equipment. Since 1996, an even more concentrated effort to incorporate recycling within waste management services contracts has been instrumental in increasing recycling and recovery activities. Several programs have been adopted to reduce net solid waste generation through waste generation reduction and increased recycling and recovery activities. White office paper is collected from major office buildings through a White Office Paper Recovery Program (WOPR) and sent to recycling outlets under general and waste management contracts. Mixed paper, which is composed of newspaper and all paper meeting white office paper criteria, is handled under the logistics system, staged in a central campus location and removed bi-weekly by a local recycling company.

Scrap metal, which includes light iron, laboratory refrigerators with the freon removed, and other miscellaneous recoverable materials, are recycled. Scrap metal from alterations performed by the NIH, Shops Branch, as well as from the property management system are sent to a metal reclamation facility.

Wood pallets are also collected by work crews and sent to a pallet recycling center. NIH has started programs to recycle styrofoam materials generated in campus dining centers, purchased balers for consolidating and compacting cardboard generated in certain areas within the Clinical Center, and organized several Recycling Action Teams (RAT). The teams have established recycling programs tailored to each building, and are educating employees to identify and recover materials in the waste originating in the NIH shops and buildings.

Waste streams, which have been added to 1995 recycling efforts, include the recovery of co-mingled waste, polypropylene laboratory and cafeteria containers, batteries, and electronics that include laboratory equipment and personal computers. Co-mingled recycled material, defined for contractual purposes, comprises steel cans, glass, beverage containers, and two types of plastics.

NIH also recycles yard waste consisting of grass clippings and tree pruning trimmings. The annual amount varies considerably, but appears to consist of a base 40 to 45 tons of grass, leaves, and ground landscaping materials. The unusually high amounts in 2001 and 2002 are due to a comprehensive periodic campuswide tree maintenance program that removed dead trees, and pruned all mature trees.

The amount of solid waste generated at NIH has remained relatively constant since 1992 despite an increase in campus population from about 16,300 to 17,500. The 10-year average solid waste generation since 1992 is 12,582 tons and yearly values are generally within ten percent of the average. Annual variance is due to the nature of continually changing research and support operations. The initiation or end of a research project, or the number of laboratory renovations or alterations can influence the amount generated in a given year. Although no trend has been established with increase in campus population since 1995, some increase in generation can be expected as the population increases from 18,000 to 22,000 in 2020. Recent experience does indicate, however, that the growth in solid waste generation is not necessarily directly proportional to population growth. The amounts of total solid waste generated in 2002 and 2003 were the lowest since 1991, and are the result of recent concentrated, efforts to minimize waste generation of all types.

Recycling amounts since 1995 have more than tripled. NIH Bethesda recycled 704 tons of solid waste in FY 1992, the first year of accelerated efforts to do so. Recycling comprised 5.4 percent of the total

SOLID WASTE GENERATION	1999	2000	2001	2002	2003
	CALENDAR YEAR				
General Waste	9,631	10,021	10,431	9,880	9,644
Yard Waste	37	105	1,155	1,023	215
Subtotal - General + Yard	9,668	10,126	11,586		9,859
Construction Waste	3,230	2,434	1,278	873	2,020
Total Solid Waste	12,898	12,560	12,864	11,776	11,879
RECYCLED MATERIALS					
White Office Paper	395	375	364	405	357
Mixed Paper	147	222	222	220	238
Mixed Paper Shredded	--	--	--	--	749
Wood Pallets	245	284	186	238	325
Baled Cardboard	340	364	387	440	501
Co-mingle	45	46	50	51	48
Scrap Metals - general	889	585	331	323	220
Polypropylene	13	34	28	79	57
Electronic Equipment (estimated)	--	--	--	--	135
Aluminum Cans	6	6	9	9	10
Batteries	*	*	1	4	15
Toner Cartridges	*	*	*	*	2
Total General Waste Recycled*	2,080	1,916	1,578	1,769	2,657
% General + Yard Waste Recycled	21.6	19.1	15.1	17.9	27.6
General + Yard Waste Recycled	7,551	8,105	8,853	8,111	6,987
% General + Yard Waste Recycled	21.9	20.0	23.6	25.6	29.1
General + Yard Waste Recycled	2,117	2,021	2,733	2,792	2,872

* Less than one ton.

TABLE 5-43 SOLID WASTE GENERATION AND RECYCLING (in tons).

generated. Most of the recycled material was mixed and white office paper. By 2003, NIH had increased its recycled amounts to 2,657 tons of general waste alone, or 27.6 percent of the total. Even higher amounts and percentages had been recovered in the previous year. These recycling amounts and percentages do not include recycled yard and construction waste. When groundskeeping waste is added, the respective values were 2,872 tons and 29.1 percent. The tonnage of general waste to disposal in 2003 was the lowest annual value since at least 1988.

Projected long term estimates for recycling are difficult to make. Since NIH has many types of waste streams in the laboratory environment, it must be cautious in applying an aggressive approach to solid waste recycling in these work areas. After the initial stages of waste minimization and recycling programs, incremental gains in waste reduction and amounts of materials to recycle and recover are more difficult to achieve and are smaller in scope. Realistically, in the long term, it is estimated that NIH may be able to recycle about 25 percent of the solid or general waste material generated on the campus.

Montgomery County has one of the highest per capita waste generation rates in the U.S. All burnable solid waste is hauled to the County Resource Recovery Facility near Dickerson, Maryland. Ash from that facility, and non-processable waste is hauled by rail and truck to a landfill in Brunswick County, Virginia. This facility will accept Montgomery County waste under a contractual agreement through 2012. NIH solid waste have negligible or no impacts on the Montgomery County system according to the Montgomery County Office of Solid Waste Management.

The initial Montgomery County Ten Year Solid Waste Plan established a goal of 35 percent recycling by 1995 and 50 percent by 2000. The County currently recycles more than 35 percent of its waste. The County had an interim goal of achieving 45 percent recycling by the end of 2002. It is now expected that the 50 percent goal will be reached sometime between 2004 and 2006.

Projections for solid waste generation and recycling cannot be made with precision. In most years, future yard waste generation should fall between 40 and 50 tons. But, it will spike in individual years, if NIH has a periodic tree maintenance and pruning project underway, or if there is extensive tree storm damage. Construction wastes will also have a wide variance, depending on the number and character of projects underway. Particularly high values will occur in those years when buildings are demolished or undergoing renovation.

5.7.2 Biomedical Research Waste

There are approximately 3,000 laboratory bench spaces for researchers on the campus. Biomedical research experiments generally involve test tube, vial, beaker, and small bottle quantities of materials. The effects of an experiment may be evident only under the microscope or through microbiological technology. Researchers may work meticulously for days or weeks to generate a teaspoonful or less of working material. The amounts of materials used in any one experiment are therefore generally small. A container with five gallons of chemicals or waste is considered to be a large amount. Waste related to biomedical research are generated in the Clinical Center hospital and all laboratories.

As a world leader in biomedical research, NIH expects its waste management program to be exemplary. According to NIH policy and manuals, all waste types are generated, identified, handled, packaged, collected, transported, treated and disposed of in a manner that protects employee and public health and safety, assures compliance with environmental regulations and permits, and promotes the effective use of resources.

NIH stringently controls waste generated by biomedical research. The NIH Divisions of Environmental Protection (DEP) and Radiation Safety (DRS) are responsible for all aspects regarding the safe use of materials and the management of waste, including the training of personnel in these areas. Waste is managed from "cradle to grave", i.e. from generation to ultimate disposal. All nonradioactive waste is managed by the Waste Resource and Recovery Branch (WRRB) within the DEP. Similarly, DRS is responsible for the management of radioactive materials and waste.

NIH has professionals in health and safety, who inspect and monitor laboratory and Clinical Center facilities, and advise and train researchers in laboratory and experimental safety on a full time basis. Of these, about 35 are specialists in radiation health and safety. These personnel inspect all facilities where radioactive materials are handled or stored, on at least a quarterly or semi-annual basis, to ensure safe use of the materials.

All NIH personnel involved in the handling, transport, and use of radioactive materials are trained in accordance with NRC requirements. Only after passing the training course examination are they authorized to handle or use radioactive materials by NIH. Such employees attend one class immediately after employment, and are required to complete refresher training once every two years. Training emphasizes radioactive material waste minimization through the use of less radioactive nuclides, lower volumes of materials used in experimentation, and delineating alternatives that do not involve radioactive materials.

The DEP and DRS act as central repositories of information for all Institute researchers in handling materials and on waste management technology and regulations. In many cases, procedures developed at NIH are used throughout the biomedical research community. These include Laboratory Safety at NIH, Working Safely with HIV and other Blood Borne Pathogens in the Research Laboratory, NIH Chemical Hygiene Plan, NIH Radiation Safety Guide, NIH Hazard Communication Program, Management of Chemical and Mixed Waste at the NIH, and Waste Disposal. The last gives summary guidance in calendar form. These documents are reviewed and updated frequently in response to changing conditions and regulatory requirements. Advisory services in the DEP, DRS, and Occupational Safety and Health Division are available to the researcher in developing experimental and waste minimization protocols.

Chemical, radioactive, and multihazard/mixed waste management operations are run on a turn key basis by specially trained and qualified private contractors. Chemical waste is handled from laboratory pickup to ultimate disposal by the NIH Chemical Recycling and Disposal Service (CRDS). Radioactive waste are handled in the same manner under the same contract by the NIH Radioactive Waste Service (RWS). Contractor personnel are qualified professionals in the handling, packaging, storing, transporting, and disposing of chemical, multihazard, mixed, and radioactive waste as well as applicable spill prevention and control measures.

Emphasis is placed on waste generation minimization at NIH. Management begins at the source of waste. Waste minimization is an integral part of each experimental protocol. Experiments are designed so that reagents and procedures that will reduce or eliminate hazardous waste are selected. Minimum chemical procurements are planned and made to avoid waste created by outdated and unused stock and to minimize storage requirements and hazards. When possible, less hazardous or nonhazardous materials are substituted. If a hazardous waste is generated, procedures that may reduce the volume of that waste are applied.

If the waste chemical from one experiment is a desirable stock chemical in another, it may be exchanged within the NIH laboratories. Prior to their designation as waste, certain materials may be treated, separated, neutralized or inactivated in the laboratory to reduce toxicity, hazard, or volume. Infectious agents, for example, may be deactivated by autoclaving or applying a disinfectant to convert a multihazard waste to a simple chemical or waste.

Waste are strictly segregated in the laboratory to avoid creating unnecessary amounts of multihazard/mixed waste. Aqueous and organic solvents, liquid and solid waste, and short and long half life radioactive materials are kept separate. A wide assortment of appropriate waste containers, many defined and specified by Federal and State regulations, are provided to researchers by the appropriate waste management groups within the DEP and DRS. The researcher labels the container for date, source, constituents, and potential hazard. Accumulated waste are stored temporarily in cabinets or in secure areas in the laboratories away from general public and easy employee access.

For chemical, radioactive, and multihazard/mixed waste, CRDS or RWS contractor personnel inspect the waste, and researcher packaging and labeling, remove the waste, and transport them to Building 21. These waste are picked up within 24 hours after the researcher calls for a pickup. If waste are generated cumulatively in an experiment over time, waste are picked up when containers are no more than three-fourths full, or at a maximum duration of sixty days from the first generation regardless of the accumulated amount.

At Building 21, chemical, radioactive, and multihazard/mixed waste are segregated by different regulatory categories. If there is doubt, waste are analyzed for content, pH, and other characteristics to ensure proper classification, handling, treatment, storage, transport, and disposal. If necessary, waste are treated to render them nonhazardous, reduce hazard, reduce volume, or convert multihazard or mixed waste to a single classification. Waste may be bulked by consolidation of compatible waste from the multiple small containers produced in the laboratory to a single container or fewer containers for subsequent shipment.

Waste are then shipped weekly by the CRDS and RWS to off site management facilities. Off site transport is manifested under applicable regulations. Ultimate disposal sites, licensed or approved by Federal or State agencies, depending on material and hazard involved, are reviewed and may be inspected by NIH. In general, all distribution, disposal, and recycling of waste occurs at off site facilities where sufficient quantities accrue to make recycling economical, or where special equipment is available. When waste are disposed of, NIH keeps a permanent certificate of disposal record.

5.7.2.1 Medical Pathological Waste (MPW)

Medical waste generation is ubiquitous in modern society. It is routinely generated at all hospitals, in private medical testing and biomedical research laboratories, and dentist and doctor offices. Medical waste generated by these sources generally are either incinerated on-site at the source or transported to off site locations for disposal. For smaller generators, contractors follow established pick-up routes and schedules in the same manner as municipal trash collectors.

Procedures for handling, treatment, storage, and disposal of medical waste are controlled by Federal and State regulations. Each defines the waste differently and gives minor variances in procedures. Pertinent regulations include EPA regulations for "regulated medical waste" in 40 C.F.R. Part 259, OSHA regulations for waste containing "bloodborne pathogens" in 29 C.F.R. §1910.1030, and State of Maryland regulations for "special medical waste" in COMAR 10.06.06, 26.13.12, and 26.13.13. Transport of medical waste is controlled by U.S. DOT regulations in 49 C.F.R. Part 171 and State regulations. To ensure compliance, NIH has merged the definitions and requirements of the various regulations into a single classification, medical pathological waste (MPW), for internal NIH use. This unification simplifies employee understanding of requirements, and in meeting NIH procedures for MPW, the employee satisfies all the Federal and State regulations.

MPW is defined as waste that because of actual, or perceived presence of pathogenic agents, requires containment or treatment to prevent occupational or environmental exposure. Pathogenic agents are bacteria, viruses, or other organisms that can cause diseases. Examples of MPW include microbiological cultures; clinical urine, fecal and blood specimens; tissue cultures; waste from surgical and autopsy suites; contaminated animal bedding; and "sharps". Sharps include needles, syringes, scalpels, razor blades and similar objects. Disposable clothing, paper towels, and sorbent materials contaminated or potentially contaminated with pathogenic agents are also classified as MPW.

At NIH, MPW is packaged at the point of generation according to established procedures. It is sealed inside two thick opaque bags, and then packed in cardboard containers referred to as "MPW Boxes". Sharps are placed intact in puncture resistant plastic containers, before packing in the outer MPW Box.

Boxes are labeled for source and content and sent to designated pick-up locations inside buildings around the campus. MPW is stored under refrigeration at each of these designated locations. MPW is then picked up, inspected for potential radioactivity in Building 21, and marshalled in Building 25 for subsequent transport to off-site disposal. If radioactivity is found, the MPW is handled as radioactive waste, or treated until classifiable as MPW alone.

Data on recent MPW generation is shown in Table 5-44. The amounts generated include about 40 tons of MPW generated at the NIH Animal Center in Poolesville each year and transported to the campus. About 70 percent of the MPW is generated in the Clinical Research Center and is hospital related.

In Fiscal Year 1994, NIH established a rigorous MPW minimization program that included employee and researcher training on MPW source reduction, management of materials and waste, and identification, packaging, and labeling of MPW. In the five years previous to FY 1994, NIH had generated MPW at an annual average rate of 1,895 tons. As a result of the program, a steady decline in generation has been realized. The annual average amount produced in FY 1994 through FY 1998 was about 1,200 tons a 33 percent reduction from levels prior to the initiation of the minimization program. Through further aggressive minimization programs, annual generation has fallen to nearly 1,000 tons in the last five years of record, or about 45 percent of pre-1994 levels. All of this has occurred while the number of researchers on campus has increased.

NIH intends to continue with the minimization program and further reductions per worker are possible. The initial program reductions are the easiest and largest. Future reductions will occur in smaller increments. It is expected that future MPW generation will be of the same order of magnitude or slightly less per worker. Since the new Clinical Center hospital will have fewer beds than the existing one, and the hospital accounts for about 70 percent of MPW generation, generation from this source can be anticipated to decline. Conservatively, it is anticipated that future MPW generation under the Master Plan will remain relative constant or decline slightly, although specific estimates cannot be given. Generation under the No Action Alternative would also continue to decline. Under the Master Plan Alternative, the campus MPW marshalling facility now in Building 25 on the south side of Building 11 would be relocated to the Building 21 area.

5.7.2.2 Radioactive Waste

NIH is licensed by the U.S. Nuclear Regulatory Commission (NRC) to use, store, and dispose of radioactive materials. The license sets maximum possession limits for various radionuclides, as well as the conditions governing their use, storage and disposal. Activities involving radioactive material are strictly controlled by the NRC through regulations, which can be found in 10 C.F.R. Parts 19, 20, 30 and 35, and others. The NRC inspects all NIH facilities for compliance with the regulations on a regular basis. Applicable regulations of the U.S. DOT (49 CFR Part 171) and U.S. EPA (40 CFR Part 60) also apply.

Examples of radioactive waste generated by NIH's biomedical research activities include contaminated paper, plastics and glassware, radioactive liquids, liquid scintillation counting fluids and vials, contaminated experimental or cleanup materials, and contaminated medical pathological waste, including patient care waste.

Nearly all radioactive material used at NIH involves quantities of very low levels of radioactivity. Materials are generally in the form of labeled proteins and compounds. Examples of radioactive materials used are Hydrogen-3 (tritium), Carbon-14, Sulfur-35, and Phosphorous-32. Most of the radioactive materials used on the campus, with the exception of C-14 and H-3, have a half-life of less than 100 days.

Fiscal Year	Metric Tons
1999	1,014
2000	1,031
2001	1,018
2002	1,090
2003	1,040
FY 89 - FY 93 Average	1,895
FY 94 - FY 98 Average	1,262
FY 99 - FY 03 Average	1,039

TABLE 5-44 MEDICAL/PATHOLOGICAL WASTE GENERATION.

Building 21 has laboratories designated for the use of radioactive materials with quantities of radioactivity higher than typically used in a standard laboratory. These laboratories have restricted access, increased air circulation with filtration, and stringent contamination survey and control procedures.

Radioactive waste are sorted by physical form, chemical form, and half-life, if appropriate. Some radioactive waste that are contaminated with materials that have a short half-life (<100 days) may be stored until they are no longer radioactive, and only then disposed of as non-radioactive waste.

Some radioactive waste are treated and processed in Building 21. Waste, which are not treated or processed on-site, are shipped to a licensed commercial processing facilities and eventually to a disposal facility. NIH is licensed to dispose of limited quantities of liquid radioactive waste to the sanitary sewer, with specific concentration limits for each isotope and a total aggregate limit per year. In general, the concentrations of released materials are less than one percent of the permissible concentrations under the regulations, and the total aggregate amount released for the year are significantly less than the permit aggregate total. Further dilution occurs within the NIH sanitary sewer system where the radioactive materials combine with nearly two million gallons of sanitary waste generated by NIH per day. All aqueous radioactive waste disposed in the sanitary system must meet all other WSSC discharge criteria (See Table 5-27). Prior to release, materials are filtered to remove suspended solids, and treated with activated carbon to remove organic contaminants. Before each release occurs, WSSC is notified, and WSSC may have an inspector on the scene to observe the release.

At one time, NIH maintained a facility for dry low level radioactive waste at the NIH Animal Center in Poolesville, Maryland because there was no outside permanent licensed radioactive waste facility operating in the U.S. Such facilities are now available and the Poolesville site has been deactivated and closed. All waste that still has radioactivity after treatment in Building 21, is now hauled by licensed contractors to licensed treatment or disposal facilities at eight off-site locations.

The amount of radioactive waste generated by NIH varies considerably from year to year depending on whether or not individual research projects use radioactive materials and the amounts they use (Table 5-45). NIH initiated a rigorous radioactive waste minimization program in Fiscal Year 1998. Proposed research protocols are reviewed for alternatives to methods requiring radioactive materials, and when they are necessary, their absolute minimization. Prior to the program, NIH Bethesda generated an average 399 tons of radioactive waste per year from 1989 through 1997. The annual generation over the last five years has averaged 105 tons, a 74 percent reduction from pre-grogram levels.

Future generation is difficult to estimate. However, waste and researcher organizations predict a long term trend for lower use of radioactive materials in medical treatments and biomedical research.

Fiscal Year	Tons
1999	78
2000	154
2001	85
2002	116
2003	92
FY 89 - FY 97 Average	399

TABLE 5-45 RADIOACTIVE WASTE GENERATION. (in tons)

NIH also operates three cyclotrons in the Building 10. The cyclotrons produce radioactive isotopes, which are valuable for medical diagnosis, with half-lives measured in terms of minutes or hours that are too short to effectively transport them from an off-campus location. An example is oxygen 15 with a half-life of 2.03 minutes. Prepared materials are, therefore, immediately applied to patients in Clinical Center suites above the cyclotron facility. Decay is so rapid that the cyclotron-generated radioactive materials are disposable as non-radioactive or other types of waste within hours or a few days. In effect, the cyclotrons generate radioactive materials, but produce no long term radioactive waste for treatment or off-campus disposal.

5.7.2.3 Chemical, Multihazardous/Mixed Waste

Chemical waste are discarded non-radioactive chemicals, including hazardous and nonhazardous chemicals. Chemical waste includes items defined as Hazardous Waste (40 C.F.R. 261), Hazardous Substances (40 C.F.R. 302.4), Hazardous Materials (49 C.F.R. 171.8), and Controlled Hazardous Substances (26 COMAR 13.02.06). Chemical waste that are not regulated under Federal or State regulations as hazardous, but which have toxic or hazardous waste characteristics, are considered to be hazardous waste by NIH. Nonhazardous chemical waste include nonradioactive chemicals that are not regulated by any government agency as a hazardous waste. Example of nonhazardous waste frequently encountered at NIH include most salts; sugars; agar; enzymes and nutrients used to formulate culture media; saline solutions; and silica and polyacrylamide gels. Most of the chemical waste at NIH consists of used, spent, or surplus chemicals. Data for chemical waste generation in recent years is as follows:

Fiscal Year	Metric Tons
1999	157
2000	143
2001	194
2002	254
2003	193

Chemical waste generation for the last 15 years follows no particular pattern. The average annual amount for this period is 192 tons, but ranges from 143 to 318 tons per year depending on individual and collective research programs that are underway at any given time.

Some reductions per research worker are expected due to two predicted long term biomedical research trends. The first trend is greater use of computers as a substitute for bench research protocols. The computing power of personal computers has increased by several orders of magnitude over the last decade. Much of the research involving DNA and genetics can be done more efficiently on a

computational basis. The second trend is greater use of miniaturization techniques in research protocols to control costs. Researches must compete for NIH grants in terms of potential results and costs. The amount of chemicals needed and the waste produced are directly proportional to costs.
Multihazard waste is an NIH definition for a waste that meets the definition and properties of more than one of the restricted waste, which are MPW, radioactive waste, and chemical waste. Mixed waste is a combined chemical and radioactive waste and is therefore a subset of multihazard waste.

Examples of multihazard waste are aqueous radioactive waste with trace levels of chloroform or heavy metals; radioactive methanol/acetic acid solutions from protein precipitations; phenol/chloroform mixtures used to extract DNA from radioactively labeled cells; and chemical or radioactive waste containing blood products.

Amounts of multihazard/mixed waste are included within the chemical and radioactive waste totals. Prior to 1987, NIH conducted its hazardous waste activities under an "interim status" hazardous waste facility authorization from the U.S. Environmental Protection Agency. Since that year, NIH has managed hazardous waste under terms and conditions established by an agreement with the Maryland Department of the Environment (MDE). NIH has a Resource Conservation and Recovery Act (RCRA) hazardous waste management facility operating permit. The permit allows NIH to continue to:

1. Provide short term storage of hazardous materials in approved containment until disposal or preliminary treatment can be arranged.
2. Chemically and physically treat hazardous waste to render it non-hazardous, reduce hazard, or reduce volume.
3. Provide longer term storage of hazardous waste (mixed waste) for which off-site disposal or treatment is currently unavailable.
4. Receive hazardous waste from off-campus NIH facilities for treatment and storage along with campus generated waste.

Under the permit, NIH continues to operate under the same MDE hazardous waste treatment and storage regulations and criteria that have applied since 1987. Treatments include bulking, blending, neutralization, and detoxification using carbon adsorption and ultraviolet peroxidation to reduce the amounts of hazardous waste or make them less hazardous. None of the treatment methods includes or involves on-campus incineration.

In an average year, NIH generates about 5,000 different types of regulated and non-regulated hazardous waste items. The vast majority of discarded material is commercially available hazardous chemical products, or mixtures of these products with nonhazardous chemicals. Overwhelmingly, the individual amounts produced at any one time in any experimental procedure are one liter or less. Approximately 150,000 vials and 50,000 small bottles containing expired or spent chemicals classified as hazardous are produced each year.

The RCRA permit allows NIH to have the capacity to store up to 26,360 gallons of liquid hazardous waste for subsequent treatment, transport, and disposal. This volume represents the cumulative capacity of Building 21 waste management facility, and is for operation of this facility. The actual amount of material on hand at any one time is less than this capacity since waste are shipped once a week to off-site treatment and disposal facilities.

If it is assumed that the chemical/hazardous waste per researcher remains constant in the future, then the amount generated under full Master Plan buildout is estimated to be about 190 tons per year. Under the No Action Alternative generation would stabilize around 150 metric tons.

5.7.3 Animal Waste

Animal waste is classified as solid waste, MPW, or sanitary waste, as determined by waste characteristics. It consists of animal bedding with animal droppings, and wash down from daily cleaning of animal holding areas and cages. Research generally employs pathogen free healthy animals under the care of professionally trained animal husbandry and veterinary personnel. The animals are used in biomedical research frequently in a preliminary step before clinical trials on human patients. They include mice, voles, rats, guinea pigs, rabbits, and nonhuman primates such as rhesus monkeys and macaques. Others include chickens, chinchillas, gerbils, frogs, and sea urchins. The many differing species are kept because each possesses some characteristic in terms of organs, function, or expected experimental response that closely approximates that of humans.

Animals are housed in Buildings 14 and 28, and in other laboratory buildings around the campus. About 30% of all animals at NIH Bethesda are located in Buildings 14 and 28. Buildings 6B, 7, 10A, 37, 49 and 50 also have comparatively large populations. Most of the new laboratory buildings have been designed to be "animal holding" compatible. Building 14 is the location for the NIH Veterinary Resources Program, but other individual Institutes also have small veterinary programs. All animal facilities are reviewed and accredited triennially by the American Association for Accreditation of Laboratory Animal Care (AAALAC). Facilities are also inspected twice a year by the Food and Drug Administration, and at frequent intervals by internal NIH groups.

Since it is a subset of other types of waste, no breakout or quantification of the amounts of animal waste generated is kept. Animal waste amounts or volumes, however, are included within the general solid waste, MPW, or sanitary waste data given elsewhere in Sections 5.7 or 5.4.4. Bedding material and animal droppings from diseased animals are managed as MPW or processed by heating to sufficient temperatures in a steam autoclave and disposed of as general solid waste. Bedding from healthy animals

is disposed of as general solid waste. Wash down from areas housing healthy animals is routed to the sanitary sewer.

5.8 CULTURAL RESOURCES

5.8.1 Historic and Architectural Resources

5.8.1.1 Identified Historic Resources

Under the National Environmental Policy Act (NEPA) and the regulations of the National Capital Planning Commission, environmental assessments of the effects of federal actions must include review of the impacts of potential master plan projects on historic properties. Historic properties both on the NIH campus and within the area of potential effect are identified below, and the impact of NIH Master Plan projects on those historic properties is delineated.

In addition, there is a link between NEPA requirements and requirements under the National Historic Preservation Act of 1966 (as amended) (NHPA). Both require pre-decisional consideration of project impacts on historic resources. Under Section 800.8 of revised Regulations of the NHPA (36 CFR Part 800, effective June 17, 1999), coordination is specifically encouraged between compliance with the National Environmental Policy Act and Section 106 of the National Historic Preservation Act.

Although the Master Plan is not "an undertaking" under Section 106 Regulations (and does not literally require Section 106 review), NIH acknowledges its responsibilities under Section 106 relative to the actual implementation of future construction projects called for in the Master Plan. Relative to these projects, NIH will consult with the Maryland State Historic Preservation Officer and the Advisory Council on Historic Preservation, as necessary, before taking any action called for in the Master Plan that may affect a historic property.

The National Historic Preservation Act's Regulations define what constitutes an "effect" on a historic property (36 CFR § 800-812). Under the relevant Criteria of Effect and Adverse Effect (36 CFR § 800.9):

> "An undertaking has an effect on a historic property when the undertaking may alter characteristics of the property that may qualify the property for inclusion in or eligibility for the National Register. For the purpose of determining effect, alteration to features of the property's location, setting, or use may be relevant depending on a property's significant characteristics and should be considered."

In 36 CFR § 800.9, the Regulations further state that an undertaking has an "adverse effect" when:

> "the effect on a historic property may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects on historic properties include, but are not limited to:
>
> - Physical destruction, damage, or alteration of all or part of the property;
> - Isolation of the property from or alteration of the character of the property's setting when that character contributes to the property's qualification for the National Register;
> - Introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting;
> - Neglect of a property resulting in its deterioration or destruction; and
> - Transfer, lease, or sale of the property."

5.8.1.2 The Area of Potential Effect

Definitions contained in the Regulations (36 CFR § 800.2) state that the "area of potential effects" for a project "means the geographic area or areas within which an undertaking may cause changes in the character or use of historic properties." Potential effects identified in 36 CFR § 800.9 were weighed relative to the NIH Master Plan, and it was determined that the primary discernable effects resulting from new construction projects would be visual – thus potentially impacting both those historic resources located on the NIH campus itself, and to a lesser extent those outside of the NIH campus. Based upon the major building setback lines and building heights delineated in the Master Plan, the area of potential effects on historic resources has therefore been set to include the entire NIH campus and the area within a half-mile radius of it. (These visual effects, as well as other potential adverse effects identified in 36 CFR § 800.9, are evaluated in the text below.)

5.8.1.3 Historic Resources Located Outside the NIH Campus

Historic resources located outside of the NIH campus are delineated in Master Plan Figure 3.4.6. This figure locates all historic properties within the boundaries of the Bethesda/Chevy Chase planning area.

The area of potential effect for the NIH Master Plan includes two historic properties listed in the National Register of Historic Places:

- The Bethesda Meeting House
- The Bethesda Naval Hospital Tower

The area of potential effect also includes eight identified historic resources listed in the Montgomery County Master Plan for Historic Preservation. These include:

- Alta Vista (Site 35/3)
- Leslie Beall House (Site 35/14-13)
- Bethesda Community Store (Site 35/43)
- Bethesda Meeting House (Site 35/5)
- Bethesda Naval Hospital Tower Block (Site 35/8)
- Walter Johnson House (Site 35/46)
- Little Tavern (Site 35/14-3)
- Samuel Perry House (Site 35/4)

The only off-campus historic properties eligible for the National Register and visible from the campus is the Bethesda Naval Hospital Tower Block at the National Naval Medical Center. The tower is situated on a knoll about 700 feet to the east of Rockville Pike and on a direct axis with Building 1 at NIH. The Stripped Classical-style tower, designed by noted architect Paul Philippe Cret, features a 20-story central tower flanked by 4-story wings to the north and south. The hospital is approached via a long semicircular road. The intervening grounds between Rockville Pike and the hospital are covered by landscaped lawn. The hospital is surrounded on the remaining three sides by expanded Naval Medical Command facilities and the Uniformed Services University of the Health Sciences.

Much of the NIH campus is visible from the upper floors of the tower, and the axial relationship between the tower and Building 1 at NIH is strong. Changes in views from the tower will principally be changes in the overall skyline of NIH, as a number of new buildings will be visible from the tower. At lower levels, and in the wings of the hospital, views are blocked by the topography and by the many trees in the buffer area and along the NIH Stream on the NIH campus. Distances between the Naval Hospital Tower Block and most construction proposed in the Master Plan ranges from a quarter to half a mile. The closest building to the Naval Hospital site's visual axis with NIH Building 1 proposed in the Master Plan is a small-scale, one-story, replacement to Building 25. Its scale and low-lying elevation both avoid obscuring views between Building 1 and the Naval Hospital. Like the existing buildings in the same vicinity, the new building would be located on the slopes of the NIH Stream valley, which rise to the east toward the Naval Hospital, and would be substantially hidden from view to and from this direction. The intervening buffer zones on both the NIH campus and the National Naval Medical Center would be retained.

The Bethesda Community Store is located on the west side of the campus on Old Georgetown Road at Greentree Road, and the Walter Johnson House is located on the northwest corner of the Old Georgetown Road/West Cedar Lane intersection. The new construction planned for the west side of the NIH campus is set a sufficient distance from the historical setting of both of these sites, and views between these sites and proposed Master Plan construction sites are blocked by existing buildings and trees in the buffer strip.

Other historic properties listed above are located at a greater distance from the NIH campus. NIH is not visible from these locations, and proposed construction would not affect the properties or their settings.

5.8.1.4 Historic Resources Located on the NIH Campus

Section 800.4 of 36 CFR Part 800 (the Section 106 Regulations) concerns the identification of historic properties, requiring federal agency officials to identify historic properties that may be affected by an undertaking and to gather sufficient information to evaluate the eligibility of these properties for the National Register. Efforts to identify historic properties should follow the Secretary of the Interior's "Standards and Guidelines for Archeology and Historic Preservation" (48 FR 44716) and meet the requirements of Section 110 of the National Historic Preservation Act.

In 1997, NIH sponsored a cultural resource study of all buildings located on the campus over 50 years of age and that exhibited the likelihood of possessing exceptional historic and/or architectural significance regardless of age. In this effort, NIH worked with the Maryland Historical Trust (MHT), which serves as the Maryland State Historic Preservation Office (SHPO), to determine which resources on the NIH campus are eligible for listing in the National Register as either individual resources, or as contributing elements to a larger historic district.

To date, the NIH and MHT have reached a consensus determination that the following buildings and historic districts are eligible for listing in the National Register. These properties, including their historic district boundaries, or environmental settings, and significant views and vistas, are depicted on Figure 5-22, and listed below:

The Administrative Complex (or Historic Core) Historic District, which encompasses:

Building 1	Administration Building
Building 2	Industrial Hygiene Building Laboratory
Building 3	Public Health Methods and Animal Unit
Building 4	Laboratory
Building 5	Laboratory
Building 6	National Cancer Institute
Building 7	Memorial Laboratory
Buildings 15B1-15G2; 15H and 15I	The Officers' Quarters
Building 15K (currently Building 15)	Tree Tops (Wilson House)
Building 16; 16A	The George Freeland Peter Estate (Stone House and Caretaker's Residence)
Building 38	The National Library of Medicine
Building 60	The Convent (Mary Woodard Lasker Center)

Buildings that have been evaluated, and by agreement with the Maryland Historical Trust, do not meet the criteria of listing in the National Register of Historic Places include:

Building 8	Laboratory
Building 9	Laboratory
Building 10	The Clinical Center
Building 61	Caretaker's Cottage (Convent)

The status of Building 11, the Power Plant, is unclear. According to NIH staff, it has been evaluated and was determined not eligible for listing in the National Register of Historic Places. No determination of eligibility, supporting documentation, or correspondence relating to Building 11 is present in the files of the Maryland Historical Trust. However, it seems unlikely that Building 11, which was completed in 1964, would prove to be exceptionally significant for its history or architecture.

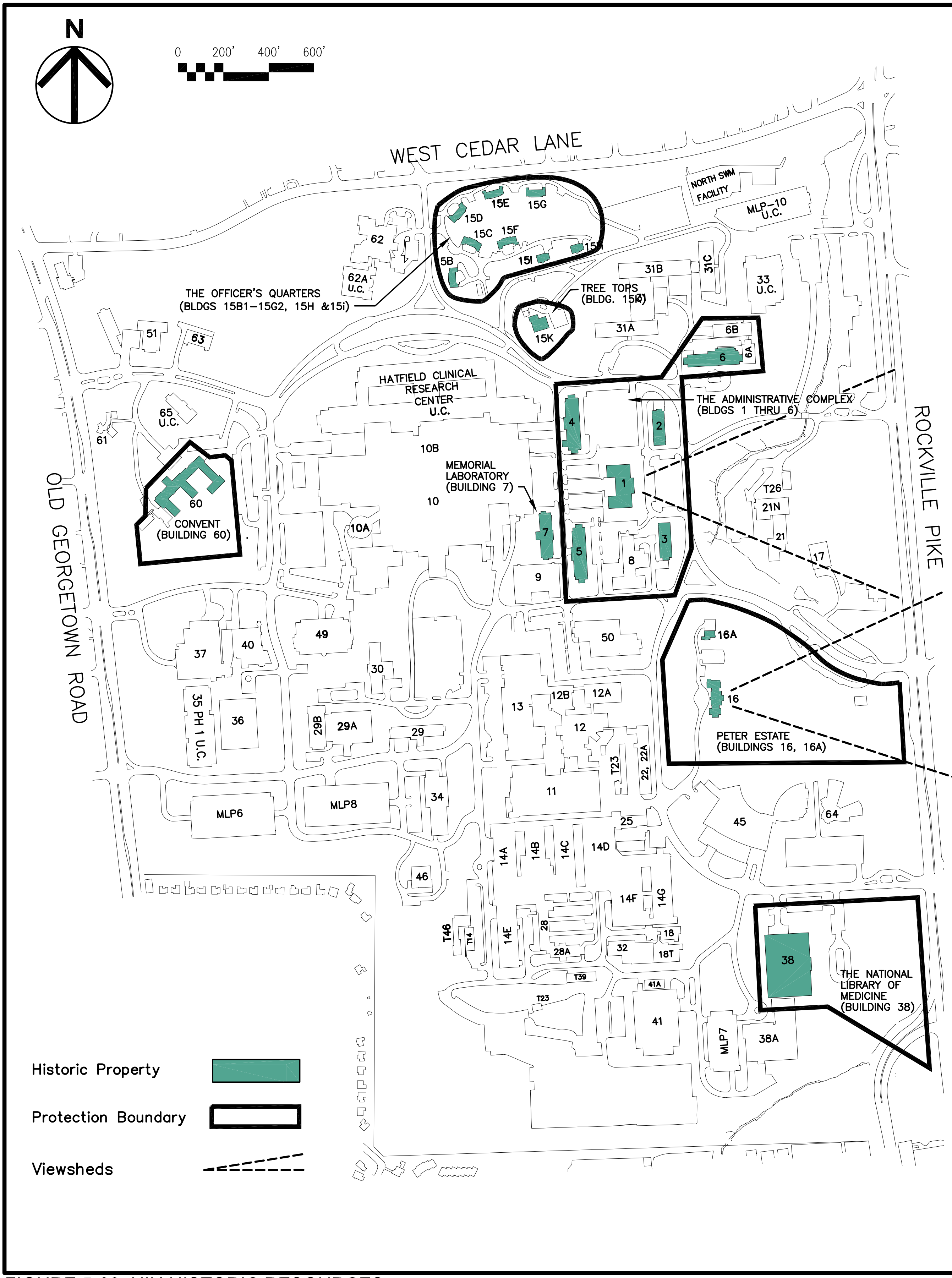


FIGURE 5-22 NIH HISTORIC RESOURCES.

5.8.1.5 Potential Effects of the Master Plan on Campus Historic Resources

Since a master plan is, by definition, a conceptual road map for future development, determining the effects of the plan on historic resources can only be accomplished in a broad context. Factors such as the exact size of planned buildings and proposed road alignments will not be decided until individual projects are initiated. For these reasons, the following analysis represents a preliminary assessment of potential effects generated by the Master Plan undertakings on resources currently identified as eligible for the National Register. This analysis is an introduction to, not a substitute for, future Section 106 review when project undertakings are actually initiated. Nevertheless, the evaluations below serve as a valuable tool in determining the future success of the Master Plan.

Campus-Wide Effects

From a planning perspective, new development proposed by the Master Plan is integrated into the orthogonal grid originally generated by the Administrative Complex, or Historic Core of NIH. This earliest grouping of NIH-constructed buildings comprises a small historic district, oriented to the east with reciprocal views across Rockville Pike to the tower of the National Naval Medical Center. This is the single highly organized historic area of the campus with other areas of the early campus following more loose planning principles. Although the new quadrangle areas proposed by the Master Plan reorient this eastern focus to a newly planned central mall to the west of the Historic Core, it does respect the earliest geometric intent of the original NIH campus.

Massing and heights defined by the Master Plan take the Magnuson Clinical Center (Building 10) as the focal point of the campus, and create a regular system for building heights that is lowest at the site perimeters and highest in the center of the site. Heights rise five degrees from horizontal at the perimeter of the site in increments, with the tallest buildings at the Clinical Center measuring 140 feet. This tends to provide more protections to historic properties on the periphery or outside of the NIH campus. Within the NIH campus, the increased heights in the center of the site visually impact historic resources more substantially, creating a more urban effect than previously present and diminishing the overall status of historic properties such as the Historic Core.

Architectural principles of the Master Plan call for future development to reflect historic patterns and priorities. Architectural policies and criteria are described as respecting the built environment in terms of materials, style, massing, scale, and color. Open-space tenets of the Master Plan call for respect for historic resources and their environmental settings.

Other campus-wide effects of the plan, which potentially affect historic resources, include the removal of most surface parking, the augmenting of landscaping (particularly around the edges of the campus and along the Loop Road), and the creation of a new Loop Road. The elimination of a majority of the surface parking and its replacement with green space will help to restore the historic settings of a number of the buildings originally surrounded by green space. The elimination of surface parking will be particularly beneficial to the setting of the buildings located in the Administrative Complex (or Historic Core.)

The new, widened, Loop Road does not appear to substantially affect the historic resources that front on it. The historic resources closest to the perimeter road are those located on the northern and eastern edge of the Historic Core (i.e., Buildings 2, 3, and 4). In these locations, the current distance between the buildings and the road will be maintained and the additional road width will be taken from the other side of the street. If proposed utility tunnels adjacent to roadways are implemented, they may have impact on historic resources, e.g., requiring a cut into the hillside to the west of the Stone House. Other historic resources appear to be located a sufficient distance from the perimeter road so as not to be affected.

Details of the widened roadway, particularly its exact path, can help protect the environmental settings of the historic properties.

Specific effects to individual historic properties on the NIH campus are addressed below.

Buildings 1, 2, 3, 4, 5, 6 – The Administrative Complex, or Historic Core

Collectively, Buildings 1, 2, 3, 4, 5, and 6 have been determined eligible for listing in the National Register of Historic Places as a small historic district.

- Buildings 1, 2, and 3

Buildings predating NIH's establishment on the site include Building 15K, "Tree Tops"; and Buildings 16 and 16A, the George Freeland Peter Estate; and Building 60, the Convent of the Visitation/Mary Woodard Lasker Center. Completed in 1938, Buildings 1, 2, and 3 are the earliest buildings to be Congressionally authorized and constructed at NIH's Bethesda campus. Collectively, Buildings 1 through 6 form the visual and symbolic core of the NIH site, and are typical examples of the academic Georgian Colonial Revival style used for many contemporary institutional buildings. In addition to their architectural merits, these buildings helped to establish NIH as one of the world's foremost biomedical research centers and are directly associated with major accomplishments in the field. Louis A. Simon designed the buildings, with J. Winthrop Wolcott, Jr., serving as the consulting architect. The George A. Fuller Company of Bethesda was responsible for construction.

- Buildings 4 and 5

Buildings 4 and 5 were constructed in 1941 as identical laboratory buildings. Constructed in the same Georgian Revival style previously used for Buildings 1, 2, and 3, Buildings 4 and 5 continue to represent the trend toward using this academic style. Building 4 was initially used as laboratory and research space, and in 1948 became the primary location for the Institute of Experimental Biology and Medicine. Other institutes housed in Building 4 have included the National Institute of Dental Research, the National Institute of Arthritis and Metabolic Diseases that later became the National Institute of Arthritis, Diabetes, and Digestive and Kidney Diseases. Building 5 initially housed researchers in infectious diseases and was home to the Microbiological Institute later renamed the National Institute of Allergy and Infectious Diseases. Because of the nature of this work, Building 5 was constructed with a sophisticated exhaust system that prevented the spread of infectious diseases from room to room within the building. Buildings 4 and 5 were constructed by the Charles H. Tompkins Company.

- Building 6

Constructed in 1939, just one year after Buildings 1, 2, and 3, Building 6 displays similar Georgian Revival characteristics as the earliest NIH buildings. Built initially to house the National Cancer Institute, Building 6 was believed to be one of few structures designed solely for research in a specialized field. Two additions have been made to Building 6: 6A was added to the east portion of the building in 1976, and 6B was added to the north side of the building in 1988.

- Potential Effects to Buildings 1, 2, 3, 4, 5, and 6

The Master Plan calls for new construction or alterations to three areas near the Administrative Complex.

The first area is located to the east of Buildings 1, 2, and 3 in a site bounded by Rockville Pike, Wilson Drive, and South Drive. It is a landscaped valley through which the NIH Stream flows. Here, under the

Master Plan, a small replacement to Building 25 is planned in the Building 21 complex. The small scale and low-lying profile of the Building 25 replacement will have no effect on the Administrative Complex. At present, due to the topography of the area and a large grove of tulip poplars along the NIH Stream valley, the existing buildings are barely visible during most of the year from Buildings 1, 2, and 3. Also, as stated previously, the new building would be lower than the tree canopy and would not disrupt axial views from Building 1 to the Naval Hospital Tower. (The existing Building 21 complex is itself not identified as historically significant).

The second area, the area to the west of the Administrative Complex, holds the Magnuson Clinical Center, which has recently been expanded significantly on the north side by the construction of the Hatfield Clinical Research Center. Under the Master Plan provisions, renovations of the Clinical Center (Building 10) will be carried out over several years. These interior renovations have no effect on the adjacent historic properties. However, the Master Plan identifies a service zone west of Buildings 4 and 5 that continues to serve as a primary service point for the Clinical Center. The combined needs of the new Clinical Research Center and renovated Building 10 require new loading docks and the extension of the steam/chilled water tunnel from Building 11 to the new Clinical Center complex. This requires the demolition of Building 7, a building determined to be individually eligible for listing in the National Register, and also appears to diminish the historic setting of Buildings 4 and 5.

The third area, to the southwest of the Administrative Complex, will comprise the site for two new laboratory buildings, Buildings D and H. Details of their height and massing will affect their possible impact upon the Administrative Complex, but it appears unlikely that they will have any adverse effect on the historic buildings.

The Master Plan also calls for the construction of two new buildings in the vicinity of Building 6, i.e., an addition to Building 6A and Building 33. The Building 6A Addition is placed at the far eastern edge of the primary facade of Building 6, but rather than being attached to the historic original facade is adjacent to a more recent addition. The Maryland Historical Trust has concurred with NIH’s finding that the proposed 6A Addition will not adversely affect Building 6. Building 33 is placed northeast of Building 6, adjacent to large-scale additions to it and buffered from it by distance and other factors. It does not affect the character of the historic building.

Building 7 – Memorial Laboratory

Completed in 1946, Building 7 was originally known as Memorial Laboratory to honor scientists who had died while researching dangerous diseases. Building 7 represents a break in the traditional use of the Georgian Revival style of architecture at NIH, although it retains elements of the style, such as massing and materials. However, the distinguishing characteristics of Building 7 are its architectural and engineering details relating to its use as a state-of-the-art laboratory with the mission of providing a safe working environment for scientists engaged in highly dangerous research. Among its sophisticated features are an advanced air-flow system that insures the decontamination of exhaust to the outside of the building, the installation of rooms of various levels of germ decontamination, and triple-sealed windows with exterior shades to avoid the collection of dust on the interior of the building. All of these features were in use to insure the proper handling of potentially infectious diseases.

- Potential Effects to Building 7

Building 7 will be demolished as part of the Master Plan provisions for an enlarged service area for the Clinical Center. As stated previously, this is an adverse impact as it comprises the removal of an individually eligible National Register building.

Buildings 15B1-15G2 and 15H and 15I – The Officers' Quarters

Collectively, the Officers' Quarters have been determined eligible for listing in the National Register of Historic Places. The Quarters are a collection of eight red-brick Georgian Revival duplexes and detached houses constructed in 1940 to serve as housing for junior officers so that they would be on the NIH site at all times. The quarters are an excellent example of the Radburn principle of planning, with residences sited around a common green in a wooded area with gently sloping topography and a series of paths linking the buildings. Louis Simon served as the architect for the buildings, and the Charles H. Tompkins Company was awarded the construction contract.

- Potential Effects to Buildings 15B1-15G2 and 15H and 15I

Distance, topography, and vegetation preclude the effects of Master Plan provisions from having an effect on the Officers' Quarters.

Building 15 (Formerly 15K) – The Wilson House (Tree Tops)

Building 15K, Tree Tops, is the last remaining building and principal residence of the Wilson Estate. Predating NIH's occupation of the site, the Wilson Estate was constructed in 1926 to be the principal residence of Luke and Helen Woodward Wilson. Tree Tops is attributed to architect Edward Clarence Dean, and is a skillful blend of Tudor Revival and Craftsman elements. Various other buildings originally present on the site were removed in 1997 as part of an 850,000-square-foot addition to the Clinical Center.

The Wilsons, both members of prominent merchandising families, were responsible for the major donations of land in Bethesda to NIH. These donations of land were responsible for locating NIH on the site and changing the character of Bethesda from an area with large estates to a densely built area with a prominent medical community.

- Potential Effects to Building 15K

Distance, topography, and vegetation preclude the effects of Master Plan provisions from having an effect on the Officers' Quarters.

Buildings 16 and 16A – The George Freeland Peter Estate and Caretaker's Residence (The Stone House; currently the Fogarty International Center)

The Peter Estate is also listed in the Montgomery County Master Plan for Historic Preservation as Site 35/9.

The Peter House (Building 16), an excellent example of the Colonial Revival style, was constructed in 1930. Designed by architect Walter G. Peter, brother of the original owner, the building exemplifies many of the qualities found in the large early twentieth-century estates that were constructed along Rockville Pike during that era. George Peter sold the estate to the federal government in 1949. The Caretaker's Residence (Building 16A), designed in the style of the main house, is also present on the site.

- Potential Effects on Buildings 16 and 16A

The Master Plan includes alterations to areas to the immediate west of the Stone House complex. The current site is occupied by a group of buildings having mixed uses; some are used for administrative functions while others include vehicle maintenance and storage, shops, grounds maintenance equipment and supplies, and the campus fire station. They are not identified as historically significant. Under the

Master Plan, their replacement by H, I, and J/K has the potential to improve the setting to the west of the Stone House. Details of the design and massing of the new buildings will affect the overall potential impact of new construction.

Building 38 – The National Library of Medicine

The National Library of Medicine, which houses one of the world's largest collections of medical literature, has been determined individually eligible for listing in the National Register of Historic Places. Although the Library was constructed in 1962 and has not yet reached 50 years of age, a period of time that is generally necessary for a building to be evaluated in the greater historic context of its time, the Library displays several areas of exceptional significance. Concerns relating to the threat of nuclear war influenced the choice of a location outside of downtown Washington for the National Library of Medicine, as well as design features thought to protect the building from an atomic bomb blast. Three of its five stories are below grade and its distinctive hyperbolic paraboloid roof shape was thought to dissipate the effects of a bomb blast. Additionally, many progressive features of library design were incorporated into the interior planning of the building in an attempt to manage the extensive holding of the Library. The New York firm of Robert B. O'Connor and Walter H. Kilham were the architects for the building, with Dr. Keyes Metcalf serving as the library consultant for the project. The structural engineering form of Severud, Elstad and Krueger, one of the pre-eminent authorities on blast-proof construction, served as engineers for the structural design of the Library.

- Potential Effects to Building 38

Certain additions to the National Library of Medicine have been evaluated for potential effect under a separate Section 106 consultation. In response to a letter of February 13, 2002, from NIH to the Maryland State Historic Preservation Officer (SHPO), the SHPO concurred with a finding of "no adverse effect." Design details of Building R, as described in the Master Plan, could require reopening consultation with the SHPO.

Building 60 – The Convent of the Visitation

Constructed in 1922-23 as a self-sufficient, cloistered convent for the Roman Catholic Order of the Sisters of the Visitation, Building 60 remained in use for its original purpose until 1982. Designed by A.B. Mullet and Company, with Marsh and Peter as associated architects, the building reflects Georgian Revival characteristics popular during its era of construction. Romanesque elements, strongly associated with ecclesiastical architecture, were used to articulate the chapel wing.

During the 1980s, the building was renovated for use as the Mary Woodard Lasker Center for Health, Research, and Education. At that time, a residential addition was constructed and linked to the original portion of the building by a modern glass entrance area.

- Potential Effects to Building 60

Building 60's environmental setting, a walled cloistered compound, gives it a protected character. The new Master Plan buildings in its vicinity, Buildings 51, 63, and 65, are small-scale in their massing and will not substantially affect the historic character of Building 60 or impinge visually upon its originally cloistered grounds.

It is possible that other resources not yet evaluated may also meet the criteria for listing in the National Register of Historic Places, or that other buildings, upon reaching 50 years of age, will be eligible for listing. Under Section 110 of the National Historic Preservation Act, federal agencies are required to identify and evaluate historic resources and to ensure that the resources are managed and maintained in a manner that is sensitive to their historic, archaeological, architectural, and cultural values. NIH is committed to working with the Maryland Historical Trust to evaluate the potential historic significance of buildings that are approaching 50 years of age. Until these evaluations are complete, NIH acknowledges that cultural resource investigations will be necessary for individual undertakings to be submitted under Section 106 review. Under Section 106 of the National Historic Preservation Act, government agencies are required to take into account the effects of planned undertakings on historic resources prior to approving funding for the undertaking. NIH will continue consultation with the Maryland Historical Trust on these and other issues.

Although a Programmatic Agreement and Historic Resources Management Plan are goals to be considered for the future, it is not possible at this time to fund or implement these documents.

5.8.2 Archeological Resources

The NIH campus is located in Maryland Archeological Research Unit 12 of the Piedmont Province. No Phase I cultural survey of the entire NIH campus has been completed. An inventory of known prehistoric and historic sites and identification of areas of potential sites was completed in 1985 (NIH Cultural Asset Inventory, D. R. Bush, 1985). The inventory included a review of Maryland Historic Trust records and files, research literature, and prior investigations in the immediate area, and a visual inspection of the campus.

Other investigations related to the campus include a Maryland DOT survey along Rockville Pike on the eastern boundary from the NIH Stream to Jones Bridge Road in 1981 (<u>The Maryland DOT Archeological Resources Survey Volume 3; Piedmont</u>, Md. Historical Trust, Manuscript Series 7, K. W. Wesler, 1981). This study extended only 50 to 100 feet into NIH property. In 1983, Koski-Karrell and Ortiz conducted archeological surveys of what was at the time the extreme southeast corner of the campus as a preliminary for construction of the Woodmont Avenue extension (<u>Phase I and Phase II Archeological Evaluation for the Woodmont Avenue Extension Project, National Institutes of Health</u>, D. Koski-Karrell, L. Ortiz, J. C. Beasley, 1983, 1986). The sector of this site within the NIH campus was reinvestigated as part of the South Pond installation (<u>Phase II Archeological Evaluation of the South Pond Water Retention Project Area</u>, EAC/Archeology, 2002). Phase I and II surveys have also been completed for the Building 45 site (<u>Phase I and II Archeological and Architectural Investigations for the Proposed Site of the William H. Natcher Building,</u> R. C. Goodwin & Associates, Inc. and AEPA Architects Engineers, 1992). Other studies include a series of Phase I investigations and Phase II evaluations completed for five archeological sites in the northern sector of the campus by EAC/Archeology Inc. between 1997 and 2001.

The first historic period occupancy date in the environs of NIH is uncertain. The property was identified as “Claggett’s Purchase” as early as 1716. Robert Peter purchased 600 acres of the tract circa 1760. By 1865, the NIH site had been subdivided between the Peter family, Joseph and H. Gingle, Robert Spate, and Alexander Briton.

By 1879, A. Peter had built a summer house called "Winona" on the present site of the Stone House (Figure 5-23). In 1902, George Freeland Peter and his three brothers inherited 200 acres of the "Claggett's Purchase" tract presumably from A. Peter. George Freeland Peter received 47.9 acres. In 1931, George Freeland Peter commissioned the design and construction of the Stone House. Winona was demolished and the Stone House, with Colonial Revival architecture, was erected on the same knoll along with a caretaker's house and landscaped grounds. It was one of the substantial County estates built along Rockville Pike in the early twentieth century. The Gingle site is located in the area between Woodmont Avenue and Wisconsin Avenue, just north of Stony Creek, and in the present location of the National

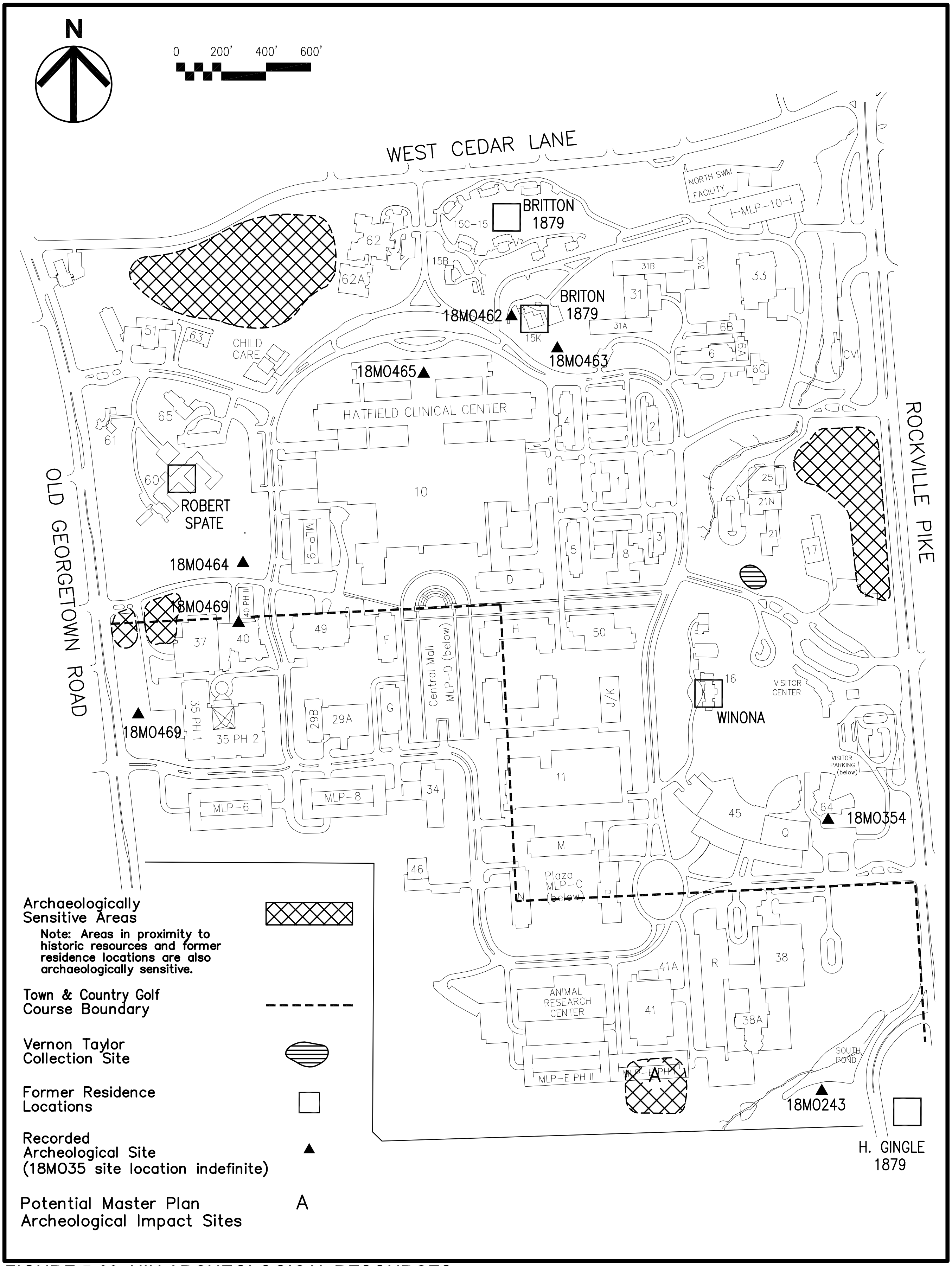


FIGURE 5-23 NIH ARCHEOLOGICAL RESOURCES.

Library of Medicine. It is uncertain whether there were two houses, a relocation, or if one of the sites was an outbuilding. Koski-Karrell found no evidence of foundations and one site was destroyed by library construction.

Robert Spate owned an 82 acre farm in the northwest sector of the campus, and Alexander Britton owned a 61 acre farm in the north central sector along West Cedar Lane. They probably grew wheat as their primary crop, if they followed typical Montgomery County agricultural patterns during the 19^{th} century.

Mapping from 1890 shows the farms distinctly as open fields with trees growing only on the knoll now occupied by Tree Tops. Britton owned his farm until he died in 1907. A subsequent owner sold the property to Helen Wilson Woodward in 1923. Robert Spate sold his farm to the Roman Catholic Church also in 1923 for subsequent construction of a convent.

Both Gingle and Spate were listed in an 1879 directory as farmers. The Peter properties around the Stone House were formally landscaped after 1931, but Phase I surveys around the Building 45 indicate a deep plow zone dating from an earlier period. Other than agriculture, the only other land use was the Town and Country golf course, which occupied the former Gingle property in southern third of the campus in 1920. This golf course was part of the Woodmont Country Club for a short period.

In 2002, there were 23 archeological sites in the vicinity of NIH on record at the Maryland Historical Trust (MHT). Of these, 15 sites wee located outside the campus, but within two miles of its periphery, and eight were on the campus. Among the 15 off campus sites, 10 were classified as prehistoric, two as historic, and three contained both historic and prehistoric materials.

Information about campus archeological resources is summarized from the various reports and surveys below.

- Informal Surveys

Informal archeological surveys of the NIH campus include a collection of prehistoric material donated to the Smithsonian Institution by George F. Peter, and a collection of several flaked stone tools and too fragments by Vernon Taylor, an NIH employee, prior to 1970. Both collectors were amateurs, and materials were gathered through casual, unscientific examination of the surface.

Site 18MO35 has no definite location. Rather, it is documentation of the Peter collection by McNett in 1871, plus a single quartz triangular blank recovered by McNett himself at an unknown location on the campus.

Only one of the three original Taylor sites or areas remains undisturbed. One Taylor site in the northern sector of the campus was overtaken by construction. A second area is now encompassed within, and has been professionally evaluated as, Site 18MO243.

- Site 18MO354

A total of 183 artifacts were recovered during Phase I and II archeological investigations of the site (18MO354). Prehistoric artifacts included 18 quartzite flakes, one fragment of steatite, and nine quartzite fragments. These 28 items accounted for 15.30 percent of the total artifact assemblage. The 42 (22.95 percent) historic and modern materials consisted of architectural and hardware items including nails and window glass; kitchen materials including bottle glass, white ware, pearl ware, ironstone, and domestic brown and gray stoneware. One faunal item, a fragment of oyster shell, also was recovered. A majority of the artifacts were modern materials, including bottle glass (clear, amber, and aqua), foil, metal, plastic, wire, leather, and a .22 caliber cartridge.

The area encompassed by this scatter of modern, historic, and prehistoric artifacts or components has been identified as multicomponent archeological site 18MO354. All components were found as a thin intermixed scatter in the historic plow zone and overlying root mat. No significant concentration of historic artifacts was observed; most cultural materials recovered dated from twentieth century domestic and institutional occupation. Prehistoric materials were found in association with modern and historic materials and lacked temporal context. All components lack integrity and the ability to yield significant data pertinent to themes in local or regional history and prehistory. This site did not meet Criterion D for eligibility for the National Register of Historic Places, i.e. it did not yield, or is likely to yield, information important in prehistory or history. The site is now occupied in part by Building 45 and the East Child Care Center.

- Site 18MO243

A third site, 18MO243, was originally investigated by Koski-Karrell in 1983. A further survey and evaluation was conducted in the summer of 2002 as part of the South Pond stormwater management project (<u>Phase II Archeological Evaluation of the South Pond Water Retention Project Area</u>,) EAC/Archeology, 2002).

The 2002 Phase II survey for Site 18MO243 dug shovel test pits on a fire meter grid throughout the potential limits of the site to the west of Woodmont Avenue. Small clusters of low density prehistoric materials were found, but no ceramics or projectile points that could be assigned to specific prehistoric archeological periods were recovered. The survey also revealed that site soils had been extensively disturbed by prior 20th Century golf course construction, and burial of natural gas, sanitary sewer, and electric power trunk lines that are interspersed throughout the area. The site did not meet Criterion D eligibility for the National Register of Historic Places.

- Sites 18MO462, 18MO463, and 18MO464

These sites are located in the northern sector of the campus. Phase II evaluations surveys of 18MO462, the Knoll site, recovered a mix of historic and prehistoric materials at the investigation site. The site appears to have been a farmstead dating to the late 18th or early 19th century. The principal historic component was a cut stone foundation that appeared to be associated with a smokehouse. Artifact recovery patterns indicated the site extends northward into an area that had been covered by a parking lot in the past.

Documentary evidence for 18MO463, the Tree Tops Terrace site, indicates that it was the location of a 19th century farmstead. Some artifacts dating to that period were recovered during a Phase II survey, but most were 20th century items almost surely associated with the Wilson Tree Tops Estate.

A Phase I investigative survey of 18MO464, the Spate/Convent site, found no trace of historic occupation earlier than Convent construction.

All three sites yielded prehistoric quartz stone tools notably projectile points, numerous quartz flakes generated during tool construction, and cores of quartz from which flakes were struck. Site 18MO463, in particular contained a large quantity of prehistoric material. Quartz occurs in veins in the micaceous schist bedrock at several locations on the NIH campus and is visible on the surface. The exposure is evident particularly in the vicinity of Tree Tops. Projectile point styles indicate that all three sites were occupied intensively in the Late Archaic and Early Woodland periods between 3,000 and 2,000 years before the present.

Prior farming, homesteads, and Wilson Estate and NIH activities have significantly disturbed all three sites. None contained prehistoric features or preserved organic remains such as seeds. All three were found to be insufficiently important for National Register nomination.

- Site 18MO465

A Phase I survey of 18MO465, the Clinical Center site, found it to be completely disturbed by construction for the original Clinical Center.

- Site 18MO469

In September 1997, a Phase I survey was conducted at the area just across South Drive from the Spate/Convent Site. A prehistoric archaeological site was found, and named the Vaccine Center Site, 18MO469. In February and March 1998, a Phase II evaluation was conducted of the Vaccine Center Site. Although the Phase II evaluation established that the site had been extensively disturbed, the nature of the stone artifacts found there were interesting. Prehistoric quartz quarrying was occurring at the site, as evidenced by the recovery of numerous cores, preforms, and bifaces. Further, the bifaces could be clearly classified into those produced during early, middle, and late manufacturing stages. Also found were seven projectile point fragments. Phase I and a limited Phase II survey were also conducted at the Neuroscience Research Center (Building 23) construction area in 2001. Materials found in the perimeter buffer area on the west side of the site revealed that this area has been used for prehistoric quarrying of quartz and tool making. Although many fragments were recovered, no complete projectile points were found.

It was determined that the Neuroscience Research Center site was related to, and an extension of, the Vaccine Research Center site. Both were subsequently identified as Site 18MO469. No features yielding important information were observed at either site, and no floral or found material permitting dating to prehistoric times were found. Both areas also had considerable soil disturbance dating prior to and including NIH occupancy. For these reasons, the combined 18MO469 sites were determined to be ineligible for inclusion in the National Register.

The ground surface in the central core of the campus, defined here as the area inside the Master Plan Loop Road, has been extensively altered by prior construction. Buildings, roads, loading docks, driveways, sidewalks, and parking lots cover about 90 percent of this area. A review of site topographic mapping indicates that the surface in each of these areas has been graded, cut, or filled to accommodate facilities. Further, the NIH Stream crosses the site from a point to the southwest of Building 46 to the northeast corner of the South and Center Drive intersection in a 96-inch pipe that is as much as 40 feet below the existing surface (See Figure 5-17). The original stream valley has been buried for several hundred feet to either side.

Figure 5-23 shows the few remaining campus areas that have not been investigated previously and remain relatively undisturbed by modern construction. They are identified as archeologically sensitive areas based on their potential, although this does not imply that they contain materials or soil context. Sites in proximity to where historic structures were located also hold potential.

Future construction in these areas will require Phase I cultural surveys prior to design and construction to satisfy Section 106 of the National Historic Preservation Act criteria for determining archeological significance and potential eligibility for the National Register. If Phase I surveys indicate that the areas contain materials of potential significance, then a Phase II survey will be completed. In the master planning process, efforts were made to avoid or minimize intrusion into archaeologically sensitive areas. However, there is one proposed facility in the Master Plan that will require a Phase I survey, if and when it is implemented. This project is MLP-E in the area south of Building 41 (Site A in Figure 5-23).

5.9 NATURAL CONDITIONS

5.9.1 Topography

The Bethesda campus is situated on the undulating topography of the uppermost stream valleys of two small independent tributaries of Rock Creek, which flow from southwest to northeast across the campus.

In general, Old Georgetown Road follows the western divide of the Rock Creek drainage basin with the Booze Creek watershed lying to the west. At NIH, the actual ridge line passes through the northwest corner of the campus and then runs southward parallel to Old Georgetown Road and about 300 feet to the east of it (Figure 5-24). Site topography is shown in Appendix A.

The peak site ground elevation, 384 feet, is located on the south side of South Drive on the ridge line. Elevations around the Convent (Building 60) immediately to the north of this point range from 375 to 380 feet. Elevations at the northwest and southwest corners of the site at Old Georgetown Road are 370 feet.

The NIH Stream enters the site near its southwest corner, but the stream is encased in pipe below the surface. The surface elevation of the filled area above the stream where it enters the campus is 312 feet. Pipe carries the stream about 2,200 feet to the northeast before it exits to daylight at an elevation of 275 feet to the northeast of the South Drive/Center Drive intersection. Once exposed, the NIH Stream continues to flow northward in a small valley or dell roughly 600 feet across and 30 feet deep until it descends to an elevation of 232 feet at the northeast corner of the campus.

More than half the campus is located on the east facing side slope between the ridge line along the western periphery of the property and the NIH Stream. Between West Cedar Lane and South Drive, a tributary ravine is incised into the general slope along the east-west axis, forming a separate valley up to 40 to 50 feet deep.

Slopes are generally 5 to 10% throughout the area. Slopes increase to 15% or more in the upper reaches of the streams. The upper section of the NIH stream valley has been buried by 10 to 30 feet of fill and the course of the stream and natural topography is only barely perceptible at some locations in the core area of development.

Stony Creek cuts across the southeast corner of the campus, entering it at an elevation of 308 feet and leaving at an elevation of 299 feet. It is separated from the NIH stream valley by a low ridge about 700 feet to the northwest. This ridge descends from 360 to 320 feet in elevation as it crosses the campus.

5.9.2 Geology and Soils

Bedrock under the Bethesda campus is composed of the Lower Pelitic Schist of the Sykesville Formation. In older geology literature and mapping, the schist is also identified as the oligoclase facies (a crystalline variety of feldspar) of the Wissahickon Formation or as the eastern sequence of the Wissahickon Formation (The Crystalline Rocks of Howard and Montgomery Counties, C.A. Hopson, in The Geology of Howard and Montgomery Counties, Maryland Geological Survey, 1964.)

The Lower Pelitic Schist is a member of the Glenarm Series of formations, which are, exposed on the surface over the eastern half of the Piedmont Plateau. It is composed of interlaced beds of medium to

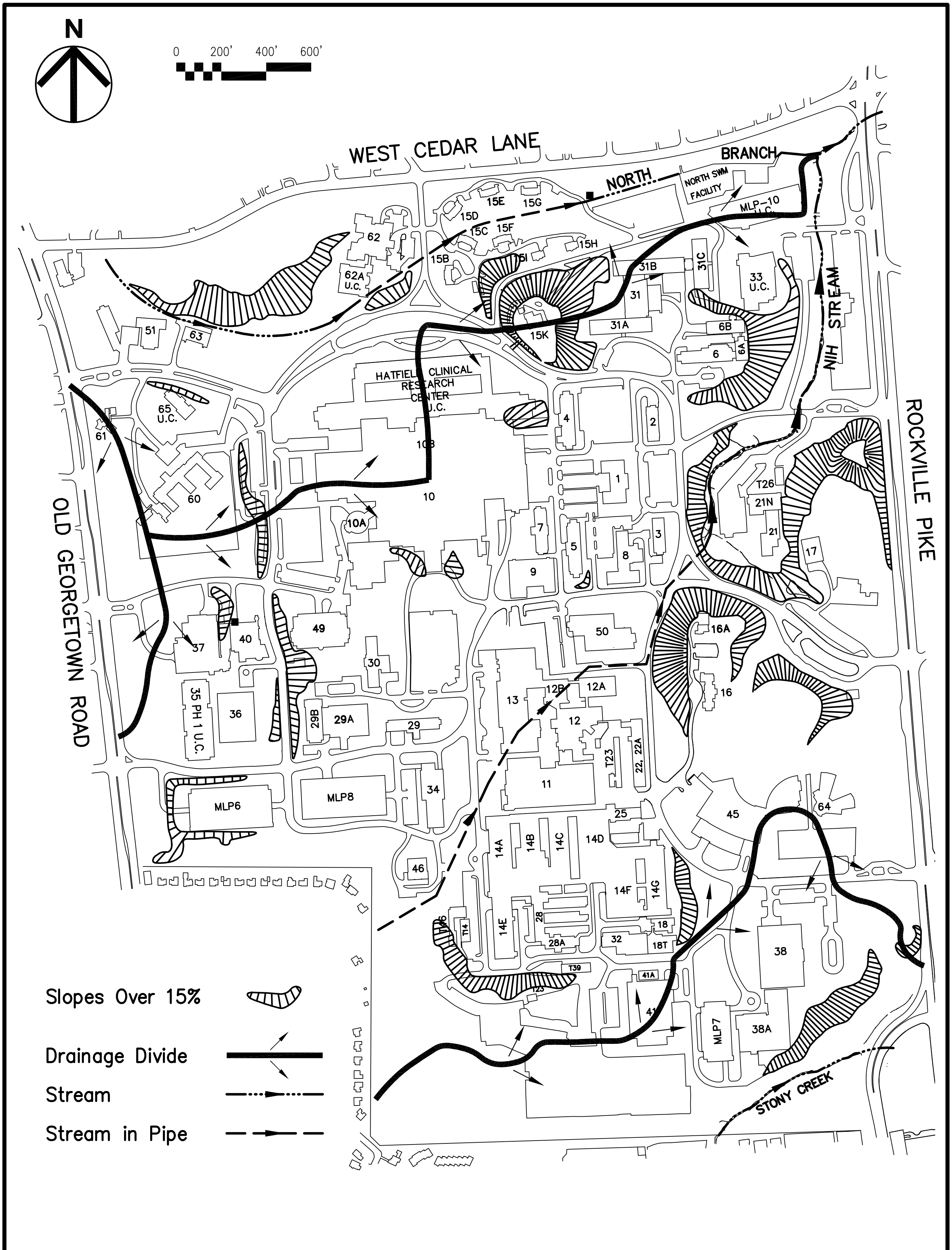


FIGURE 5-24 NATURAL FEATURES AND DRAINAGESHEDS.

coarse grained pelitic (originally depositional mud) schists and fine to medium grained psammatic (originally sand) beds with the latter more predominant near the top of formation. Its age has not been fixed but is estimated to be late Precambrian. It has been intensely folded, dislocated, and metamorphosed. The formation is approximately 5,500 feet thick. Bedrock on the campus is generally 55 to 65 feet below the surface but it may be at half this depth in the northeast sector of the site where the NIH Stream has eroded the surface geologically.

The bedrock is overlain by about 15 to 40 feet of saprolite subsurface material. The boundary is a gradual transition, and not a distinct interface. The saprolite is composed of the decomposed and weathered residual crystalline rocks of the base formation. Three distinct saprolites are found under the campus (Figure 5-25):

Saprolite 5B - predominantly well drained micaceous schist
Saprolite 5D - predominantly well drained, silty, bouldery, gneiss
Saprolite 5F - predominantly poorly drained with intermixed clays and mafic rock

In general, the saprolites consist of sand, silt, clay, angular rock fragments and residual soft red brown to gray earthy porous materials derived from the decomposed crystalline rock. Hard quartzic intrusions may be encountered at widely separated intervals. The saprolites are oriented in the north-south direction. A geologic syncline runs along the axis of Rockville Pike, or just to the west of it so that the surface saprolites on the Naval Medical Center are mirror images of those in NIH.

Radon is a gas that occurs naturally in soils through radioactive decay of uranium. Radon has a natural tendency to move from higher pressures in soils to lower pressures in buildings. The recommended indoor annual average radon level is 4 picocuries per liter of air (pCi/L). Many factors influence the amount of radon at a specific location. Well drained, highly permeable soil facilitates the movement of radon. Daily and seasonal factors occur, but in general, local geology controls the source and distribution of radon in the soils.

Figure 5-25 shows the radon potential for campus subsurface soils. A low radon potential corresponds to a less than 40 percent chance that radon levels will exceed 4 pCi/L in the interior levels of a building below outside soil surface. Radon levels exceeding 4 pCi/L generally will occur only in isolated instances. In areas with a moderate rating, there is an approximately 50 percent chance that building floors below subgrade levels will be in the 1 to 20 pCi/L range, but as many as 10 percent of the buildings measured in these soil areas in Montgomery County can have radon levels exceeding 20 pCi/L (Map Showing Radon Potential of Rocks and Soils in Montgomery County, Maryland, L.C.S. Gundersen etal., USGS, 1988). Radon is not expected to be a site problem in either alternative.

The surface soils range from 2 to 15 feet in thickness (Figure 5-26, Table 5-46) . Glenelg silt loam predominates. Much of the central portion of the campus has been disturbed by construction of facilities and surface soils can be a mixture of native, borrow, and fill materials. Most of the area occupied by Buildings 11, 12, 13, and 14 is covered by fill material placed in the NIH stream valley with the bottom of the 96-inch storm drain carrying the stream representing the original ground elevations. Borings for the Building 11 Phase I expansion project imply that the fill extends 300 to 350 feet to either side of stream bed before feathering to native soils. Older soil mapping indicates that within the core area of the campus now designated as urban land (UB), Gaila silt loam was predominate, while Glenelg silt loam predominates to the south of South Drive.

Campus soils have comparatively low nominal erodability. However, erosion control measures are necessary when slopes exceed about 5%, and exposure during construction should be minimized. Cut slopes tend to be stable, and steep slopes can be maintained. Piles are needed for building construction

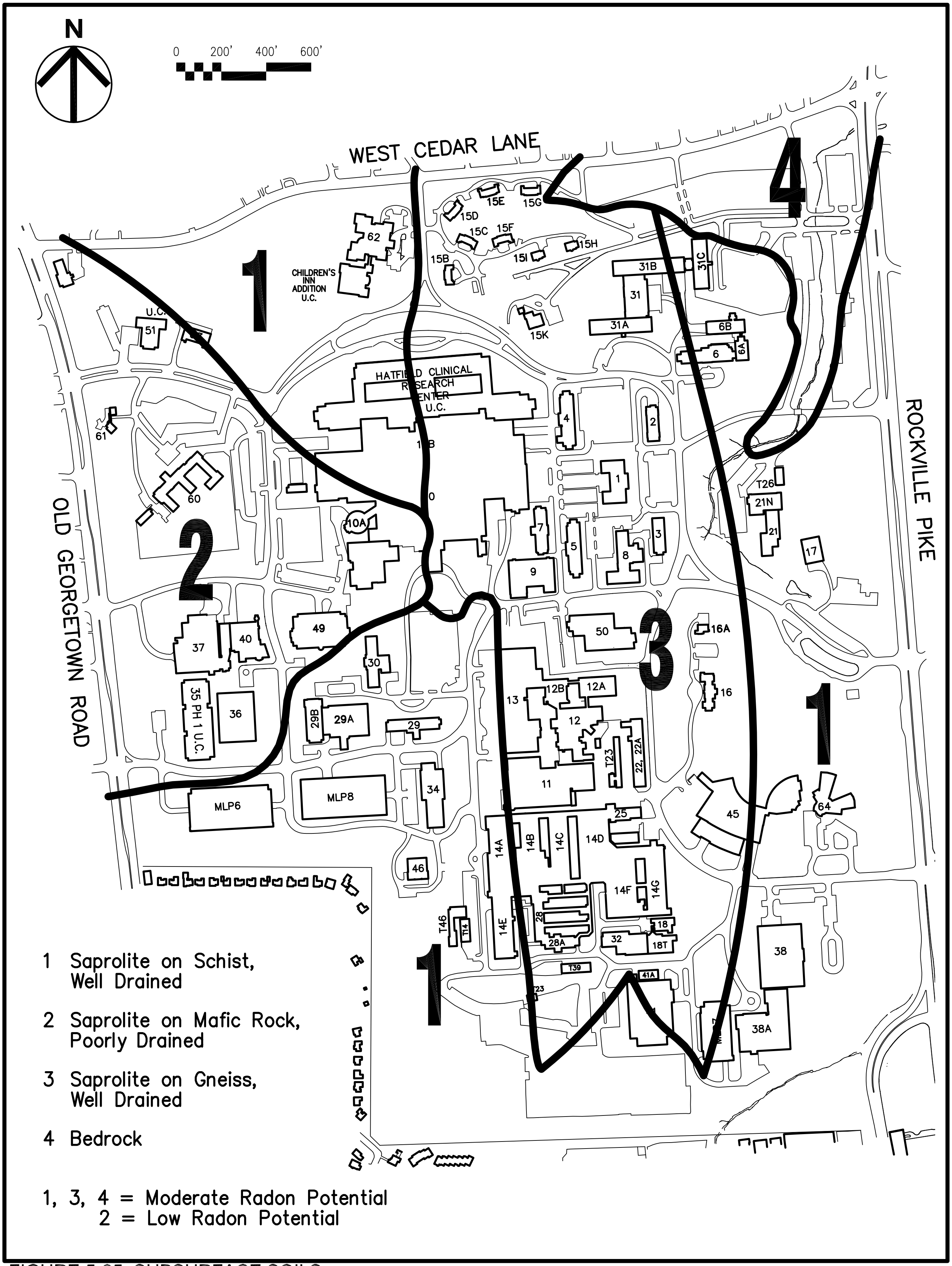


FIGURE 5-25 SUBSURFACE SOILS.

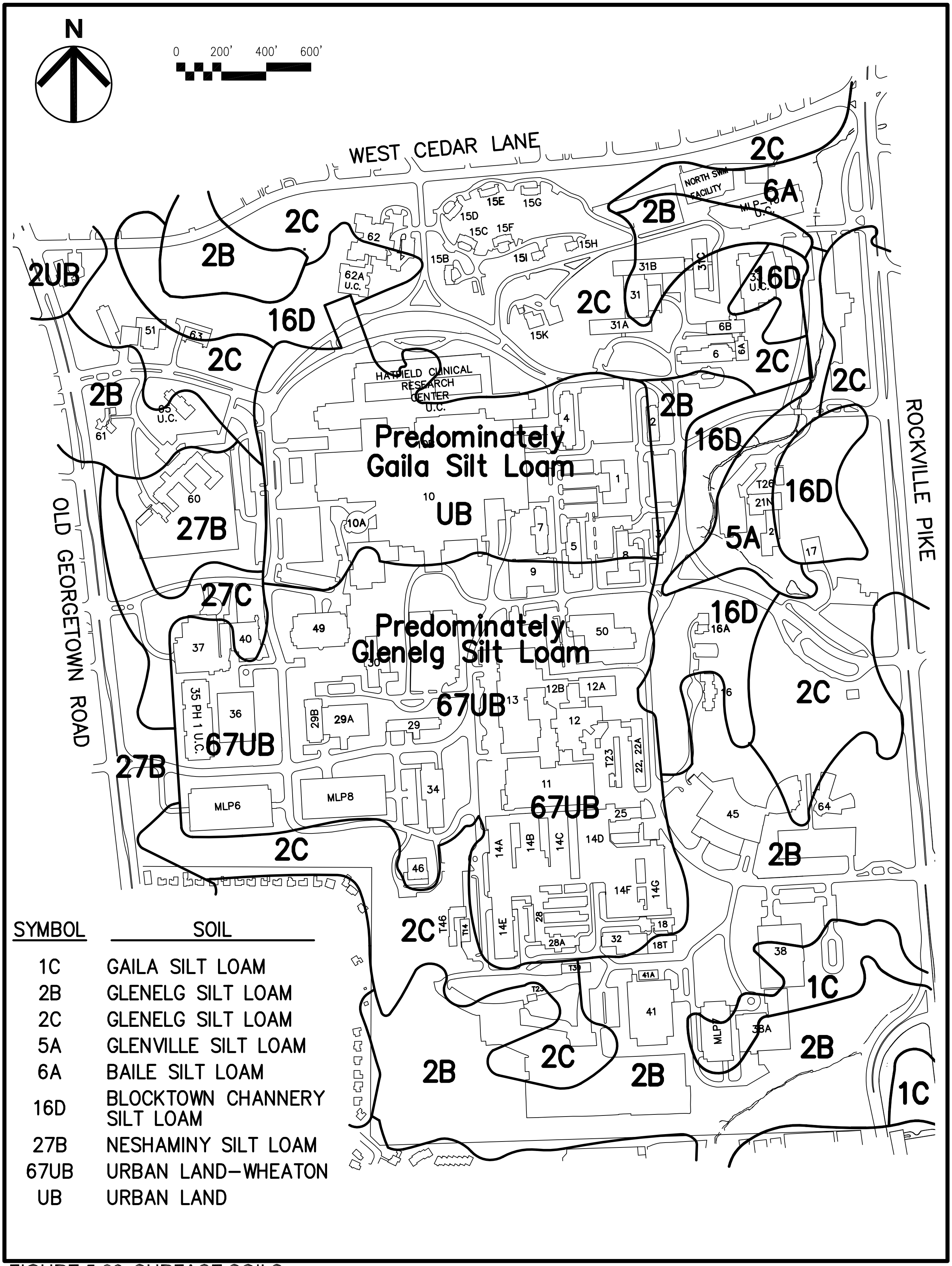


FIGURE 5-26 SURFACE SOILS.

Symbol	Soil	Slope %	Erosion Hazard	Depth To Water (ft)	Hydrological Soil Group	Hydric Soil	K Factor
1C	Gaila Silt Loam	8-15	High	>6.0	B	No	0.37
2B	Glenelg Silt Loam	3-8	Slight	>6.0	B	No*	0.32
2C	Glenelg Silt Loam	8-15	High	>6.0	B	No*	0.32
2UC	Glenelg Soils Urban	8-15	Moderate	>6.0	B	No	0.32
5A	Glenville Silt Loam	0-3	Slight	0.5-3.0	C	No	0.32
6A	Baile Silt Loam	0-8	Slight	0-0.5	D	Yes	0.43
16D	Blocktown Silt Loam	15-25	High	>6.0	C/D	No*	0.28
27B	Neshaminy Silt Loam	3-8	Slight	>6.0	B	No	0.32
27C	Neshaminy Silt Loam	8-15	High	>6.0	B	No	0.32
67UB	Urban Land-Wheaton	0-8	Slight	>6.0	B	No	0.49
UB	Urban Land	More than 80% covered by urban structures or disturbed					

* Hydric if in association with Baile Silt Loam.
** Depth to normal seasonally high water table.

Sources: For Tables 5-46 and 5-47:
Montgomery County Soil Report, USDA Resource Conservation Service (SCS), 2002
Montgomery County, Highly Erodible Land Report, Update 1985-1992, USDA RCS

TABLE 5-46 SITE SOILS.

over 60 to 70 feet in height. All but the Baile silt loam and Blocktown-Channery silt loam are good as natural soils for landscaping. The Baile silt loam found in the northeast corner of the campus is the only site hydric soil. The Glenelg silt loam with low slopes and the Blocktown silt loam may be hydric when in close association with the Baile silt loam. Hydric soils are defined as those, which are saturated, or flood or pond during the growing season.

General parameters for site soils are shown in Table 5-47. Surface and subsurface soils have good bearing strengths ranging from 4,000 to 8,000 lbs/sf. near the surface to 9,000 lbs/sf at greater depths. Construction of buildings proposed in the Master Plan Alternative would extend to as much as 50 feet below the surface for placement of underground parking, basements, and subbasements. This is not expected to have significant impacts on soils, subsoils, or the underlying aquifer.

The U.S. Geological Survey is currently conducting groundwater investigations in the vicinity of the Medical Center Metro station. The station is located under Rockville Pike between South Drive and Jones Bridge Road. Study data indicates that wells or excavations in the vicinity will encounter two distinct groundwater conditions.

Groundwater in the overlying saprolites may be encountered 10 to 50 feet below the natural ground surface. Boring data from NIH projects and the USGS study indicate that this most frequently occurs 20 to 30 feet below the surface. The saprolites collectively act as one uniform groundwater storage reservoir. The water table in the saprolites does not respond to precipitation events, and wells or excavations encountering the stored groundwater do not produce much drawdown. Transmissivity of groundwater ranges from 0.0001 to 10 gallons/sf/day with the values increasing with depth.

The saprolites are not hydraulically connected to the underlying Sykesville Formation. No infiltration or flow between the two occurs. Instead, groundwater in the Sykesville Formation is present under pressure. USGS test wells just east of Rockville Pike on NNMC show that, although the physical top of the Sykesville Formation is 55 to 60 feet below the surface at the wells, water from the formation rises 30 feet to elevations 25 to 30 below the surface when permitted to flow into wells.

Therefore, groundwater near the top of the Sykesville Formation is present at pressures of about 15 pounds per square inch under undisturbed conditions. Pressures at the depth of the subway station are sufficient to drive groundwater through the seams of the tunnel liner. Groundwater is pumped to relieve pressure on a continuous basis at the tunnel level. It is discharged to the NIH stream on the east side of the Rockville Pike bridge at a rate of 3,500 gallons per hour.

In contrast to the overlying saprolite, the Sykesville Formation groundwater does respond to precipitation events. Groundwater in both formations has a high calcium carbonate content.

Two underground fuel oil storage tanks, each with a 500,000 gallon capacity, are located on the west side of Building 11. These were installed in 1951 when the power plant was built. Smaller underground fuel oil feed tanks are located to the north and south of Building 11. About a dozen other fuel tanks ranging up to 1,000 gallons in capacity are located around the campus on the surface. These tanks supply fuel to emergency diesels and individual pieces of equipment.

In the Master Plan Alternative, the large fuel oil tanks would be replaced with a new tanks on the south side of Building 11 after Building 14 is demolished. In the Master Plan Alternative, the fuel feed tanks on the north side of Building 11 would be replaced when Boiler 7 is installed. Old tanks would be removed or decommissioned in accordance with Underground Storage Tank regulations. NIH has completed a program to bring all underground tanks on the campus into conformance with Federal (40 C.F.R. Part

Symbol	Soil	Profile*	pH	Permeability (inches/hr)	Shrink-Swell Potential	AASHTO Class	Suitability For		
							Fill/Subgrade	Topsoil	Impoundment Area
1C	Gaila Silt Loam	0-7	5.1-5.5	0.68-2.0	Low	A-4	Fair-Good	Fair-Good	No
2B 2C	Glenelg Silt Loam	0-12 12-24 24+	4.5-5.5 4.5-5.0 5.1-5.5	0.63-2.0 0.20-2.0 0.63-2.0	Low Low Low	A-4 A-6 A-5	Fair-Good	Fair-Good	Suitable
2UC	Glenelg Soils-Urban	25-40% of soil area developed and disturbed.							
5A	Glenville Silt Loam	0-5 5-28 28+	4.5-5.5 4.5-5.0 4.5-5.0	0.63-2.0 0.06-2.0 0.20-0.63	Low Low Low	A-4 A-4 A-5	Poor	Fair	Suitable
6A	Baile Silt Loam	0-11 11-50 50+	5.1-5.5 4.5-5.5 4.5-5.0	0.20-0.63 0.06-0.20 0.20-0.63	Low Moderate Low	A-4 A-4, A-6 A-4, A-5	Poor	Poor	Suitable
16D	Blocktown Silt Loam	0-10 10+	5.1-6.5 4.5-5.0	0.63-6.3 0.63-6.3	Low Low	A-4 A-2, A-1	Fair-Good	Fair-Good	Permeable Substratum
27B 27C	Neshaminy Silt Loam	0-8 8-24 24-48 48+	5.1-5.5 5.1-5.5 5.1-5.5 5.5-6.0	0.63-2.0 0.20-0.63 0.06-0.20 0.20-0.63	Low Moderate Moderate Moderate	A-4 A-4, A-6 A-6, A-7 A-4, A-5	Fair-Good	Good	Suitable
67UB	Urban Land-Wheaton	No data. 25-45% of soil area developed and disturbed							
UB	Urban Land	No data. More than 80% covered by urban structures							

* Inches below surface

TABLE 5-47 ADDITIONAL SITE SOIL PARAMETERS.

2800) and State regulations (COMAR 26.13). In the No Action Alternative, the existing fuel oil tanks would be upgraded and remain in service.

5.9.3 Terrestrial Vegetation and Habitat

5.9.3.1 Trees and Vegetation

The grounds of the NIH campus are managed and controlled to the highest degree. Landscaping gives it the appearance of a college campus or urban park. All of the pervious areas around the campus are covered by standard commercial landscape grasses, which are assiduously mowed and maintained, or ornamental gardens. NIH planted more than 10,600 annuals, 7,000 daffodils, and 3,800 Asian and day lilies in Fiscal Year 2000. The only exceptions to this condition are where slopes are too steep to mow and a small tract around the Wilson Estate. The former area is covered by ornamental landscape shrubbery, ground covers such as English ivy and vinca minor, or mulch, the latter by remnant of the original forest. Except for the Wilson Estate parcel, the ground surface is free of natural tree litter such as leaves, fallen timber, and branches. Trees grow under open conditions. There is no shrub or sapling layer, and a natural vertical forest stratification is missing.

In the summer of 2000, NIH conducted a tree inventory or delineation survey of the Bethesda campus. The survey counted all trees with a bole or trunk diameter of six inches or greater at breast height (DBH). The inventory lists 3,530 trees with the size (DBH), health, and campus location indicated. Delineated trees were tagged for future reference. The total number of trees on the campus is much greater, since the survey does not include smaller trees with diameters less than six inches.

The population of mature trees with a DBH greater than six inches is diverse with 98 individual species identified in the survey. Hardwood species account for about 60 percent of the inventoried trees, and evergreens, primarily white pines and other pinus species, another 24 percent. Ornamentals, primarily flowering cherries, (prunus sp.), dogwoods (cornus sp.), and zelkovas (zelkova sp.), comprise the remaining 16 percent of mature trees. However, most of the campus ornamental trees are of lesser size than those included in the inventory. They comprise a much higher proportion of the population, when trees of all sizes are under consideration.

The predominate inventoried hardwoods include tulip trees or tulip poplars (L. Tulipfera - 685 trees); oaks (Quercus sp. - 194 trees); maples (Acer sp. - 139 trees); and black walnut (Juglans, Nigra - 55 trees). Individuals in other species classes are three dozen or less. The tulip poplars, which account for nearly 20 percent of all mature trees are grouped in nearly solid or single species stands and groves in the northern sector of the campus, and in the vicinity of the Wilson Drive entrance on the east side of the campus.

Research for archeological investigations on the campus indicates that most of the campus was under field cultivation during the 19th century. It is estimated that a majority of the campus trees have been planted by NIH during its tenure based on obvious landscaped areas, and the ordered species grouping and physical arrangement of trees elsewhere. The trees that predate NIH occupancy are primarily comprised of the tulip poplars, and very large oaks maples and other trees scattered throughout the campus. These apparently grew when the cultivated fields were abandoned.

A vast majority of the mature six inch or above trees are located in the perimeter buffer, particularly in the northern half of the campus, or along the stream valleys. The understory is generally lawn throughout. Trees densities are generally less than 50 per acre, although densities of up to about 85 per acre occur in smaller areas in two locations on the north side of the campus. Tree densities do not meet the MDNR density criteria of 100 per acre for forest.

The campus has five Montgomery County champion trees as follows:

Tree Number	Species	Circumference	Height	Crown
2179	Black Willow	59 in.	54 ft.	61 ft.
2341	Red Buckeye	129	35	42
3040	Japanese Zelkova	99	54	82
4724	Golden Rain	53	46	30
4875	Carolina Hemlock	42	38	24

Champion trees are those that have the highest formulaic sum total of tree bole or trunk circumference in inches and height and crown or spread in feet. The tree locations are shown in Figure 5-27.

The primary value and function of the campus trees, including the hardwoods, are aesthetics and ornament. Many of the trees in the perimeter buffer have been planted to screen campus facilities from surrounding neighborhoods and activities. They also provide erosion and nutrient protection, as well as faunal habitat and food chain support within a densely developed suburban environmental context.

NIH loses 60 to 70 mature trees each year from natural attrition. NIH has had a policy of no net tree loss, or one for one replacement, due to natural causes or construction since 1996. In general, NIH does much more. In Fiscal Year 2000, 184 trees were lost for these reasons, but they were replaced with 382 trees planted around the campus. Landscaping plans for the Neuroscience Research Center construction specify 110 new trees to compensate for a loss of 56 trees of all sizes. Similarly, 264 trees and about 850 shrubs and smaller plants are planned for the projected loss of 37 trees at the Commercial Vehicle Inspection Facility site.

The NIH Grounds Maintenance and Landscaping Section (GMLS) conducts a continuing program for tree inspection, maintenance and care either by staff or by contractor specialists. When feasible, trees that may be affected by development or situation are transplanted. Most transplants are five inches or less in bole diameter, although GMLS has been successful with trees up to ten inches in diameter. NIH is installing drip irrigation systems in selected shrub beds. And, as an innovative measure, groundwater that seeps into the excavations for the many ongoing campus construction projects is pumped and used for grounds irrigation. An estimated 126,000 gallons was recovered in this way in a three month test period in 2000.

The cumulative tree losses associated with implementation of proposed Master Plan Alternative facilities can only be estimated roughly. Losses are dependent on individual project configuration and details, and the number of trees that can be salvaged through transplanting.

It is estimated that about 500 mature trees with a caliper of six inches or greater could be lost if all Master Plan facility proposals are implemented. This is an increase of about 200 over that estimated for the 1995 Master Plan. Much of the increase is attributable to more detailed in formation about campus trees made available in the interim. New facilities that were not in the 1995 Master Plan account for the increase in part. The Visitor Center and Commercial Vehicle Inspection station could require the taking of up to 80 mature trees. No other specific projects would result in an inordinate number of lost trees. The five County champion trees would remain undisturbed by proposed Master Plan development. NIH policy of no net loss of trees would be followed under both the Master Plan and No Action Alternatives. Minimization of tree losses would be determined when individual project site and tree conservation plans are prepared. Project plans would also include mitigation and replacement plans.

It is the goal of the federal government to protect and enhance vegetation and habitat on its facility

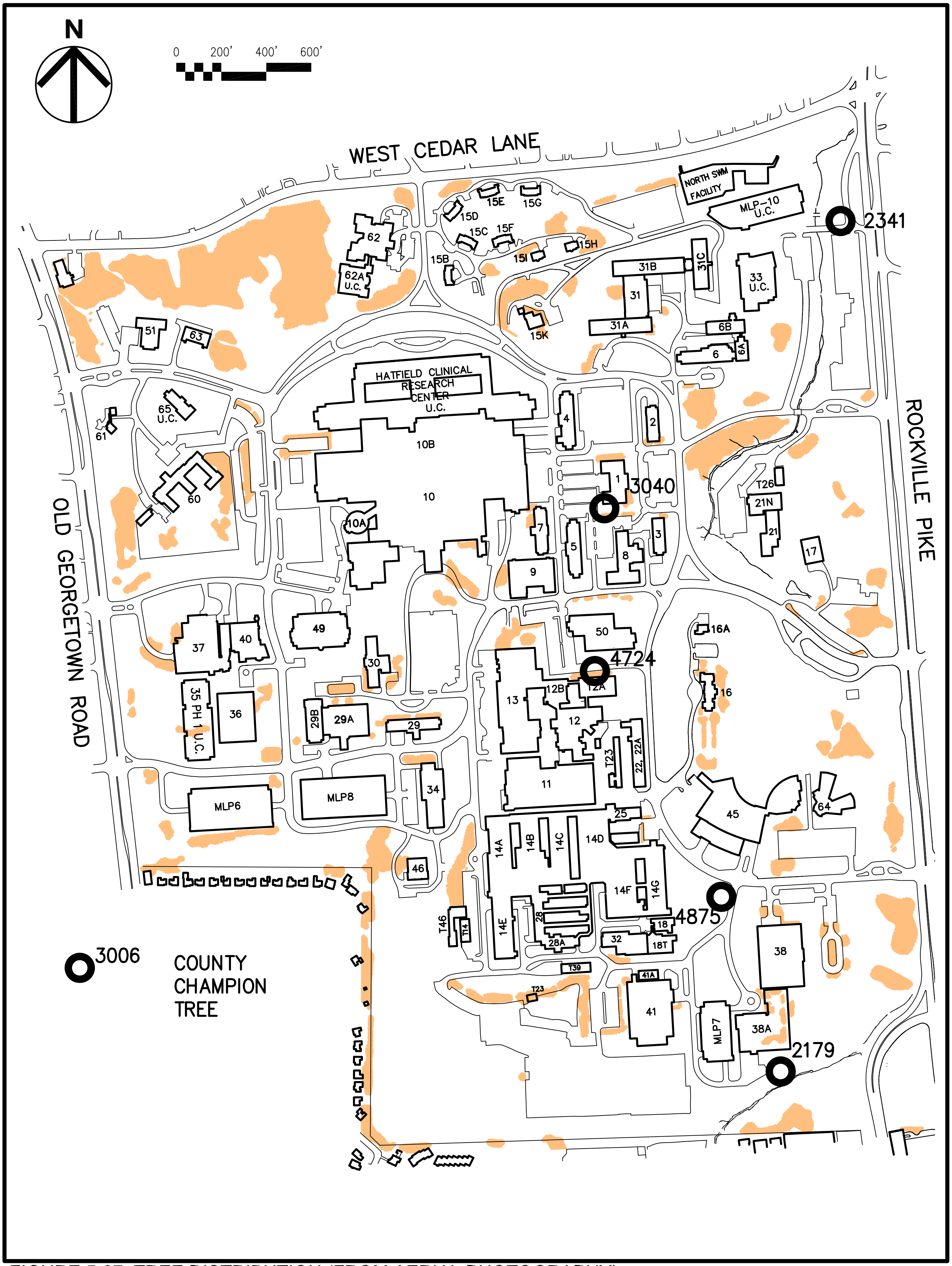


FIGURE 5-27 TREE DISTRIBUTION (FROM AERIAL PHOTOGRAPHY).

compounds. The National Capital Planning Commission (NCPC) has issued guidelines in The Comprehensive Plan for the National Capital for achieving these goals including:

- incorporation of trees and vegetation in all federal developments to moderate temperatures and minimize energy consumption.
- encourage the use of street trees to enhance visual and aesthetic features.
- avoid removal of woodland and vegetation from steep slopes and areas with high erosion potential.
- preserve existing vegetation, especially large stands of trees to the extent possible.

The Maryland Forest Conservation Act of 1991 along with the Montgomery County Forest Conservation Law (Chapter 22A) establish a program for conserving forest and tree resources. Effective July 1, 1992, all applications for development, or sediment control permits for construction projects encompassing at least 40,000 square feet of previous area, must be accompanied by a Natural Resources Inventory (NRI), Forest Stand Delineation (FSD), Forest Conservation Plan (FCP), and Forest or Tree Protection Plan (FPP or TPP).

NIH Bethesda is surrounded by an urban environment with the Bethesda Central Business District immediately to the south of the campus. Since it has no forest, conservation is best handled on a "tree" rather than "forest" basis.

NIH is in the process of developing a campuswide Urban Forest Stand Delineation and Conservation Plan that will meet the State criteria noted above. A field survey conducted as part of the plan will update the 2000 campus tree survey and add smaller diameter trees as well. Finalization and approval of the plan are expected in 2005. Individual project tree preservation and replacement plans will be prepared within the framework of the campuswide plan, and submitted to the Maryland Department of Natural Resources for review and approval.

5.9.3.2 Fauna and Habitat

The NIH campus is surrounded by five miles or more of commercial and residential development in all directions. The only large tracts within this region that remain natural are park lands used for active recreation or as stream valley parks. The highly controlled natural environment on the campus has limited value as habitat for terrestrial fauna. There is no protective cover at ground level and no substantive natural food resource. The sole exception is the Eastern gray squirrel, which finds ideal conditions among the many oak, walnut, and dogwood trees on the campus, primarily in the buffer area.

Avian species also have suitable habitat. Transient and nesting birds are those common to a suburban environment in the mid-Atlantic area. The human population density of the campus is 40,000 per square mile during daylight hours, and species are generally limited to those that associate with man or are not shy. The campus contains no Critical Habitat.

5.9.4 Water Resources

5.9.4.1 Stream Characteristics and Flows

Three water courses cross the campus: the NIH Stream; a normally dry tributary swale of the NIH Stream which joins the former in the northeast corner of the site; and Stony Creek, designated as such in previous studies (see Figure 5-25). All three are unnamed tributaries of Rock Creek (Basin Code 02.14.02.07). All are classified as intermittent streams on U.S. Geological Survey (USGS) topographic mapping and are non-jurisdictional waters. All have been heavily impacted by past development and now function principally as stormwater drainage courses and process water outfall.

The NIH stream enters the campus in a 42-inch diameter storm drain in the southwest corner. All of the headwater drainage area upstream from NIH is contained in the pipe network of the Montgomery County stormwater collection system. The western boundary of the drainage area follows Old Georgetown Road as indicated by 1910 U.S.G.S. mapping. It is roughly estimated that the drainage area upstream from NIH encompasses about 57 acres (Table 5-48).

The stream crosses the campus in a northeasterly direction, passing under Buildings 12B and 13, in a progressively larger storm drain interceptor for a distance of about 2,350 feet. The interceptor is eight to 20 feet below the surface. Stormwater drains for most of the southwest quadrant of NIH connect to the interceptor throughout this length. Connections carrying chilled water system blow down join the interceptor as it passes Building 11.

The stream finally exits to daylight at a 96-inch diameter outfall northeast of the Center Drive/South Drive intersection, where it immediately passes through two oil and grease separators. Total drainage area upstream of this point is estimated to be 204 acres.

The stream continues to flow north-northeastward toward the northeast corner of the campus for about 2,000 feet. Once exposed, the stream follows a riffle and pool flow regimen, ranging from two to twelve feet in width and averaging about four feet wide. The stream banks are most commonly about 25 feet across and from two to seven feet deep. The width of the stream itself varies from about three to 10 feet.

The stream gradient averages about 1.5% between Center Drive and the Rockville Pike culvert. North of Wilson Drive, the stream winds between East Drive and parking lots for its full length. Eleven stormwater culverts empty into the stream in its exposed section. These culverts have no flow except for north branch in the northeast corner is estimated to be 294 acres of which 212 acres are on the NIH campus.

After leaving the campus, the stream passes under Rockville Pike and Cedar Lane in successive culverts. It then flows through an arm of Rock Creek Park following Cedar Lane and Park Drive through the Locust Hill Estates before flowing into Rock Creek about one mile to the northeast of NIH near the intersection of Cedar Lane and Beach Drive. The elevation at the confluence with Rock Creek is 199 feet based on M-NCPPC topographic mapping.

The NIH Stream is not gauged and there is no information about flow rates. It is uncertain how much of the natural flow is attributable to headwater springs, and how much results from ground water infiltration in the storm water system. Using Manning's formula and procedures given in Roughness Characteristics of Natural Channels, USGS Water Supply Paper 1849, 1977, with the average rectangular stream flow channel 7 feet wide and two inches deep, a stream slope of 0.015, and a channel roughness coefficient of 0.50, it is estimated that the average natural flow at Rockville Pike is where $7Q_2$ is the flow which is not exceeded for seven consecutive days at a recurrence interval of, once every two years on the average. Since, the stream is largely "unnatural", being contained within pipe systems, these estimated flows may be in error by plus or minus 70 percent. Flows after rainfall are about 1.0 cubic feet per second (cfs). Using procedures established for Maryland streams (Characteristics of Streamflow in Maryland, Maryland Geological Survey Report of Investigation No. 35, 1983), natural low flow discharges are computed as:

$$7Q_2 = 0.201 \text{ cfs}$$
$$7Q_{10} = 0.074 \text{ cfs}$$
$$7Q_{20} = 0.033 \text{ cfs}$$

	Subarea In Acres	Area in Acres
NIH Stream		
NIH Campus Upstream of 96" Outfall	147	
Off Campus - Glenwood Residential Area	57	
At 96" Pipe Culvert Outfall		204
Campus Drainage North of 96" Outfall	65	
Naval Medical & Rockville Pike	25	
		90
North Branch		
NIH Campus	61	
West Cedar Lane & North of West Cedar Lane	45	
		106
Eastern Sector of Maplewood (Outfall at Rockville Pike Bridge)		55
Estimated TOTAL NIH Stream Drainage Area at Rockville Pike		455
Booze Creek		
NIH Campus		5
Stony Creek		
Off-site South of NIH Campus (residential)	129	
Off-site South of NIH Campus (Bethesda CBD)	58	
NIH Campus	32	
Estimated TOTAL Stony Creek Drainage Area at Woodmont Avenue		219
Note: Approximately 12 acres of NIH located to east of Woodmont Avenue drains to Stony Creek separately.		

TABLE 5-48 ESTIMATED STREAM DRAINAGE AREAS (in acres).

where $7Q_2$ is the flow that is not exceeded for seven consecutive days at a recurrence interval of once every two years on the average. Since the stream drainage area is largely “unnatural”, being contained within pipe systems, these flows may be in error by plus or minus 70 percent. Flows after rainfalls or storms are estimated to be in tens of cfs. By permit, NIH is allowed to release up to 300,000 GPD (0.464 cfs) of chilled water blowdown to the NIH Stream. Releases vary with chilled water production, which in turn, varies with the ambient temperature. Under peak production conditions when the temperature exceeds 90EF, the estimated blow down release is 0.39 cfs. During the winter, the average estimated release is computed to be about 0.09 cfs.

The Metro tunnel under Rockville Pike is subject to heavy groundwater infiltration. Water is pumped continuously to the surface and deposited in the NIH Stream on the east side of Rockville Pike. The constant rate of pumpage is about 0.13 cfs.

The north branch of the NIH Stream runs along the northern boundary of NIH. Its drainage area covers the residential area to the north of West Cedar Lane and the northern periphery of NIH. All of the drainage off the campus is encased in the County stormwater collection system. It enters the campus from a series of outfalls from curb catch basins or inlets on West Cedar Lane. On the campus, the watercourse is channelized in a concrete ditch for two-thirds of its length. The remaining mid-third of its length passes under a residential area in a concrete culvert. The entire drainage course on the NIH campus is artificial and merely functions as a stormwater drainage channel. During dry weather, there is no stream flow. Flows are limited to the 24 to 48 hour period after rainfalls with the greatest portion occurring as intercepted runoff.

Stony Creek traverses the southeast corner of the campus in a shallow valley. As is the case for the other water courses, its original stream network upstream from the campus is encased in the Montgomery County stormwater collection system. Two branches join just before entering the NIH campus. The main branch flows through a 66-inch pipe and drains most of the Woodmont Triangle area in the Bethesda Central Business District. The other branch flows eastward in a 42-inch pipe that parallels the southern boundary of NIH and drains the apartment complex area along Battery Lane. Construction documents indicate that the first 200 feet of stream length on the NIH property was subject to channelization when the 66 and 42 inch pipes were installed by the County in the early 1960's.

The stream width varies from 6 inches to 6 feet with an average width of about 3 feet. Stream depths range from one to about 15 inches as it follows a riffle and pool flow regimen. The stream falls only 9 feet as it passes the 1,040 feet across the campus to Woodmont Avenue. It exits the site in twin 66-inch conduits under Woodmont Avenue and proceeds as an independent tributary to Rock Creek across the National Naval Medical Center. It joins Rock Creek about 0.3 mile downstream from the NIH Stream confluence, about 500 feet to the west of Connecticut Avenue.

Where it was channelized by past construction, the stream has banks about 12 feet wide and 3 feet deep. For the remainder of its length across NIH, there are no distinct banks. Maintained lawn extends up to the water's edge throughout this reach. On a basinwide basis, the creek is classified as a Level II, Type F4, stream under the Rosen channel stability rating system. Class F streams are typical of urban conditions. The stream was rated as being in fair to good hydrologic condition in 1998.

Sources and volumes of natural flows in Stony Creek are unknown. Much of the flow during dry weather may be attributable to man-made sources in the Bethesda CBD. The dry weather flow is generally less than one cfs. Studies completed for a proposed County stormwater management pond in the southwest corner of the campus indicate that the one, two, 10, and 100 year storm flows at the Woodmont Avenue culvert are 197, 325, 698, and 1,133 cfs, respectively.

5.9.4.2 Water Quality

The NIH Stream and Stony Creek are designated as Class I surface waters by the Maryland Department of the Environment (MDE). Uses for Class I waters include water contact recreation, aquatic life, and water supply. Water quality criteria for Class I waters are shown in Table 5-49.

In adopting a fecal coliform bacteria standard of a geometric mean of 200 MPN/100 ml (Most Probable Number of organisms per 100 milliliters) for water contact recreation, Maryland moved to a position in conformity with the EPA and adjacent states. The standard is applied to all Class I waters in Maryland. In other states, the standard is applied to primary contact waters such as those used for swimming and bathing, and waters with secondary body contact activities such as wading, fishing, and boating have a higher limit. Many of the streams in Maryland do not meet the 200 MPN/100 ml standard, but this does not necessarily mean the waters are unsafe or constitute a public hazard. For example, the geometric mean total coliform densities in the upper reaches of Rock Creek range from 200 to 4200 MPN/100 ml. (Water Quality of Streams in Montgomery County, Maryland, Montgomery County Dept. of Environmental Protection, 1980.)

Water temperature limits in Class I waters have been established to prevent (1) temperature changes that adversely affect aquatic life, (2) temperature changes that adversely affect spawning success and recruitment, (3) thermal barriers to the passage of fish. It does not preclude the discharge of heated water provided the resultant volume and duration of exposure is not deleterious to organisms. Water temperature elevations above natural temperatures must be limited to 5EF and the temperature must not exceed 90EF or 32.2EC outside of the designated mixing zone.

To characterize stream water quality, grab samples were collected from the NIH Stream and Stony Creek during May and August, 1992 (Water Quality Impact Study, in Environmental Impact Studies for William H. Natcher Building, Phase II, EBASCO and AEPA, 1992). This sampling supplements data collected by NIH during 1984 and 1985. Summary physical and chemical parameters of the streams along with fecal coliform counts are given in Table 5-49.

Concentrations and parameters are within Class I water quality criteria. Measurements are within similar ranges taken by on the main stem of Rock Creek near the East-West Highway Bridge in Bethesda (Station RCM0111) (ibid). In comparison to Rock Creek, nutrient concentrations (nitrates and phosphorus) are slightly elevated at on site streams.

Dissolved oxygen concentrations are surprisingly high considering the entire upper drainage systems of both streams are enclosed in subsurface pipe networks. However, fecal coliform counts, an indicator of the presence of wastes from human or animal sources, are elevated. Pollutant pet droppings are the likely ultimate sources for the fecal coliforms in this case. Sampling indicates that physical and chemical characteristics improve as the streams traverse the campus. Further dilution is achieved in the NIH Stream by releases from the power plant. NIH affects the water quality of the NIH streams through releases of chilled water system blow down from Buildings 11 and 34. Releases are regulated through National Pollutant Discharge Elimination System (NPDES) permit MD0025496 which is issued by MDE. The current permit allows an average release of 300,000 gallons per day (gpd) provided that total residual chlorine does not exceed 0.1 mg/l and the temperature of the NIH Stream does not exceed 90EF at the point where it exits to daylight to the northeast of the Center/South Drive intersection. This point is 1,400 feet downstream from the underground release points near Buildings 11 and 34. A mixing zone of 50 feet downstream from the discharge basin is permitted. The pH range must be between 6.0 and 9.0.

Under current conditions, NIH meets the NPDES permit requirements. Effluent temperatures monitored at the point of release during the summer of 2000 ranged from 73 to 89° F. The pH of chilled water blowdown releases ranged from 7.0 to 8.1, and the maximum recorded residual chlorine concentration was 0.08 mg/l.

Impacts under the Master Plan and No Action Alternatives are similar except for the volume of heated water released. To accommodate the expansion proposed in the Master Plan, the chiller plant capacity would increase from 43,000 to 80,000 tons. Heated water discharges are projected to increase from 300,000 to 560,000 gpd.

In the No Action case, it is assumed that committed chillers 22 through 27, would still be installed under this Building 11 Phase I expansion. This would increase the chiller capacity to 66,000 tons to meet increasing demands from existing and recently built buildings. This would increase the average daily discharge to about 460,000 gpd.

NIH expects to apply for a new NPDES permit increasing the permitted discharge rate when it is necessary to do so. It is anticipated that the parameters set for temperature, chlorine content, and pH will remain the same. Since the releases under both alternatives must meet the criteria, it is expected that neither will produce significant water quality impacts as a result of power plant heated water releases.

Constituent	Concentration Range NIH Stream	Concentration Range Stony Creek	Detection Limit	Maryland State Limits Class I Waters*
Temperature (CE)	3.3 - 23.8	5.6 - 21.8		max 32.2
Electrical conductivity (µmho/cm)	360 - 1050	447 - 510		---
pH (units)	6.4 - 8.6	6.4 - 8.6		6.5 - 8.5
Dissolved Oxygen	8 - 13.4	8.6 - 13.6		min 5
Arsenic	<.005	<.005	0.005	0.05
Barium	0.019 - 0.108	.06 - .086	0.010	1.0
Cadmium	<.0005 - 0.001	<.0005	0.0005	0.01
Chromium	<.002 - 0.033	<.001 - .008	0.0010	0.05
Lead	<.005 - 0.029	<.005	0.005	0.05
Mercury	<.0005	<.0005	0.0005	0.002
Selenium	<.005	<.005	0.005	0.01
Silver	<.001	<.001	.001	0.05
Sodium	3.1 - 30	.97	5	
BOD 5	<1 - 16	<.05 - 1	0.05	
Fluoride-F	0.06 - 3.2	1.1	0.05	
Nitrate-N	0.2 - 8.25	1.81 - 2.76	0.1	
Total Phosphorus	0.14 - 1.0	.03 - .11	0.01	
Fats, Oil and Grease	<5 - 7	<5	5	
Fecal Coliform	20 - >2400**	300 - >2400**	20	log mean 200

Data Source: Water Quality Impact Study, EBASCO and AEPA, 1992.
*Source: COMAR 26.08.05.04
**Results expressed as most probable number of organisms per 100 ml (MPN/100 ml)

TABLE 5-49 PHYSICAL AND CHEMICAL CHARACTERISTICS OF NIH STREAMS (in mg/l unless otherwise indicated).

5.9.5 Aquatic Habitat

The NIH Stream and Stony Creek drainagesheds are heavily urbanized and altered by past development at NIH and in the surrounding area. The upper reaches of both streams are encased in stormwater collection pipe systems. Stony Creek drains the Bethesda Central Business District and less than 5 percent of the drainage area upstream from NIH is in natural cover.

A biological assessment of the streams was conducted in April and May, 1992 (Wetlands Assessment, Natcher Building Phase II, Booz, Allen, Hamilton and AEPA, 1992). Both streams had a relatively sterile benthic structure. Submerged vegetation and algae growth was insufficient to support an aquatic community. Vertebrates were not found in either stream. A survey of Stony Creek in 1998 also noted the absence of macroinvertebrates and fish thought its length to Rock Creek.

The NIH Stream is subjected to NIH power plant process water releases that have an elevated temperature. The releases make up most of the dry weather flow. The banks of the stream are now stabilized by concrete blocks rubble, gabions, and riprap. The areas adjacent to both streams are in lawn that is mowed to the top of the stream banks or the very edges of the stream. Both streams receive over land runoff from impervious areas. All of these factors contribute to a reduction in the natural values of the aquatic habitat.

The aquatic habitat of all three campus streams is expected to improve under both the Master Plan and No Action Alternative. NIH is conducting a two phase improvement program for the NIH Stream. In the first phase, which is complete, the stream banks have been stabilized in the short northernmost campus reach between Rockville Pike and the North Branch. The second phase, which was completed in 2003, improved the remainder of the stream both biologically and physically. The project goal is to return the stream environment to its "natural condition". Work included installation a bioretention pool planted with indigenous and native species, bank stabilization using natural stones, rocks, and hydrophilic plantings, and control or retardation of flows from storm drain pipe outfalls and drainage ditches.

Further aquatic habitat improvements could occur when the North and South stormwater management facilities are built. The North facility would be a detention pond on the North Branch just upstream form its confluence with the NIH Stream. The character and type of the South facility, which would be built by Montgomery County, has not been determined. It could take the form of a wet detention pond, micropool, or a series of pools with habitat meeting MDE criteria. In all cases, stream habit would improve. In addition, stream buffers extending 50 feet to either side of streams would be designated as priority areas for tree plantings.

5.9.6 Wetlands

Wetlands are delineated by the presence of three criteria set forth in The Field Guide for Wetland Delineation Manual, U.S. Army Corps of Engineers, 1987. The three criteria are hydric or saturated soils; predominant hydrophytic vegetation; and suitable hydrology in that the area is inundated or saturated with water for a significant period during the growing season. In most cases, all three criteria must be met, but in disturbed areas, it may be necessary for only one or two of the criteria to be present to classify an area as wetland.

Wetland delineation of the campus has been accomplished by a review of available reference materials and information and an on-site investigation of the NIH stream and Stony Creek (William Natcher Building, Phase II Wetlands Assessment, AEPA, 1993). National Wetland Inventory Maps and Maryland Non-tidal Wetland Guidance Maps show no formal designation of wetlands on the campus.

The only hydric or normally saturated soil on the campus is the Baile loam in the northeast corner of the site (See Figure 5-26). Approximately 90% of the soil area is now covered by parking lots. Five test pits dug during the Natcher survey along Stony Creek and the NIH stream revealed unsaturated and disturbed soil structure.

The entire remaining Baile loam surface area is covered by turf or lawn grasses even to the banks of the NIH stream. There are no herbaceous, shrub, or understory layers. Most of the trees in the area are cultivated. There are a few occurrences of natural facultative species within the hydric soil zone such as tulip tree (L. Tulipifera); red maple (A. Rubrum); and silver maple (A. Saccharinum), but landscape and ornamental trees are dominant.

Stony Creek and NIH Stream experience over bank flow after every large or intense storm. The headwaters of both streams are entirely contained within stormwater collection pipe systems draining the Bethesda Central Business District and the NIH campus, respectively. Flows generally return to bank flow within a period measured in hours as runoff is completed. Long-term inundation or saturation is not present. Campus areas bordering site streams can be classed as hydrologic zone V during the growing season in that they are irregularly inundated or saturated.

It is concluded that the wetland delineation criteria are not met and wetlands are not present. No wetland impacts are expected to be created by any of the alternatives.

5.9.7 Threatened and Endangered Species

No threatened or endangered species are known to inhabit the area.

5.9.8 Floodplains

There is no Federal Emergency Management Agency, M-NCPPC, U.S. Geological Survey floodplain mapping for the NIH Stream or Stony Creek.

The NIH Stream floodplain was determined by analyzing the enclosed watershed upstream from NIH as a storm drain system to determine flows at the outfall as it enters the campus. The HEC II computer program was then used to determine the 100-year flood plain for the exposed section of the drainage shed on the NIH campus (Figure 5-28). Flood flows are estimated to be 530 cubic feet per second (cfs) at the point where the stream exists from the piped storm drainage system at Center and South Drives and 656 and 1,016 cfs above and below the confluence of the NIH Stream with its north branch in the northeast corner of the campus. Montgomery County storm drains which drain the eastern portion of Maplewood and Rockville Pike to the north of Cedar Lane empty into the stream immediately downstream from this point.

In flood, the NIH Stream is generally confined within relatively narrow limits widening to 80 feet only in the vicinity of existing Building 21. The Wilson and North Drive vehicle bridges, and three pedestrian bridges all have sufficient clearances to maintain access, although about a foot of backwater is created at the Wilson Drive bridge. The addition of less than one cfs of cooling tower blowdown to the stream at Building 11 has no effect on projected flood elevations. The curb on the west side of the Building 21 parking lot is an important constraint limiting the flood zone in this area. Stony Creek outfalls from the NIH main campus on the west side of Woodmont Avenue through twin 66-inch diameter culverts. They course to the northeast under Woodmont Avenue passing below the Rockville Pike intersection.

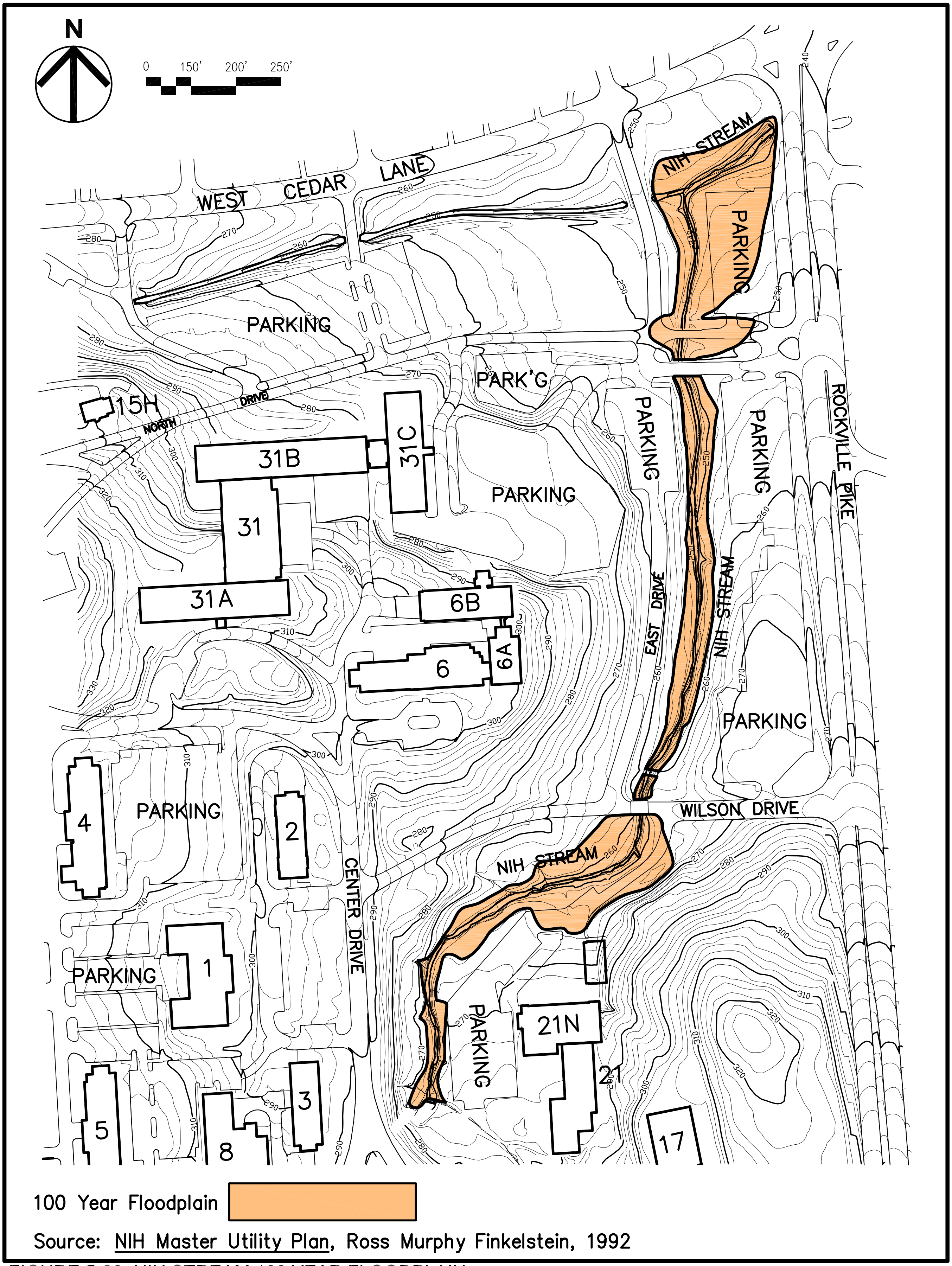


FIGURE 5-28 NIH STREAM 100 YEAR FLOODPLAIN.

Stony Creek has a gradient of only 0.9% as it crosses the campus. Except for the first 100 feet or so on campus, it does not have well defined banks. These range from nonexistent to 18 inches in height where they occur. Areas adjacent to the stream are flat, and it overflows into these lawn covered areas after nearly any rainfall of significance. While a comparatively large area is flooded under maximum potential flow conditions, the water is not deep.

Upstream from NIH, Stony Creek flows within the County storm drain system. Two storm drains outfall to form the stream just beyond the NIH property line; a 66-inch line which approaches from the south Battery Lane Urban park, and a 42-inch line that runs parallel to and a few feet outside the NIH boundary from the west. The gravity flow capacities of the two lines are 333 and 75 cfs, respectively, or 408 cfs total.

Under normal circumstances, runoff flows follow the above routing. The estimated 100-year storm flow at the entrance to the Woodmont Avenue culverts is 1,133 cfs (NNMC Stony Creek Watershed Study, A. Morton Thomas, 1998). Since the 100-year runoff volume exceeds the storm drain capacity, which is designed to handle 10-year recurrence storm runoff, much of the flood volume will arrive by overland sheet flow through the areas to the south of NIH to reach the Stony Creek 100-year flood pool.

The 100-year floodplain as determined in design analysis for the South Pond is shown in Figure 5-29. The 100-year rainfall in Montgomery County is 7.2 inches in 24 hours. The existing flood water surface elevations of Woodmont and Wisconsin Avenues with the South Pond in place are 308.04 and 307.15 feet, respectively. The difference in stream discharge with and without the facility dam are virtually identical. Water surface elevations are about 0.03 feet (0.36 inches) less under existing conditions. A dam breach analysis for the facility determined that there was no increase in flood hazards downstream.

Under 100-year flood conditions, flood water would flow to a depth of several feet across Woodmont and Wisconsin Avenues. This occurs under both existing and future conditions. Similar conditions occur along MD Route 355 at two locations between the Beltway and Cedar Lane, and in the Bethesda CBD, when 100 year floods occur.

In accordance with Executive Order 11988, Floodplain Management, the Master Plan and No Action Alternatives do not propose construction of non-stormwater management facilities in the floodplain, nor do they support floodplain development in the floodplain within and without the campus. Natural and beneficial floodplain values would be preserved under both alternatives.

5.9.9 Coastal Zone

The NIH Bethesda campus is not in an area governed by the Maryland Coastal Zone Management Program. No coastal zone impacts are expected.

5.10 VISUAL AND AESTHETIC

Implementation of the Master Plan Alternative would create many opportunities for improving the visual and aesthetic character of the campus. These opportunities range from campus wide proposals to subtle touches that can enhance specific small areas.

The Bethesda-Chevy Chase Master Plan notes that a land use element of particular importance to the adjacent communities, as well as those travelling by on Old Georgetown Road and Rockville Pike, is the visual impact of the NIH campus. The B-CC Master Plan emphasizes that the buffer surrounding the

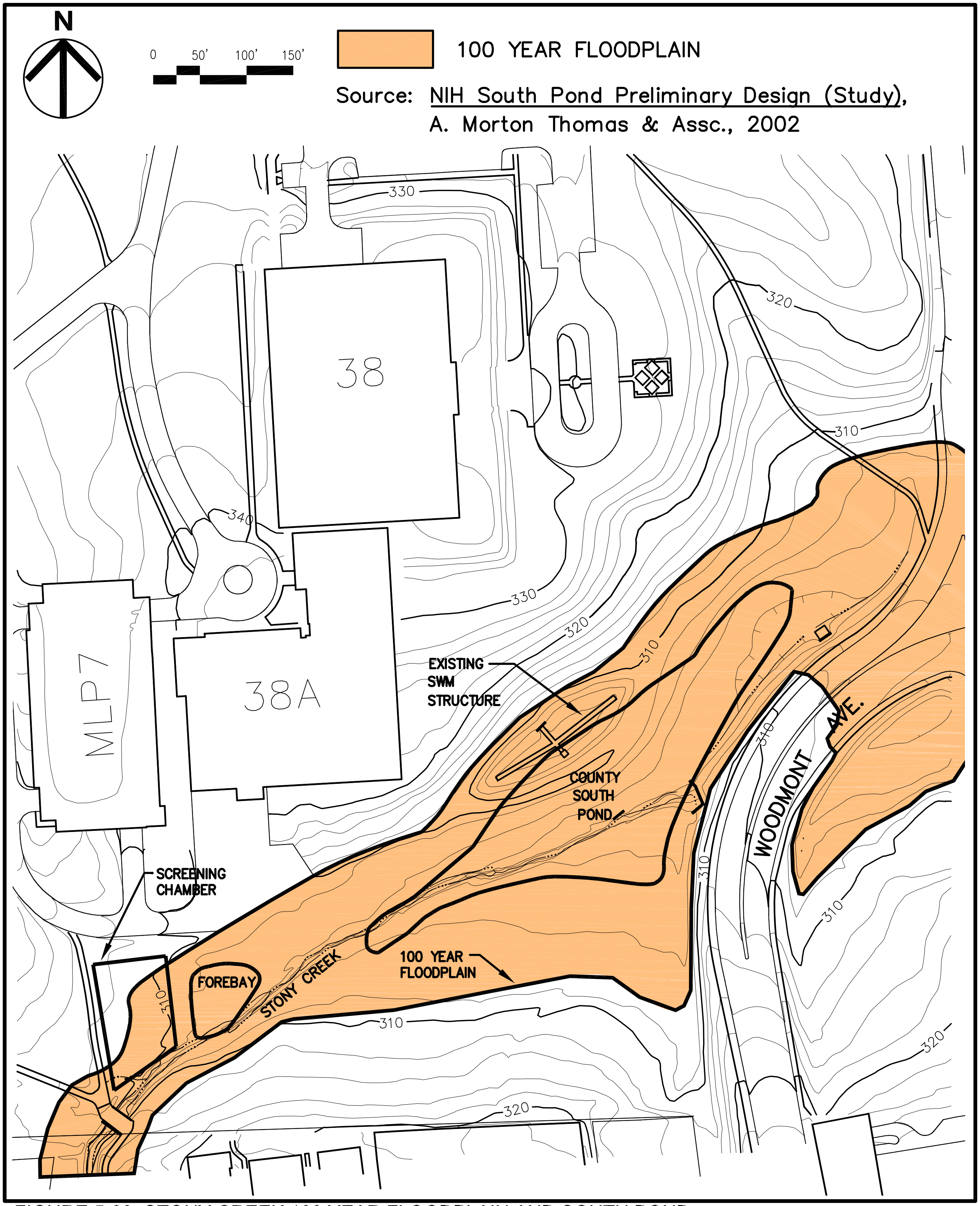


FIGURE 5-29 STONY CREEK 100 YEAR FLOODPLAIN AND SOUTH POND.

campus is critical to continuation of the existing campus ambiance, and as an interface with the surrounding neighborhoods. The plan reconfirmed the need for the buffer around the campus.

The 1995 Master Plan increased the dimensions of the buffer and proposed enhancements throughout its area. The width was increased from 150 to 200 feet as presented in previous campus master plans to a uniform 250 feet (See Figures A-1 and A-2 in Appendix A).

Both 2003 update alternatives maintain the 1995 Master Plan buffer dimensions. Under the Master Plan, the buffer area in each corner of the campus would receive distinctive treatment. Widening the buffer had indirect impacts. With two or three exceptions, NIH was in conformance with the old pre-1995 buffer limits. When the width was expanded, many of the buildings, parking lots, and other facilities built prior to 1995 that were in conformance were now nominally within the new expanded buffer limits.

Designation of a 250-foot buffer ground the entire campus periphery means that 82.1 acres, or more than one-fourth of the 310 acre campus, is unavailable for research and support facilities. For a fixed amount of building space, preservation of the buffer leads to denser development in the campus interior. Denser development subsequently reduces opportunities for green space in the campus interior.

About 66.0 acres of the existing buffer has natural cover. About 1.9 acres are covered by buildings, 6.2 acres by roads and sidewalks, and 7.4 acres by surface parking. The remaining 0.6 acres are occupied by Metro station facilities.

New security conditions will require control of campus access. In turn, this will require construction of associated facilities in the Rockville Pike buffer under both the Master Plan and No Action Alternatives. They include employee vehicle inspection queue lanes at the North Drive entrance, a truck or commercial vehicle inspection station between North and Wilson Drives, and a new Gateway Center and parking garage in the vicinity of the Metro rail station. These facilities combined will convert an estimated 4.9 acres of green buffer to impervious cover.

Elsewhere, under the Master Plan Alternative, roads and sidewalks in the buffer would be reduced to 4.8 acres of ground coverage, and buffer parking by 6.8 acres to 0.6 acre. The remaining parking, is associated with the new fire station, the Children's Inn, and the officer's residences along West Cedar Lane. Exclusive of the new security facilities along Rockville Pike, a net of 8.4 acres of impervious area in the buffer would be returned to natural cover.

Under the No Action Alternative, the road and sidewalk coverage would be reduced in the same manner, but most of the buffer parking would remain.

The southeast corner is considered to be an important arrival view for visitors. It presents open pastoral views across the Stony Creek valley to the National Library of Medicine and the Natcher Building. The South Pond will create a visual amenity. The Master Plan proposes leaving the area surrounding the pond as relatively unchanged with the addition of a few select trees to supplement and succeed current plantings.

As one proceeds northward along Rockville Pike, the buffer would be relatively open. The BCC Plan notes that the vista of the Peter Estate or Stone House from Rockville Pike should be maintained in any planning effort on the campus, and this is proposed in the Master Plan. Views to and from other potential historic structures and areas are discussed in Section 5.8.1.

Construction of the new Gateway Visitor Center and parking garage at the Metro rail station will create a definitive "front door" entrance to the campus. Site topography, the security perimeter location, and maintenance of bus transit service during construction imply that the new facilities will be oriented to a greater degree in the north-south direction in the buffer zone. The Gateway visitor parking garage would be constructed below grade to minimize visual impacts. The commercial vehicle inspection facility would be suitably screened by landscaping on both the NIH Stream and the Rockville Pike sides.

The northeast corner presents winter views of the campus through the leafless tree canopy on another important arrival route. The Master Plan proposes thickening the tree and shrub cover between Rockville Pike and the NIH Stream in this area. This is already underway as part of the NIH Stream restoration project. Siting of future Building 33 and MLP-10 take advantage of the elevation differential in this area to lower the building profiles and maintain views. Along West Cedar Lane, screening of the residential community by augmented evergreen and ornamental plantings is proposed. The NIH Stream valley would be visually enhanced through the two phase stream restoration program, removal of parking in the northeast corner of the campus along Rockville Pike, and giving it priority as a tree planting area.

In the northwest corner, the plan recommends permitting the tulip poplar grove area to revert to natural conditions with regeneration of the natural understory and leaf litter ground cover. This reversion would reduce maintenance costs and provide additional screening. Along Old Georgetown Road, the wooded buffer at the Convent would be extended to the north and south. Open views of the laboratory complex between South and Lincoln Drives would be maintained.

The Master Plan landscape plan proposes augmentation of the understory and tree cover along the entire southwest edge of the campus from the Lincoln Drive entrance to Stony Creek. The proposed south quadrangle laboratory buildings, Animal Research Center and MLP-E would have a first floor elevation of about 315 feet. Subgrade levels would be built. Ground levels rise to 360 feet along the southern NIH property line and are 340 feet directly to the south of the proposed structure locations.

The ordered massing of buildings, coupled with the concept of intervening quads and malls, will produce a more functional and visually appealing arrangement of buildings on the campus. In general, new, taller buildings would be located in the central core of the campus, emphasizing the concept of Rockville Pike as the "front door" to the campus, concentrating more employees near Metro, and reducing visual impacts in adjacent neighborhoods. Ground elevations decrease from Old Georgetown Road to Rockville Pike. Recommended building heights in the Master Plan Alternative account for building mass relationships between proposed and existing structures. Heights are arranged to create coherent patterns among all campus buildings and to give a sense of hierarchy or visual prominence to the more important ones. Recommended maximum building height ratios to building property line distances are given in the Master Plan to ensure that proposed structures will have unobtrusive skyline profiles, when viewed from adjacent neighborhoods.

For various sectors of the campus, the Master Plan Alternative recommends general building materials that are compatible with and extend the character of each sector. New construction in the central core area would be built with modern brick designs reinforcing patterns of recently constructed buildings. The plan recommends that the predominant material for buildings in this area be red brick, responding to and respecting the materials used in the Historic Core. Structures white or light in color, and built of stone or concrete, are recommended around the periphery.

Landscaping in the central core would be more formal resembling a well-shaded city streetscape along the Loop Road. Open spaces create opportunities for aesthetic ornamental landscaping on a smaller scale. They have one or more pedestrian routes and offer greater aesthetic diversity than a simple sidewalk next to a roadway. Benches and other features can provide lunchtime respite for NIH workers, and passive recreational opportunities to nearby residents in the evening hours. Trees planted along the periphery buildings can further screen the lower floors from neighborhood view.

With the current building arrangement, it would be difficult to improve the visual and aesthetic character of the campus in the No Action Alternative beyond some improvements in the buffer zone.

5.11 ENERGY

Executive Order 13123, issued on June 3, 1998, observes that the federal government is the largest energy consumer in the U.S., and as a result, the government can provide leadership in energy efficiency and reduction of emissions created by energy consumption. The Executive Order has established a number of goals. The first is to reduce energy consumption per gross square foot of federal facilities by 30 percent by 2005 and 35 percent by 2010 relative to 1985 as a base year. Energy consumption per gross square foot is to be reduced in laboratory and industrial spaces by 20 percent by 2005, and by an additional five percent by 2010 relative to base consumption in 1990. Federal agencies shall also reduce greenhouse gas emissions by 30 percent by 2010 compared to such emissions in 1990. Greenhouse gases include carbon dioxide (CO_2), nitrous oxide ($N_2 0$), methane (CH_4), ozone (CO_3), and halogenated fluorocarbons (HFC). Reductions are to be accomplished by adopting measures indicated as appropriate by life cycle, cost effective analysis.

The Executive Order also notes that the federal government shall strive to reduce total energy use as well as consequent associated greenhouse gas and other emissions as measured at the source where the source is external to the agency's facilities. Agencies shall undertake cost effective projects in which source energy decreases even if site energy use increase. Agencies shall reduce petroleum use by switching to natural gas renewable energy sources, or other methods.

Overall energy consumption at NIH Bethesda will unavoidably increase under both the Master and No Action Alternatives due to projected overall growth in building space. The No Action Alternative includes new buildings, such as Buildings 40 and 50 and Hatfield Clinical Research Center to which NIH has already committed. The projected growth is:

Year/Case	Research Space (gsf)	Total Space (gsf)	Percent Research
2002 Existing	5,024,000	7,445,000	67.5
2008 No Action Alternative	6,189,000	8,981,000	69.0
2020+ Master Plan Alternative	7,747,000	10,671,000	72.6

Research space includes laboratories, animal holdings facilities, and the clinical research hospital for energy use purposes. Research spaces have much higher utility and subsequent energy demands per unit of space than other types of space used for administration and support. Steam, chilled water, and electric power are the three primary energy related utilities. The following compares the peak demand per gross square foot factors for research and other space:

Utility	Research/Laboratory	General/Office
Steam	0.129 lb/hr	0.021 lb/hr
Chilled Water	0.0085 ton	0.0026 ton
Electric Power	0.007 kw	0.004 kw

The day to day demands of each type of space generally correspond to peak demands. Overall campus energy consumption per unit of building space will also increase under both alternatives, because research space with its higher utility requirements will occupy a greater proportion of total campus space.

Research space demands for heating and cooling, which are satisfied by steam and chilled water, respectively, are several times greater than for other types of space. This occurs for two reasons. The predominant one is ventilation requirements set in national handbooks or standards. Most commercial spaces require five to six air changes per hour, i.e. circulated air within the building volume is replaced every 10 to 12 minutes for proper ventilation. The number of hourly changes within hospitals varies considerably by space subtype, i.e. operating rooms patient rooms, administration, but averages about ten per hour. Biomedical research laboratory and animal facility requirements range from 12 to 20 per hour. Additional secondary steam and chilled water demands are attributable to direct or process use in research space. For example, steam is used at the at the laboratory bench for sterilization, and for cleaning animal holding spaces.

The Master Utility Plan 2000 Update makes the important point that high ventilation rates severely reduce the cost effectiveness of many conventional energy conservation measures, particularly those involving the transport of energy through the building envelope. The air circulating through a research building is resident only for three or four minutes, when the exchange rates are 15 to 20 per hour. It is evident that many conservation measures will be only one-third as effective when applied to research space than they would be applied to other space types, if the respective air change rates are 15 and 5 per hour. Under weather extremes, the amount of energy need to heat or cool accumulated air from outdoor ambient temperatures to interior levels dwarfs that passing through the building envelope in research space. Conservation measures must be evaluated in this context.

The above implies that the most cost effective life cycle energy conservation measures are those that are applied to the air flow itself, i.e. where it is heated and cooled, or where energy that would normally be exhausted is recovered for use. It is in this area where NIH has concentrated its efforts and will continue to do so.

Although growth in utility and energy consumption will occur, NIH is in the process of implementing projects and programs proposed in the 1992 Master Utility Plan (MUP) Infrastructure Modernization Program and the MUP 2000 Update that will reduce the rate of growth. Significant reductions will be realized on a gross square foot basis. And off site source energy consumption and emissions will be reduced.

The first program is the complete renewal of the chilled water plant, which is in progress. Prior to 1991, chilled water was supplied to the campus by fifteen electric driven chillers, one through fifteen. When auxiliary equipment requirements are included, these chillers needed about 1.25 kw of electric power to generate one ton of refrigeration. NIH is replacing these old chillers with new high efficiency units. Old units one through nine have already been retired, and all but two of the remainder are scheduled for retirement around 2004.

The new chillers need only a comparable 0.85 kw/ton or 32 percent less electric power per ton than the old units. The peak chilled water demand in 1990 was about 34,000 tons. It is projected to grow to about 80,000 tons in 2020 under full Master Plan build out conditions, an increase of 132 percent. However, the high efficiency chillers will limit the increase in chilled water generation electric power demand to only 58 percent between 2002 and full build out conditions.

Installation of the PEPCO/NIH COGEN unit, which includes NIH heat recovery boiler 6 will have several benefits that satisfy Executive order goals. The Executive Order encourages use of alternative financing mechanism, including energy savings and performance contracts, particularly those with “no net cost to taxpayers”. The NIH PEPCO contract to build and operate the COGEN unit meets these conditions through performance clauses. NIH will pay for the facility over ten years by receiving monetary credits for the electricity generated, eliminating the need for federal funding for the project itself.

The Executive Order also notes that federal agencies shall consider combined cooling, heating, and power facilities when upgrading and assessing facility needs. The COGEN unit at NIH will combine all three when the chillers are steam driven. The COGEN unit, in effect, uses "free" energy that would normally be wasted if steam generation was not present. Hot gases from the combustion of oil or natural gas is used to drive a turbine that will generate about 21.6 megawatts of electricity. Exhausted heat is recovered or used a second time to generate 100,000 pounds per hour of steam before it is released up the stack. When desired, supplemental firing will allow NIH to generate up to 180,000 pounds per hour. On an annual basis, the steam produced by the COGEN/boiler 6 system will satisfy about half of the existing demand. By 2020, the portion of steam will still meet approximately 20 percent of the annual campus demand.

The electric power produced in the COGEN unit will conserve off site source energy. Electric power is lost in the transmission through a distribution system; electric resistance in the transmission lines convert power to heat. The greater the distance traveled, the greater the line losses. Power companies may have to generate three or four watts to deliver one watt to the customer. Power generated by the NIH/PEPCO unit will be routed to the nearby PEPCO substation in Building 46, where it can be distributed to NIH and other connected customers. Transmission line losses will essentially be eliminated. Transmission distances are measured in feet instead of miles.

Similarly, NIH will soon be capable of running three chillers with a combined capacity of 15,000 tons with dual electric/steam drives. Steam drive eliminates about 0.6 kw/ton of electric power demand for chilled water generation. If the units are run at capacity, about 885 MW as measured on site, are saved. As noted above, the energy needed to generate this power at off site sources and deliver it to the campus would be still greater.

NIH has also installed free cooling heat exchangers to produce chilled water during the winter. The exchangers use outdoor air to cool the returned chilled water.

NIH has already achieved the Executive Order goals for reductions in greenhouse gas emissions. Since 1992, NIH has successively switched from fuel oils to cleaner burning natural gas as the primary boiler fuel. Natural gas has significantly lower pollutant emission rates per unit of energy consumed than oil or coal. Emissions at NIH have been reduced further by the boiler modernization program, which was implemented in the interim. Measures included the installation of economizers to preheat combustion air and low nitrogen oxides emitting burners. Boilers 1 through 3 also have oversized combustion chambers with high heat transfer rates between the boiler firing and steam sides. Less fuel is needed to generate a pound of steam than that in conventional boilers.

The resultant reductions in greenhouse gas emissions are dramatic. The 1992 MUP estimated that the 1990 NIH power plant emissions for nitrogen oxides and volatile organic compounds (VOC) were 324 and 4.4 tons per year. The two pollutants combine with sunlight as a catalyst to form low atmospheric level ozone. The corresponding 2001 annual emissions are estimated to be 61 and 1.4 tons, respectively, equivalent to reductions of 81 and 68 percent in 1990 emission levels. Although sulfur dioxide is not a greenhouse gas, the above boiler modernization improvements have reduced annual emissions from 758 to 3.6 tons.

In the future, further reductions per unit of energy consumed will occur, if NIH Boilers 7 is installed with high efficiency units, as recommended in the Master utility Plan 2000 Update. Such units emit nitrogen oxides at a per energy unit consumed rate that is approximately half that of conventional boilers.
Still further greenhouse gas reductions will be experienced indirectly with double effect. NIH uses low pollutant emitting natural gas as its primary fuel for generating site steam, and electricity in the COGEN unit. Most of the power produced by public utilities and private suppliers is generated using coal, the

fossil fuel with the highest uncontrolled stack emission rates. Substitution of on site energy sources for outside power is not only cleaner, but also requires no additional fuel consumption, and consequent emissions, to compensate for transmission losses.

In accordance with the Executive Order, NIH is preparing a Draft Strategic Energy Conservation Plan. The plan identifies additional measures that NIH can take to conserve energy use and lower concomitant emissions. Individual measures must be judged for life cycle cost effectiveness in each application. The measures can be generally categorized as follows:

- Those that match energy delivery to demands more closely. They may be applied building wide or to individual spaces. Measures include state-of-the-art equipment or systems that permit variance in air flow or the energy it contains. These systems are coupled to, and quickly respond to, sensors monitoring conditions.

- Innovative technologies - NIH already has installed an energy recovery heat wheel in the recently constructed Building 50 laboratory. The wheel transfers heat from building air exhausts to supply air streams, it is estimated that the device will reduce peak heating demands by 40 percent. Another innovative concept involves using the steam distribution system to generate electric power that would be sufficient for individual building needs. Steam is driven through the distribution system under pressure. The pressure is reduced at individual buildings for use by passing it through pressure reducing valves. Substitution of small turbines or generators for the values would accomplish the same reduction. However, about 400 KW of power could be generated using the turbines.

- High efficiency lighting that is tied to programmable controls that permit adjustment of intensity, or automatically shut off lighting depending on space occupancy or night setback schedule. Greater emphasis is given to limiting lighting to work stations and where needed, and to maximizing the use of natural light through fenestration.

- Chilled Water Distribution System Improvements. Water produced in the central plant is released to the distribution system at 42° F. It returns from individual buildings at about 52° F, a ten degree difference. The 1992 MUP and its update recommend increasing the temperature to 18° F. Increasing the temperature increases the amount of heat a fixed amount of chilled water can transport. Since a greater amount of heat can be carried, distribution system pipe, pumps, and equipment do not need to be enlarged to increase system capacity. All new central plant and building systems are installed in accordance with the 18 degree design criteria. Full realization of benefits will require retrofitting older buildings.

- Submetering of steam, chilled water, and electric power that the building level to monitor demands, and evaluate energy conservation measures.

- Replacement of existing central plant computer control systems with modern state-of-the-art steam and chilled water control and monitoring systems.

5.12 CONSTRUCTION

Physical facility requirements for conducting and supporting biomedical research change continuously. Revisions to national building codes, hospital laboratory design standards, and regulation for occupational safety and handling materials and wastes respond to these changes. Increasing emphasis on electronics and computers place greater stress on electric power and air conditioning systems. Useful life expectancies for laboratories and hospitals are 40 to 50 years, and major renovations are frequently needed every 20 to 30 years.

The Bethesda campus has more than 70 buildings. The number of buildings, coupled with the need to continually modernize and upgrade facilities is such that construction at NIH Bethesda would still occur on a continuous basis under the No Action Alternative as existing buildings and utilities are renovated, rehabilitated, and repaired. Renovation and repair with continued building occupancy takes longer than new construction.

The Master Plan proposes construction of 30 new buildings and parking structures, demolition of 12 existing buildings, and renovation of four buildings. In addition, the Master Plan proposes upgrading the streetscape and utility infrastructure, new malls with underground parking, sidewalks and landscaping, and demolition of surface parking.

Currently, construction is underway at Building 11 on two projects, expansion of chilled water production and installation of the PEPCO cogeneration plant. The fire station, Children's Inn expansion, and Neuroscience Research Center are also under construction. Even if the Master Plan is not fully implemented, construction will be underway around the campus on several projects on a continuous basis.

The brunt of construction impacts will fall on NIH operations and employees because of proximity. Those in buildings adjacent to sites will experience the greatest amount of construction related noise, dust, and traffic. The degree to which these factors affect daily research operations or laboratory equipment, instrumentation, and conditions will run the gamut from negligible to severe, even within a single building. For some projects, such as the Central Mall and Loop Road, it may be necessary to close internal campus streets temporarily and detour traffic. The number of parking spaces on campus will fluctuate up and down as new parking structures are opened and old surface lots are demolished.
The greatest impacts to employees will occur with the Building 10 renewal or renovation. Construction is scheduled to be underway nearly continuously through four phases that will take 15 years to complete. Approximately, one-fourth of the building will be out of service in each phase. In the initial step, some of the employees will be rotated into the new Clinical Center, to vacate space for the first renewal phase. Subsequent phases will involve employee transfers internally within Building 10 as well as to and from other on site facilities as each newly renovated area is available for occupancy.

Construction impacts on surrounding residential community are dependent on proximity and general duration. Those projects with the highest potential site construction impact that are 500 feet or less to the nearest residence are:

Project	Distance to Residence	Community
North SWM Facility	150	Maplewood
MLP-B	300	Maplewood
MLP-E	400	Battery Lane
Building 34 demo/Building L	475	Edgewood/Glenwood
Loop Road/Utility Tunnel	500	Edgewood/Glenwood

Mitigation of construction site impacts would be determined at the time of project implementation when more specifics are known about the project and the resultant necessary mitigation.

Truck traffic associated with construction depends on the state of work. It can range from none or a few for several weeks to a steady stream arriving and departing every few minutes. Operations involving high truck volumes include hauling demolition and excavated soil materials away from the site, and delivery of the basic structural materials such as concrete, masonry, and steel framing.

Under both Alternatives, all construction truck traffic will enter the campus via the commercial vehicle inspection area off Rockville Pike. Departures will be entrances assigned by individual project specifications.

5.12.1 Noise

Maryland has established a maximum noise level limit of 90 dBA at property boundaries for construction sites (COMAR 26.02.03). This limit is applicable from 7 AM to 10 PM. During the hours from 10 PM to 7 AM, the maximum allowable noise level from construction at receiving commercial and residential properties adjacent to construction are 62 and 55 dBA, respectively. Limits do not apply to pile driving, but it is permitted only between 8 AM and 5 PM.

Montgomery County requirements are more stringent. The maximum allowable noise levels must not exceed 85 dBA between 7 AM and 5 PM, if the County Department of Environmental Protection has approved a noise suppression plan and 75 dBA if it has not. The general nighttime noise criteria of 62 dBA at commercial properties and 55 dBA at residential properties apply to the hours between 5 PM and 7 AM.

Noise is produced during construction by equipment, transport and handling of materials, construction related traffic, and powered hand tools. The dominant noise source at construction sites is gasoline or diesel driven equipment. Noise from different types of equipment varies by model, manufacturer, and muffling system. Tables 5-50 and 5-51 give reference noise levels at 50 feet from the source for various types of construction equipment and general construction operations.

Soils at NIH Bethesda have a relatively high load bearing capacity. Many existing campus structures are built on piles, and in general, piles will be needed for buildings over 60 to 70 feet in height. Soil characteristics are such that piles can be installed using the caisson method instead of being driven to refusal. In the caisson method, holes are drilled for piles, then the piles are inserted and grouted in place. This method is quieter than the driving method, where repeated blows are applied to the top of the pile until a set depth is reached or no further movement is recorded.

Noise would also be generated by construction related truck traffic hauling dirt and delivering concrete, steel, lumber, masonry and a myriad of other materials. This truck traffic would increase average noise levels (Leq) by 1 to 3 dBA in the vicinity of campus streets depending on the volume of traffic on a given day.

Individual pieces of equipment can emit noise levels as shown in Table 5-50. Overall noise levels from 2, 3, and 4 units of a given type operating simultaneously from 2, 3, and 4 units increase by 3, 4.7, and 6 dBA, respectively, if they are all operating within a 50 foot diameter circle. For example, for bulldozers:

Units Operating	Noise Level at 50 ft (dBA)
1	88
2	91
3	92.7
4	94

	RANGE (in dBA)	AVERAGE (in dBA)
Cranes	70-90	76
Backhoes	74-92	84
Front End Loaders	77-94	85
Bull Dozers	77-95	88
Compressors	83-92	88
Compressors With Silencers	70-78	75
Jack Hammers	95-105	100
Source: Highway Construction Noise: Measurement Prediction and Mitigation, FHWA, 1977		

TABLE 5-50 CONSTRUCTION EQUIPMENT NOISE LEVELS AND RANGES AT 50 FEET.

	AVERAGE (in dBA)
Ground Clearing	83
Excavation	88
Foundations	81
Erection	81
Finishing	88
Source: Noise from Construction Equipment and Operations, Building Equipment and Home Appliances, EPA, 1971.	

TABLE 5-51 CONSTRUCTION OPERATION OR PHASE NOISE AT 50 FEET.

Noise levels are attenuated by distance, and the level of attenuation is a function of the ground cover of the area intervening between the source and the receiver. If hard or paved, a 3 dBA reduction with successive doubling of distance is achieved. If the ground is soft or has natural cover, a 4.5 reduction with doubling of distance is achieved. Example noise levels are given in Table 5-52 for one and four bulldozers operating at a single location (50 foot diameter circle) and with hard and soft ground cover. As a construction noise mitigation measure, NIH would commit to the following for inclusion in construction specification, where feasible:

- Mix concrete off-site instead of on-site, where practical.
- Use electric instead of diesel or gasoline powered equipment.
- Use hydraulic instead of pneumatic tools.
- Schedule noisy operations to coincide with times of highest ambient noise.
- Turn off idling equipment when not in use.

Distance From Source	One Bulldozer		Four Bulldozers	
	Hard	Soft	Hard	Soft
50 ft	88	88	94	94
100	85	83.5	91	89.5
200	82	79	88	85
400	79	74.5	85	80.5
800	76	70	82	76

TABLE 5-52 ATTENUATION OF CONSTRUCTION NOISE WITH DISTANCE (in dBA)..

- Provide enclosures around stationary equipment.
- In construction areas within 500 feet of residences, require contractors to use quieter methods and powered equipment.
- Require silencers on air compressors

5.12.2 Fugitive Dust

Fugitive dust is defined as natural or man made dusts that become airborne due to wind or human activity. Construction associated with fugitive dust is generated by operations that expose or handle soil such as site clearing, excavation, fills, cuts, and grading operations. Quantities of dust generated depend on construction practices, the frequency of operations, the weather, and soil characteristics. Large amounts of dust can also be generated by demolition activities. Where demolition is internal to buildings, NIH General Provisions in construction contract specifications re quire drop cloths, drapes, barriers, and partitions to control dust and dirt that can be spread by tracking or air currents. The effect of outdoor heavy construction activities and site preparation on air quality are generally short-term and confined to the vicinity of construction activity, i.e. normally within 500 feet.

NIH is committed to including the following mitigation measures in construction specifications:

- Contractors comply with applicable State regulations governing open bodied trucks carrying loose materials.
- Areas disturbed during construction would be seeded and stabilized as soon as possible.
- Provide stabilized stone construction entrances.
- Apply spray-on adhesives to mineral soils.
- Sprinkle or wet high dust areas.

5.12.3 Sedimentation/Siltation

Sedimentation and siltation can occur when stormwater runoff flows over exposed soils without vegetative or protective cover. All construction contracts would be completed in accordance with the 1994 Maryland Standards and Specifications for Erosion and Sediment Control.

5.12.4 Scheduling

In general, contractors are permitted to work at NIH only from 7:00 AM to 4:00 PM, Monday through Friday, in accordance with the General Provisions on NIH's construction contract specifications. Some construction activities are completed outside of these hours to minimize disruptions to campus operations and activities. For example, building utility services connections to the campus systems can be made most easily during the evening or weekend hours. During these periods, they can be shut down or segmentally disconnected when loads or service requirements are comparatively low.

Contractor employee traffic would arrive between 6:30 and 7:00 AM and depart between 4:00 PM and 4:30 PM. Most contractor employees now park at a lot in Pooks Hill and are shuttled to the campus.

Delivery and unloading of construction materials are generally restricted to the normal working hours. Deliveries may occur throughout the day. Construction specifications at NIH assign specific pre-approved routes to the work site for deliveries. Future specifications can route truck deliveries to the Rockville Pike and South and Center Drive entrances or to the Center Drive entrance on Old Georgetown Road as a mitigation measure.

5.12.5 Construction Waste

Construction generates considerable amounts of waste materials and debris. These include materials from demolition; trimming and fitting; and packaging and shipping. Based on current generation from renovation projects, it is estimated that about 1,500 tons per year of construction wastes will be produced. There will be considerable variance in amounts depending on the number and type of projects underway at any one time. NIH General Provisions in construction contract specifications require prompt removal of all waste material and debris.

5.12.6 Hazardous and Other Materials

NIH has a standard protocol for inspection and removal of hazardous and other materials prior to demolition. The inspection and testing phase can last for several weeks; removal of materials, several months. If necessary, prior to demolition or renovation, radioactive, chemical, and biomedical materials would be relocated using standard NIH procedures for distribution, handling, storage, and collection of such materials. If the contractor uses hazardous working materials in the course of work, the contractor must maintain Material Safety Data Sheets, and store, handle, and use the materials in accordance with OSHA regulations.

Asbestos was commonly used for nearly half a century in standard construction prior to investigations revealing its potential hazards. Asbestos is most frequently found as pipe insulation, as a sprayed on fire retardant protective covering for structural beams and columns, and as vinyl asbestos tile flooring. Removal is accomplished by specially trained and permitted contractors. Work areas are sealed to prevent airborne transmission of fibers beyond the work area. Work involving asbestos removal, and disposal is strictly controlled by Federal regulations, including EPA regulations at 40 C.F.R. Part 61, Subpart M, and OSHA regulations at 29 C.F.R. § 1910.1101.

5.13 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS

The Master Plan is a guidance document for future development. Any adverse impacts are therefore conditional upon implementation of individual projects proposed in the plan.

Unavoidable adverse impacts associated with the Alternatives, if implemented, include:

- Construction Impacts

If the Master Plan Alternative is fully implemented, about 70 to 80 large construction projects would be necessary to build new buildings and demolish existing buildings, expand and upgrade the utility support structure, consolidate campus parking in structures, and improve roads, walks, malls, and landscaping. The Bethesda campus has more than 70 buildings. The large number of buildings is such that at any one time, there is a need for renovation or expansion of buildings. While the No Action Alternative proposes no new development beyond that needed to satisfy regulatory criteria and serious overcrowding, construction would still be necessary.

The number of projects associated with either alternative implies that construction would be underway on one or more projects on the campus on a continuous basis over the 20 year planning period. The number and scale of projects associated with the Master Plan Alternative are greater than that for the No Action Alternative. Under both alternatives, NIH employees, visitors, and neighboring residents will be unavoidably subjected over the long term to construction related impacts such as construction traffic, noise, dust, and campus detours. These impacts would be mitigated by the measures proposed in Section 5.12.

- Energy Impacts

Increasing the number of buildings and occupiable floor area for research and clinical facilities as proposed in the Master Plan Alternative, would unavoidably increase energy consumption for heating, cooling, and supplying electric power. Energy consumption would also increase under the No Action Alternative, but to a significantly lower level. Additional energy would be consumed in the construction and demolition processes. New construction provides the opportunity to include many conservation measures in the design and construction of new facilities.

- Mature Tree Loss

It is estimated that implementation of the Master Plan would result in the loss of about 500 mature trees on the campus. Over the 20 year planning span, some of these mature trees would be lost to natural attrition.

5.14 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The proposed action is a planning document and does not commit resources irreversibly or irretrievably per se until implementation. If the Master Plan Alternative is implemented in whole or in part, the following resources would be committed:

- Energy

Fossil and nuclear fuels would be committed, either directly or indirectly, to construct, maintain, heat, cool, and power proposed campus facilities. Energy would also be committed for employee transportation, either in vehicles or by public transit.

- Building Materials

Implementation of the proposed action involves commitment of a range of natural and raw materials for construction of facilities. Additionally, large amounts of labor and natural resources are used to fabricate and manufacture construction materials. These materials generally are not retrievable, but recycling of building materials such as copper pipe, metals, and some plastics is increasing. In general, materials needed for construction are not in short supply, and their use will not have an adverse effect upon continued availability of these resources.

5.15 LOCAL SHORT TERM USE AND LONG TERM PRODUCTIVITY

While the proposed Master Plan Alternative would require the use of resources for construction, operation and maintenance, this would be offset by the enhancement of long-term productivity in biomedical research. NIH could continue its legislative mission as a world-class basic and clinical research facility, exploring the causes and cures for diseases and afflictions, both directly on the campus and through its extramural research program. NIH is a key element in the productivity of biomedical research throughout the world. Economic benefits accrue directly through its grant and research programs. Much more importantly, however, nearly every American citizen will benefit in the long term from medical advances made at NIH, or under its auspices in the extramural research program.

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