Chapter Four
Existing Conditions on the RML Campus

4 Baseline Conditions on the RML Campus

As noted in Chapter 1, the Master Plan is based on data and conditions existing at the close of calendar year 2005. This date is the baseline for the personnel and space projections in the plan, as well as for cataloging campus conditions. Unless otherwise noted, the information in this chapter is from baseline year 2005.

4.1 Site Overview

4.1.1 Site Size and Condition

The Rocky Mountain Laboratories (RML) is approximately 33 acres in size and located in the southern portion of the City of Hamilton. The principal borders of the property are as follows:

- North – Baker Street, residential streets and properties, and a parcel belonging to the school district of Hamilton which contains a senior citizens' recreation center.
- East – 4th Street with single-family residences opposite the RML property, and an alleyway serving the residential area.
- South – The boundary between the city and Ravalli County. The area is a single-family residential neighborhood with yards, driveways, alleyways and miscellaneous structures abutting the RML property line and fence.
- West – The Bitterroot River, its floodplain and wetlands. The area is also part of a contiguous River Park belonging to the city.

See Figure 4.1.1-a

The site is of diverse character with buildings that vary in size, style, and materials. Two Colonial Revival, two-story, wooden, residential clapboard sided buildings are located in a park-like setting in the southeast corner of the site separated from the rest of the campus by the 4th Street extension. Visible from the 4th and Grove Streets intersection is a cluster of laboratory buildings ranging in height from two to four stories and consisting of campus Buildings A, 1, 2, 3, 5, 6 and 7. This red brick Neo-classic academic-style complex is known as the Quad. New, one-story, modern western-style stone, timber and stucco structures that serve as Building 30 (the Visitors' Center) and Building 29 (the Shipping and Receiving Building) complete the perimeter buildings in the northeast corner of the site. At the center of the site is Building 28, a new, modern, three-story glass and masonry laboratory building that dominates the site. This building is also known as the Integrated Research Facility, or IRF. On the rest of the site are various one-story, split-faced masonry and metal utilitarian buildings with above-ground utilities and support structures. The site has very little vegetation except in the southeast area, and is largely comprised of graveled or barren ground outside the area immediately adjacent to the Quad. The appearance is somewhat industrial, and there is little or no sense of cohesion or order other than the comparatively tranquil southeast corner of the site. See Figure 4.1.1-b.

4.1.2 Land and Building Use

As will be seen from Figure 4.1.2, the site has five categories of building use:

- Research (primarily laboratories, researchers' offices and support space)
- Animal Holding
- Administration
- Service and Support
- Mechanical (including boiler and refrigeration plants, emergency power, switchgear, etc.)

These functions are somewhat scattered, but the research is generally in the Quad, Building 28, and portions of the one-story utilitarian buildings adjacent to these main research buildings.

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Hamilton, Montana

Figure 4.1.1-a

RMLSite

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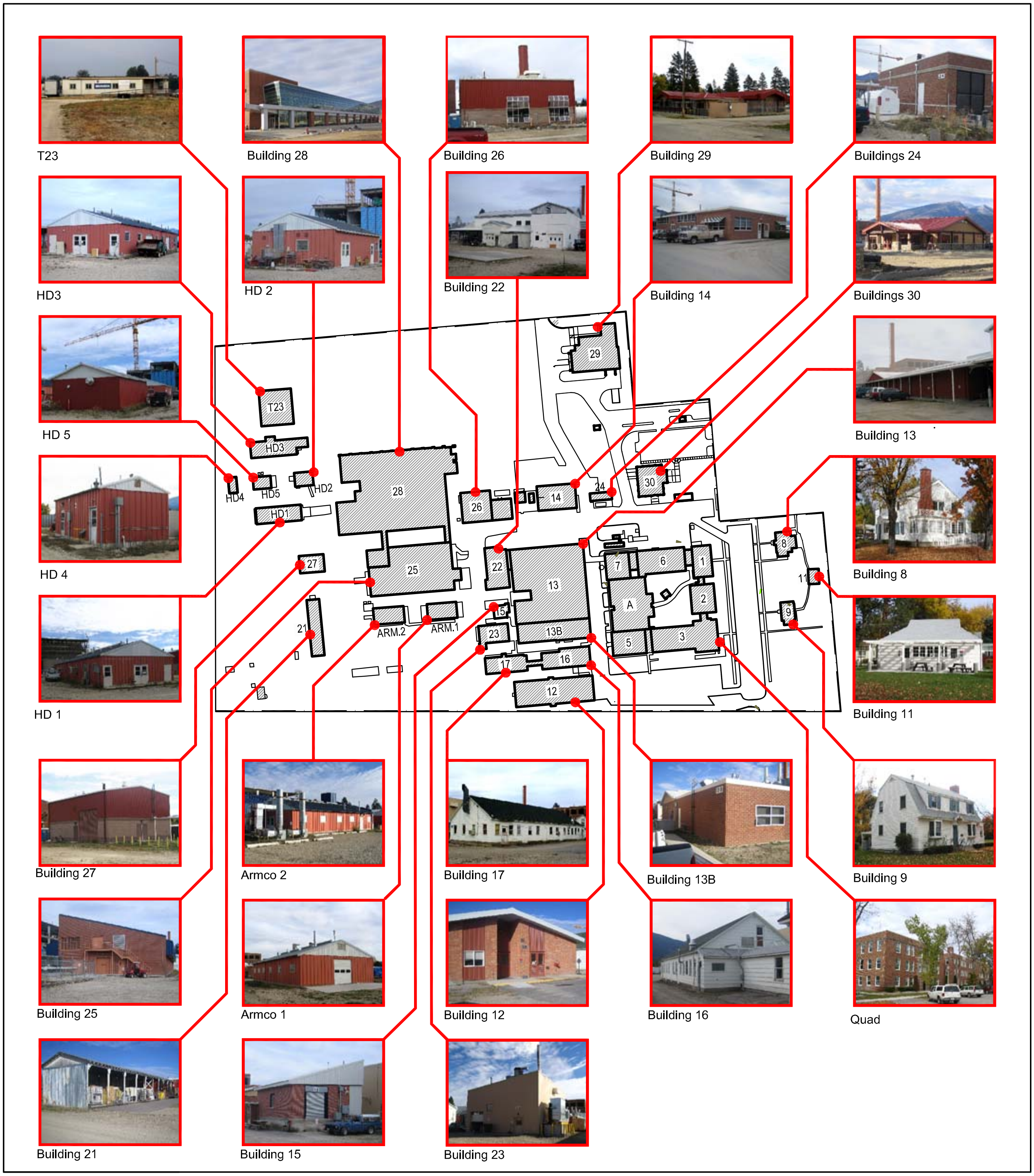

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Figure 4.1.1-b

Building Photos

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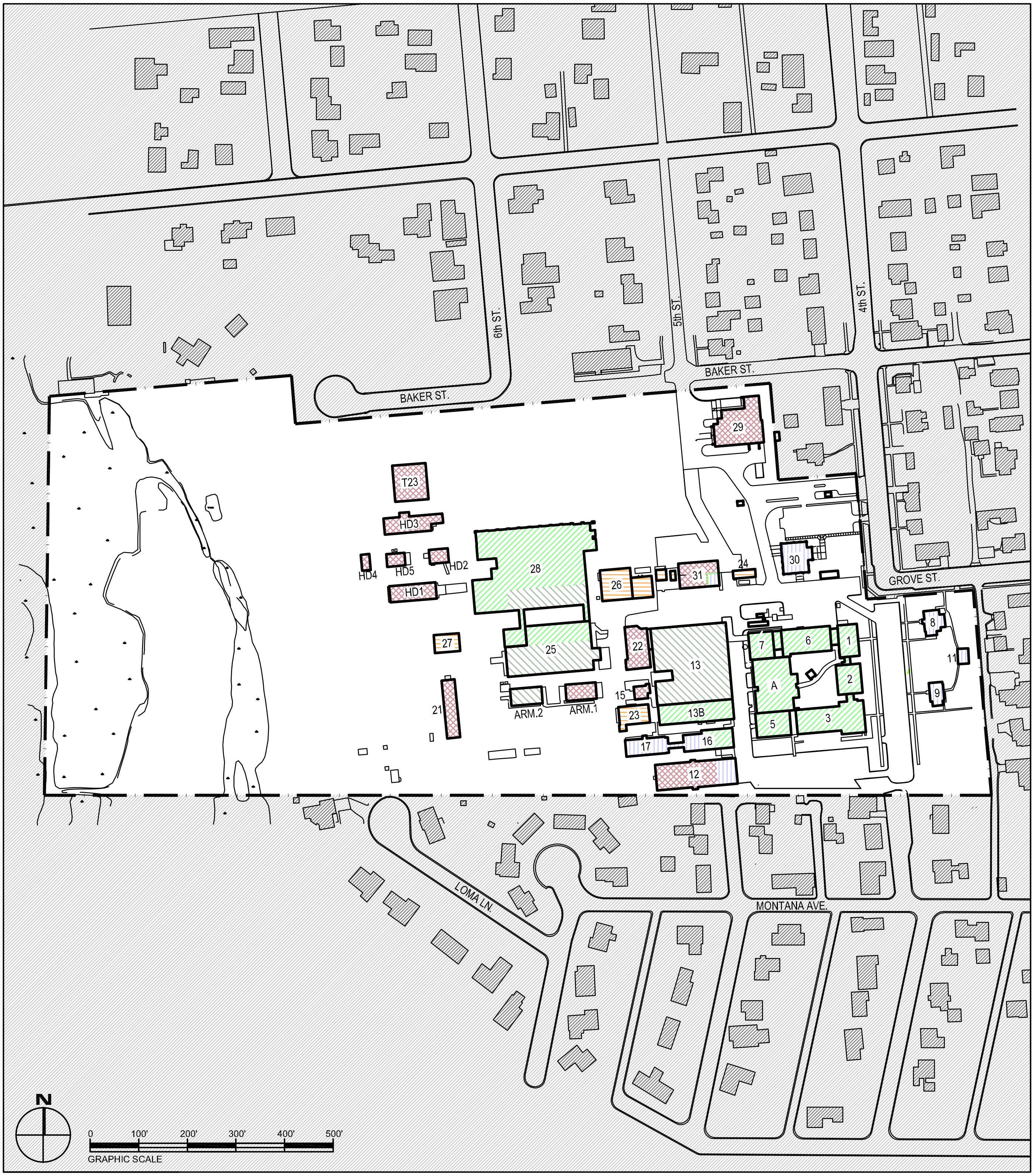

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- Research
- Animal
- Service/Support
- Administration
- Mechanical

Figure 4.1.2

Building Use

Animals are housed primarily in Buildings 13 and 25 and portions of Building 28. Administration is located in portions of the Quad and in Buildings 8, 9, and 30.

The remaining activities scattered about the campus are support buildings of various kinds or mechanical/electrical equipment. The campus buildings and functions are summarized in Table 4.1.2a.

Table 4.1.2a Existing Campus Buildings

Building	Gross Area	Primary Use
1	8,246	Research
2	9,468	Research
3	24,814	Research
A	24,929	Support
5	7,224	Research
6	15,000	Research
7	3,975	Vacant
8	4,461	Administration
9	3,156	Administration
11	660	Administration
12	7,690	Visual Medical Arts and Freezer Storage
13	17,800	Animal Research
13B	5,880	Research
14	4,000	Storage
15	1,092	Radiological Waste Storage
16	3,520	Research Support
17	2,975	Storage
21	2,843	Equipment Storage
22	2,624	Central Stockroom
23	2,356	Incinerator
24	700	East Emergency Generator
25	15,332	Research
26	3,844	Central Boiler Plant
27	1,961	West Emergency Generator
28	105,000	Integrated Research Facility
29	7,525	Shipping and Receiving
30	3,562	Visitors' Center
HD1	3,072	Maintenance
HD2	1,120	Maintenance
HD3	3,482	Maintenance
HD4	512	Maintenance
HD5	864	Maintenance
SS1	384	Storage
SS2	216	Storage
SS3	216	Storage
ARMCO1	2,048	Storage
ARMCO2	2,048	Animal Research
T23	4,624	Maintenance
Total	**309,223**	

Most of the land area not dedicated to structures is devoted to paved and unpaved parking and circulation paths with patches of vegetation dispersed throughout the campus. Most of vegetation is concentrated in the southeast corner of the campus. Refer to Figure 4.1.2b for a summary of pervious and impervious areas. Also see Table 4.1.2b.

Table 4.1.2b Baseline Land Areas

Land Use	Acres	% of Site
Open Space		
Landscaped	2.7	8.2%
Other	21.3	64.6%
Circulation		
Parking, Roads, Walks, Service	4.4	13.3%
Buildings	4.6	13.9%
Totals	33	100%

4.1.3 Density

The density of the site with the completion of Building 28 will be approximately equivalent to a Floor Area Ratio (FAR) of 0.2, with a lot occupancy of 13.4%. The only comparable density in the Hamilton Zoning Ordinance allows 70% lot occupancy at three stories for Industrial and Commercial Manufacturing uses. This would yield an FAR of 2.1.

The tallest building on the RML campus is Building 28 at 52 feet, slightly higher than the highest portion of the historic Quad (Building A) at 50 feet. The Hamilton Zoning Ordinance restricts most zones to a maximum of 45 feet or three stories, though no height is specified for the Public Institutional zone (in which RML is located) or for the adjacent Single-Family Residential zone.

The campus population density is about 7.6 persons per acre when all employees are present, compared to a density of about 12 persons per acre permitted by the City of Hamilton's Zoning Ordinance for a Single-Family Residential zone (such as the neighborhood to the immediate north). In the Single-Family Residential zone, 7,000 square foot minimum lots would yield about six houses per acre and the average household size of 1.95 persons per dwelling unit for Hamilton in the 2000 Census would result in about 12 persons per acre.

4.2 Natural Features

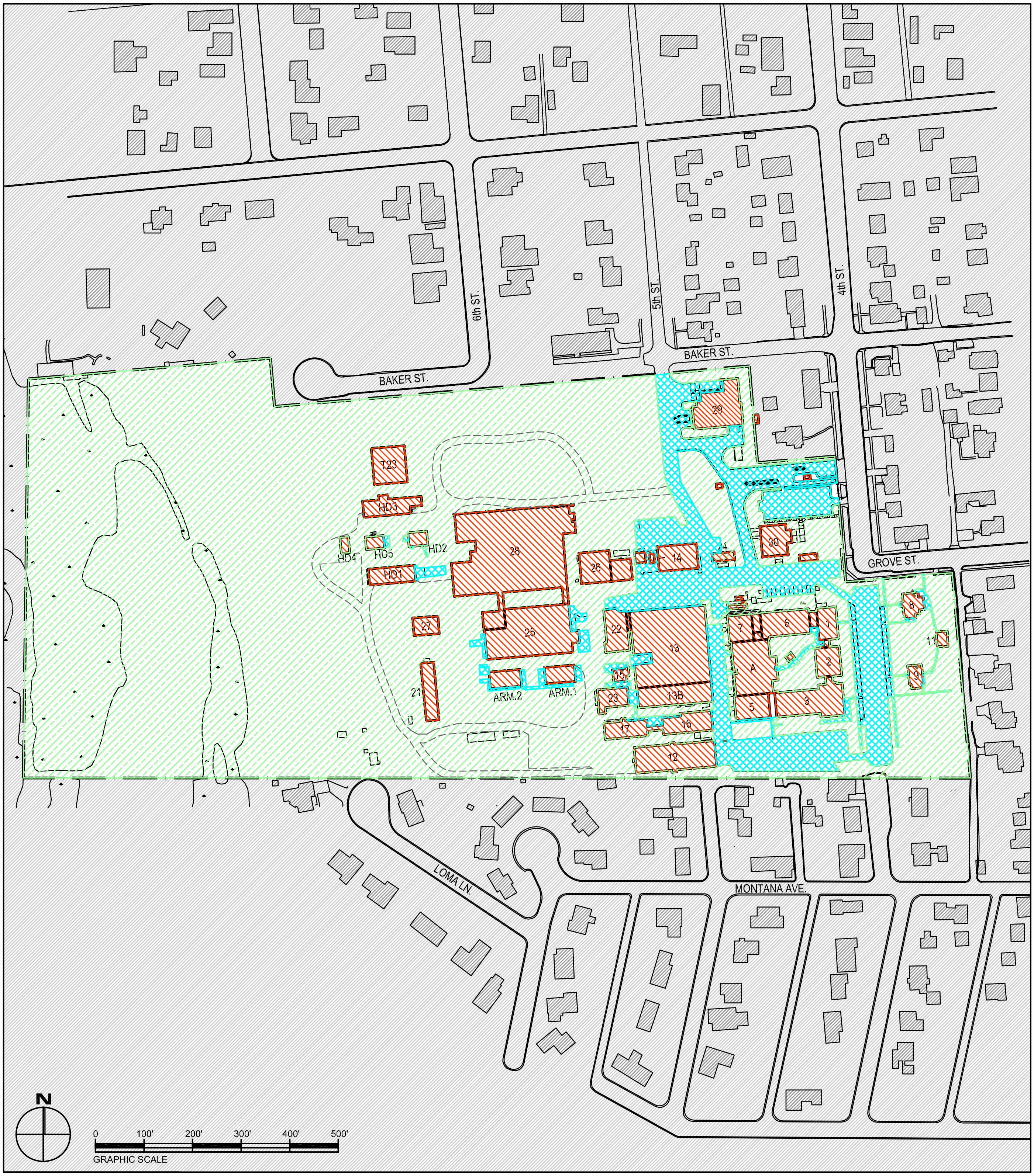
The RML property is mostly flat, with an elevation of 3,585 feet above sea level (asl) at its most eastern end at 4th Street, sloping to 3,580 feet asl at the western end before descending to the floodplain, wetlands and river which are at 3,557 feet.

4.2.1 Floodplain

Refer to Figure 4.2. The west end of the RML property is in the Bitterroot River floodplain, which lies approximately at 3,563 feet asl.

Floodplains, such as the far western end of the RML site, are areas of relatively flat land bordering a river that are inundated fully and partially when the river floods. Floodplains are formed by fluvial erosion and deposition of sediment during floods. The extent of floodplain inundation depends in part on the magnitude of the flood, defined by the return period. Federal policy governing construction within floodplains is as follows:

> Executive Order 11988 requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains



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Pervious Area
Impervious Area - Pavement
Impervious Area - Roof

Figure 4.1.2b

Pervious and Impervious Areas

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Wetlands

Floodplain

Site Contour- 5' interval

Site Contour- 1' interval

Figure 4.2

Natural Features

and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. As applied to RML's west end of the property, the Order requires, in part, that RML, "… take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by flood plains in carrying out its responsibilities" for the following actions:

- acquiring, managing, and disposing of federal lands and facilities;
- providing federally-undertaken, financed, or assisted construction and improvements; and
- conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities.

No RML facilities are located within the property's floodplain area.

4.2.2 Wetlands

Refer to Figure 4.2. The west end of the RML property is in the wetlands of the Bitterroot River, which correspond roughly, but not exactly, with the floodplain.

Generally, wetlands are lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface (Cowardin, December 1979). Wetlands vary widely because of regional and local differences in soils, topography, climate, hydrology, water chemistry, vegetation, and other factors, including human disturbance. Indeed, wetlands are found from the tundra to the tropics and on every continent except Antarctica.

For regulatory purposes under the Clean Water Act, the term wetlands means "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas." [from the EPA Regulations listed at 40 CFR 230.3(t)]Protection of the nation's wetlands is provided under Section 404 of the Clean Water Act:

> The basic premise of the program is that no discharge of dredged or fill material may be permitted if: (1) a practicable alternative exists that is less damaging to the aquatic environment or (2) the nation's waters would be significantly degraded. In other words, when an applicant applies for a permit, he must show that he has, to the extent practicable:
>
> - Taken steps to avoid wetland impacts;
> - Minimized potential impacts on wetlands; and
> - Provided compensation for any remaining unavoidable impacts.

Minor road activities, utility line backfill, and bedding are activities that can be considered for a general permit. States also have a role in Section 404 decisions through State program general permits, water quality certification, or program assumption.

4.2.3 Geology

The Bitterroot Valley is a north-south trending intermontane basin about seven miles wide and 64 miles long, encompassing about 430 square miles. The Bitterroot Valley ranges from approximately 5,500 feet asl on its highest terraces to 3,250 feet at its termination at the Missoula Valley. It is bounded by the Bitterroot Mountains on the south and west, the Sapphire Mountains on the east, the Anaconda-Pintler Mountain range on the southeast, and the Missoula/Clark Fork Valley on the north. The Bitterroot Valley is characterized by two topographic features: a broad one- to two-mile wide floodplain in the center of the basin; and high, broad alluvial/colluvial terraces on the east and west flanks that are on average two to three miles wide. The terraces slope from 4º to 5º on the basin edges to less than 1º near the Bitterroot floodplain. West side terraces slope gently and merge with the floodplain and are bisected by small drainages. East side terraces have generally smooth topography, are flat topped, and relatively steep escarpments ranging 50 to 150 feet above the floodplain (Kendy and Tresch 1996).

4.2.4 Geologic Structure and Seismicity

The Bitterroot Valley is a structural basin formed during the emplacement of the Idaho Batholith in the late Cretaceous or early Tertiary Period resulting from basin floor dropping along pre-existing faults (McMurtrey et al. 1972) or as a result of eastward block displacement of crustal material along low-angle thrust faults (Hyndman *et al.* 1975). Geophysical data indicate that the western valley margin is relatively straight, but the eastern side has an irregular margin (Noble *et al*. 1982). The structural depth of the basin is one mile (Lankston 1975). Lower Tertiary age sediments within the basin have been deformed into a faulted syncline, whereas Pliocene sediments are relatively undisturbed (McMurtrey *et al*. 1972), indicating that the major tectonic events that formed the Bitterroot basin have slowed considerably since the end of the Tertiary period. The basin is on the western edge of a broad region of basin and range tectonism. Extensional tectonism in the Bitterroot Valley, relatively dormant at present, occurs along existing fractures which are part of a regional northeast, northwest, and north-south trending fault system that exhibit long histories of recurrent activity (Barkman 1984).

At least six Class A faults or fault systems have been identified within 100 miles of the Hamilton area in western Montana (Haller et al. 2000). The closest Class A fault to Hamilton is the Bitterroot Fault, which runs along the east flank of the Bitterroot Mountains for a distance of approximately 60 miles and dips 45° to 90° east (Lindgren 1904, McMurtrey *et al*. 1972). The age of the faults extends from Cenozoic into late Quaternary time, with the most recent deformation occurring in pre-Bull Lake and Bull Lake glacial deposits, 300,000 to 130,000 years ago (Barkman 1984). The surface traces of the Bitterroot Fault system are shown by McMurtrey *et al*. (1972) as four traces that run along and into the Bitterroot Range from near Florence to south of Victor. Barkman (1984) identified several distinct fault scarps in the Bitterroot Valley that have been active in Quaternary time: the Bear Creek Scarp and the Curlew Fault located west of Victor, and the Tin Cup and Como Scarps located north of Tin Cup Creek.

The most recent faulting appears to have occurred around 7,700 years ago on the Mission Valley section of the Mission Fault. Class A faults have evidence that at least one large-magnitude earthquake occurred on that fault during the last two million years. Within the last 40 years, two recordable earthquakes greater than 2.5 Richter magnitude have occurred within 50 miles of Hamilton. In 1982, a 2.5 Richter magnitude tremor occurred approximately 20 miles southeast of Hamilton (Stickney et al. 2000), and on June 28, 2000, a 4.5 magnitude earthquake occurred approximately 40 miles northeast of Hamilton.

The Bitterroot Valley has one of the lowest seismic activity ratings in western Montana (Stickney *et al*. 2000). The International Conference of Building Officials (ICBO) rates Hamilton as a low seismic risk area (Zone 0). By comparison, Salt Lake City is in Zone 2, and part of San Francisco is in Zone 4.

4.2.5 Vegetation and Ground Cover

Vegetation within the RML campus consists of sparse lawn grasses and weeds competing with pavement, buildings and pebbly bare earth, except for the southeast corner of the property where some mature trees stand between the east side of the Quad (Buildings 1, 2 and 3) and the existing historic houses (Buildings 8 and 9) along the current parking lot which was formerly the right-of-way of 4th Street. The trees are a mixture of deciduous, including elms, in various states of health, and various conifers.

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4.2.6 Fish and Wildlife

In the vicinity of Hamilton, the Bitterroot River provides a variety of game fish, including: bull trout, brook trout, brown trout, rainbow trout, westslope cutthroat trout, and mountain whitefish. Brook, brown, and rainbow trout are not native to the Bitterroot River. The river is one of the regional recreational attractions because of the fishing.

The fauna of the valley near Hamilton is characteristic of the northern Rocky Mountains. Many species of mammals, amphibians, and reptiles may occur in the vicinity of Hamilton and RML. Also, a wide variety of birds may breed in the valley near Hamilton. Wildlife habitat has generally been altered by agriculture and other human developments. Highly altered urban environments meet the habitat needs of fewer species, most of which tend to be generalists, and several of which are non-native (e.g., European starling, house mouse, eastern fox squirrel). Species inhabiting urban environments tend to be tolerant of disturbance.

Common species of mammals that may occur in or adjacent to Hamilton include white-tailed deer, mule deer, coyote, red fox, striped skunk, raccoon, badger, long-tailed weasel, deer mouse, house mouse, meadow vole, Columbian ground squirrel, yellow-bellied marmot, eastern fox squirrel, several species of bats (e.g., big brown bat), and shrews (e.g., masked shrew). Terrestrial garter snakes, common garter snakes, and gopher snakes may live in Hamilton. Common bird species likely to breed in the urban habitats of Hamilton include rock dove, mourning dove, great horned owl, downy woodpecker, hairy woodpecker, northern flicker, western wood-pewee, eastern kingbird, tree swallow, barn swallow, black-billed magpie, black-capped chickadee, house wren, American robin, European starling, warbling vireo, yellow warbler, western tanager, American tree sparrow, chipping sparrow, dark-eyed junco, brown-headed cowbird, house finch, American goldfinch, and house sparrow.

4.3 Built Environment

4.3.1 Site Organization

The RML site is organized in an orthogonal grid pattern which parallels the surrounding Hamilton streets and is most apparent around the Quad. More recently, Building 28, located in the approximate center of the site, provides a new focus visually since it is the largest and tallest building on the campus.

These dominant buildings and the recently completed Building 30 and Building 29 are of an architectural character that conveys a sense of permanency that is less characteristic of many of the other buildings on site. While all buildings are related to the orthogonal grid, and many are of masonry construction, they are of a more utilitarian design and appear transitory and incidental to the other structures.

In the southeastern sector of the site, opposite the east face of the Quad, are two wooden houses that originally fronted on 4th Street when it continued past Grove Street (where it now terminates) to Montana Avenue south of the property. The former street right-of-way has been used for on-site parking for many years. Interspersed among the occupied buildings are a variety of smaller structures housing mechanical, electrical and storage functions.

4.3.2 Places and Open Spaces

Although the arrangement of buildings and landscape on the RML campus lacks a formal orthogonal geometry, the open space extending from the former main entrance to the site at 4th and Grove Streets to the connection between Buildings 25 and 28, contain elements of the axial master planning philosophy that was prevalent in the early 20th Century. This portion of the campus is flanked on both north and south by a miscellany of buildings and structures that frame an irregular open service courtyard. Spaces leading north or south from this axial service yard are loosely defined spaces mostly occupied by circulation and service functions with little architectural definition or character.

Between Buildings 25 and 28 and within the Quad complex are the only formal exterior courtyards on the campus, and these spaces are accessible only from the buildings that surround them.

There remains a large amount of unoccupied open space, especially on the north and west portions of the site, which are undefined architecturally. The western portion of the site which extends to the Bitterroot River has the most compelling aspect which is the Bitterroot Mountains rising across the river from the site, and provides a backdrop of singular beauty.

4.3.3 Building Heights

Until completion of Building 28 at a height of 52 feet, the tallest building on site was a portion of the Quad at 50 feet. All other buildings except the residences (Buildings 8 and 9) are single-story and relatively low profile. Refer to Figure 4.3.3. The placement of the tallest building at the center of the site provides a focus that is visually apparent from nearly every vantage point surrounding the campus, although the Quad continues to retain a sense of prominence when seen from 4th Street or Grove Street from which most traffic approaches the site.

4.3.4 – Building Area Summary:

Table 5.2.1 in Chapter 5 lists existing buildings by gross area and existing use.

4.3.5 Building Conditions

Building conditions on the RML campus are rated using a performance metric established by the Department of Health and Human Services (DHHS). The Condition Index (CI) is a general measure of constructed asset condition which the Federal Real Property Council requires agencies to track for all their facilities. It is calculated as the ratio between the repair needs of the asset and its replacement value. NIH has committed to achieve a CI of 90 or more for all its buildings by 2017 (except for Building 10 on the Bethesda campus).

A summary of building conditions is graphically presented in Figure 4.3.5-a. Buildings with a CI score of 90-100 are shown as “Excellent”, those with a score of 80-89 are shown as “Fair”, and those below 80 are identified as being in “Poor” condition. Building 28, the IRF, has not yet been rated on its Condition Index. However, since this is a new facility it is shown in Figure 4.3.5 as “Excellent”. Building T23 is a leased trailer and has likewise not been rated; temporary leased trailers are not required to be rated.

The Condition Index Ratings are summarized in Table 4.3.5.

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UP TO 20'

UP TO 40'

UP TO 52'

Figure 4.3.3

Building Heights

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Hamilton, Montana

Excellent- Condition Index Rating of 90-100
Fair- Condition Index Rating of 80-89
Poor- Condition Index Rating below 80

Figure 4.3.5

Building Conditions

Table 4.3.5- Conditions Index Ratings

Building	Condition Index	Building	Condition Index	Building	Condition Index
RML-A	99	RML-13B	99	RML-29	100
RML-01	94	RML-14	90	RML-30	100
RML-02	99	RML-15	87	ARMCO-1	98
RML-03	99	RML-16	89	ARMCO-2	100
RML-05	99	RML-17	38	RML-HD 1	90
RML-06	99	RML-21	84	RML-HD 2	81
RML-07	76	RML-22	87	RML-HD 3	82
RML-08	95	RML-24	100	RML-HD 4	75
RML-09	92	RML-25	99	RML-HD 5	100
RML-11	100	RML-26	99	T-23	Not Rated
RML-12	100	RML-27	99		
RML-13	99	RML-28	Not Rated		

4.3.6 Building Functional Suitability

Functional suitability is based on the ability of a particular structure to continue to be used effectively for the activity assigned to it. In some cases, buildings which are judged to be in fairly good structural condition may no longer meet the functional requirements of the uses they house, or may not have a high reuse potential for other activities. Buildings deemed to be obsolete could not practically be reused because of inadequate mechanical systems, inflexible structural systems, building configuration, or cost factors.

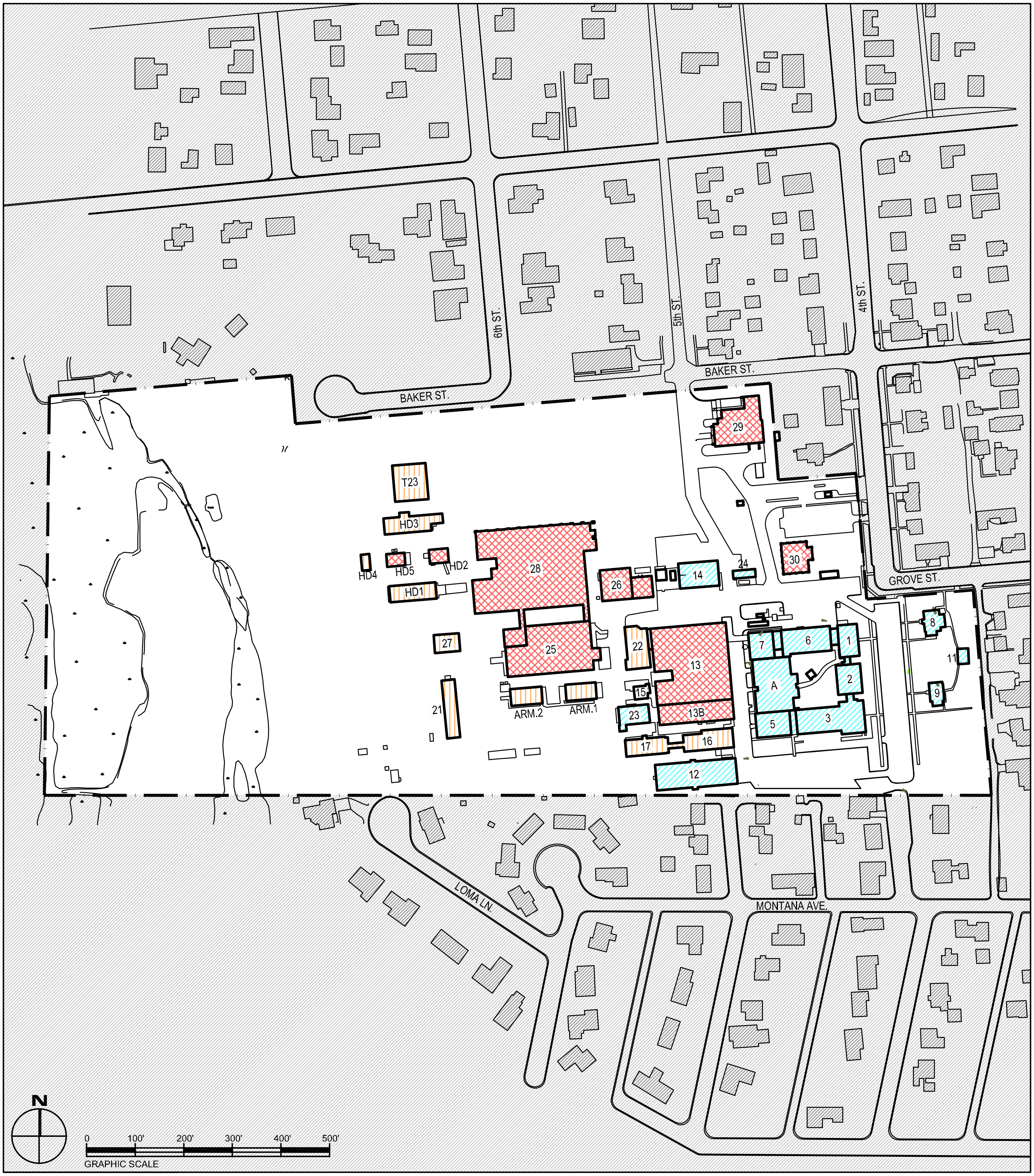
Most buildings on campus are considered to be functional for the uses they currently house. Marginal buildings include prefabricated buildings, industrial buildings and a barn that have been retrofitted for functions other than their original purpose. A summary of building functional suitability is graphically presented in Figure 4.3.6.

4.3.7 Campus Entries

The quality and character of entries onto the RML campus create an important arrival image for employees as well as visitors. Campus entries also act as key orientation points for understanding the organization of the entire site. The two existing campus entries, at 4th and Grove Streets and 5th and Baker Streets, have only limited landscaping or architectural features, but are obvious for the gates and guardhouses present at these locations. Visitors' and employees' vehicles, bicyclists, and pedestrians enter at 4th Street, and commercial delivery and service vehicles access the campus from Baker and 5th Streets, as shown in Figure 4.3.7. The 4th Street entrance has a sign identifying the installation, and its width, its gate arrangement, and the prominence of Building 30 set it apart as the main campus entry point. The second entrance has few distinguishing features. The remainder of the site perimeter is closed by a security fence. Previously, the main entrance was at 4th Street, between Baker and Grove Streets with a secondary entrance just east of 4th at Grove Streets. Both have been permanently closed.

4.4 Circulation

Although, as stated above in Section 4.3.7, the entrances to the RML campus are clear and few in number, the circulation onsite is less well defined beyond the entrance gates and control points. Because of the scattered buildings on the site and their multiple entrances, and informal parking and service areas, buildings are virtually surrounded by pavement or gravel drives which are shared by all forms and modes of circulation – vehicular, pedestrian and bicycle. Visitor vehicles are



NIH-RML
Master Plan
Hamilton, Montana

Excellent
Good
Poor

Figure 4.3.6

Functional Suitability

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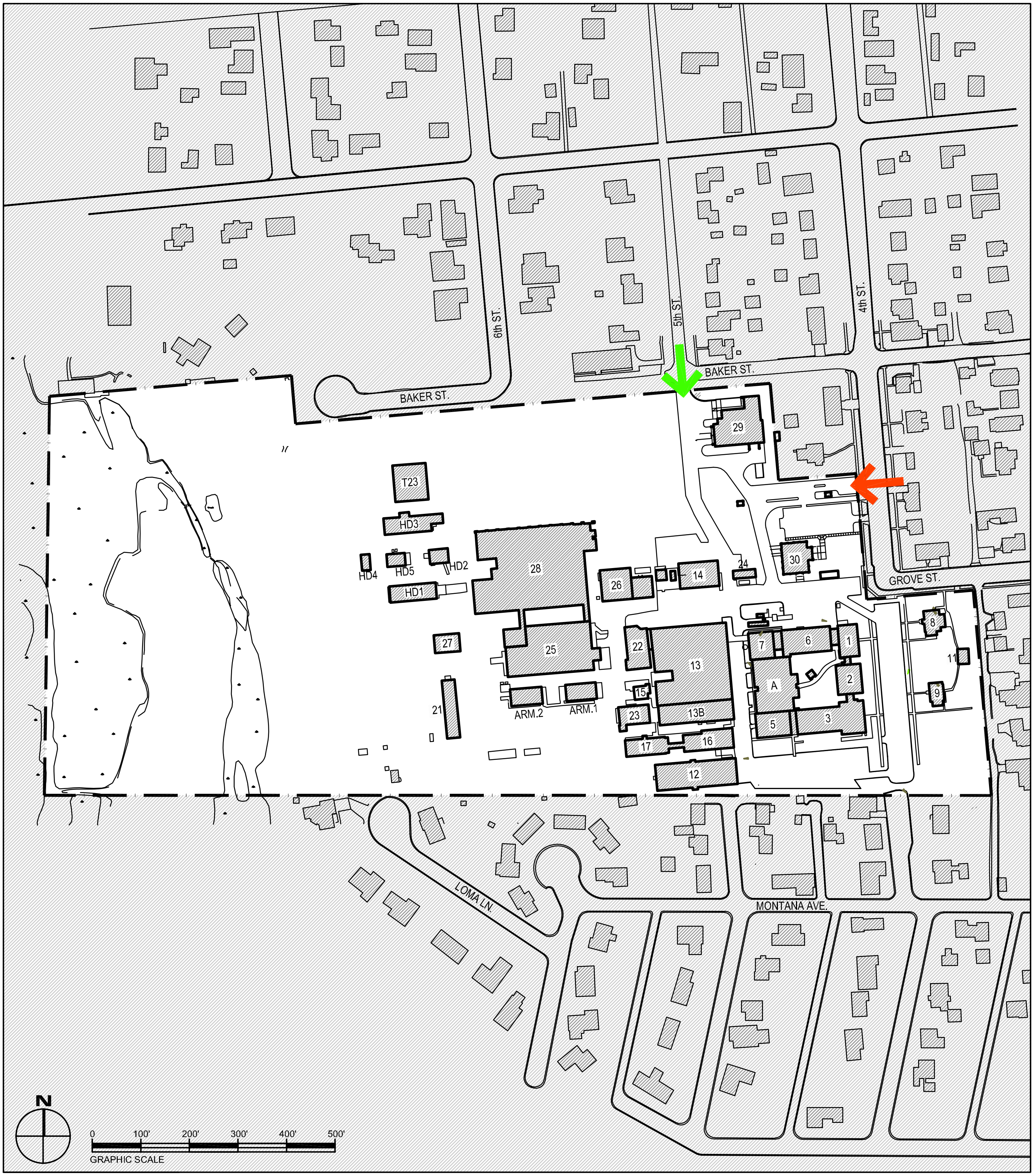


NIH-RML Master Plan

Hamilton, Montana

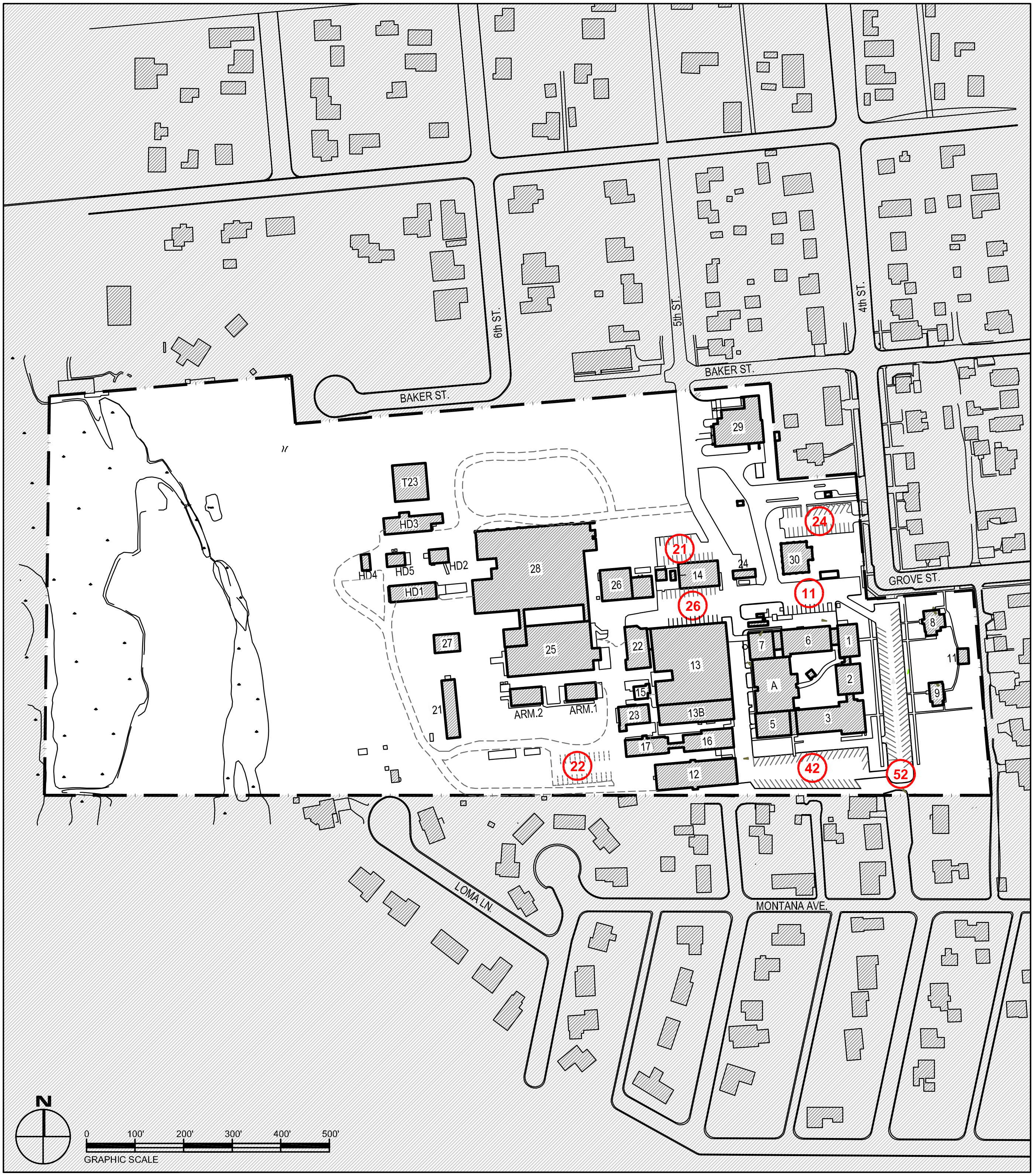
Passenger Vehicle, Pedestrian & Bicycle Entry

Service Entry

Figure 4.3.7

Campus Entries

NIH/ORF/DFP LSY Architects Oudens + Knoop Architects, PC



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Hamilton, Montana

24 Parking Area - Number of Spaces

Unpaved Drive

Figure 4.4.1

Parking Distribution

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confined to a visitor parking lot clearly demarcated and located outside the secure perimeter near the Visitors' Center. Similarly, commercial delivery vehicles are generally restricted to the service yard immediately inside the gate at Baker and 5th Streets and the loading bays for the Shipping and Receiving Building. Some service vehicles belonging to contractors, suppliers, vendors, etc., are permitted to proceed directly to destinations on campus after security screening. The shared use of the paved areas is seldom a serious problem due to the very light vehicle volumes on the site.

4.4.1 Parking

With the exception of dedicated parking for 24 visitors' vehicles at the 4th Street entrance, all other parking is distributed around the buildings with the largest lots totaling 94 spaces to the east and south of the Quad. Eleven spaces are provided north of the Quad; 26 spaces have been located between Buildings 13 and 14; and 21 spaces are located north of Building 14. Another 22 are located west of Building 17. Additional parking occurs in undefined areas throughout the campus. See Figure 4.4.1.

4.4.2 Access for Persons with Disabilities

Existing buildings on the RML campus are required to meet the criteria of the Uniform Federal Accessibility Standards (UFAS). As a federal entity, the NIH does not fall under the jurisdiction of the Americans with Disabilities Act (ADA). However, the agency has adopted the Americans with Disabilities Act Accessibility Guidelines as its standard for accessibility planning for new construction.

4.5 Amenities

The proximity of commercial services in Hamilton has obviated the need for on-site amenities for the most part.

- Dining – Many employees bring their own lunches to work; others drive to their nearby homes; while still others frequent restaurants on U.S. Route 93. No on-site dining is offered other than scattered vending machines.
- Child Care – No on-site child care is offered, and it is presumed that all employees make their own arrangements within the community.
- Recreation and Fitness – Commercial fitness facilities are available in Hamilton, and there are many recreational opportunities throughout the Bitterroot Valley, including hunting, fishing, hiking, skiing and other sports. Although there are no formal recreational facilities on site, the adjacent River Park system is used by RML employees at times for walking, picnicking and other recreation.

In preparing the Master Plan, the RML staff was asked to respond to a questionnaire using a scale from 1 (Essential) to 5 (Unnecessary) to determine preferences for amenities such as conference rooms, food service, staff lounges, fitness centers, staff showers, bicycle racks and break rooms. The results of this survey are shown on Table 4.5. Fifty-five staff members participated in the survey. The results of the survey indicate clear preferences for bicycle racks, break rooms, showers and lockers, food concessions and conference rooms for 5-15 people. Full service dining and conference rooms for 3-5 were seen as less important.

Table 4.5-Amenities Questionnaire Results

Amenity	Rating-Number of responses Essential 1	2	3	4	Unnecessary 5	Total Responses	Average Rating
Conference Rooms							
for 3-5 people	3	7	19	8	18	55	**3.56**
for 5-15 people	19	18	10	1	7	55	**2.25**
for 15-30 people	14	14	15	2	10	55	**2.64**
for 30-50 people	9	7	10	7	22	55	**3.47**
Food Service							
Full Service Dining	3	11	12	10	19	55	**3.56**
Concessions	20	11	14	6	4	55	**2.33**
Catering	3	12	17	7	16	55	**3.38**
Lounge Areas	8	18	10	11	8	55	**2.87**
Day Care	11	12	15	3	14	55	**2.95**
Fitness Center	17	16	10	7	5	55	**2.40**
Showers/Lockers	15	19	12	3	6	55	**2.38**
Bicycle Racks	38	12	3	0	2	55	**1.47**
Break Rooms	36	13	3	1	2	55	**1.55**

The types and scale of amenities appropriate for NIH facilities is based on staff population, and the ranges are set forth in NIH's *Guidelines for Amenities and Services Within NIH Facilities, December 2004*. Based on the Guidelines, the RML campus qualifies for several amenities including vending areas, wellness centers, unsupervised fitness rooms, bicycle racks, lockers/showers and lactation cubicles. Currently, only vending machines, bicycle racks and lockers/showers are provided. See Figure 4.5

4.6 Architectural Character

The architectural character of the buildings on the RML campus varies from the traditional brick academic style of the Quad, to the clapboard frame houses within the eastern portion of the historic district, to the various modern styles represented by the IRF, Visitors' Center, and Shipping and Receiving Building, and the assorted utilitarian buildings scattered about. In general, the site lacks a consistent architectural character that would prescribe future building designs. See Figure 4.6.

4.7 Historical and Archeological Features

The eastern portion of the campus contains structures that together comprise the Rocky Mountain Laboratories Historic District which was listed in the National Register of Historic Places in 1988. The boundary description of the district in the Register includes Lots 1-9 of Block 18 and Lots 1-7 of Block 19 of the Pine Grove Addition to the City of Hamilton, MT. This includes RML Buildings 1, 2, 3, A, 5, 6, 7, 8, 9 and 11, as well as site amenities such as mature trees, period lighting, and landscaping that contribute to the integrity of the District.

NIH-RML Master Plan

Hamilton, Montana

Bicycle Rack

Vending

Lockers/Showers

Figure 4.5

Amenities

NIH/ORF/DFP

LSY Architects

Oudens + Knoop Architects, PC

Institutional - Contemporary
Institutional - Brick
Industrial
Residential - Wood

NIH-RML Master Plan
Hamilton, Montana

Figure 4.6

Architectural Character

4.8 Environmental Features

4.8.1 Climate and Outdoor Design Conditions:

The severity and variability of the climate in Hamilton warrants special design considerations for building envelopes and mechanical systems. These include special treatment of outside air and design and control strategies as they pertain to extreme outdoor conditions. The design parameters for outdoor conditions are as follows:

- Project Location

Location:	Hamilton, MT
Latitude:	46 degrees, 30 minutes
Elevation:	3,578 feet asl

- Outside Design Conditions

Summer*	96° F dB / 65° F wB, Daily Range = 36° F
Winter*	-30° F
Heating - Degree - Days	7,931 (65° F base)

* Note- These are normal summer/winter extremes and are based upon NOAA weather records. These exceed the ASHRAE design parameters of -9 degrees F (99.6%) winter and 91/62 degrees F (0.4%) summer.

Hamilton's prevailing weather conditions are actually quite mild by Montana standards. However, the area experiences virtually the same extremes as the rest of the state. Very warm temperatures can be expected for a period of at least several days in the summer and can be accompanied by relatively high humidity levels. Extreme cold can also be expected for some duration every winter. Use of the ASHRAE data tables for design temperatures should be considered very carefully as this data does not embrace, to any significant extent, the normal extremes. It is recommended that all buildings that utilize large amounts of outside air be designed to accommodate extreme temperatures, especially for winter conditions. As the data listed above indicates, the normal extreme temperatures for Hamilton are more than 20° F less than the recommended ASHRAE winter design temperature. No building system designed for -9° F will accommodate -30° F temperatures with ease, and if the fresh air (ventilation) load is at all significant, a massive undersizing of the mechanical systems may result by following ASHRAE criteria. The temperature extremes from summer 2003 to winter 2004 went from 106° F to -29° F.

Humidity levels in the region are typically quite low and rise to significant levels only on a sporadic basis. Consequently, humidification systems must be installed to maintain even minimal indoor relative humidity levels. Without humidification systems, the winter indoor conditions would be less than 15% relative humidity for the bulk of the winter, and would rise only slightly above this in the summer. The fact that high outdoor humidity in the summer is expected to be significant at times, but is commonly quite low, implies that dehumidification systems are not normally required. Finally, the prevailing low outdoor humidity levels make the Hamilton climate very well suited to the use of economizer cooling with outdoor air for a great amount of time each year. They further allow the use of evaporative cooling as an energy saving measure for utilitarian type buildings which require cooling only in the summer months.

Caution must be exercised in building envelope design to ensure that vapor barriers are employed in a very complete fashion. The extremely low outdoor humidity levels in winter, combined with elevated levels indoors for a humidified building, give rise to a significant vapor pressure gradient. This gradient will drive considerable amounts of moisture through any breaks in a vapor barrier and will condense and freeze within building structures where this is allowed to happen.

The above analysis is taken from the 2002 Site Utilization Study by Architects Design Group of Kalispell, Montana. Complete meteorological data is available for Hamilton from the National Oceanic and Atmospheric Administration (NOAA) for the designers use.

4.9 Existing Utilities

The Site Utilization Study (SUS) conducted by Architects Design Group (ADG) was completed in 2002. This Master Plan updates programmatic and other background material included in the SUS, as appropriate. The site utility information in the study describes in detail existing site utilities in *Part III: Existing RML Resources and Conditions*, and is repeated in part in this section without the analyses, judgments and recommendations contained in the SUS. A Master Utility Plan (MUP) is currently under development for RML. Where possible the information below has been coordinated with that effort and is therefore more current than the baseline year information.

4.9.1 Natural Gas Distribution System:

As the gas distribution in Figure 4.9.1 indicates, there are currently three small gas service lines and one large industrial service line feeding the campus. The three small lines serve Buildings 8, 9, and 11 located on the east side of the former 4th Street right-of-way.

The 6” industrial service line, which enters the north side of campus, was installed in 2000 and is constructed of polyethylene. This high capacity line originally served only the new steam plant in Building 26 but it later became the source for an entirely new campus distribution system installed in 2003. Although the current load on this line is only on the order of 60,000 standard cubic feet per hour (scfh), this service is sized to accommodate a future load of over 150,000 scfh without undue pressure drop. This is equivalent to twice the current boiler plant load plus all other current campus usages.

The new campus gas distribution system is constructed entirely of polyethylene. It is routed as indicated on the distribution plan and has a depth of bury which generally ranges from 18” to 24”. The previous gas distribution system was abandoned in place and is largely constructed of steel. When abandoned, the system was cleared with compressed air in compliance with Fuel Gas Code requirements.

The gas distribution pressure on campus is 30 pounds per square inch (psi). This allows tremendous capacity in the distribution system, even in relatively small piping runs. Regulators are used at each building to reduce incoming gas to the appropriate pressure. For all but the incinerator building, Building 23, and the boiler plant, Building 26, the building service pressure is reduced to 7” water column (1/4 psi).

4.9.2 Steam System:

Refer to Figure 4.9.2. The majority of the buildings on campus are connected to the central steam system, and it is utilized for building heat and humidification, hot water production, sterilization, and cage and glassware washing. The steam plant operates continuously year-round.

- Distribution:
  The central steam distribution system on the RML campus is comprised of an underground direct-bury conduit piping system. Steam is produced and distributed to campus buildings at approximately 100 psig.

  The campus steam plant in Building 26 was constructed in 2000; the “old”, now defunct, steam plant occupies Building 7 at the northwest corner of the Quad complex. The two plants are connected with a large (12”) underground steam main and two (4”) pumped condensate lines. This arrangement previously allowed steam produced at either location to be distributed through the other. Likewise, condensate returned to either plant could be transferred to the other via the underground condensate lines. The plant in Building 7 is now abandoned and the fuel supplies to the boilers have been removed. However, all steam for the Quad complex and for Buildings 13, 13B, 16, 17, and 12 are routed through the old boiler header arrangement that still exists in Building 7. In the future, the header will be removed under the Building 7 renovation project but the distribution scheme will remain the same. The design for renovating Building 7 into laboratory space has been completed but funding is not available.

Building 25 is served by a dedicated 6” direct-bury steam line and a 2” direct-bury pumped condensate line. The underground piping between Building 26 and Buildings 25 and 7 was installed between 2000 and 2001. Both the steam and the condensate systems utilize Schedule 40 steel carrier piping with calcium silicate or rock wool insulation, a spiral welded steel outer casing, which is insulated on the exterior with foam insulation and an FRP (fiberglass reinforced plastic) outer jacket. The system is Ricwil model “ Multi-therm 500”. The underground piping mains which leave Building A to serve Buildings 12, 13, 13B, 16 and 17 are also this same type of piping (Ricwil Multi-therm 500) but were installed new between 1995 and 2000. The branch lines, which connect Buildings 12, 16 and 17 to the newer mains, are quite old and are largely run in shallow trenches. The condition of the line set serving Building 17 is reported to be in poor condition and of questionable integrity.

The steam plant, or Building 26, is served by its own dedicated emergency power generator in the plant and designated generator G5, which is discussed in more detail in Section 4.9.9 below. The fuel supply for the generator is No. 2 diesel fuel. The only fuel tank is a base tank beneath the generator. This tank is sized to support 40 hours of generator operation at full load.

The boilers burn natural gas as their primary fuel and utilize No. 2 diesel fuel as a back-up fuel source. A 20,000 gallon storage tank sits adjacent to the east side of Building 26 and stores enough fuel for approximately 45 hours of plant operation at full (design) load.

Building 26 was configured to allow expansion to the east for one or more additional boilers. The condensate and boiler feed assemblies were also sized to support additional boilers. With the construction of the IRF, the plant building shell was expanded to allow for two boilers. A new boiler stack was installed and it was sized for two boilers as well. However, only one new boiler was added with the IRF project, leaving space for a fourth boiler to be added in the future.

- System Capacity – Steam Plant:
  The new steam plant (Building 26) currently houses three boilers, each rated to produce 50,000 lbs/hr of 100 psi steam. The plant design is such that each boiler is sized to accommodate the entire connected campus load with the remaining boilers serving as a fully redundant stand-by to the active boiler.

  The actual available capacity from the plant will be the rated output of one boiler less the amount of steam consumed within the plant itself for the deaerator unit which pre-heats the feed water before admitting it to the boilers to make steam. The amount of heat required by the deaerator depends primarily on the makeup water load (the amount of fresh cold water admitted to the system). In turn, the makeup water consumption rate is driven primarily by the humidification loads on campus. It is estimated that the deaerator could consume as much as 3,500 lbs/hr of steam, leaving the available steam capacity from a single boiler to be 46,500 lbs/hr.

During cold weather experienced in January 2004, when low temperatures of 25 degrees Fahrenheit below zero were experienced, the maximum steam demand recorded was 24,300 lbs/hr, on an hourly demand basis. During summer heat in August 2003, with temperatures exceeding 102 degrees Fahrenheit, the highest demand was 11,110 lbs/hr on an hourly demand basis. Also, a surge in demand of 2,000-3,000 lbs/hr is experienced when the cagewash facilities fire up in Building 13 each morning. However, recent analysis of the available data indicates that the current peak campus design load should be considered to be in the range of 40,000 to 45,000 lbs per hour of steam. With the IRF project, the addition of one boiler equal in size to each of the two existing units, has essentially doubled the steam production capabilities of the plant.

During design of the steam plant, the campus steam demand was assessed in a coordinated effort between Gordon-Prill-Drapes, Inc. (GPD) and the NIH. It is difficult to assess the true, current peak steam demand for the RML campus due to the sporadic nature of equipment loads. This is not normally the case, as equipment loads do not typically comprise such a large percentage of a total campus load. However, in the case of RML, the large sterilization and cage wash equipment loads are very significant. As such, NIH and GPD explored and then agreed upon what was thought to be a reasonable diversity factor to accommodate the load associated with equipment, which does not operate continuously. The results of those calculations indicate a total connected load of approximately 66,000 lbs/hr and a diversified (adjusted, realized) load of approximately 48,000 Lbs/Hr. These figures were summarized in a joint spreadsheet (NIH/GPD), dated September 17, 1998, and assume a 0.9 diversity factor for connected heating loads and a 0.5 diversity factor for the equipment loads. It is interesting to note that the connected *equipment* loads (28,000 lbs/hr) in this study were very nearly as high as the connected *heating* loads (38,000 lbs/hr).

The load figures are considered to be very conservative in that they assume that all of the systems in all of the buildings operate at or near (90%) full capacity simultaneously. Further, and perhaps of equal or greater importance, no internal heat gains from lights, equipment and people are allowed in the calculations. It is highly likely that when all of the current buildings are fully occupied, the peak steam load for the campus could prove to be as much as 10% to 20% lower than these calculations indicate.

- Distribution System:

  There are only two steam pipelines leaving Building 26. The largest of these is a 12" service that extends to Building 7, and the other is a 6" line that feeds Building 25. The line that feeds Building 7 extends to Building A where it serves all of the Quad buildings, the large central cooling system absorption chillers, and then the underground distribution system which was originally connected to Building 7.

4.9.3 Chilled Water System:

There are two chilled water plants on campus. The original plant is located in Building A on the west side of the Quad Complex. The other is located in Building 28.

- Building 28 Chilled Water System:

  The Building 28 plant serves both Buildings 28 and 25. Chilled water lines will also be extended from this plant to serve Building 31, which has been approved for construction.

  The Building 28 chiller plant is a hybrid arrangement of three types of chillers. There is a 170-ton outdoor air-cooled screw chiller, and a 700-ton centrifugal water cooled chiller and nominal 700-ton water cooled steam fired absorption chiller located inside the plant. The centrifugal chiller and the absorption chiller are redundant to one another and are not intended to operate together. There are two redundant cooling towers located on the roof of the chiller plant. The outdoor air-cooled chiller is located between Building 25 and Building 28 on the west side of the facility. The system uses a primary-secondary pumping arrangement. There are redundant primary chilled water pumps and redundant condenser water pumps located inside the chiller plant. The secondary chilled water pumps for this system are dispersed in the system and are located in each building served. Buildings 28 and 25 each have their own redundant secondary chilled water pumps. Building 31 will also have its own dedicated pumps when complete.

The plant utilizes the outdoor air cooled chiller as its first stage of cooling at low loads and during spring and fall weather. The chiller can operate to an outdoor air temperature of 40 degrees F. At temperatures lower than this, each building can provide cooling via dedicated equipment or outdoor air economizer cycle. As soon as the load is high enough, the centrifugal chiller starts and operates and is the most efficient of the three chillers. The absorption chiller is strictly intended as a backup to the centrifugal chiller. An absorption type unit was utilized in order to avoid the need for an emergency generator large enough to power the centrifugal chiller. In the case of a commercial power outage, the plant can operate both the air cooled chiller and the absorption chiller.

Should the cooling load at the west side of campus grow significantly, the Building 28 plant is designed to accommodate future expansion to the west and the roof of the plant is designed to accommodate one more cooling tower at the north end. Expansion of the Building 28 chilled water plant to the west would impact the underground electrical duct bank as shown in Figure 4.9.9. that feeds the RML site northwest quadrant; a campus distribution gas line as shown in Figure 4.9.1; and the portable generator location for Building 28.

- Building A - Chilled Water System:

The Building A chiller plant serves the Quad buildings plus Buildings 13, 13B, and 12. The system utilizes two electrical centrifugal chillers located in the Building A ground floor mechanical room and an open ("wet") outdoor cooling tower located just west of Building 14.

The cold water produced by the two absorption chillers is piped to all of the air handlers that serve the Quad buildings. Additionally, a 6" piping loop (supply and return) extend underground from Building A to serve Building 13 (via a pipe entrance closet in Building 13B) and branch south to serve a new air handler in the east end of Building 12.

The chiller system in Building A, and the accompanying underground distribution piping, were installed between 1995 and 2000. The underground piping for this system is identical to that used for the Building 25 system.

4.9.4 Compressed Air and Vacuum Distribution Systems:

- Underground Distribution Piping:

These two piping systems extend from Building 7 into Building A. A branch line that serves the underground distribution leaves the west side of Building A then turns southward in the alley between Building A and Building 13 to serve Buildings 13, 13B, and 16. The two services (air and vacuum) parallel one another and serve the same buildings . Despite their similarities, the capacities of these two systems to accommodate additional loading vary quite significantly.

These services are routed just west of the Quad complex and extend to the south where they now terminate at the services for Building 12. The mains remain undiminished in size from Building A to their terminus.

4.9.5 Energy Monitoring and Controls Systems:

The building control systems on the RML campus are a mixture of new direct digital controls (DDC) and older, local pneumatic and local electric controls.

All of the DDC control systems on campus are less than 6 years old, are manufactured by Trane, and are networked to a common front end located in HD-3. The Trane PC based operators' terminal in Building HD-3 features color graphics for all of the connected systems. In addition to featuring graphics for each HVAC system, the main operators' terminal has separate graphics pages for monitoring and alarming the central chillers in Building A, the boilers in Building 26 and all of the (5) emergency power generators on campus.

Complete, new DDC systems by Trane serve Buildings A, 1, 2, 3, 5, 6, 12, 13, 24, 25, 26, and 27.

The Trane DDC system is the most dominant control system on campus and has been employed exclusively in every major renovation and new construction project in the last five years. The Trane system is LonWorks compatible and can be adapted to a LonWorks front end operating station should this be desired in the future in order to allow one common front end to communicate with DDC controls by other manufacturers.

Building 7 has an aging, but functional, all-pneumatic control system. It is the only all-pneumatic control system on campus and serves old antiquated steam radiators. Building 7 is slated for renovation in the future and will be fit with new DDC controls at that time.

A number of buildings have hybrid systems consisting of local pneumatic or electric controls and limited DDC monitoring and control capabilities. Trane DDC systems have been added to the pneumatic control systems in Buildings 16 and 17. The functions of the DDC controls are to monitor and alarm fan failures, automatically switch operation of redundant fans upon detection of a fan failure and to control new humidification systems in these buildings. The controls in Building 13B are similar in that the existing electric/electronic controllers packaged with the air handlers are augmented with Trane DDC controls for monitoring, alarm, fan switching and humidification control.

Local electric or combination electric/electronic packaged controls are used in Armco 1, HD-1, HD-2, HD-4 and HD-5 and Buildings 9, 10, 11, 14, 22 and 23.

Temperature Controls Compressed Air Supply Systems: Most of the buildings on campus receive air for temperature control actuation from dedicated air compressors resident in each building. Aside from the Quad buildings and Buildings 13 and 13B, which receive their temperature control air from the compressor in Building 7, all of the other campus buildings which require compressed air for controls have their own compressors.

4.9.6 Water Distribution:

Refer to Figure 4.9.6. The RML campus has a single connection to the city's water system at 4th and Grove Streets. The pipeline to the meter pit, located adjacent to the roadway, is 12" diameter PVC. A water meter assembly (two meters) is located in the pit and maintained by the city. The water service building, which houses two parallel 8" diameter reduced pressure back flow preventers and a booster pump system, is located approximately 50 feet downstream from the meter pit. The interior campus water distribution system is 10" diameter PVC. Fire hydrants (9 total) are located strategically throughout the system.

The entire water distribution system has been installed within the last eleven years and is in good condition. Almost all of the RML buildings have had new water service connections installed with recent improvement projects.

There is an active 6" water line running under 4th Street that is owned by the City of Hamilton. A new fire hydrant was installed on 4th Street south of the campus to replace the hydrant in that area that has become inaccessible with the construction of the perimeter fence. There is a fire hydrant off this 6" line at the northeast corner of Building 1.

4.9.7 Sanitary Sewer Collection System:

Refer to Figure 4.9.7. The RML has a conventional gravity collection system consisting of 8" diameter sewer mains and 4' diameter concrete manholes. The manholes are located at pipe junctions and changes in pipe direction. The manholes are all less than 400 feet apart.

The RML has four connections to the City of Hamilton's sanitary sewer system. The first connection is in the alley on Baker Street between 5th and 6th Streets. This sewer main is an 8" clay tile main which serves most of the RML buildings. The sewer main was probably installed shortly after the sanitary sewer system was installed in Hamilton, which was in the early 1950s. The second connection is at what would be the alley between 6th and 7th Streets. This 8" PVC main was installed in the mid-1980s and serves facilities at the western end of the campus and Building 25. There is a third connection at the intersection of 5th and Baker Streets, an 8" PVC pipe that was installed in 2005. The fourth connection is in the alley behind Building 11, and connects only to this building. Its size and composition are undetermined.

The sewer collection system has been modified within the last five years. The sewer lines from MH A-3 east to MH A-11 and south to MH A-13 are new 8" PVC mains. Also, the sewer line from MH A-8 to MH A-15 is an 8" PVC and was installed recently. Building 31, planned for construction, will connect into the existing sanitary sewer at man hole C3. As part of this project, the clay pipe and manholes running from MH-A1 to MH-A3 are being replaced with 8" PVC. Most of the sewer mains at the RML are at or near 0.4%, the minimum slope allowed for sanitary sewers. Since the existing mains are at minimum grade, it is difficult to make changes in the sewer main routing.

4.9.8 Storm Sewer:

The RML campus has two pipes which daylight at the west end of campus. The southerly pipe which runs just inside the RML's south boundary is an overflow pipe for the irrigation pipe system in the alley between 3rd and 4th Streets. No water from RML runs in this pipeline. It is currently still active in the summers. The northerly pipe carries limited water from area drains inside the RML campus. Other storm water on campus is managed through dry wells or sumps.

The State of Montana has issued a Montana Pollutant Discharge Elimination System (MPDES) permit to the RML for discharging boiler blow-down and cooling water to the Bitterroot River. The permit listed two discharge points. The permit expired on November 30, 2002 and has not been renewed since RML no longer disposes of boiler blow-downs and cooling water in the pipes on campus.

The Phase II storm water regulations under MPDES Permit System (Storm Water Discharges associated with Small Municipal Separate Storm Sewer Systems) apply primarily to areas with populations of at least 10,000. However, the rule also includes other areas such as military bases, large educational, hospital and prison complexes and highways and municipalities with less than 10,000 people depending on the receiving water designation. Currently, only construction activities that disturb more than 1 acre at RML are subject to MPDES Phase II rules (primarily Best Management Practices for erosion and sediment controls)." [REF: MPDES Permit Number: MTR 040000]

Considering the likelihood that both Hamilton and RML will be included under additional Phase II requirements within the 20-year time frame of the Master Plan, NIH will adopt a proactive storm water management approach incorporating storm water Best Management Practices (BMP) and Low Impact Development (LID) strategies. These methods are described in more detail in Chapter 6.

- Drainage System:
  An 8" pipe from Building 7 used to flow boiler blow-down water under Building 13 into a 12" diameter drain beginning on the west side of Building 13. The original 12" diameter corrugated metal pipe (CMP) was replaced by PVC pipe to the section west of Building 25. The drain line terminates below the irrigation ditch west of the campus. This pipeline also has four storm water intakes, two each between Buildings 22 and 25, and two each south of Building 25 on the easterly section of pipe. The portion of drain line from the outfall to the first manhole is a 12" diameter corrugated metal pipe (CMP), 310 lineal feet. This pipe shows rust on the inside, but otherwise is in good condition. A service connection is located 256 lineal feet from the outfall. An existing connection from a drain from HD 5 has been removed. The remaining of this drain is 12" PVC installed recently under current construction projects. This pipe is in good condition. This pipe is one of the discharge points listed in the MPDES permit. The pipe capacity is 2.9 cfs.

- Storm Water Management:
  Most of the storm water on the RML site is disposed of in dry wells (sumps), which percolate the water into the ground. The Bitterroot Valley soils have good drainage characteristics so sumps are good methods of storm water disposal. Normally a 4' diameter x 8' deep sump is designed to drain a 10,000 square foot surface area. The State of Montana does <u>not</u> require permits for storm water discharged into the ground. Only storm water from parking lots, roadways, roofs, and grassy areas can be discharged without a permit. Remnants of an old system have been found south of Building 30, reportedly consisting of two area drainage sumps piped to a French drain. The extent and use of this system should be investigated in order to determine its potential impact on campus planning.

4.9.9 Electrical Building Systems:

- Power Distribution:
  The campus currently has two 480-volt distribution systems – an East Distribution system and a West Distribution system. Both have separate 2500 KVA utility pad-mount transformers. The campus also has one 120/240-volt single-phase service on the southwest end of the site that serves lighting in Building 21 and the watering systems for the sheep pens. A new 480-volt service has been installed for Building 28.

  - East Distribution System:
    The East Distribution system in Building 7 was originally a 120/208 volt 3-phase, 4-wire distribution system with two 120/208 volt generators, G1 and G2, providing backup power to the entire campus. As part of the facility renovation project, the East Distribution was converted to a 277/480-volt distribution system. The renovation project provided a new 480-volt distribution switchboard MSBA1, located in Building A, that is also connected to a new 480-volt emergency generator, designated G3 and located in Building 24. Generator G3 has a capacity of 1250 KW, but would typically be rated for 80% of this load, or 1000 KW. Recent readings taken for the MUP indicate a demand load of 900 KW on this generator. Ongoing construction projects which will be explored in more detail in the MUP may affect this demand load.

The East Distribution system is rated for 4000 amps (3,324 KVA) at the Main Distribution Board (MDB), but is limited by the utility provider's 2500 KVA transformer noted above. If necessary, utilizing the 4000 amp potential would require a new utility transformer.

- West Distribution System:
  The West Distribution system was installed to provide additional power to accommodate the increased load created during the renovation and future expansion. It is a 277/480-volt 3-phase, 4 wire, wye system. It consists of a dedicated building housing normal and emergency power distribution switchboards and a new 1500 KW emergency standby generator, designated G4, located in Building 27. Generator G4 has a capacity of 1500 KW, but would typically be rated for 80% of this load, or 1200 KW. Recent readings taken for the MUP indicate a demand load of 1000 KW on this generator. With the exception of the Building 26 feeder, all other loads being fed from the West Distribution are fully backed up by the emergency generator. Building 26 has its own dedicated generator, designated G5, located in Building 26. It has a capacity of 300 KW, but would typically be rated for 80% of this load, or 240 KW. It is connected to the Normal Power Distribution Board in Building 27. Recent readings taken for the MUP indicate a demand load of 150 KW on this generator, but this will likely change when construction of Building 31, which post dates the baseline, is complete. The West Distribution primarily serves all buildings west of the main Quad Complex and is intended to provide service to any additional buildings on the west end of the campus. As noted in Chapter 3, Section 3.3.4, the demand load for the West Distribution system has been estimated to be 1000 KW. In August 2007, there was a peak demand of 1200 KW but the 200 KW spike was attributed to a temporary rental chiller used on Building 13 during that time period.

- Emergency Backup Power System:
  The entire campus is fully backed up with emergency generators with the exception of Building 21. All are diesel engine generator sets. There are five fixed generators currently installed and two generator sets that have been installed for Building 28. For temporary power purposes, RML has a portable 750 KW generator set.

  A generator replacement project has replaced the generators previously designated as G1 and G2 with a single generator capacity of 1250 KW and designated as G1. Generator G1 would typically be rated for 80% of its capacity, or 1000 KW. Recent readings taken for the MUP indicate a demand load of 400 KW on this generator. Under the same project a second generator rated at 1250 KW and designated as G2 has been installed to support the campus cooling system. Generator G2 would typically be rated for 80% of its capacity, or 1000 KW. Recent readings taken for the MUP indicate a demand load of 900 KW on this generator. Both G1 and G2 are located on the exterior of Building 7.

  Generator G3 is a 1250 KW, 277/480 volt, 3-phase, diesel engine generator set that serves switchboard MSBA1, which is located in Building A. It has a separate 4,000-gallon fuel tank.

  Generator G4 is a 1500 KW, 277/480-volt, 3-phase diesel engine generator set installed in 2002 to provide backup Power to the West Distribution system. With the exception of Building 26 (Steam Plant), G4 provides backup power to all buildings tied to the West Distribution system. The set has an 8,000-gallon fuel tank providing over 80 hours of backup fuel, however, the tank was sized for the addition of a second 1500 KW generator which would decrease the fuel capacity to 40 hours each.

Generator G5 is a 300 KW, 277/480-volt, 3-phase diesel fired engine generator set located in the new steam plant built in 2001 and serves only that facility. The G5 has a sub base mounted 200-gallon fuel tank to provide a minimum of 40 hours of backup capability.

As part of the Building 28 (Integrated Research Facility), a generator set (G6) and generator set (G7) are provided. Generator G6, located in Building 25, has a capacity of 2000 KW, but would typically be rated for 80% of this load, or 1600 KW. Recent readings taken for the MUP indicate a demand load of 1600 KW on this generator. Generator G7, located in Building 27, has a capacity of 600 KW, but would typically be rated for 80% of this load, or 400 KW. Recent readings taken for the MUP indicate a demand load of 400 KW on this generator. The demand loads for both G6 and G7 are estimates, as at the time of the readings Building 28 was not fully operational. G6 serves the main building complex while the G7 provides a separate backup power source for the cooling systems within the building. G6 has a 10,000 gallon fuel storage tank for 72 hours backup capacity with a 300 gallon sub-base tank which acts as a day tank. G7 is a fully enclosed, exterior unit with a 3000 gallon sub-base tank for 72 hours also. G7 is provided with a radiator mounted resistive load bank rated at 75% load. G6 is provided with an exterior air cooled resistive load bank rated at 75% load, located between Buildings 25 and 28.

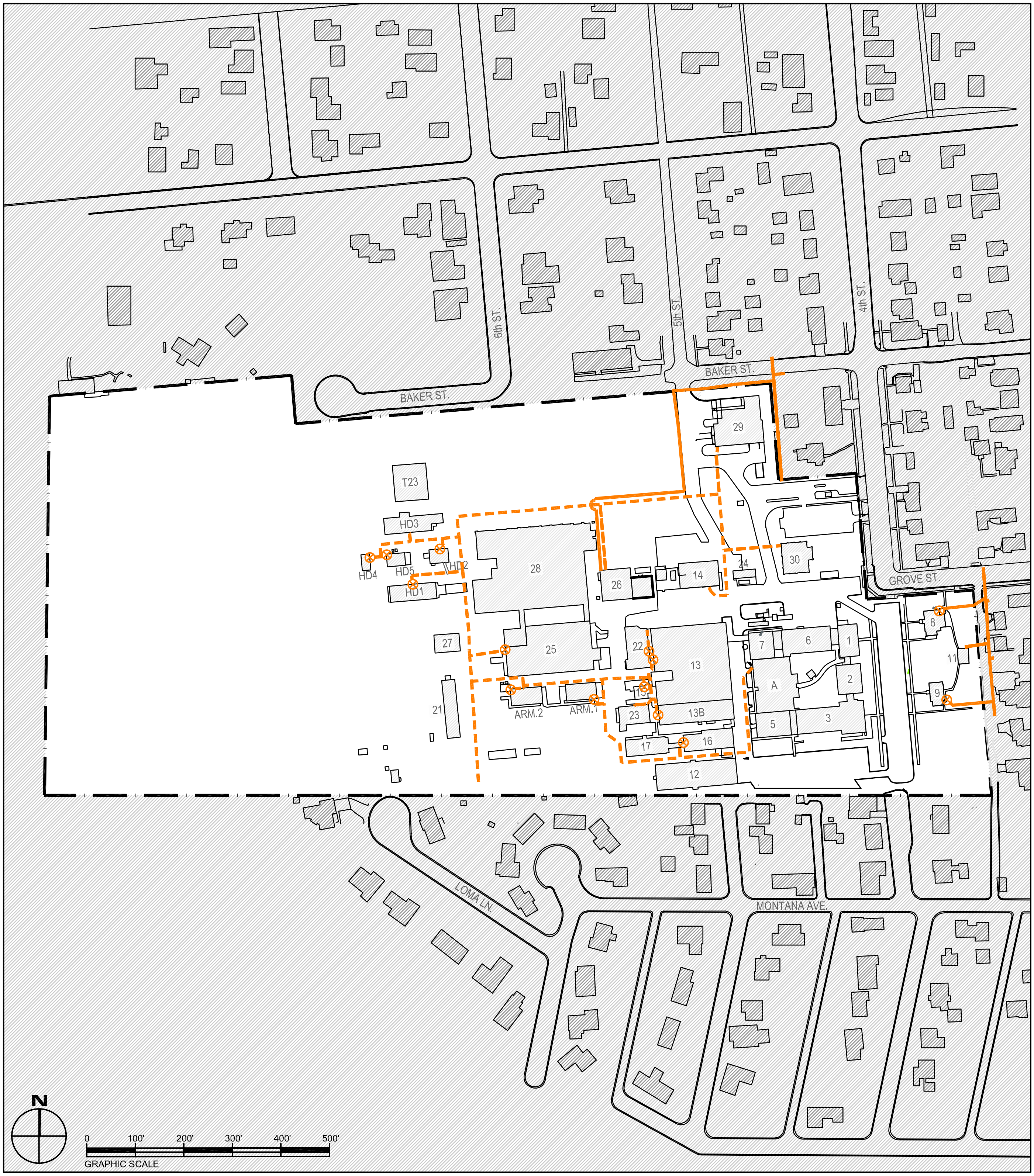
- Underground Power Distribution System:
  Refer to Figure 4.9.9. A system of power manholes and an underground duct bank system have been installed with conduits running from both the East and West Distribution systems and connecting to each building on campus. Spare conduits have been installed in each bank of conduits to allow addition of future facilities. The system was installed with the conduits approximately 6 feet below grade and bedded in sand. Spare conduits were installed in all duct banks with the main concentration out of Building 27. The manholes are large enough that additional conduits can be added to the existing system without significant difficulty or conflicts with existing conduits. The number of spare conduits starting out from the West Distribution System should be adequate for the capacity of the building. At each manhole the spare conduits divide to cover more area. This results in fewer spare conduits as the distance from Building 27 increases. The potential need for additional conduits for new projects therefore also increases as the distance from Building 27 increases. The requirements for new conduits will have to be evaluated on a case by case basis as new projects are developed.

- Telephone and Network Systems:
  The entire campus telephone and network system is fed from one Main Distribution Frame located on the first floor of Building 6. At this location is the main telephone PBX switch. All telephone service comes from this location and switch. From this room, telephone tie cables are provided to dedicated rooms for Intermediate Distribution Frames and Building Distribution Frames located in other buildings.

  The entire campus networking system is based in the same location in Building 6 as the telephone. From the Network, a fiber backbone distribution system is used to extend the campus network throughout the facility.

- Fire Alarm System:
  The electrical components of the Campus Fire Alarm system consists of a main panel located in Building A and a main panel in Building 28 with remote panels in individual buildings with communication back to the main panels. The system is monitored remotely at the guard's station in the Visitor's Center (Building 30).

- Signal Systems Underground Raceway Distribution System:
  A system of signal manholes and an underground duct bank system has been installed with conduits running between each manhole and connecting to each building on campus. Spare conduits have been installed in each bank of conduits to allow addition of future facilities. The system was installed with the conduits approximately 6' feet below grade and bedded in sand. The manholes are large enough that additional conduits can be added to the existing system without significant difficulty or conflicts with existing conduits. The spare capacity is adequate for most future additions at the campus. In general there are three 4" signal conduits to each building and four 4" signal conduits between each manhole.



NIH-RML Master Plan

Hamilton, Montana

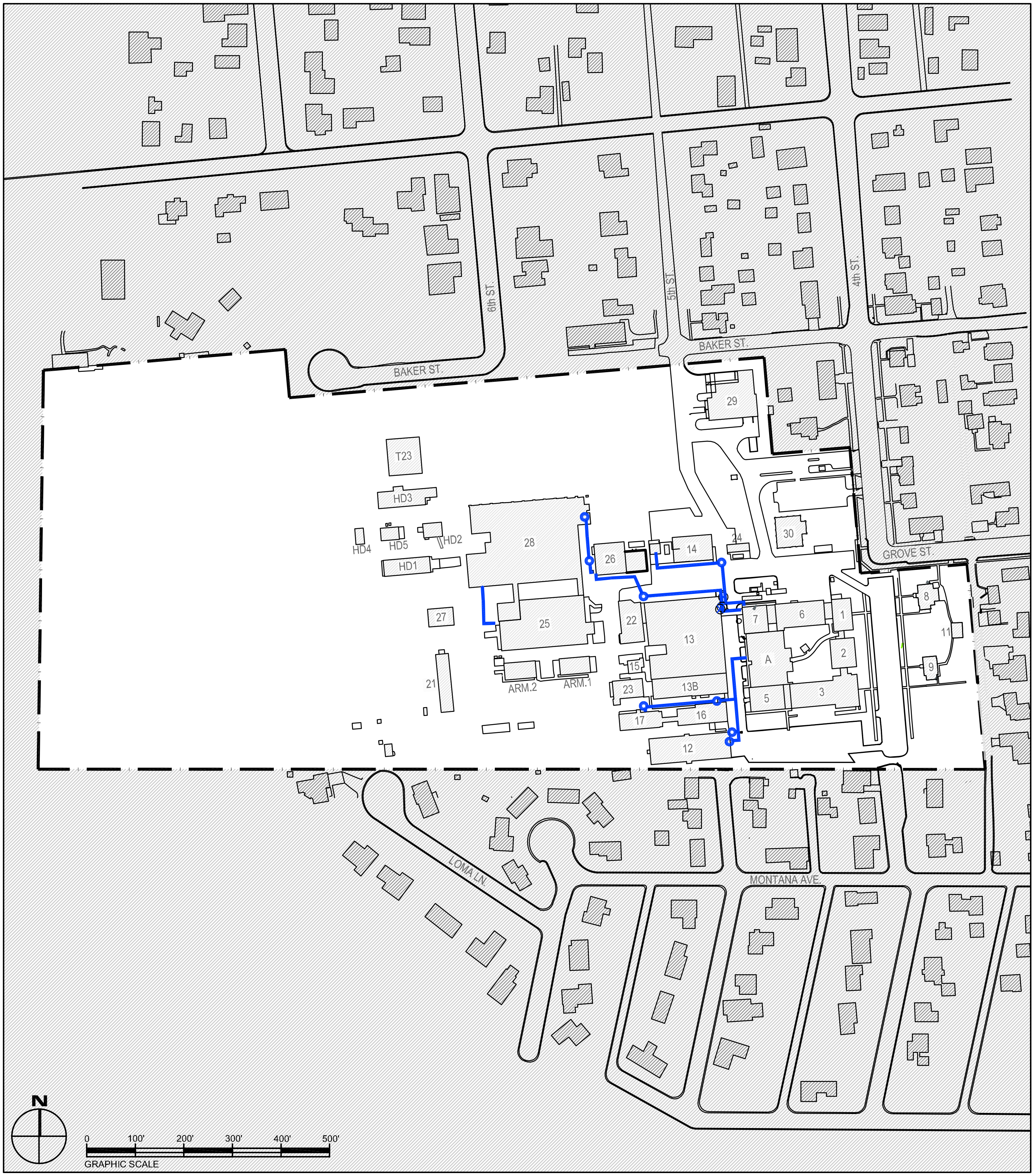
GAS LINE- SERVICE

GAS LINE- CAMPUS DISTRIBUTION

VALVE

Figure 4.9.1

Gas Lines



STEAM LINE

VALVE

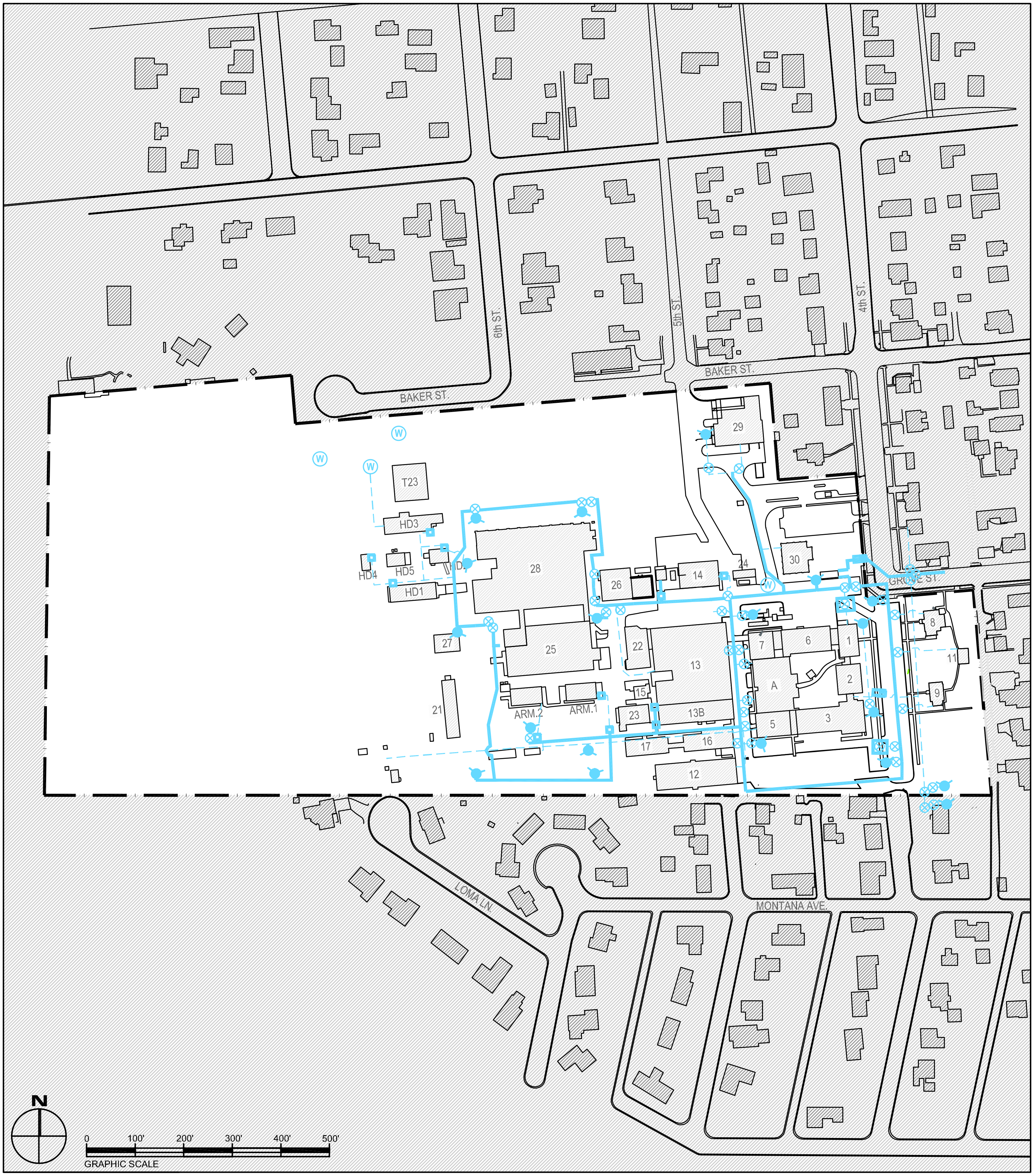
STEAM MANHOLE

NIH-RML Master Plan
Hamilton, Montana

Figure 4.9.2

Steam Lines

NIH/ORF/DFP LSY Architects Oudens + Knoop Architects, PC



NIH-RML Master Plan

Hamilton, Montana

WATER LINE- 10" OR GREATER

WATER LINE- LESS THAN 10"

VALVE

HYDRANT

CURB BOX

WELL

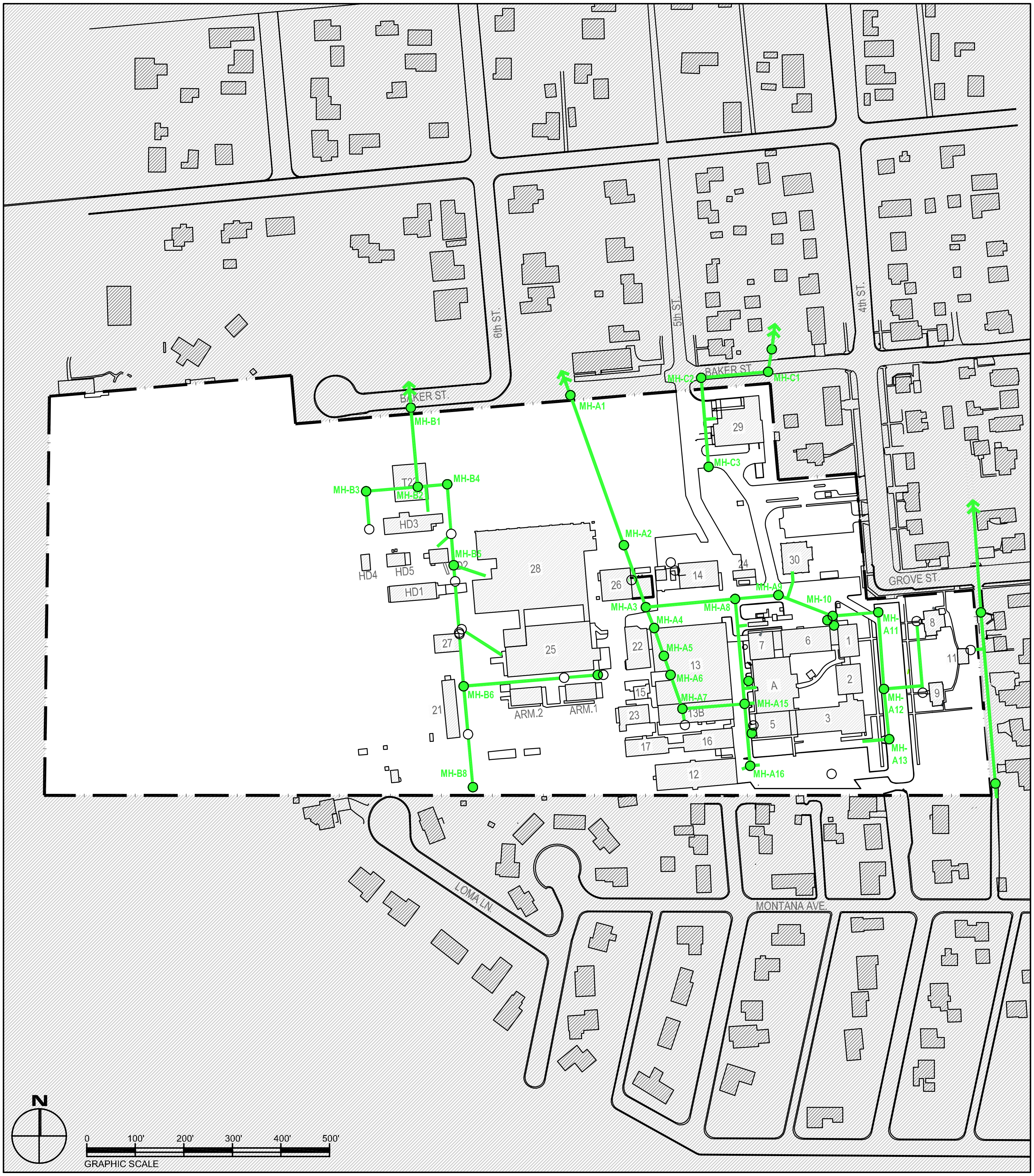
Figure 4.9.6

Water Lines

NIH/ORF/DFP

LSY Architects

Oudens + Knoop Architects, PC



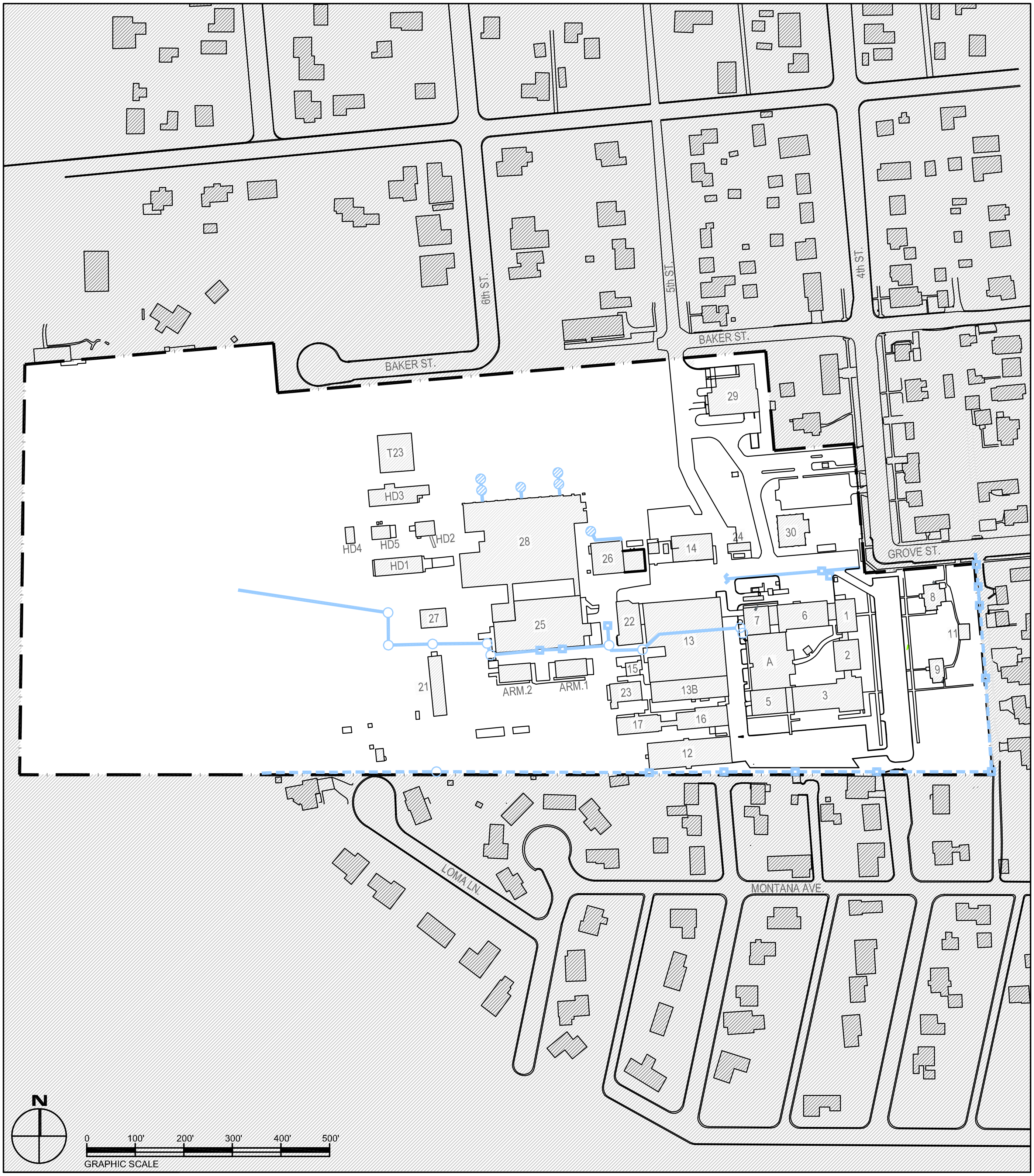
NIH-RML Master Plan

Hamilton, Montana

- SANITARY SEWER LINE
- CLEANOUT
- MANHOLE (MH-XX)
- CONNECTION TO CITY OF HAMILTON SANITARY SEWER

Figure 4.9.7

Sanitary Sewer Lines



NIH-RML Master Plan
Hamilton, Montana

RML STORM WATER LINE

OVERFLOW LINE (ON RML PROPERTY, NOT PART OF RML SYSTEM)

MANHOLE

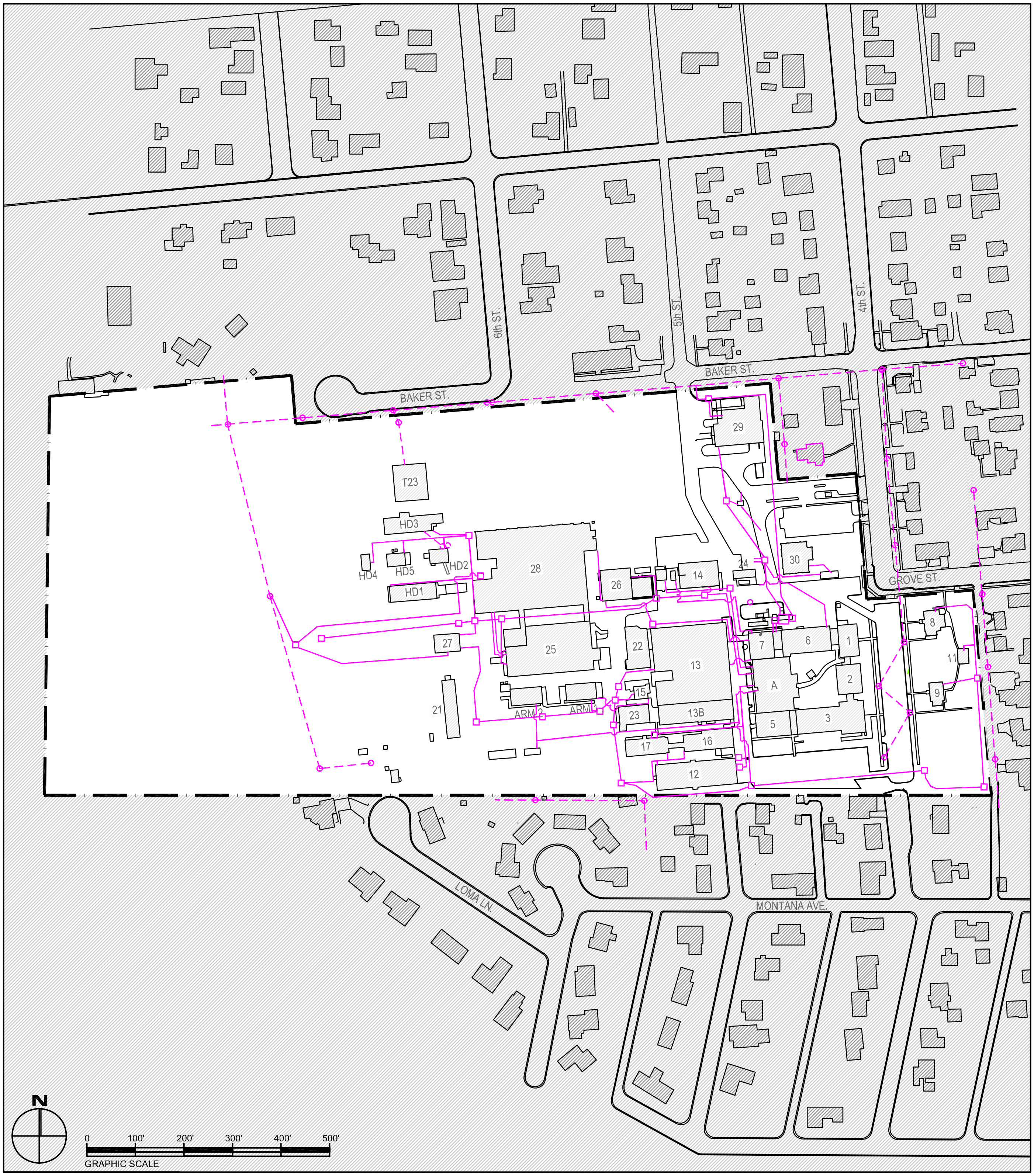
CATCH BASIN

ROOF DRAIN SUMP

Figure 4.9.8

Storm Water Lines

NIH/ORF/DFP LSY Architects Oudens + Knoop Architects, PC



NIH-RML Master Plan
Hamilton, Montana

UNDERGROUND DUCT BANK

OVERHEAD POWER LINE

POWER MANHOLE

POLE

Figure 4.9.9

Power Lines

NIH/ORF/DFP

LSY Architects

Oudens + Knoop Architects, PC