Neilson Spearhead Center
Development Master Plan

MISSISSIPPI HEADWATERS AUDUBON SOCIETY, INC.

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Section 1

Introduction / Project Background

Introduction

The project focused on the preparation of a comprehensive development master plan for the Neilson Spearhead Center (NSC), located in Rockwood Township, Hubbard County. The property is owned and operated by the Mississippi Headwaters Audubon Society, Inc., Bemidji, Minnesota. The master plan complements NSC’s ongoing natural resources stewardship program, which focuses on enhancing and preserving the natural character of the site for its intrinsic values and for human appreciation and understanding of natural systems. The planning process took into consideration the site’s historical landscape qualities, its past uses, and the northern Minnesota setting. The master plan was shaped around long held educational, research, and stewardship goals that NSC has had for the property.

The master plan confirms NSC’s vision for the property and provides guidelines for its physical development to accommodate programmatic uses. The plan also serves as a tool for presentations and preparing funding applications.

Although intended to be comprehensive, the master plan remains dynamic to allow it to evolve over time. It should be viewed as firm enough to guide improvements, yet flexible enough to change based on increased knowledge, experience, changing needs or programmatic focus as the plan is implemented.

Historical Context

The 460 acre tract known as the Neilson Spearhead Center was acquired by George W. Neilson in the 1930’s. In 1978, George Neilson’s daughter, Katharine Neilson Cram, donated the property to The Nature Conservancy, which later deeded it to the Mississippi Headwaters Audubon Society. A management board acts to fulfill the original agreement to use the property for ecological research and environmental education.
Integrating Human Use and Ecological Preservation

Finding the right balance between human use of the property and its ecological preservation and protection was an important concern and consistent goal throughout the planning process.

Going back to the days before Katharine Neilson Cram’s donation of the property to The Nature Conservancy, preserving the site’s natural values and sense of place has been a core emphasis. The planning process went to extensive lengths to ensure that the natural qualities present across the property today would be preserved while at the same time fulfilling the NSC’s educational and research mission. In addition to its intrinsic values, stewardship of the property’s natural landscape will also serve to enrich the cultural and educational experience for those visiting it.

Since 1978, the MHAS has acknowledged that the NSC is a very special place that should be protected into the future. This perspective is due to the awareness and appreciation of the high-quality environmental functionality of the NSC’s “least-disturbed” property, and also for the original value and vision of the Neilson family. The MHAS was so motivated to ensure the property was protected into the future that a perpetual conservation easement was entered into with the Minnesota Land Trust on April 6, 1999 – the 100th such agreement in Minnesota! The Minnesota Land Trust’s mission is to permanently protect the lands and waters that define our communities and enrich our quality of life. They accomplish this through establishing and monitoring permanent conservation easements which limit the development potential and use of the enrolled land. The NSC property remains in MHAS ownership but the easement “runs with the title” ensuring that the protections remain in place regardless of future land ownership.
Section 2

Vision Statement and Management Goals

Overview

This section integrates, and in select instances, updates Neilson Spearhead Center’s (NSC’s) 2001 Management Plan for the property. The vision statement and management plan elements establish the context for preparing the master plan and the basis for planning decisions related to natural resources stewardship, site development, and programming.

NSC’s Identity

The NSC is an environmental science facility owned and managed by the Mississippi Headwaters Audubon Society (MHAS), a non-profit 501(c) (3) organization. Their stewardship responsibility includes maintaining the integrity of the natural communities present on the NSC property and providing opportunities for experiential education and research.

Knowledge and Beliefs

The environmental virtues of north central Minnesota are constantly changing. Increasing human population, coupled with a demand for a quality of life involving the depletion of limited natural resources, is increasing pressures beyond what the land and water may be capable of supporting. With sound management, some of these resources are renewable and self-perpetuating, while others may be seriously degraded.

Relatively undisturbed watersheds are fast disappearing. Places are needed where students can experience, study, and document the characteristics of such ecosystems. Places are needed that can be preserved as a benchmark to compare against similar unprotected areas.
The NSC contains components of relatively undisturbed ecosystems that have been set aside for these purposes. The NSC will be active in educational programs and research aimed at understanding and improving our environment in northern Minnesota.

**Vision and Goals**

The vision and goals for the NSC are:

- To maintain the integrity of the natural communities present on the NSC property
- To provide and be a resource for education in environmental science
- To conduct and be a resource for research in areas of environmental science

**Management Guidelines**

Management guidelines complement the core goals and focus on stewardship of the property to enhance the health, biological diversity, and wildlife value of ecosystems. Management guidelines include:

- Encouraging natural processes within communities, including natural regulation of numbers and distribution of species
- Giving special consideration to species, communities, or features that are endangered, threatened, rare, unique or otherwise of special interest
- Establishing inventories of the flora and fauna of NSC for baseline documentation and educational use
- Managing the site on the basis of ecologically-defined management units, whereby:
  a. All activities will be appropriate for that management unit
  b. Monitoring and inventory will vary based on the management unit
  c. Group activities will be permitted only on management units where and when detrimental effects will be minimal

Natural resource preservation is at the core of NSC’s vision and goals – setting the stage for educational programming that enhances participants’ lives and research that enhances our understanding of the natural environment.
d. Sensitive management units will be monitored to assure they are receiving adequate protection for their perpetuation

- Natural processes and relationships will not be disrupted except for reasons of health, safety or achieving management objectives
- Overnight camping is not allowed unless for an approved research or education project
- Fire is seen as a natural process. A M.O.U. (Memorandum of Understanding) will be developed with DNR Forestry providing guidance in the event of a fire.

**Board Guidance**

NSC is guided by a Board of Directors responsible for overseeing the stewardship, development, programming, operations, and maintenance of the property. Board operational guidelines include:

- The NSC will form committees consisting of Board members and others to oversee the activities of the management plan
- Caretakers will be used for maintenance and care of the grounds and facilities; a Caretaker Agreement between NSC and the caretaker will be used to define responsibilities and compensation; the agreement will be annually reviewed and renewed, if appropriate
- All activities, programs, and projects will must be reviewed for approval by Board of Directors to ensure the relatively undisturbed and pristine condition of the managed land area
- The Board of Directors will provide final approval of Operational Policies
- The Management Plan will be subject to a major review by the Board and rewritten if necessary every five years; this is to take place in years divisible by five
- The Management Plan’s Objectives and Operational Policies will be annually reviewed by the Board of directors and amended as needed
- The Objectives and Operational Policies may be changed by the Board at any time to facilitate growth and development in education or research programs

Board operational guidelines are complemented by member guidelines, which call for Board members to:

- Carry out the management plan in a responsible, economic, and professional manner
- Use accepted organizational management practices
- Establish and maintain a positive relationship with adjacent landowners and local units of government
- Provide caretakers and a Maintenance Committee to oversee the facilities, grounds, and driveway
- Ensure all educational programs and projects are financially self-supporting
- Ensure NSC pursues grant funding for needed facilities, programs, and other capital improvement projects
• Ensure NSC operates on a debt free approach; that is, to procure the means before making the expenditure
• Ensure NSC maintains a scholarship fund to be used at the Board of Directors’ discretion in relation to Educational and research projects
• Meet, when appropriate, with township and county boards to report on NSC activities and obtain their input
• Be available to meet with special interest groups whenever possible and appropriate to explain goals and objectives of the NSC
• Ensure that county and township officials are given the opportunity to comment on proposed activities of possible significance to adjacent land prior to final approval by the NSC Board
• Invite local landowners to periodic “activity reviews” designed to present information on management and research activities and progress
• Ensure that news releases will be issued periodically describing important events and activities

Goals of Young Naturalist Program

A subset of goals has also been established for the Young Naturalist Program, which is a well-received and highly successful program that NSC has been providing since the early 1980’s. Goals for program participants include:
• Developing a sense of “wonder” and “joy” for nature
• Learning to think ecologically: to consider the interconnections of the biotic and abiotic elements of nature
• Engaging the unexpected, to be receptive to new knowledge and new ways of thinking
• Developing a sense of the importance of wild places
• Learning the names and habits of common Spearhead plants and animals
• Caring for and respecting life and learning to be good stewards of the land
• Recognizing the ecosystems/communities of Spearhead: plants, animals, geology, origins, succession patterns, etc.
• Emphasizing children and families through experiential learning for awareness of the natural environment
Section 3

Existing Conditions / Property Boundary

Property Overview

In 1922, shortly after intensive logging ended in the Bemidji area, George Neilson began acquiring government lots in sections 11, 14, and 23 of Rockwood Township, Hubbard County. By 1939 the Spearhead property totaled about 466 acres. George Neilson built a house in 1924, located near the present campfire circle. He later constructed a cottage, near the present day parking lot, which later became Katharine Neilson Cram’s home from 1958 until the cottage was destroyed by fire in 1968.

Spearhead Lake covers 172 acres, is 1.5 miles long, and .25 miles across at the widest point. The greatest depth is 81 feet. Spearhead Lake is primarily spring fed, although a small, seasonally intermittent stream, nicknamed “The Amazon,” discharges into a cattail marsh on the northwest side. The lake empties through Revoir Creek on the east, eventually draining into Lake Plantagenet. Several large beaver dams on the creek have raised the lake’s water level since the late 1970s, resulting in the many dead elms, ash trees and tamaracks bordering the lake.

The upland ridges surrounding Spearhead Lake were deposited as part of the Lake Plantagenet tunnel valley during glacial retreat. Since they originated as mostly sand and gravel deposits, the soils tend to be well drained to excessively drained. In this part of Minnesota such droughty soils support fire-prone red pine and jack pine forests. George Neilson attempted to restore the logged forests by establishing white spruce and red pine plantations from 1958 to 1961.

The bird, mammal, and plant life of Spearhead has been documented since the 1970s, most notably in a Resource Inventory conducted by Bemidji State University students and faculty in 1979. Bald eagles, ospreys, loons, black-backed woodpeckers, and yellow-headed blackbirds are only some of the bird species recorded as nesting around the lake. Wolves, fishers, and otters frequently visit the property. Over 200 vascular plant species have been noted. The Spearhead property includes a floating bog, located just north of the lake.
Built features on the site are primarily aggregated in a single main learning center area on a ridge above the eastern shore of the lake. The primary access to the Spearhead property is via the “Old Tote Road” gravel road, which traverses through another private property via easement from County Road 29 before entering Spearhead property.

Built features in the learning center area (and the site in general) are limited in keeping with the vision for the property as largely an undisturbed natural landscape. Features include an entrance drive, parking area, and an assortment of historic and more recent buildings serving a variety of purposes.

A storage shed was built in the early 1920s, a garage in 1941, the jeep shed in 1951, and an outhouse in 1958. Their metal roofs have contributed to their longevity. The Lehmann Lab began as a shed in 1920, with additions in 1940 and 1966, a major remodeling in 1980, and renovations in 2000. The earth home was completed in 1981. Other built features include a kiosk near the parking area and a fire ring near the Lab building. A well and septic system are also provided.

Outside of the learning center area, the only other significant built feature is the primitive boat launch on the southern end of the lake. An access drive is provided to the launch from County Road 9 through County and Spearhead property. A nature trail with an occasional foot bridge is also provided on the east side of the lake.

A DNR Grants In Aid Snowmobile Trail re-route was constructed approximately 2003, and lies adjacent to the property in the northwest corner of Section 14. This route by law is open for snowmobile traffic only, being closed to other forms of motorized use. ATV and OHV violations have been observed by law enforcement personnel, who continue to monitor the area to discourage illegal trail usage.

For visual context, the following photos highlight some of the built structures that currently exist on the site.

*The existing storage shed (left photo) dates back to the 1920’s. The jeep shed (right photo) was built in 1951. Both structures are retained, as defined in Section 4.*
The existing outhouse (left photo) will be retained as much for nostalgia as for practical use. The old garage (right photo) will be removed and replaced with a caretakers house and garage, as defined in Section 4.

The existing lab building (left photo) is reaching the end of its functional life and is proposed to be replaced. The existing caretakers residence (right photo) will be retained but turned into a storage and maintenance building.

As noted, the Spearhead property totals about 472 acres, with the lake covering an additional 172 acres. Surrounding lands are primarily undeveloped, with much of it being owned by Hubbard County. Two private parcels also abut the Spearhead property, with one being a 40-acre tract and the other an 80-acre tract. Figure 3.1 on the next page identifies the general location of the built features currently found on the site.

Property Boundary and Surrounding Land Ownership

Figure 3.1 on the next page illustrates the current boundary for the Spearhead property and highlights ownership of adjoining public and private properties.
Figure 3.1 – Property Boundary and Land Use Map

**Spearhead Property**

- Naramore Private Property
- Moen Private Property
- Learning Center Development Area
- Primitive Boat Launch Area

**All Other Surrounding Land is Owned by the State of Minnesota and Managed by Hubbard County**

(Schummer) Private Property
Property Expansion Potential

As illustrated on the map in figure 3.1, several privately-held properties border the Spearhead property. The master plan includes leaving open the option to acquire these properties should the opportunity present itself. As would be expected, a cost-benefit analysis would have to be completed should any of these properties became available on the marketplace.

Of the three, acquiring the Moen property would be the top priority given its proximity to the main learning center area and the fact that the entrance drive to Spearhead property traverses through this property. Ensuring complementary land use on this property would be the biggest concern and rationale to purchase the property, if made available. The second priority would be the acquisition of (or entering into a land use agreement with Hubbard County for) the adjacent lands in the northwest due to its relationship to the Spearhead Lake watershed.

Historic Programmatic Focus

Since around 1975, the Neilson Spearhead Center has been used as an outstanding outdoor classroom for environmental science. The Young Naturalist Program has seen marked success, having reached hundreds of Bemidji-area young people since 1985 with a unique combination of traditional camp fun and nature education.

Research projects have included studies of groundwater chemistry, vegetation monitoring plots, moss and lichen surveys, aquatic invertebrate studies, and regular collection of climatological data. Water clarity readings are recorded weekly as part of the MPCA Citizen Lake Monitoring Program.

As defined in Section 4, continued growth of these successful programs is envisioned in sync with facility improvements.
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Section 4

Development Master Plan

Overview

The development master plan reflects the consensus reached between the members of the MHAS board regarding how the property should be developed to meet programmatic needs both today and in the future. Notably, it should be recognized that the master plan remains dynamic and will likely evolve as it moves through implementation steps where specific development details are considered and addressed.

Changes and updates to the plan may also be warranted based on evolving programmatic direction and operational experiences in the years to come. For this reason, the MHAS board should remain open to giving additional consideration to each of the plan elements as it is being implemented to ensure that actual development is in line with documented needs and expectations. This will ensure that the true values that the property brings to the greater region will remain at the forefront of the decision making process.

Balancing Human Uses with Ecological Protection

The master plan represents a balance between accommodating educational and research uses of the site while preserving its natural and ecological values. While providing a variety of educational and research opportunities remains a fundamental goal, showing restraint in the size of the built footprint is also a clearly established NSC value. With this in mind, determining the most appropriate location for development relative to ecological resources was an important consideration that affected outcomes.
Consistent with the philosophy of ecological preservation, the majority of the proposed development purposefully stays within the existing developed areas and away from the most sensitive areas within the property. The exception to this includes nature trails and select trail overlooks, where direct connection with the natural setting is necessary to support programs. Otherwise, larger scale features are all located in areas already disturbed, where impacts can be managed and fragmentation of natural systems is less of an issue.

**Development Form Follows Programmatic Function**

Consistent with the vision of Spearhead’s founders, the programmatic focus of the site will continue to center on education, research, and stewardship associated with the natural environment and ecology. As with the past, programming levels and the capacity to accommodate visitors on the site at any given time will remain purposefully modest to maintain the sense of place and educational context. In the tradition of form-following-function, development on the site will be modest in keeping with the spirit of the NSC founders.

Although the level of development will remain limited, upgrading facilities to enhance NSC’s capacity to effectively and efficiently deliver educational programs, undertake research, and provide visitors an opportunity to simply immerse themselves in nature are justified and much needed. From a number-count perspective, the forthcoming development master plan for built facilities is based on the following site capacity thresholds:

- 20 to 30 students for typical educational programs, such as the Young Naturalist Program, with capacity to have multiple groups on the site at one time on a limited basis
- 50 to 100 visitors for special events
- 10 to 20 researchers working independently or in small groups

Note that the capacity thresholds assume that these groups will not all be on the site at the same time, with the exception of an occasional researcher doing independent research at the same time a student group is participating in an educational program.

With respect to building and site design, the overarching objective is to maximize the flexibility of each facility to accommodate a wide range of programmed uses. This is especially the case with the proposed new lab building and the upgraded jeep shed.
Development Master Plan Overview

The development master plan provides a cross-section of features and amenities to meet current and anticipated programmatic demands. The mix of facilities included in the master plan provides for day-long and overnight outings on the property where visitors can learn, do research, and enjoy the natural setting. Figure 4.1 illustrates the overall development master plan.

**Trail Alignment Note:** The trail location as shown is conceptual and illustrates intent and general location. Expansion of the trail and development of overlooks will occur over time in sync with program needs.

The location of overlooks is also conceptual and will require site-specific evaluation to determine the best location to meet programming needs.

**Land Use Zone Map**

Descriptions of each of these use zones are provided on page 4.4.
Development Zones

As figure 4.1 illustrates, the property is divided into four zones, each of which serving a specific land use purpose and accommodating a select mix of facilities and amenities to support prescribed activities. The following provides an overview of each of these zones.

Learning Center Zone

This zone encompasses the existing camp area and accommodates the majority of the buildings and built features on the site. The area is well suited for the learning center, is centrally located, and is already developed. It also has an established access road and a pleasant sense of entrance.

Primary Outdoor Learning Zone

This zone encompasses the east side of the lake where developed nature trails, observation points, boardwalks, and trail overlooks will be provided in select locations. Trail development will be limited to sustainable natural-surfaced trails and simple built structures to support educational programming, research, and general uses. Although limited development occurs in this zone to aid access to visitors of varying levels of abilities, the focus still remains on preservation of the natural amenities the site offers.

Primitive Outdoor Learning Zone

This zone encompasses the west and south side of the lake west of the boat launch area where development will be purposefully limited to maintain a scientific natural area context where nature prevails. Although visitors will be allowed to use this area for educational and research purposes, no formal trails will be provided. Any developed buildings would be limited to primitive shelter. Some primitive camping would also be permitted within this zone.

Boat Launch Zone

This zone encompasses the area associated with the boat launch and its access drive where development will be limited and highly controlled. All development in this zone will be of a “primitive” nature to preserve the sense of place associated with the Spearhead property. Development will be only as needed to provide access and prevent public users of the area from venturing off the established access drive and parking area.

Forthcoming is a description of the facilities, features, and amenities envisioned in each of these zones.
Learning Center Zone Development

This zone is situated in an aesthetically pleasing location on a high ridge on the eastern shore of the lake. It also is where all of the existing buildings are located. Figure 4.2 provides an overall master plan for this area.

Figure 4.2 – Learning Center Zone Master Plan

Major facilities in this area include the lab building, jeep shed, storage facility, wood shed, and caretaker house, along with assorted support facilities and amenities. The following describes each of these features in greater detail.
New Lab Building and Associated Exterior Spaces

The most significant upgrade to the site is the proposed replacement of the existing lab building to improve NSC’s capacity to effectively and efficiently meet programmatic needs. The current Lehman Lab building, which was originally built as a shed in the 1920’s, has served NSC well over the years but has now simply reached the end of its useful lifecycle.

Although renovation of the existing building was considered, its current condition and physical space arrangement coupled with the high cost to renovate suggests that replacement is a more prudent and long-term solution. This approach allows NSC greater flexibility to more fully consider programmatic needs and design a new building to best accommodate those needs.

With respect to the building design program, key features include a classroom/lab space, kitchenette area, toilets, sheltered gathering exterior space, administrative space, storage and mechanical room, and small office. For reference, the anticipated capacity of the new lab building in each of the key spaces (as defined in option two on page 4.8) is as follows:

- Classroom/lab (768 s.f.): 22 occupants with table and chair seating and 51 occupants with lecture seating
- Sheltered exterior gathering space (768 s.f.): 22 occupants with table and chair seating and 51 occupants with lecture seating

The architectural style will be in keeping with the natural, northwoods setting, using simple forms and extended overhangs. Structural durability, ease of maintenance, and energy efficiency are also important design concerns. The use of “green” building technologies and application of pertinent LEED-type certification guidelines is a major design goal in making the lab an environmentally sound structure. As a sustainable structure, the building itself could become part of the educational program, whereby the use of environmentally friendly approaches have application to even modest buildings in the northwoods.

After serving the Spearhead well for decades, the existing lab building is reaching the end of its useful lifecycle without substantial and costly renovation. For this reason, replacement of the building is thought the more prudent and cost-effective option.

Building Design Note: Refer to Appendix A for additional description of architectural design intent for this and the other buildings!
Specific examples of sustainable design practices include the use of alternative energy sources (solar, geothermal), super-insulation, and natural cooling and heating (through building orientation, window placement, venting, etc.)

Figures 4.3 and 4.4 illustrate a couple of schematic options for the lab building, each of which using a different physical form to accommodate programmatic uses and spaces. Each of these design concepts offer various strengths worthy of additional critique as part of detailed building design as the plan is implemented.
This schematic design centers on a linear building form with a footprint of around 2,816 s.f. of interior space and 1,280 s.f. exterior sheltered space. Entrance into the building would be through an entrance vestibule into a corridor. As with Option One, maintaining an ease of flow between the classroom/lab and the sheltered exterior space is suggested to maximize building use flexibility. The sheltered exterior space would also be screened. As the above elevation illustrates, the linear building shape lends itself to a simple and purposefully understated form. Here too, the use of extended overhangs would provide some weather protection for the structure and shade windows from the summer sun. As with Option One, siding materials would be stylistically in keeping with the northwoods theme, but made of more durable, reduced maintenance material more commonly available today. Adding a fireplace to the end of the structure was raised as an option to consider.

As each of these schematic designs illustrate, building a new lab structure offers many advantages over attempting to renovate the existing lab in terms of layout options, energy efficiency, maintenance, and operations.
Adjacent to the lab building the master plan includes two complementary spaces in the form of an outdoor kitchen/gathering area and outdoor classroom. These features are included to entice visitors to spend more time outdoors and in direct contact with nature when the weather allows. Activities in these free-flowing spaces range from group meals to fireside chats, lectures, and classroom activities. Figure 4.5 provides a conceptual illustration of these use areas.

As illustrated, the design of these space would be free-flowing and simple. The outdoor kitchen and gathering area would include a grill, water tap/fountain, and countertop. This feature could be designed as a standalone feature (as illustrated) or an extension of the building structure. Otherwise, a lawn area with movable picnic tables would also be provided. In similarly simple fashion, the outdoor classroom would consist of a lawn area with a central fire ring and bench-style seating. The space would be large enough to gather a class for lectures. Although not envisioned initially, leaving open the option to add a pull-down screen on the face of the building would allow for evening presentations, side shows, or movies. Providing a simple structure for storing wood near the camp fire ring may also be a worthwhile consideration.
Renovated Jeep Shed

Built in 1951, the jeep shed offers some interesting architectural character worthy of preserving. It also an under-utilized building asset. Currently, the shed is primarily used for storage. Structurally, the building is reasonably sound, making renovation a viable option.

As the photo illustrates, the jeep shed is an interesting structure that fits well in a northwoods setting. Expanding its use is a key highlight of the master plan.

Under the master plan, renovating the shed would serve a variety of uses, including classroom, event gathering space, bunkhouse, and general use shelter. For reference, the anticipated capacity of the shed is 35 occupants with table and chair seating, 58 with lecture seating, and 86 for reception standing.

With respect to the renovation design program, key features include maintaining a larger multi-purpose space for flexible use and adding toilets, storage space, and possibly a kitchen area. Adding a concrete floor, cleaning and repairing interior surfaces, upgrading electrical wiring, and fixing the doors and windows will all be necessary to make the space more usable. Adding “foldaway” bunks along the walls in bunk-bed style is proposed to allow the building to be used as an overnight bunkhouse. Adding a partition wall would provide additional use options.
Figures 4.6 illustrates a couple of schematic options for the jeep shed renovation with a varying mix of added features to accommodate a variety of uses.

As each of these schematic designs illustrate, expanding the utility of the jeep shed can take a couple of different forms, depending on program desires at the point of implementation.

As with the lab building, the master plan includes a complementary space in the form of an outdoor kitchen/gathering area adjacent to the jeep shed. Figure 4.7 provides a conceptual illustration of this area.
Figure 4.7 – Complementary Outdoor Space Adjacent to Jeep Shed

As illustrated, the design of this space would be free-flowing and simple. Similar to the lab building, the outdoor kitchen and gathering area could include a grill, water tap/fountain, and countertop. In addition, a lawn area with movable picnic tables is envisioned.

Canoe Launch Area

Down the hill from the main camp area following a pathway is the primary canoe access to the lake. Currently, there is very little development, as the following photos illustrate.

Currently, direct access to the lake is provided. Unfortunately, this can lead to erosion as use levels increase. Stabilizing this edge while preserving the simplicity of the access is the design challenge.

Currently, basic canoe racks are provided. Whereas this is a simple enough approach, open racks do not provide adequate protection for modern canoes and kayaks sitting in the elements for long periods of time.
The design approach to the canoe launch area centers on: keeping the design simple using site-appropriate materials; reducing the potential for erosion while still providing access to the shoreline; providing a dock for dropping canoes into the water; and providing adequate covered storage for up to 12 canoes or kayaks and a storage locker for life jackets and paddles. Figure 4.8 provides a conceptual illustration of this use area.

Figure 4.8 – Canoe Launch Area Conceptual Design

As illustrated, the design of this area is simple and utilitarian, although design detail does matter. This is especially the case with the shoreline, where the use of plants, boulders, and wood decking will need to be carefully placed to retain the natural character of this edge. Making sure that the canoe racks are accessible yet not dominant is also of design importance.

Renovated Storage Facility (Currently Caretaker Residence)

Currently, the earth home built in 1981 is being used as the caretaker residence. Unfortunately, there are a number of building issues that make using the structure as a living space over the long term less and less viable without major renovation investments.

Transitioning the existing structure from a home to a storage and maintenance building should be relatively straightforward given its concrete design.
The building’s location and orientation also make it less effective as a place for caretakers to observe the comings and goings of visitors. Although renovation was considered, the more prudent approach is to build a new caretaker residence and then use this structure for storage and as a maintenance shop. In doing so, the structure still serves a viable and needed purpose, but without the extraordinary costs for renovation.

**New Caretakers Residence**

The master plan includes development of a new caretaker residence to take the place of the current one as previously considered. As illustrated on the master plan, the residence would be located in the general proximity of the old garage, which is in poor repair and would be removed. Through careful building orientation, caretakers would be able to monitor the comings and goings of visitors. A new structure would also offer a more appealing living environment for caretakers.

From a design standpoint, the home should be stylistically consistent with the new lab building and approximately 1,350 s.f. in size, plus an attached or detached garage and porch. Figure 4.9 illustrates a schematic option for the caretaker residence.

*Building Design Note: Refer to Appendix A for additional description of architectural design intent for this and the other buildings!*

*Either removing or more effectively screening the mechanical and venting elements on the roof of the structure is also recommended to improve the aesthetic of this area.*
Looking back down the entrance drive from near the lab building, there is very little clarity as to how far up the drive vehicles should go.

Looking up toward the lab building from the entrance drive, a logical place already exists to terminate the main drive and provide parking.

The architectural style would remain essentially the same as it is in keeping with the natural, northwoods setting. Structure durability, ease of maintenance, and energy efficiency would also be assessed and modified as needed to ensure that the renovated structure is efficient, durable, and sustainable. As with the lab building, the use of “green” building technologies and application of pertinent LEED-type certification guidelines is a design goal – albeit with practical limitations since this is a renovation and not new construction. Nonetheless, the use of alternative energy sources and natural cooling and heating (through window placement, venting, etc.) would still be considered and used as appropriate.

**Site Circulation – Access Drive, Parking, and Walkways**

In general, the intent of the master plan is to keep circulation simple, direct, and accessible for vehicles and pedestrians. Another key objective is to provide greater clarity on where vehicles are allowed and not allowed to go, which is currently a bit too undefined, as the following photos on the left illustrate.

By placing the parking in the location illustrated on the Learning Center Master Plan on page 4.5, vehicles can be kept out of the main camp activity area, which in turn creates a pedestrian-only space where people are aggregating and walking about. This approach also creates a physical (and psychological) separation between vehicles and pedestrian activities, which reinforces the center’s focus on nature over the built or mechanized environment.

As illustrated on the master plan, parking for around 21 cars is provided in the main parking area, with the option to add a couple of spaces for buses in the future if needed. The design of the parking lot with a center island is purposeful and used to break up the massing and minimize hard surfacing. Although the main entrance drive will remain gravel, paving the parking area is an option to consider to clearly define parking spaces and the end of the driveway. This could also be gravel if the edges are reinforced with plant materials, some well-placed boulders, and felled trees. That said, the aesthetic of the area should be kept in mind when using boulders and logs since these can detract from the sense of entrance if excessive or poorly placed.

As shown, gates are recommended in a couple of locations to reinforce where vehicles are no longer allowed, but still allowing for handicap visitors and service vehicles to get to the buildings. A simple, rustic-type gate is recommended to serve the purpose without being too obtrusive. A rustic informational kiosk is recommended at the gateway to orientate visitors, the design of which should set the design theme for the entire property.
As the master plan illustrates, overflow parking and a maintenance yard are provided near the proposed storage building. Providing space for up to 25 cars in this lot seems reasonable to accommodate larger events. Gravel surfacing is recommended for the entire area if use levels require it. Otherwise, parking on grass is recommended if it is sustainable to reduce the visible expanse of parking.

With respect to pedestrian circulation, continued use of the existing pathways is recommended, with each of them being reviewed and upgraded as needed to prevent erosion. Providing an accessible route between the lab building and the canoe launch as well as the jeep shed is recommended. The exact alignment will need to be field established, taking into consideration grades and vegetation. The MN DNRs Trail Planning, Design, and Development Guidelines should be used to guide development of sustainable trails. Note that a well-designed accessible trail can still be soft-surfaced if constructed using proper techniques.

### Ancillary Amenities and Site Features

Ancillary facilities include the existing and historically significant storage shed built in the early 1920’s and the outhouse, which is less historic but retains sentimental value.

Retaining both of these structures has merit for their intrinsic values. With the storage shed, reuse possibilities range from wood storage to historic memorial. A final determination on this should be made after other improvements to the camp are made to determine its best end use. Whatever is decided, preserving the structure’s historic context is envisioned.

Another site improvement illustrated on the master plan is upgrading the existing septic system to a wetland wastewater treatment system. This approach is increasingly proving to be a more sustainable and ecologically-sound approach to dealing with wastewater from buildings and toilet facilities. As figure 4.10 illustrates, this type of system could be seamlessly integrated into the natural landscape and used as part of NSC’s educational program.
Primary and Primitive Outdoor Learning Zones

As defined on page 4.4, there are two outdoor learning zones defined under the master plan that complement the facilities in the learning center zone. In both zones, the level of development is quite limited, with the focus being on preservation of natural resources and in-the-field educational programming and research. The primary distinction between these two zones is that the Primary Outdoor Learning Zone offers a higher level of formal nature trail development and more trailside amenities than is the case with the Primitive Outdoor Learning Zone. The following considers development in each of these zones.

Primary Outdoor Learning Zone

As illustrated in figure 4.1 on page 4.3, this zone is located on the eastern side of the lake. Development will include formal nature trails, select observation points, boardwalks, and a couple of larger trail overlooks. The location for trails would be driven by programmatic and research needs. For the most part, the existing trails will remain, although realignment will occur as needed to address sustainability issues and programming needs as they arise.
The intent with the design of the nature trails is to provide a sequence of events highlighting the natural character of each area and create interest and intrigue “around every corner.” Inspirational viewing locations and contemplative spaces should also be taken advantage of as the trail system is completed. Creating loops, even short ones, is also recommended to add interest.

All trails should be designed using a “rolling grade” technique to ensure long-term sustainability and to limit impacts to surrounding ecological systems, especially wetlands and creeks. The rolling grade technique essentially aligns trails in harmony with landforms and contours, which reduces construction impacts and helps prevent erosion. Figure 4.11 provides an overview of the rolling grade technique (as described in MN DNRs’ Trail Planning, Design, and Development Guidelines).

As the following photos illustrate, many of the existing trails already exhibit desirable design characteristics that are in keeping with the setting. The same holds true with existing boardwalks, which are simple in design yet durable and appropriate.
Continued use of rustic boardwalk and bridge structures is recommended. However, trail realignment should be the first consideration in situations where existing trails are routinely flooded or susceptible to erosion. The exception to this is when a boardwalk or bridge is needed to allow access to a higher quality natural area for programming or research purposes.

To complement the nature trails on the eastern side of the lake, the master plan identifies a number of locations for potential trail overlook structures. As figure 4.12 illustrates, a simple deck and roof structure with roll-down sides is envisioned at these locations.

Figure 4.12 – Trail Overlook Structure

As illustrated, trail overlook structures are envisioned to be simply designed and complementary to the building style used in the camp area. The roll-down sides could be a combination of no-seeum netting and heavy weight synthetic canvas to shield against rain and bugs. An alternative to this is to use foldaway walls or sliding doors to open or close down the structure.
Note that the size of potential trail overlook structures is variable. For small-group wildlife viewing, the structure could be as small as 8-foot by 8-foot. For larger class-size groups, a 12-foot x 16-foot deck area would be appropriate, or even slightly larger depending on group size. With roll-down or retractable walls, the structure could used both for day outings as well as overnight camps. If used for the latter, a nearby outhouse would also be needed, which could be a very simple, rustic structure.

Trail signage and interpretive markers should be provided along the trails for locational reference and native plant, animal, and ecosystem interpretation. Although simple wood posts and frames are recommended, sign faces made of newer, more durable laminates has merit to better convey information and extend replacement timeframes. Although these depart from traditional wood sign faces, the added value of more robust graphic displays enhances the learning environment. Many of the products now available are designed to complement the natural setting by using earth tone colors and non-glare surfaces.

In addition to trail signage, placing an information kiosk at main trailheads is also recommended.

**Primitive Outdoor Learning Zone**

As illustrated in figure 4.1 on page 4.3, this zone is located on the western and southern side of the lake west of the boat launch area. Development in this zone will be purposefully limited to maintain a scientific natural area context. Access will be primarily by following “the game trail,” with an occasional felled log or two serving as a means to cross a channel or stretch of wetland.

The primitive outdoor learning zone will be essentially undeveloped to encourage exploration and immersion in the natural environment without the distraction of man-made features.
**Boat Launch Zone**

As illustrated in figure 4.1 on page 4.22, this zone encompasses the area associated with the primitive boat launch and its access drive where development will be limited and highly controlled. All development in this zone will be of a “rustic” nature to preserve the sense of place on the Spearhead property. Development will be only as needed to provide access and prevent public users of the area from venturing off the established access drive and parking area. The following addresses issues pertinent to this zone as related to the master plan for the Spearhead property and as stipulated in the NSC/Rockwood Township Agreement. The intent is to articulate the provisions for public use of this area to minimize its impact to the activities of NSC and to preserve, as best as possible, the natural, pristine qualities of the property and lake.

**Primitive Road and Boat Launch Design**

Maintaining the road and boat launch as a “primitive” amenity is most in keeping with the MHAS vision for the property and lake. Although public access through Spearhead property has a long history, managing that in a manner that is least disruptive is a very important master plan issue. To that end, the following describes the level of development envisioned for the boat launch and access drive.

With the access drive, the average maximum width should not exceed 12 feet, which is adequate for most boats and tow vehicles. Occasionally, providing pull-outs to allow vehicles to pass is recommended, but only on existing county-owned land, which lies to the south of the Spearhead property line. One or two locations as field determined seems reasonable. Gravel surfacing using aggregate consistent with a township road is recommended.

Road grades should ensure adequate drainage of stormwater and spring runoff from the road to avoid excessive standing water and soft spots after rains. Culverts should be placed where needed to cross drainage flowages and avoid overflows (does not necessarily preclude overflows for heavy rain events that might occasionally occur). Side-slopes of adjacent embankments should be graded to allow vehicles with trailers to pass. Side-slopes should also be used where appropriate as a deterrent vehicles leaving the defined roadway surface.

Public parking at the launch site for parking tow vehicles and trailers will be limited to the existing use area. The use of physical barriers (such as logs, posts, or boulders) is recommended on the periphery of the launch area to help prevent vehicles from driving across private property, which has been a problem in the past.

*Note: It is assumed that cost responsibility for boat launch-related development will be part of an agreement between MHAS and the township or county. Discussion in the master plan is not intended to assign that responsibility, just define the built form that the facility will be limited to in serving the interests of MHAS.*
The boat launch should be limited to a single ramp, up to 15 feet wide and suitable for one-at-a-time launching. Figure 4.13 provides a conceptual illustration of the boat launch area.

As illustrated, the design of this area is simple and utilitarian, with the major goal being limiting the encroachment of motor vehicles onto Spearhead property. As shown, the use of physical barriers including larger boulders, logs, and rustic-style fencing will likely be necessary to control wayward vehicles and ATVs.
The master plan also calls for a gate to be provided at the property line or other agreed upon locations to control access during the spring season – basically from the end of ice fishing until the area is dry enough for access. MN DOT standard practices for determining the date is suggested. The gate would also be closed when the road is otherwise impassable due to periods of unseasonably heavy rainfall or other conditions that might temporarily limit its use. A turn-around or backup space should be provided on county-owned land near the gate to allow vehicles to turn-around if the gate is closed.

**Signage**

The following signage is recommended to provide needed information and remind visitors of their responsibilities while on private land:

- “Designed for small boat access”
- A “minimum maintenance road” sign should be provided where the access road intersects with the county road; no official “boat access” signage should be provided at any location along the road since the access is not an official DNR-type public access
- A sign prohibiting the use of the access road by ATVs and mud trucks or other such vehicles placed at the intersection with the county road and at the point where the road crosses into the Spearhead property; signage to be consistent with MN DNR sign standards
- At the boat launch, a signage board/kiosk defining the specifics/limitations of lake use should be provided consistent with the agreement provisions; this includes statements about staying off of private property, user’s responsibility for carrying out their trash, no ATVs or mud trucks allowed except in the winter for moving ice houses, etc.
- MN DNR standard signs related to controlling invasive species, etc. should be posted as appropriate at the launch area; Spearhead should coordinate signage needs and posting with MN DNR to ensure consistency with its program

**Improvements and Maintenance**

Periodic maintenance of the access drive and boat launch should be provided by either MHAS or the Township through formal agreement. Examples of maintenance to be undertaken on an as-needed basis:

- Periodic grading of the road to eliminate rough spots and ridges
- Import and place gravel to in-fill holes and low areas
- Cut back brush that encroaches excessively into the road
- Maintain culverts

To ensure consistency, a representative from the Township and MHAS shall meet each spring to review the road and determine if any maintenance is needed or if other issues need attention.

**Managing Use of the Access Drive and Launch**
The following stipulations are recommended as part of any agreement with the township or county related to the boat launch and access drive through MHAS property:

- ATVs shall be prohibited from using the road and launch except during a defined winter season for moving ice houses and fishing
- Mud trucks shall be expressly prohibited all year from leaving the designated access road surface
- Public users shall be responsible for carrying out their own trash (this includes winter uses) and making sure that their boats, trailers, and equipment are free of exotic species
- Public users shall be directly responsible for any damage done to private property beyond normal use of the access drive and boat launch area

The agreement should include stipulations related to 1) providing signage as previously defined to address these issues; 2) assisting Spearhead in education efforts to inform users of the access agreement; and 3) alerting public law enforcement of problems that they become aware of or are otherwise reported to them by citizens. (Note that actual enforcement of laws is the responsibility of Hubbard County and the MN DNR as per applicable statues. The Township is also not inherently responsible for law violations, including vandalism or abuse of private property.)

**Lake Use**

The following stipulations are recommended as part of any agreement with the township or county related to lake use:

- Lake use shall be limited to non-motorized crafts (i.e., canoes and paddle boats) and motorized fishing-type boats under the condition that such use be limited to no-wake travel/trolling speed with a maximum speed of 10 mph
- Electric trolling motors be encouraged as an alternate method of propulsion for fishing boats
- Jet skis and other like watercraft are expressly prohibited from using the access and the lake

Note that adoption of these provisions by other legal authorities, including, but not limited to, Hubbard County and the MN DNR as it relates to lake use would be required for enforcement.

**Other Considerations**

Although not a certainty, MHAS leaves open the possibility of having a caretaker and/or seasonal camp host assist with maintenance of the overall property, help out with programs, and provide oversight of the property. This may include having them help out with lake-oriented boating programs, keeping an eye on the boat launch, providing assistance in checking for invasive species, and informing users of the management plan for the lake. In addition, NSC may provide lake-related programs from the launch area, including fishing, canoeing, and so forth.
With respect to lake management, MHAS will coordinate management with the Minnesota DNR to ensure a sustainable fishery. An agreement should outline how this would actually work, with input from DNR fishery managers in the region.
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Section 5

Complementary Natural Resources Protection Strategies

Overview

This section covers several natural resource protection strategies related to development of the site. The strategies complement NSC’s ongoing natural resources stewardship program, which focuses on enhancing and preserving the natural character of the site for its intrinsic values and for human appreciation and understanding of natural systems.

Application of these strategies will ensure that the development proposed under this master plan minimizes disruption to sensitive natural areas. In doing so, greater assurance can be gained that the very act of developing the site does not unduly compromise the landscape qualities that are being preserved and observed for human enrichment and understanding.

Providing Buffers to Protect Sensitive Ecological Systems

Maintaining buffers between built features (including trails) and adjacent sensitive natural areas is essential to ensuring their long term ecological quality, diversity, and habitat value. Irrespective of how well they are aligned and designed, development has an impact on the resource, including habitat fragmentation, soil compaction, increased runoff, and erosion. For these reasons, providing adequate buffers is an essential part of development planning and design.
Buffer Definitions

Buffers refer to the area between a sensitive ecological system and the edge of a development or construction related to development. It is an area in which no development should occur, with the exception of stewardship of natural resources. Managing stormwater through the use of natural infiltration techniques can occur in this zone if it is done in harmony with the natural systems that are found on the site.

The term “sensitive ecological system” refers to lands where ecological systems exhibit qualities that would be unacceptably degraded (i.e., health, function, diversity, etc.) due to development if a buffer was not provided. Under this definition, the term is inclusive of all ecological systems that hold the promise of being stable, functioning, and productive systems if managed and cared for through a routine stewardship program.

Consistent with common practice, wetlands, riparian areas, and water bodies are always considered sensitive ecological systems irrespective of their location and current condition. This also holds true for steep slopes and other landscape or geological features that if disturbed would significantly impact other ecological systems. In each case, adequate buffering is essential to protecting these systems.

Buffer Width Guidelines

Buffer widths vary in response to a number of conditions, including:

- Sensitivity of the ecological systems being impacted
- Size and scale of the natural area being impacted (larger areas allow for more liberal buffers)
- Physical and biological character of the buffer area (e.g., soil erodibility, slope, density of vegetation)
- Type of development being proposed and its potential for creating ecological impacts
- Desired educational experience

The type of development and desired educational experience are important considerations when establishing buffer requirements for development, including trails and trailside amenities. For example, a trail might be legitimately located within a sensitive area for educational purposes. Depending on the circumstances, each of these situations will affect the optimal width of a buffer.

As a general guideline, figure 5.1 on the next page highlights recommended buffer widths primarily associated with riparian areas. Notably, these guidelines may also have application to non-riparian areas that are considered to be ecologically significant. Given the variability of the situations that may be encountered, the extent to which buffers are provided adjacent to a given development should be carefully considered by a trained specialist as part of the development planning and design process.
Figure 5.1 - Buffer Width Guidelines Associated with Filter Strips and Riparian Management Zones

General Buffer Guidelines for Riparian Areas

The buffer guidelines are consistent with those recommended in the following publications: MN DNR Trail Planning, Design, and Development Guidelines (2006) and Sustaining Minnesota Forest Resources Handbook (Minnesota Forest Resources Council, 1999). These publications define buffers as “filter strips” for managing non-point pollution near surface water and wetlands associated with timber harvesting, prescribed burning, and construction. The guidelines have application to trail and other forms of development adjacent to perennial and intermittent streams, lakes, open water wetlands, wetland inclusions, seasonal seeps, and springs.

The guidelines also make a distinction between filter strips and riparian management zones (RMZ). Filter strips help minimize the runoff of sediment, debris, nutrients, and pesticides into water bodies and wetlands. RMZs encompass the area of land and water forming the transition from aquatic to terrestrial ecosystems along streams, lakes, and open water wetlands. Within this zone, a higher level of protection is recommended to protect the intrinsic qualities of these ecosystems. This includes greater scrutiny of trail alignments. The graphic and related text define the width guidelines for filter strips and RMZs.

<table>
<thead>
<tr>
<th>Water Body Type</th>
<th>Recommended Widths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stream &gt; 10 feet wide</td>
<td>100 feet minimum/200 feet preferred</td>
</tr>
<tr>
<td>Stream 3-10 feet wide</td>
<td>50 feet minimum/100 feet preferred</td>
</tr>
<tr>
<td>Perennial Stream &lt; 3 feet wide</td>
<td>50 feet minimum and preferred</td>
</tr>
<tr>
<td>Open water &gt; 10 acres</td>
<td>100 feet minimum/200 feet preferred</td>
</tr>
<tr>
<td>Open water &lt; 10 acres</td>
<td>50 feet minimum/100 feet preferred</td>
</tr>
</tbody>
</table>

Slope of Land: Recommended Width

<table>
<thead>
<tr>
<th>Slope of Land</th>
<th>Recommended Widths</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10%</td>
<td>50 feet</td>
</tr>
<tr>
<td>11-20%</td>
<td>51-70 feet</td>
</tr>
<tr>
<td>21-40%</td>
<td>71-110 feet</td>
</tr>
<tr>
<td>41-70%</td>
<td>111 to 150 feet</td>
</tr>
</tbody>
</table>

Buffers Associated with Ecotonal Areas

Ecotonal areas are the transition zones between ecological systems where native plant diversity is often the greatest. These areas are also notable corridors for wildlife where animals travel from one type of habitat to another. Poorly placed development can pose significant impediments to travel for some species, even creating “sinks” that trap animals in an isolated area.

Understandably, ecotonal areas also appeal to humans and it is very tempting to place development right along or through the edges of these diverse landscapes. Finding a balance between providing the experience of being in proximity to an ecotonal edge while still protecting the ecotone is a major consideration. A robust understanding of these systems is critical to aligning a trail, for example, in the least disruptive manner.
Typically, the ecotonal edge is the first 50 to 100 feet on either side of a vegetation transition line, although this can vary considerably. If trails, for example, are located within this zone, careful consideration should be given to minimizing the impact on these diverse systems. Even locating a trail a few feet one direction or another can substantially improve the protection of ecotonal areas without diminishing the experience. As with buffers in general, this typically requires technical evaluation by a trained specialist.

When trails inevitably cross vegetation transition lines, it will be done at select locations where impacts can be minimized. Figure 5.2 provides examples of trails on the edge of ecotonal areas.

Figure 5.2 – Buffers Associated With Ecotonal Areas

**Trail In Conflict With An Ecotone**
A trail located right along the edge of the ecotone impacts the most diverse area of native plants and disrupts the primary wildlife corridor. It also makes it more challenging to manage the ecotone with prescribed burning since the trail creates an unnatural fire break.

**Trail In Harmony With An Ecotone**
A carefully located trail on the periphery of an ecotone but still close enough to enjoy the “edge effect” makes for a pleasant trail that is sustainable. Although all trails impact the site, through thoughtful design they can be much more sensitive to native plant communities and wildlife.

*Lakefront Buffers and Shoreline Protection Strategy*

Along the lakeshores, the extent of buffers will have to be balanced against providing access for educational purposes. Although an optimal buffer width may not be achievable in all cases, the intent along the lakefront is to use natural vegetation and bio-engineering techniques over mechanical or engineered means to stabilize embankments and the shorelines. In addition, access to the shorelines will be limited to select locations where docks and overlooks will be provided to control pedestrian movements and prevent trampling of natural vegetation along the shoreline.
**Limiting Impacts to Wildlife Habitat**

Wildlife habitat is a function of ecological quality. The healthier and more diverse the ecological systems found on a site, the more diverse and rich the array of wildlife that can be sustained. Today, the Spearhead site retains a high capacity to support wildlife, albeit less robustly than historically would be the case due to habitat alternative land uses that have occurred over time. The innate qualities of the property, its landforms, access to water, and ecological diversity are especially important to avian and waterfowl species.

Many other species of wildlife frequent the property for the same essential reasons that attract avian populations – namely the wetlands, lake, and variety of upland ecological systems. Here too, habitat degradation and fragmentation has had an impact on the diversity and frequency of wildlife sightings. Species adaptable to disturbed landscapes, such as deer, are thriving. Those that are less adaptive are less frequently sighted and more threatened.

**Limiting Habitat Fragmentation**

Within the context this master plan, mapping ecological systems, limiting the development footprint, and providing buffers adjacent to development will collectively reduce the potential for habitat fragmentation. In spite of these efforts, fragmentation can still occur if wildlife needs are not specifically considered as development is undertaken and final trail alignments are planned.

Limiting the fragmentation of ecotonal areas is especially important with wildlife since many species tend to concentrate along these edges. This is especially true of riparian areas, along the edge between forests and meadows, and areas adjacent to steeper slopes and wetland edges. The less a trail or other development encroaches into these areas, the less fragmentation will occur.

To reduce habitat fragmentation, the physical design and management of trails and other forms of development should incorporate the needs of wildlife and protect the ecological values that are most important to species of greatest conservation need. The publication entitled *Tomorrow’s Habitat for the Wild and Rare: An Action Plan for Minnesota Wildlife* published by the MN DNR is important resource in this regard and should be referenced as specific development projects are implemented.

**Water Resources Management**

Water resources management refers to managing stormwater within and adjacent to the site in an ecologically-sound manner that is consistent with the larger ecological vision for the property. The main principle is to manage stormwater using natural infiltration methods and preserve the natural hydrology of the site. Under this approach, stormwater runoff from parking areas, roads, buildings, trails, and other built features will be effectively captured and treated prior to reaching downstream wetland, pond, and lake systems. The following provides a framework for water resource management.
Natural Infiltration Method as an Underpinning for an Ecologically-Based Approach to Stormwater Management

The natural infiltration approach to stormwater management relies on passive, overland routing of runoff, as opposed to storm sewers, engineered ponds, and other built structures. This approach offers a couple of distinct advantages over conventional stormwater systems (i.e., storm sewers, engineered ponds, and other built structures), including:

- Introduced contaminants picked up by runoff are removed at the initial stages of water flowage, rather than being transported to downstream locations and accumulating in wetland, lake, and river systems; this greatly reduces degradation to water quality and vegetative health in downstream systems.
- Stormwater flow rates and volumes more closely emulate natural conditions; this greatly reduces unnatural fluctuations in water levels in downstream systems (wetlands and lakes) and therefore reduces impacts to the natural condition of water systems and vegetation.

For these reasons, the use of natural infiltration for managing stormwater is fundamental to creating sustainable trails and other development where impacts to adjacent ecological systems are to be kept to a minimum. These systems typically consist of four primary components, as illustrated in figures 5.3 and 5.4.

Figure 5.3 – Natural Infiltration System

<table>
<thead>
<tr>
<th>Developed Edge</th>
<th>Component #1 - Natural Swale/Infiltration Basin</th>
<th>Component #2 - Upland System</th>
<th>Component #3 - Wetland System</th>
<th>Component #4 - Water Body/Stream System</th>
</tr>
</thead>
</table>

Stormwater infiltration expedited through natural processes

Flow rates diminished through overland disbursement and infiltration of stormwater (results in a more naturalized fluctuation of water levels in downstream systems)

Contaminant load captured early in stormwater disbursement cycle, which minimizes nutrient and pollutant loading in downstream systems
Component #1 – Shallow Natural Infiltration Swales and Basins Systems
Initially, stormwater runoff from development is routed into natural or man-made shallow swales or, more recently, “raingardens” or “natural infiltration basins” that are planted with native plants with deep root systems. These swales, basins, and raingardens provide initial infiltration and removal of pollutants, as well as convey runoff from developed areas and disperse it across upland and prairie systems.

Component #2 – Upland Systems
The upland systems (i.e., prairies, upland forests, etc.) are the second component, functioning to convey stormwater as diffused overland flow to the wetland systems that often link directly or indirectly to lakes. These systems infiltrate a substantial portion of the annual surface runoff volume due to their deep and/or extensive root systems. They also provide additional solids settling and biological treatment.

Component #3 Wetland Systems and Component #4 – Water Body/Stream Systems
The wetlands are the third component of the natural infiltration system and provide both stormwater detention and biological treatment prior to runoff entering the lake and stream systems. The final component is the lake or stream, which provides stormwater detention, additional solids settling and biological treatment.

Figure 5.4 – Overview of Natural Infiltration System Components

(Left photo) The “ribbon infiltration area” between these trails is a depressional area (about 5 feet deep) to promote natural infiltration of runoff. With native grasses, absorption rates are increased and standing water only occurs after longer or heavier periods of rain. (Right photo) Similar situation, with the natural infiltration approach being ecologically sound and also visually appealing to trail users.

(Left photo) Deep-rooted prairies and savannas are well-suited for natural infiltration system, especially their capacity to slow down the rate of flow associated with stormwater leaving hard surfaces. (Right photo) Diverse forested systems also serve to capture stormwater runoff in a natural way. Notably, systems that are degraded are much more susceptible to erosion than more intact, native systems.

(Left photo) By the time water gets to a wetland, most of the impurities should be taken out by the previous parts of the infiltration system. Still, wetlands serve an important cleansing function and are critical to ensuring surface and ground water quality. (Right photo) By using natural infiltration systems, water fluctuations in lakes and rivers will be much more natural and stable. By limiting unnatural water fluctuations, native plants will remain vital and be able to compete with non-native species that thrive when natural systems are compromised.
Best Practices for Stormwater Management

The use of natural infiltration methods to managing stormwater should also be supported by the application of a variety of best practices that address common development circumstances likely to be encountered as the master plan is implemented. There are a variety of best practices related to managing stormwater, preventing erosion, and limiting non-point water pollution that have application to future development and complement the guidelines provided in this master plan. The following table highlights several publications that are recommended resources covering many relevant best practices. NSC should apply pertinent best management practices whenever a new development is being implemented. This should include the application of best management practices recommended by the MN DNR and local Soil and Conservation and/or Watershed Districts.

**Minnesota Pollution Control Agency**

The Minnesota Pollution Control Agency (MPCA) has developed a manual entitled Protecting Water Quality in Urban Areas to help local government officials, urban planners, developers, contractors and citizens prevent stormwater-related pollution. The manual contains detailed information about BMPs that can be used to protect lakes, streams and groundwater from stormwater-related pollution. The manual is available online through their website (http://www.pca.state.mn.us/water/pubs/sw-bmpmanual.html) and covers the following topic areas:

- Water quantity and quality
- BMP selection
- Comprehensive stormwater policies and plans
- MPs for stormwater systems
- Stormwater-detention ponds
- Erosion prevention and sediment control
- Pollution prevention
- Models and modeling

**Urban Small Sites Best Management Practice Manual**

Available through the Metropolitan Council, The Urban Small Sites Best Management Practice (BMP) Manual provides information on tools and techniques to assist municipalities and watershed management organizations (WMOs) in guiding development and redevelopment. The manual includes detailed information on 40 BMPs that are aimed at managing stormwater pollution for small urban sites in a cold-climate setting. The BMP Manual is available online on the Metropolitan Council’s website (http://www.metrocouncil.org/environment/watershed/bmp/manual.htm). Key sections that have application to trail development include the following:

- Runoff pollution prevention
- Impervious surface reduction
- Pavement management
- BMP maintenance
- Landscape design and maintenance
- Grading practices
- Soil erosion control
- Mulches, blankets, and mats
- Vegetative methods
- Sediment control
- Silt fences
- Inlet protection
- Temporary sedimentation basins/traps
- Check dams
- Stormwater treatment BMPs
- Infiltration systems
- Infiltration basins
- Infiltration trenches
- Filtration systems
- Bioretention systems
- Filter strips
- Wet swales
- Retention systems
- Wet ponds
- Detention systems
- Dry ponds
- Dry swales

**Minnesota Stormwater Manual**

This manual is a valuable tool for those involved in stormwater management and conserving, enhancing, and restoring high-quality water in Minnesota’s lakes, rivers, streams, wetlands, and ground water. The manual is a dynamic document and revisions will take place every two years, with the most recent version posted on the MPCA website (www.pca.state.mn.us/water/stormwater/stormwater-manual.html#manual).
Section 6

Development Cost Projections

Overview

Implementing the master plan for Neilson Spearhead Center will require substantial initial and long-term capital investments for development, operations, and maintenance – as well as natural resource stewardship. Realistically, implementation will occur over a number of years as funding and other resources are made available. This section considers development costs associated with the development program defined in Section 4 to aid the decision process and the setting of priorities.

Cost Projections

The cost projections define the potential costs associated with each development component of the master plan. It is based on a combination of site-specific development requirements and projects of similar size and complexity. The costs are also based on having the work completed by private contractors and specialists. It does not take into consideration work that could be performed by NSC, volunteer groups, or by other means.

The cost figures are based on master plan level evaluation, which brings with it inherent limitations. The cost figures are meant for general budgeting purposes, project phasing, and comparing the relative cost of one item to that of another. The costs are in 2008 dollars.

Although intended to be conservative, actual costs will vary depending on the year that each aspect of the master plan is implemented, detail implementation parameters, economic conditions affecting bidding, and the actual site conditions found in the field during construction. The following table summarizes potential development costs using unit pricing.
The following line-item cost projections are broken down by buildings and site-related amenities, with a grand total provided at the bottom of the table.

<table>
<thead>
<tr>
<th>Line Item</th>
<th>Area (SF)</th>
<th>Cost/SF</th>
<th>Cost Option A Package</th>
<th>Cost Option B Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab Building Option A</td>
<td>2,944 (Building)</td>
<td>250*</td>
<td>736,000</td>
<td>704,000</td>
</tr>
<tr>
<td></td>
<td>1,536 (Porch)</td>
<td>100</td>
<td>153,600</td>
<td>128,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>889,600</td>
<td>832,000</td>
</tr>
<tr>
<td>Lab Building Option B</td>
<td>2,816 (Building)</td>
<td>250*</td>
<td>704,000</td>
<td>704,000</td>
</tr>
<tr>
<td></td>
<td>1,280 (Porch)</td>
<td>100</td>
<td>128,000</td>
<td>128,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>832,000</td>
<td>832,000</td>
</tr>
<tr>
<td>New Caretaker Residence</td>
<td>1,600 (House)</td>
<td>200</td>
<td>320,000</td>
<td>320,000</td>
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<tr>
<td></td>
<td>576 (Garage and porch)</td>
<td>100</td>
<td>57,600</td>
<td>57,600</td>
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<tr>
<td>Jeep Shed Option A</td>
<td>864 (Existing)</td>
<td>250*</td>
<td>216,000</td>
<td>216,000</td>
</tr>
<tr>
<td></td>
<td>128 (New)</td>
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<td>32,000</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>248,000</td>
<td>248,000</td>
</tr>
<tr>
<td>Jeep Shed Option B</td>
<td>864 (Existing)</td>
<td>250*</td>
<td>216,000</td>
<td>216,000</td>
</tr>
<tr>
<td></td>
<td>256 (New)</td>
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<td>64,000</td>
<td>64,000</td>
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<tr>
<td></td>
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<tr>
<td>Rehab Earth Bldg. for Storage/Maintenance</td>
<td>Budget figure</td>
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<td>90,000</td>
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<tr>
<td>Site Improvements - Main Camp Area</td>
<td>Budget figure**</td>
<td></td>
<td>130,000</td>
<td>130,000</td>
</tr>
<tr>
<td>Site Improvements - Boat Launch Area*</td>
<td>Budget figure***</td>
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<td>30,000</td>
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<tr>
<td>Site Improvements - Nature Trails</td>
<td>Budget figure****</td>
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<td>86,000</td>
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<tr>
<td>Subtotal Building Costs</td>
<td><strong>1,851,200</strong></td>
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<td><strong>1,825,600</strong></td>
<td><strong>1,825,600</strong></td>
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<td>Contingency 10%</td>
<td>185,120</td>
<td></td>
<td>182,560</td>
<td>182,560</td>
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<tr>
<td>Non-Construction Costs 20%</td>
<td>370,240</td>
<td></td>
<td>365,120</td>
<td>365,120</td>
</tr>
<tr>
<td>Grand Total - All Items</td>
<td><strong>2,406,560</strong></td>
<td></td>
<td><strong>2,373,280</strong></td>
<td><strong>2,373,280</strong></td>
</tr>
</tbody>
</table>

Cost Projections Notes:

* $250/s.f. cost used for the lab building and jeep shed strives for a LEED Gold building rating and the use of geothermal under common conditions. Solar, wind, etc. would be additional, with costs being dependant on level of energy provided – i.e., zero net energy or just a demonstration installation.

** Main camp area site improvements budget includes: parking lot (paved and gravel areas); outside amenities near lab building; outside amenities near jeep shed; canoe launch/boat racks/dock area; kiosks and signage; trail/walkway improvements, and misc. improvements.

*** Boat launch site improvements budget includes limited roadway improvements and budget for fencing, signage, etc. related to Spearhead property. Also includes DNR-style improvements to boat launch landing area. It is assumed that improvements to the road would be made, at least in part, by the Township or County.

**** Nature trail improvements budget is based on having a contractor specializing in nature trail development do the work, versus volunteers. Includes adding 2,000 feet of trail and 100 feet of boardwalk. It also includes development of two trail overlook platforms with roof structure at 28,000 each, as a couple of smaller observation platforms with small or no roof.

Note that the cost projections are based on the presumption that durable construction techniques and materials suitable for the northern Minnesota setting will be used. In turn, this will result in lower ongoing maintenance and operations costs for the buildings and site features. If budget limitations require cost containment, eliminating an entire item(s) is recommended over reducing the quality of the items that are being built. This approach will result in enduring built features that will serve NSC well for decades to come.
Appendix A

Architectural Design Description

Overview

The following is a complementary, more detailed description of the design intent for the major buildings and structures as described in Section 4.
Purpose
The Neilson Spearhead Center provides space for environmental and educational research.

Building Program
Laboratory Classroom
2,816 GSF (Interior), 1,280 GSF (Exterior Sheltered)

Jeep Shed
1,120 GSF (Interior)

Caretaker Residence
1,600 GSF (Interior)

Design Intent
A primary goal for the design of the buildings is that they be authentic to their location and convey by their very nature a sense of place.

Form
The buildings will serve as a transition from the built environment to the natural environment.

A porch surrounds the building, reducing scale and providing a transition between interior and exterior. The porch provides sheltered exterior gathering space and sheltered access to many interior spaces directly from the exterior.

If used, the vegetative roof will visually “anchor” the building to the landscape.

Color
Exterior
The exterior color will reflect the color of the surrounding landscape (trees) and will allow the building to visually recede into its surroundings.

Interior
Wood will be finished with a clear sealer to express its natural color and characteristics.

Accent colors will reflect the color of wildflowers found on site.

Concrete floor stain will reflect color(s) of soil.

Sustainability
The building will not only incorporates sustainable design principles but also exhibit them for interpretive benefit.
A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise.”

Aldo Leopold

The following represents a partial list of strategies (in LEED™ format) that will be considered to mitigate the environmental impact of building and site development of the Neilson Spearhead Nature Center:

**Sustainable Sites**

Erosion & Sedimentation Control
- Erosion control to reduce negative impacts on water and air quality with strategies such as temporary seeding and silt fencing

Site Selection
- Development of inappropriate sites was avoided and the environmental impact was reduced from the location of buildings on the site
  - Site development footprint was reduced in the space programming phase
  - Building will be constructed on a previously impacted site
  - The existing entrance road and parking is used

Alternative Transportation (Bicycle Storage & Changing Rooms)
- Pollution and land development impacts from automobile use will be reduced
  - The design will provide transportation amenities including bicycle storage racks & showering/changing facilities

Alternative Transportation (Parking Capacity)
- Pollution and land development impacts from single occupancy vehicle use will be reduced
  - The size of the parking lot will be minimized

Reduced Site Disturbance (Protect or Restore Open Space) (Development Footprint)
- Existing natural areas will be conserved and damaged areas restored to provide habitat and promote biodiversity
  - A site development master plan is being development
  - The buildings are located on previously impacted areas

**PARTNERS & SIRNY architects**
Building footprints are minimized
Construction boundaries will be clearly marked to minimize disturbance of existing site

Stormwater Management (Rate and Quantity)
- Disruption and pollution of natural water flows will be limited by managing stormwater runoff
- Infiltration will be promoted by possibly incorporating a vegetated roof and rain gardens
- Impervious surfaces will be minimized

Stormwater Management (Treatment)
- Disruption of natural water flows will be limited by eliminating stormwater runoff, increasing on-site infiltration and eliminating contaminants
- Site stormwater will possibly be treated with vegetated roof and bioswales

Heat Island Effect (Non-Roof)
- Existing vegetation will be used and/or new vegetation planted to shade impervious surfaces and buildings
- Overflow parking will have a pervious surface

Reduce Light Pollution
- Exterior lighting will be minimized
- Cut-off fixtures will be used

Reduce Heat Islands (Shade, Vegetated Roofs)
- A vegetated roof will be considered
- Paved surfaces will be shaded with new and/or existing trees
- Light-colored surfacing will be used
Water Efficiency

Water Efficient Landscaping will be incorporated

No permanent irrigation will be required due to the use of native vegetation.

Water Use will be reduced

High-efficiency plumbing fixtures will be used

Occupant sensing faucets will be used

Collection and use of stormwater and greywater will be considered for sewage conveyance

Energy & Atmosphere

Fundamental Building Systems Commissioning will be incorporated

No CFC refrigerant will be used in HVAC&R Equipment

Energy performance will be optimized through the following potential strategies:

- Daylighting
  - A highly-insulated envelope
  - Natural ventilation systems
  - Heat recovery systems in conjunction with mechanical fresh air ventilation
  - Highly efficient lighting fixtures
  - Ambient light-sensing lighting dimming
  - Occupancy sensing light switching
  - Gasketed service boxes at exterior walls
  - High-efficiency equipment

Renewable energy generation will be considered including, biomass, passive solar, photovoltaic, and wind
Materials & Resources

Space and facilities will be provided for storage and collection of recyclables

A Construction Waste and Recycling Plan will be required by the Contractor

Resource reuse strategies will be incorporated

Materials will be used that contain recycled content, are manufactured and extracted in the region, are rapidly renewable

Certified wood will be used

Indoor Environmental Quality

Interior spaces will be ventilated through the introduction of fresh air

Environmental Tobacco Smoke (ETS) Control measures will be incorporated

Carbon dioxide (CO2) level monitoring will control mechanical ventilation

Ventilation effectiveness measures will be implemented

Low-emitting materials will be used, such as adhesives & sealants, paints & coatings, carpet, composite wood

Indoor chemical & pollutant source control measures will be implemented

Staff control of thermal, ventilation and lighting systems will be implemented for perimeter and non-perimeter spaces

Natural ventilation will be implemented through operable windows located to enable cross and stack ventilation

Thermal comfort will be assured through compliance with ASHRAE 55-1992

Thermal comfort-permanent monitoring system will be considered

A minimum of 90% of interior spaces will have daylight and views
Innovation & Design Process

Sustainable design strategies will be interpreted via personal and non-personal means to encourage implementation.

Building design will incorporate the modularity of the materials used to minimize construction waste, i.e., a 4 foot module which is a derivative or multiple of 4’x8’ sheets of plywood and gypsum board; stud, joist and truss spacing at 16” and 24”.

A strongly integrated indoor/outdoor relationship fostering a connection between the user and site.

Flexibility in planning enabling space to be used to its full potential through multi-use, and to facilitate future retrofitting.

Timeless design will minimize probability of future renovation due to aesthetics.

Efficient space planning will minimize size.

Materials will be used that are low-maintenance, durable, sustain biodiversity of the planet, have low embodied energy, and are easily recycled.

Material use will be minimized by exposing infrastructure.