LEBANON HILLS REGIONAL PARK SUSTAINABLE TRAILS STUDY

Dakota County MN

January 12, 2023

Dakota County
forever wild
PARKS

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DAKOTA COUNTY MINNESOTA

JANUARY 12, 2023

PREPARED FOR:

Dakota County forever wild PARKS

PREPARED BY:

SRF Consulting Group

Applied Trail &
Boardwalk Design LLC

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SECTION 1 - PROJECT INTRODUCTION

PROJECT PURPOSE

This Study is being undertaken to provide a detailed assessment of existing trail conditions at Lebanon Hills Regional Park, identify opportunities for improving the long-term sustainability of the trail system, and ensuring trail compatibility with the parks surrounding natural and cultural resources. A sustainable trail is defined as trails that are physically, ecologically, and economically sustainable while providing high quality trail recreation and nature-based experiences for the community.

The Study addresses the following trail issues and opportunities in the park:

- Preservation of high-quality trail recreation and nature-based experiences
- Minimization and mitigation of impacts to natural resources
- Minimization and mitigation of impacts to culturally important sites
- Identification of trail use conflicts
- Identification of safety and risk concerns
- ADA accessibility
- Reduction of trail related erosion issues
- Identification of deferred trail maintenance needs
- Improvement of sustainable maintenance practices

The primary four areas of this study include:

1. Assessment of current trail system based on the above defined criteria
2. Recommendations for modifications and improvements to current trail system based on the field assessments
3. Identification of maintenance practices and resources needed to maintain sustainable trails
4. Development of a phasing plan and preliminary cost estimate to inform funding needs for trail improvements

This Study does not include detailed design or engineering for any new trail improvements.

PROJECT INTENT

The intent of this Study is to assess the existing trail system and refine the 2015 Master Plan conceptual trail network to achieve safe, sustainable trails throughout the park, improve ADA accessibility, and provide quality nature-based visitor experiences. Refinements minimize natural resource impacts and improve long term sustainability of trails by integrating sustainable trail building practices.

Outcomes of this Study will determine operations and maintenance needs for the trail system in the park and will establish an implementation strategy for trail improvements. Recommendations from the 2015 park Master Plan and 2019 park Natural Resource Management Plan were used to guide outcomes and recommendations of this trail study. Not all trail recommendations identified in the 2015 Lebanon Hills Regional Park Master Plan are addressed in this study. Other trail recommendations, for example the year round accessible connector trail and Holland Lake peninsula trail, grade separated crossings, trailhead improvements, and Camp Sacajawea trails, not included in this study may be addressed as separate projects in the future. Other guiding resources used for this study include:

- Trail Planning, Design, and Development Guidelines, Minnesota Department of Natural Resources - Trails & Waterways Division, 2006
- Trail Solutions IMBA's Guide to Building Sweet Singletrack, 2004
- Natural Surface Trails by Design, Troy Scott Parker, 2004
- Managing Mountain Biking IMBA's Guide to Providing Great Riding, 2007

TRAILS TYPES ADDRESSED IN PLAN

This study addresses all approximately 50 miles of trails found in the West, Middle, and East segments of the park (Figure 1). The existing trails in the park include:

- Mountain Bike Trails
- Equestrian Trails
- Skate Cross Country Ski Trails
- Classic Cross Country Ski Trails
- Winter Hiking/Snowshoe trails
- Summer Hiking Trails
- Portage Trails

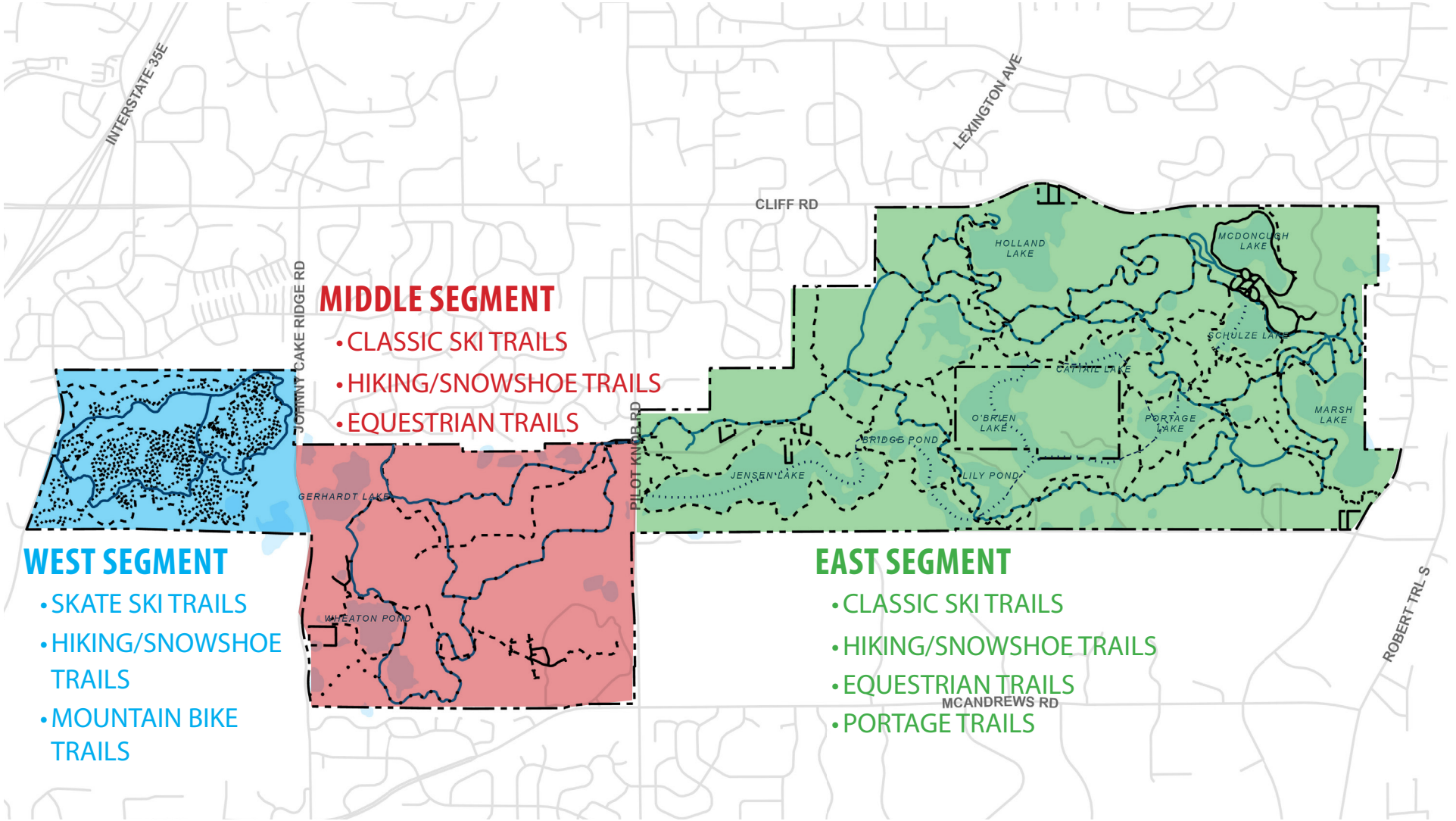

Figure 1: Park Context Map

PROJECT SCHEDULE

The Lebanon Hills Trail assessment was composed of a two phased process over an eight-month timeframe. The Phase I Assessment occurred in July with a week long field assessment of all trails. GPS and photo documentation was used to document and guide recommendations for trail improvements. Data collected in the field served as the basis for the Phase II Recommendations and Implementation Strategy.

The entire process was guided with engagement from stakeholder groups and guidance from Dakota County staff with representatives from the Parks, Planning, and, Communications Departments (Figure 2). The project team met with Dakota County staff six times to review and provide feedback on progress. In addition, two meetings with Minnesota Off-Road Cyclists (MORC), Wilderness in the City (WITC), and ISD 196 School of Environmental Studies students (SES) were held. A summary of outreach and engagement is described in Section 4.

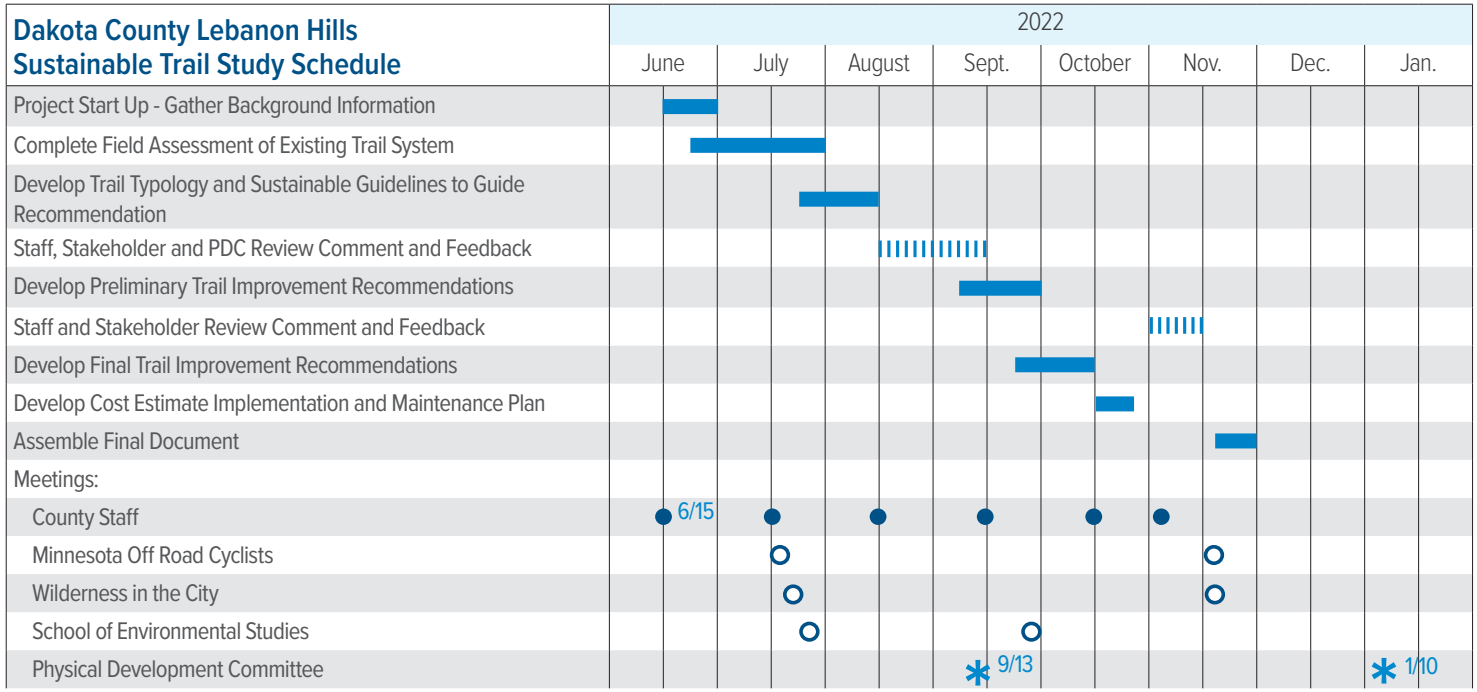

Figure 2: Project Schedule

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SECTION 2 - PHASE I: TRAIL ASSESSMENT

The Phase I: Trail Assessment had four main components. These include development of trail evaluation criteria used for assessing trails, review of existing trail typologies, development of desktop analysis of natural resources, and a field assessment of all trails. All four components established a comprehensive trail assessment that was used as a bases for trail recommendations.

TRAIL EVALUATION CRITERIA

Before field evaluating all 50 miles of trails in the park, a series of trail evaluation criteria was developed to assess trail sustainability. The following ten criteria were used to evaluate the existing trail system in the park:

1. Trail Erosion Issues – Identification of minor, moderate, and severe erosion issues on trails.

- Minor Trail Erosion
  - Trail erosion less than 6” deep
  - Trace amount of visual erosion
- Moderate Trail Erosion
  - Trail erosion 6-10” deep
  - Significant visual erosion but no deep gullies
- Severe Trail erosion
  - Trail erosion greater than 10” deep
  - Deep gully erosion present

Minor Trail Erosion

Moderate Trail Erosion

Severe Trail Erosion

2. Conflicts Between User Groups – Trail intersections between user groups which have poor sight lines or approaches pose a higher chance of conflict or collision.

3. Safety, Risk, and Hazard Concerns – Tight turns, steep slopes, or other obstacle which poses a higher chance of injury to trail user.

4. Wayfinding and Circulation Issues – Trail intersections or alignments which are confusing for trail user to follow and stay on intended route.

5. Poor Site Drainage – Trail segments that have low spots that collect storm water or do not allow for cross slope drainage.

6. Deferred Trail Maintenance– Trail segments showing signs of minor degradation due to lack of routine maintenance. These segments will become more serious issues if not addressed.

7. Accessibility Issues – Barriers or locations which do not allow for people living with physical disabilities to access trail system or park amenities.

8. Factors Impacting a High-Quality Trail User Experience – From a trail user perspective, trail alignments which offer exposure to a wide variety of scenic viewsheds, landscape types, and terrain to create a high-quality trail user experience.

9. Impacts to Natural and Cultural Resources – Trail segments which may be impacting high quality vegetation, water, wildlife habitat, or cultural resource areas.

10. Long Term Sustainability - Trail locations which are prone to high use and in need of improvement to require less maintenance and be more sustainable over the long term.

EXISTING TRAIL TYPOLOGIES

The park currently supports both summer and winter use trails in all three segments of the park (See Figure 3) . Many of the equestrian trails serve as cross country ski trails and hiking trails are used by snowshoers during the winter months. The existing mountain bike trail system is used year-round by riders as winter fat tire biking has increased in popularity over the last several years.

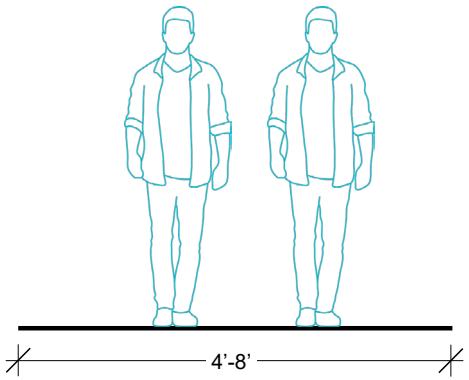
The equestrian/ski trails are maintained at ten to twelve feet wide to accommodate double track classic skiing in the winter and side-by-side equestrian riding during the summer. The hiking and snowshoe trails are maintained at a minimum of six feet wide to accommodate comfortable passing on the trail and provides the minimum width for maintenance and emergency vehicle access. The mountain bike trails are maintained at an average width of three feet which provides the single-track biking experience that most users are looking for in a year-round use mountain bike trail system.

INTEGRATION OF NATURAL RESOURCES

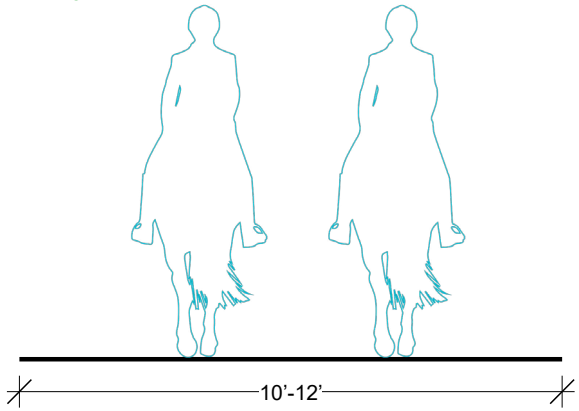
Existing natural and cultural resources were also evaluated in the park and their compatibility with existing trail alignments and circulation. When the trail system was initially developed, trails were not designed to be integrated with sensitive wildlife, habitat, and natural resource areas. The Phase I assessment evaluated the existing trail system and its impact on these park resources. Phase II recommendations focuses on reducing impacts to natural resources while improving the physical sustainability of the trail system.

Summer Use

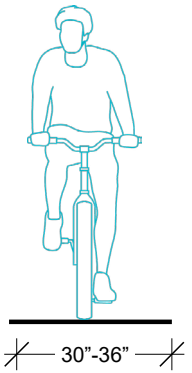
Hiking Trails
Surface: Grass, dirt, gravel
Width: 4’-8’



Equestrian Trails
Surface: Grass, dirt, gravel
Width: 10’-12’

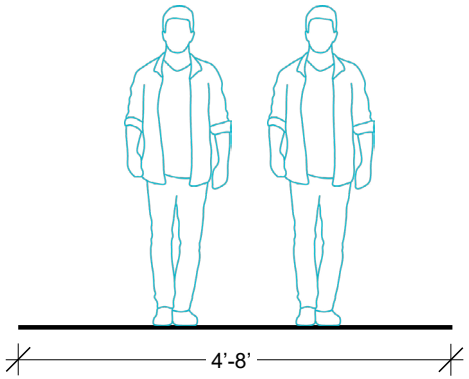


Mountain Bike Trails
Surface: Dirt (summer) or Snow packed (winter)
Width: 30”-36”

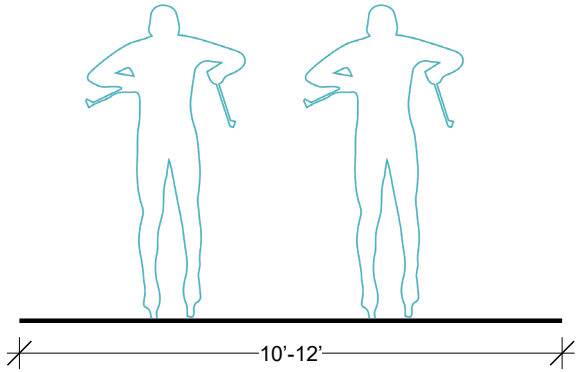


Winter Use

Snowshoe Trails
Surface: Natural snow
Width: 4’-8’



Classic Ski Trails
Surface: Snow tracked
Width: 10’-12’



Skate Ski Trail
Surface: Snow groomed
Width: 8’-10’

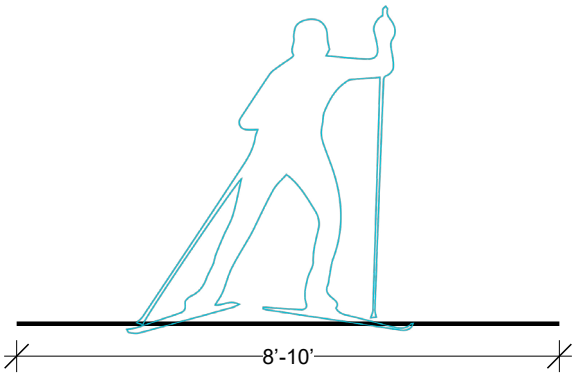


Figure 3: Existing Trail Typologies

WETLANDS

Wetlands are one of the many sensitive natural resource in the park. Eroded trails within close proximity to wetlands degrade wetland quality. To evaluate how existing trails are impacting the quality of natural resources, all trail erosion issues identified within 100 feet of wetlands or lakes were measured (See Figure 4). Erosion on trails within 100 feet of wetlands or lakes will negatively influence water quality over time.

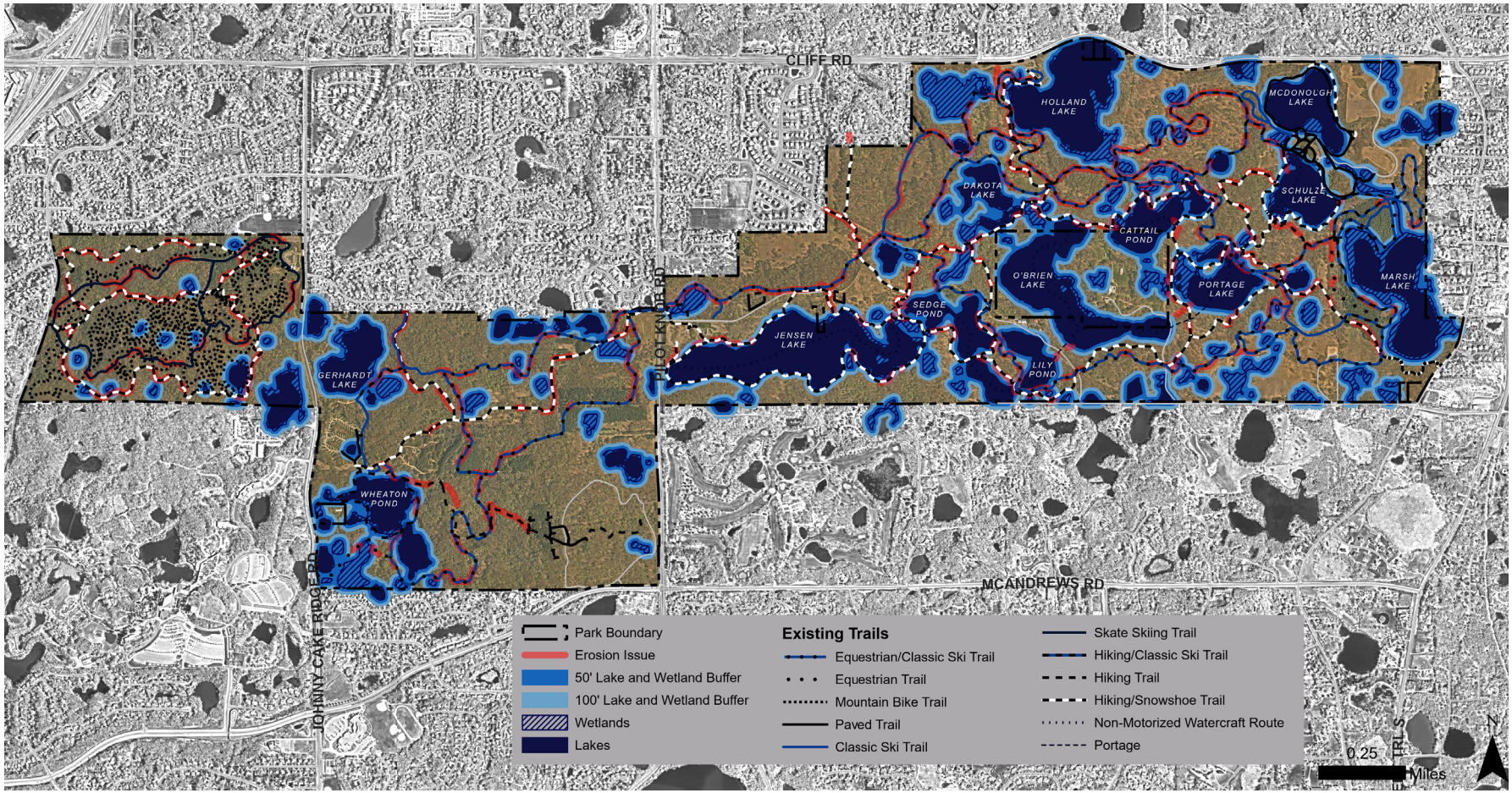


Figure 4: Lakes and Wetlands Buffer

STEEP SLOPES & SOILS

In addition to evaluating erosion near lakes and wetlands, the Phase I assessment located all existing steep slopes (See Figure 5) and highly erodible soils (See Figure 6 & Figure 7) as these areas are more likely to erode overtime.

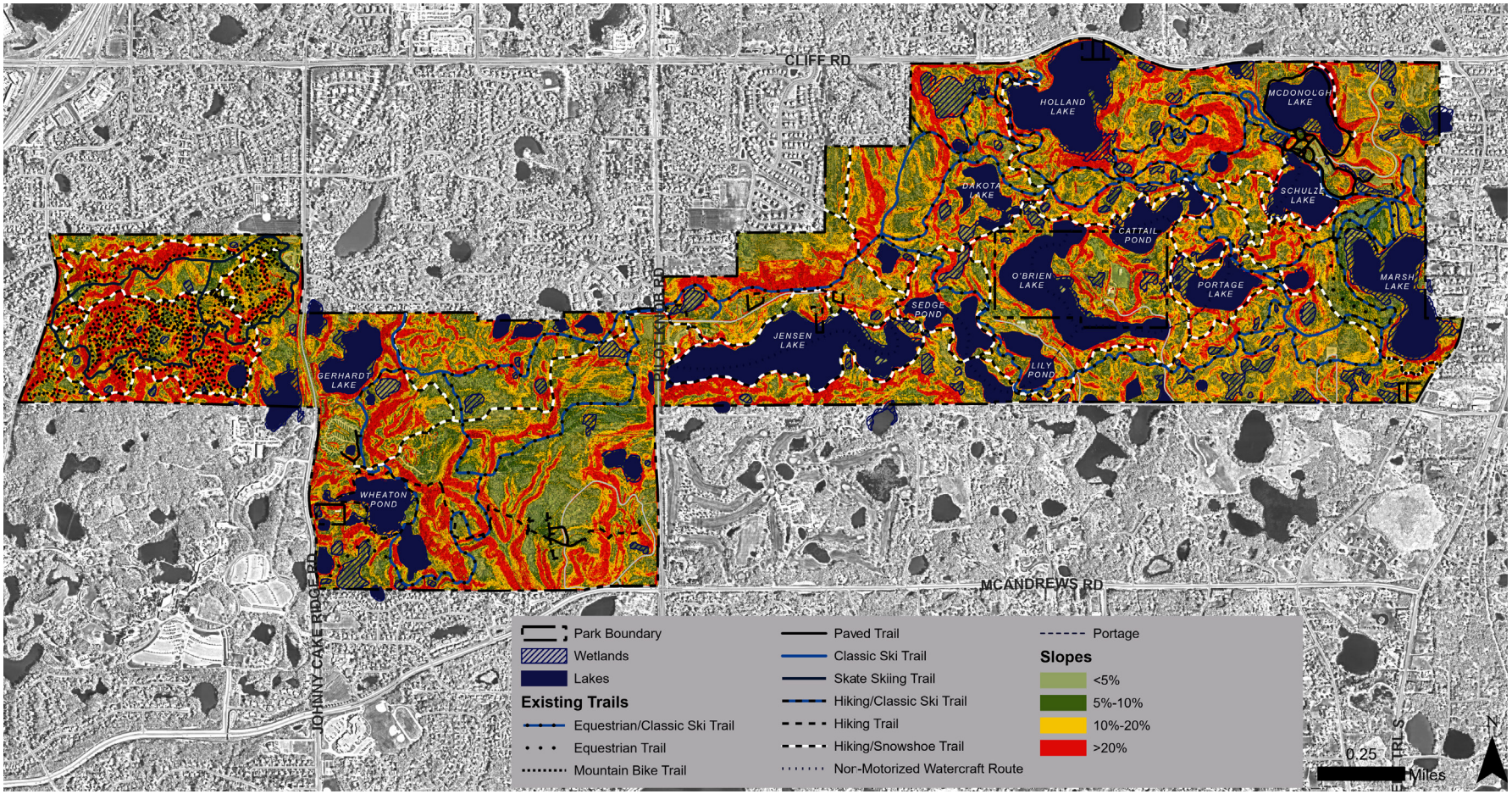


Figure 5: Slopes

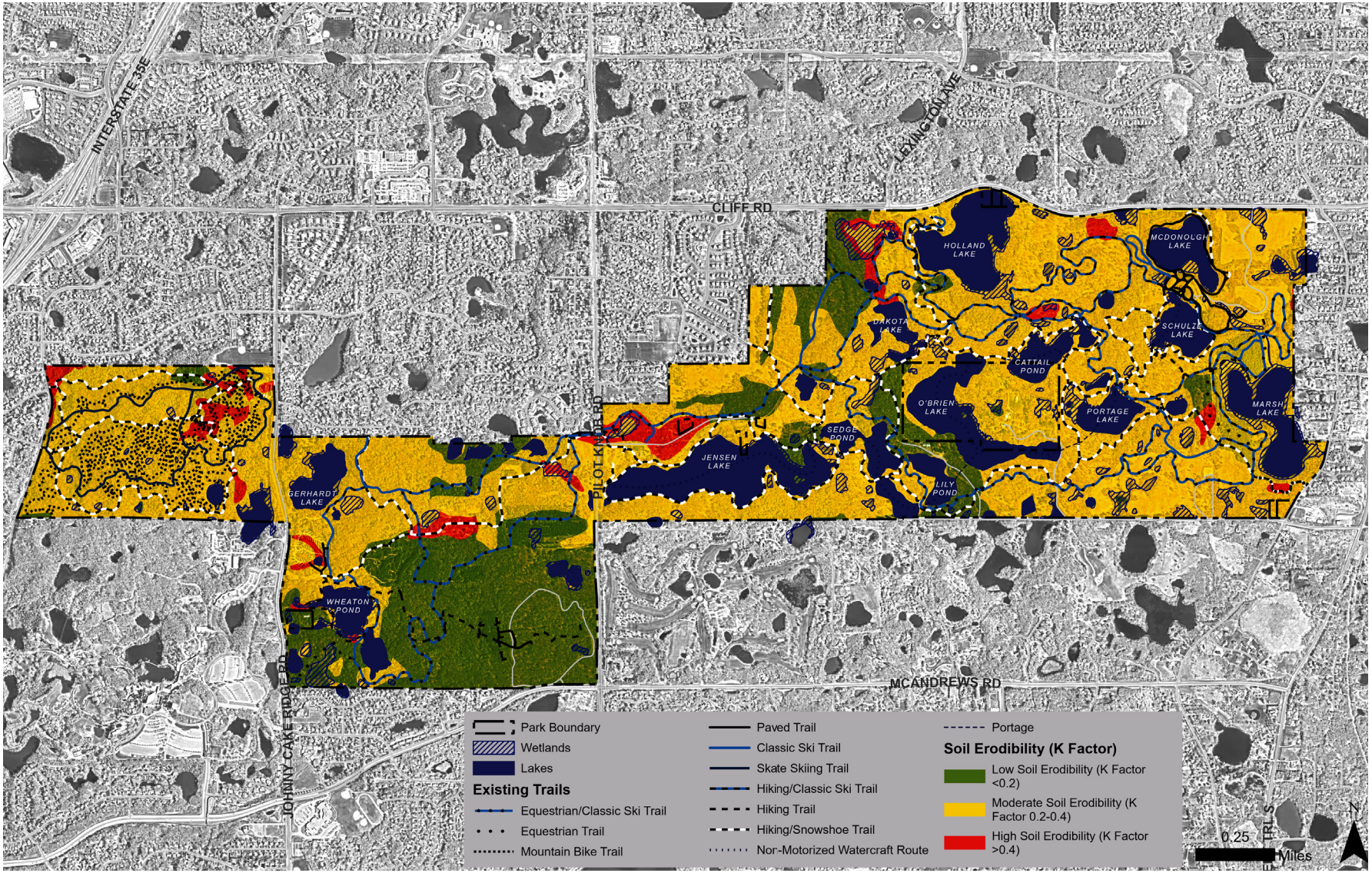


Figure 6: Soil Erodibility K Factor

USDA Limiting Soil Properties Rating for Trails

The limiting soil properties rating for trails was developed by the USDA soil survey staff. The ratings are based on the soil properties that affect trafficability and erodibility. These properties are stoniness, depth to a water table, ponding, flooding, slope, and texture of the surface layer.

The rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the specified use.

- *"Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected.*
- *"Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected.*
- *"Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.*

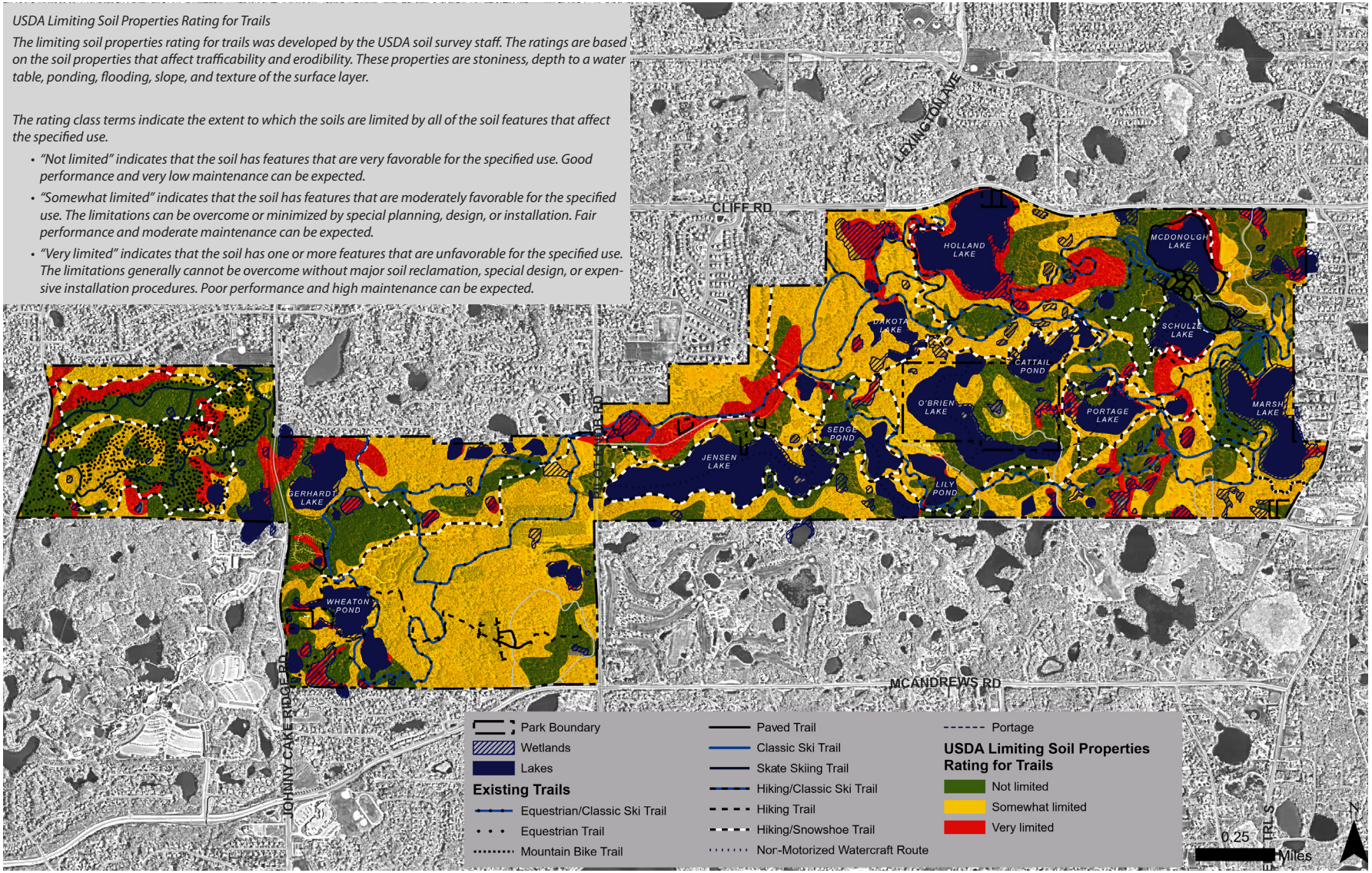


Figure 7: USDA Limiting Soil Properties Rating for Trails

STEEP SLOPES & SOILS - CUMULATIVE MAP

For the purpose of evaluating trail sustainability, slopes greater than 20%, soil erodibility K factor greater than 0.4, and soils identified as "very limited" for trail development as defined by the USDA soil survey were identified as areas where trail development should be limited to the extent feasible or have the highest level of sustainable design standards applied to ensure long term sustainability (See Figure 8).

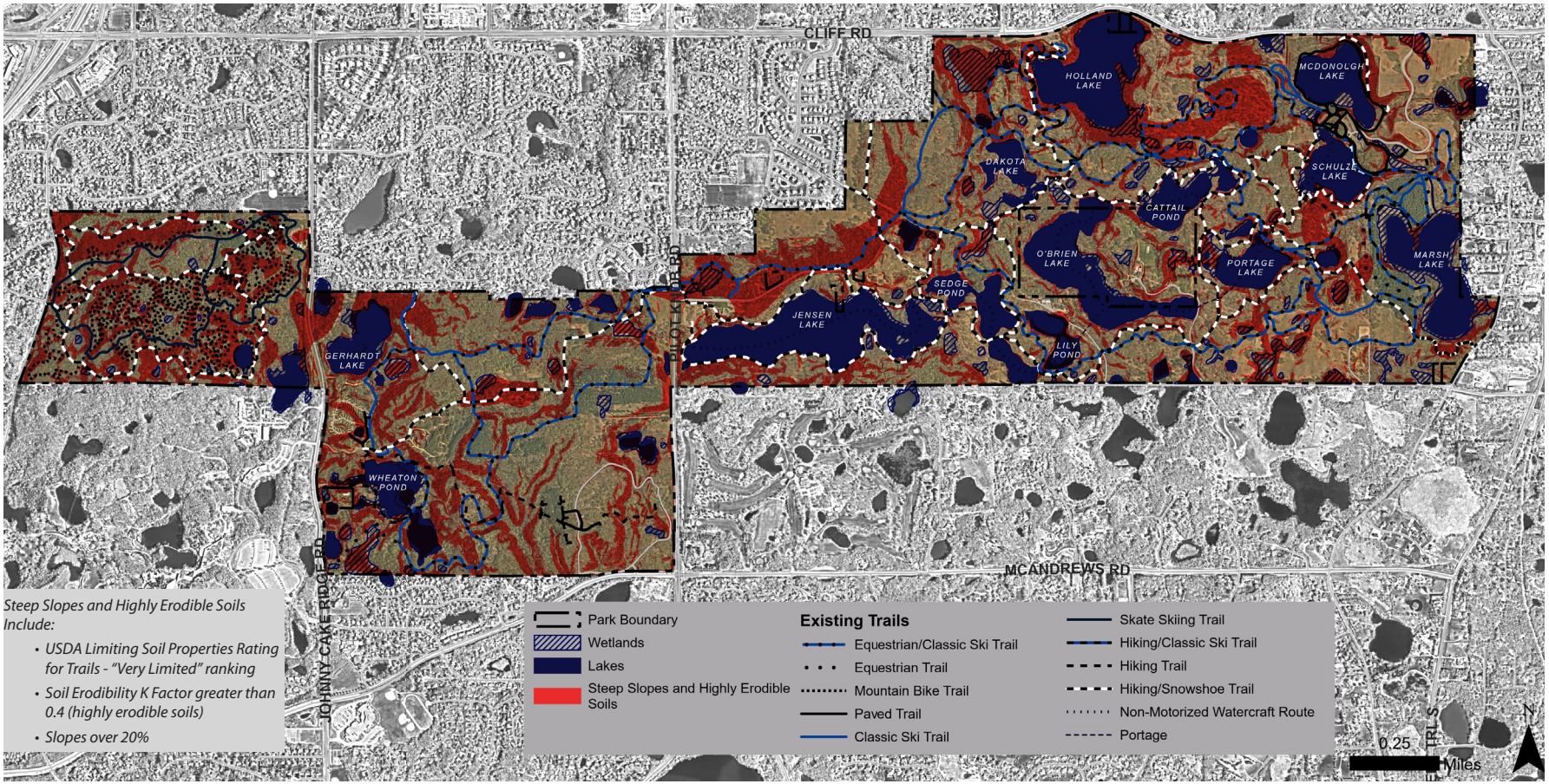


Figure 8: Steep Slopes and Highly Erodible Soils

SIGNIFICANT AND SENSITIVE NATURAL RESOURCES

All significant and sensitive natural resources in the park were identified through coordination with Dakota County Natural Resource staff (See Figure 9). Significant and sensitive natural resources identified in the park include:

- Interior/old growth forest areas
- Former Oak Savanna
- Remnant prairies
- Swamps and Peatlands
- Sensitive wildlife habitat areas
- Minnesota Biological Survey (MBS) Site Biodiversity Significance - Moderate or higher rank
- All lakes and wetlands including a 50 foot buffer
- All restored areas

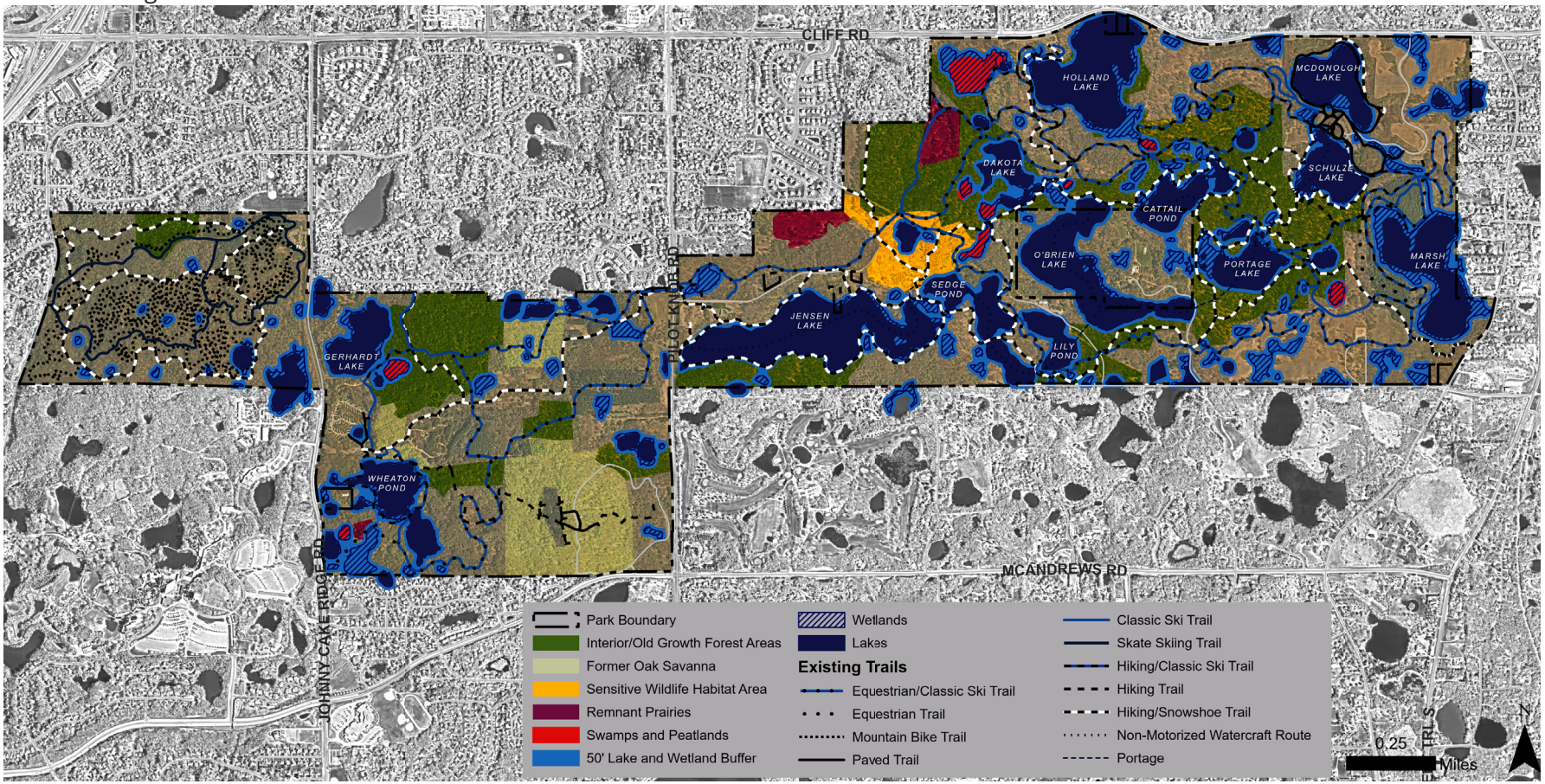


Figure 9: Sensitive and Significant Natural Resources

NATURAL RESOURCE CATEGORIES

The significant and sensitive natural resources identified in the park were grouped into three categories to help guide recommendations for trails that currently are impacting sensitive natural resource areas in the park (See Figure 10).

Natural Resource Category A

Category A represents the most sensitive natural resources in the park. Much of the most sensitive natural resources are found in the East Segment of the park. While all areas of the park have natural resource value, areas identified as Category A have the utmost sensitivity and significance and therefore warrant extra protection and consideration to trail development through or adjacent to these areas. Natural Resource Category A includes:

- Highly sensitive natural resource areas
- Sensitive wildlife habitat area
- Remnant prairies
- Swamps and peatlands
- Minnesota Biological Survey – site biodiversity significance ranking at moderate or higher
- 50' buffer of lakes and wetlands

Natural Resource Category B

Category B represents high quality natural resources in the park but trail development posses less potential to impact these areas. Much of category B natural are wooded areas that have been largely undisturbed or restored. As such, trail development is possible in these areas with less potential impacts than those in Category A. Natural Resource Category B include:

- Sensitive natural resources
- Interior/Old Growth Forests
- Former Oak Savanna
- Recently restored areas

Natural Resource Category C

Natural Resource Category C are still important natural resources of the park but represent areas that are disturbed natural resources such as unrestored agricultural land, pine plantations, or developed areas of the park such as campgrounds and trailheads. Natural Resource Category C include:

- Disturbed natural resource areas
- Developed sites (campgrounds, trailheads)
- Previously disturbed agricultural land

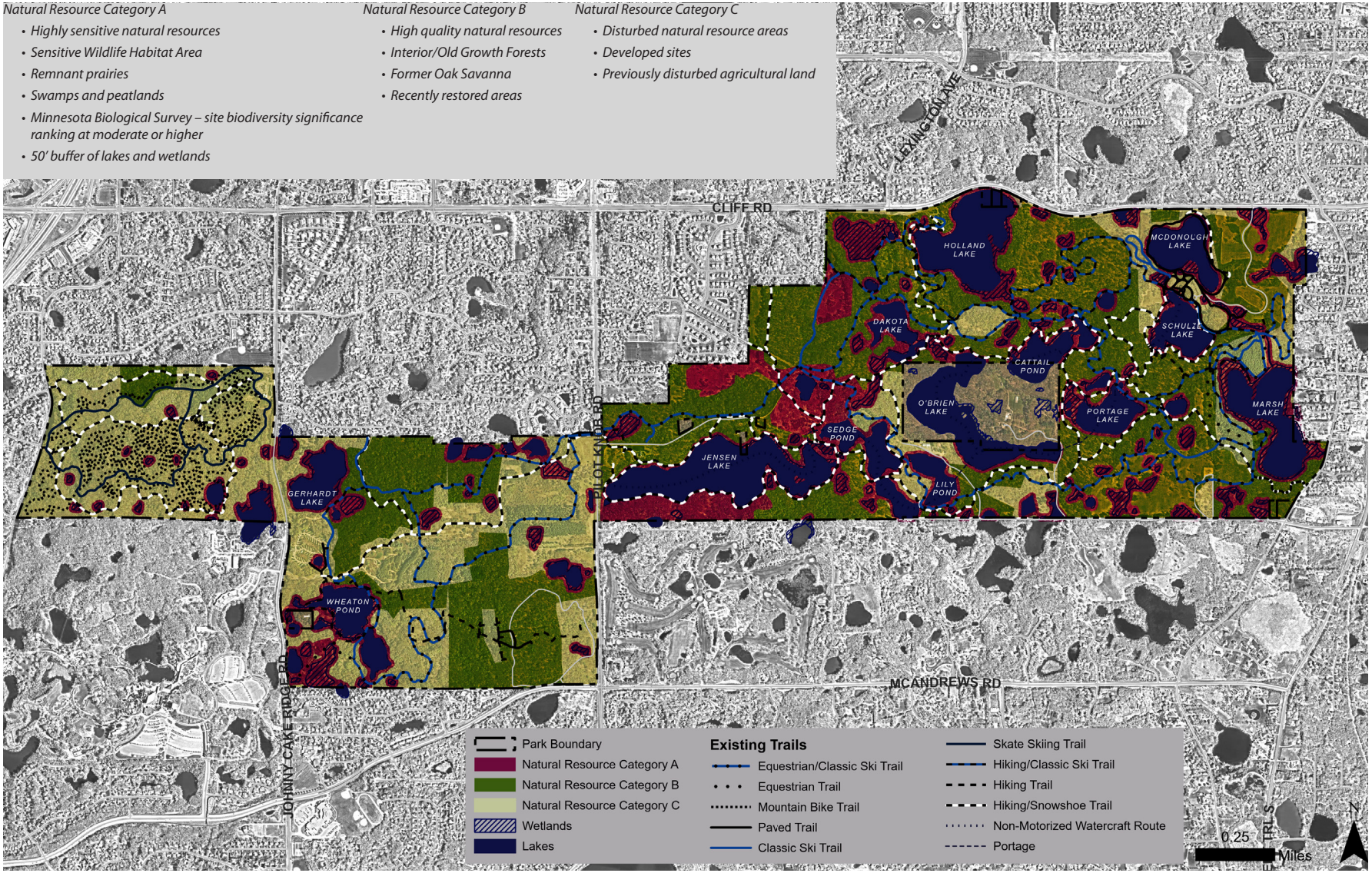


Figure 10: Natural Resource Categories

FIELD ASSESSMENT OF TRAILS

Based on observations made in the field, trail lengths and points were mapped using a handheld GPS device and photo documentation to document trail conditions. Mapping and analysis of natural resources helped identify other areas in need of improvement and conflict areas. Physical trail assessment criteria were also quantified for each segment of the park to begin to understand the scope and scale of work needed for trail improvements. Quantified trail condition summary tables establish a framework for developing cost estimates, establishing a phasing and funding plan for implementation, and developing a long-term trail maintenance strategy for the park. The following summarizes key findings from the field assessment of trails broken down by segment and trail type.

WEST SEGMENT

The west segment of the park serves as the primary year-round destination for all abilities of mountain bike trail users while also accommodating hikers in the summer and skate skiers and snowshoers during the winter months. See Figure 11 and Figure 12 for map and table of west segment assessment summary.

Mountain Bike Trails

Most of the existing mountain trail system in the park provides a high-quality recreation experience for beginner, intermediate, and advanced riders and remains one of the more popular mountain bike destinations in the Twin Cities.

Constructed over twenty years ago, some portions of the trail system need improvements and on-going maintenance including:

- Removal of Buckthorn vegetation at trail intersections and along trail edges to improve sightlines for trail users.
- There is significant Buckthorn in the west segment of the park. Buckthorn provides an effective barrier between trails and discourages trail jumping. When Buckthorn is removed, it will need to be replaced

with plantings that effectively prevent trail jumping.

- Eliminating some high-speed intersections with the hiking/ski trail pose safety risks for trail users.
- The skills course is situated in a good location but needs updating to better meet the needs of user groups.
- The current trails system and skills course does not accommodate adaptive biker user needs.
- The trail segment known as the prairie area has continual erosion issues and needs updates to be more sustainable.
- Embankment turns are subjected to more frequent erosion and maintenance.
- MORC volunteer crews are doing an excellent job with ongoing regular maintenance and coordinating with County staff resources.
- MORC has expressed a desired to refresh the mountain bike trail system with new features.

Hiking/Snowshoe and Skate Ski Trails

- The designated hiking and skate ski trail system in this area of the park have been subjected to more severe erosion over time based on their locations on steeper fall line alignments. Erosion issues include:
  - Deep gullies and washouts causing poor trail surface conditions that do not provide a high-quality trail experience for most users.
  - Severe trail erosion has caused runoff to some surrounding waterbodies and wetlands.
  - Many trail segments in need of realignment to prevent ongoing erosion issues.
- No accessible trails are present in this area of the park except for access to the trailhead restroom/shelter facility from the adjoining parking lot.
- Steep and challenging topography only accommodates advanced hikers and skate skiers.
- Tight corners on steep downhills are safety concern for beginner skiers.
- Lack of vegetative cover on trails has increased the erodibility of soils.
- Erosion control blanket placed on steep slopes has lost its effectiveness over time.
- Existing hiking trail network does allow loops of varying distances.

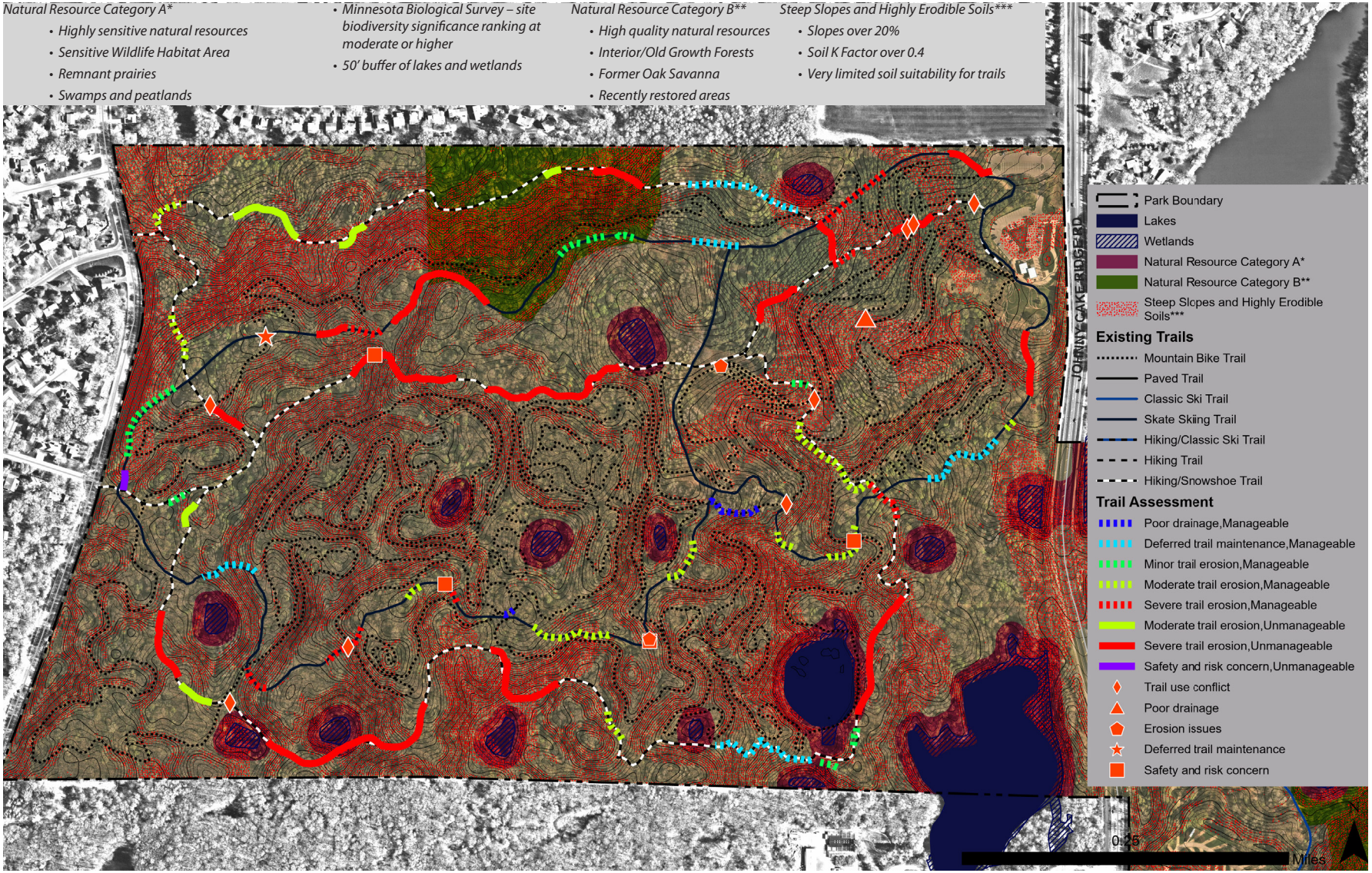


Figure 11: West Segment Trail Assessment Summary Map

TRAIL EVALUATION SUMMARY - WEST TRAIL SYSTEM (86,927 LF or 16.5 mi)					
Observation	**Number of Point Features Collected**	**Number of Line Features Collected**	**Length (FT)**	**Percentage of West Trail System (86,927 LF)**	**Percentage of West Hiking/Sking Trail System (28,128 LF)**
Deferred Trail Maintenance*		5	758	0.87%	2.69%
Poor Drainage	1				
Intersection - poor wayfinding/alignment					
ADA Accessibility Issues	2				
Safety/Risk Concern	4	1	35	0.04%	0.13%
Trail Use Conflict	8				
General Erosion Issue	3				
Minor Trail Erosion, Manageable		8	408	0.47%	1.45%
Moderate Trail Erosion, Manageable		11	825	0.95%	2.93%
Severe Trail Erosion, Manageable		7	547	0.63%	1.94%
Moderate Trail Erosion, Unmanageable		5	352	0.40%	1.25%
Severe Trail Erosion, Unmanageable		15	2,323	2.67%	8.26%
TOTALS		**52**	**5,248**	**6.04%**	**18.66%**

**Only includes trail segments showing significant deferred trail maintenance needs. Majority of trail system is in need of some routine maintenance.*

TRAIL NATURAL RESOURCE SUMMARY - WEST TRAIL SYSTEM (86,927 LF or 16.5 mi)		
Category	**Length (FT)**	**Percentage of West Trail System (86,927 LF)**
Trail in highly significant natural resource area (Category A)	2,352	2.71%
Trail in significant natural resource area (Category B)	3,359	3.86%
Trail erosion within 100' of wetland or lake	1,535	1.77%

Figure 12: West Segment Trail Assessment Summary Table

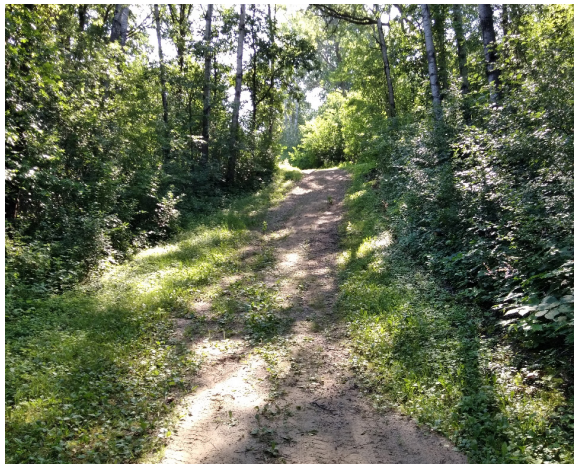
MIDDLE SEGMENT

The middle segment of the park provides trail segments that accommodate hikers, equestrian riders, and cross-country skiers. Both the existing campground and Camp Sacajawea are visitor destinations within this area of the park. See Figure 13 and Figure 14 for map and table of middle segment assessment summary.

Hiking Trails

The hiking trails in this segment of the park primarily serve campground and Camp Sacajawea visitors while also providing a connection to the more expansive trail system in the middle and east segments of the park. Some observations include:

- Many steep fall line trails have moderate to severe erosion and direct runoff to lakes and wetlands.
- Lack of trail connections from Camp Sacajawea to other areas of the park. The current trail connecting the Camp with the middle segment hiking trails is in poor condition.
- Lack of a trail connection to the west segment to accommodate campground users.
- Lack of interconnected looped trails within the middle segment
- Confusing trail circulation and wayfinding east of Wheaton Pond.
- Lack of accessible trails.
- Presence of unofficial trails going down to lakes and connecting to adjoining neighborhoods.
- Trail around Wheaton Pond is less than 50 feet from the shoreline, but trail has minimal erosion and impacts.
- Hiking trail south of Gerhardt Lake extends past a high-quality natural resource (swamp and peatland) and exhibits severe trail erosion.



Equestrian Trails

Many of the equestrian trails have been subjected to severe erosion because of poorly designed trails on steep slopes in this area the park. Other observations included:

- Hikers, trail runners, and bikers were observed using equestrian trails.
- Equestrian use of trails was observed to be higher at the east segment of the park during the field evaluation.
- Most equestrian trails are not in a sensitive natural resource area but the spur trail to Johnny Cake Road extends along a remnant prairie and a swamp and peatland.

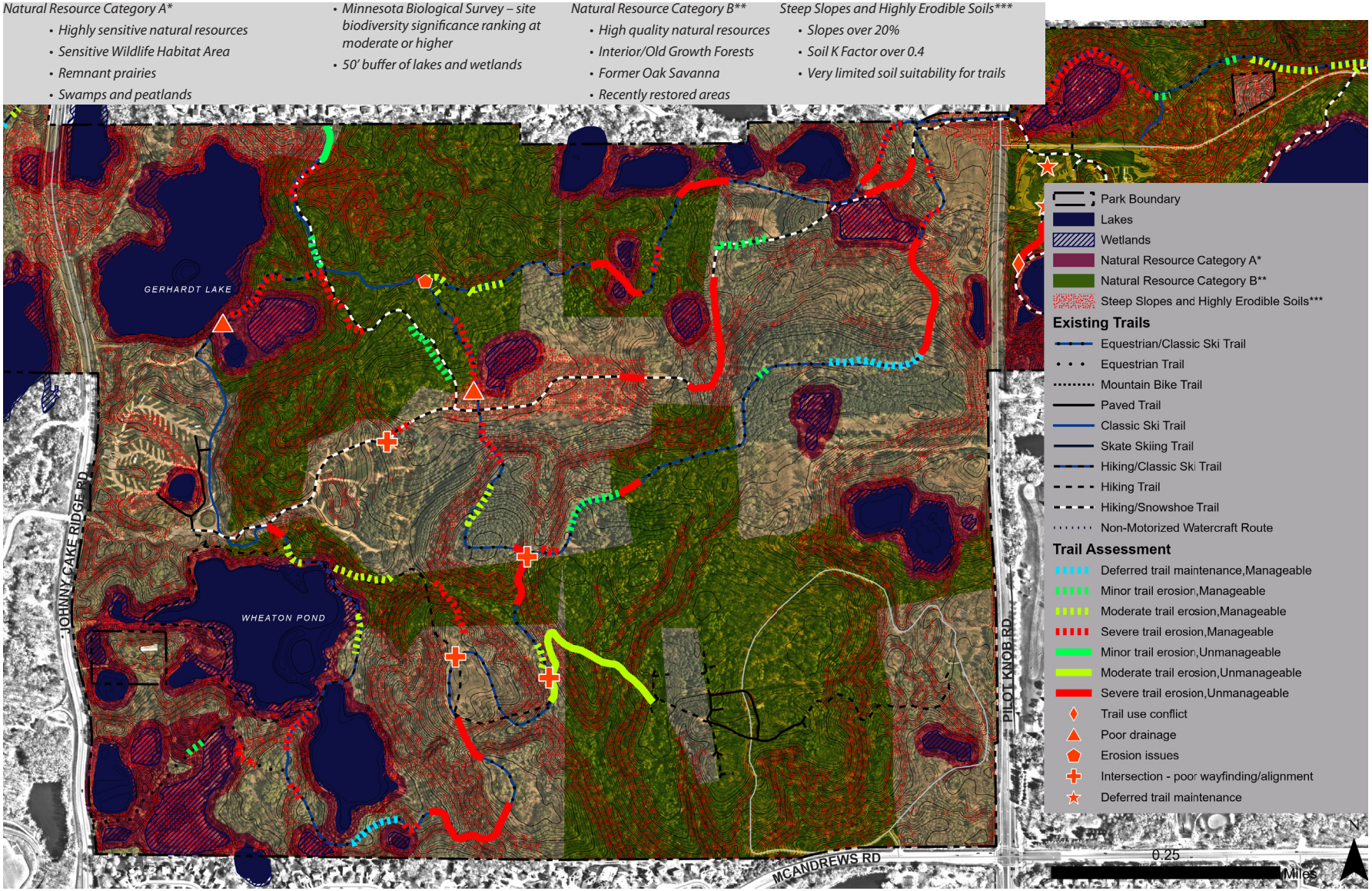


Figure 13: Middle Segment Trail Assessment Summary Map

TRAIL EVALUATION SUMMARY - MIDDLE TRAIL SYSTEM (41,134 LF or 7.8 mi)				
Observation	**Number of Point Features Collected**	**Number of Line Features Collected**	**Length (FT)**	**Percentage of Middle Trail System**
Deferred Trail Maintenance*		2	381	0.93%
Poor Drainage	2			
Intersection - poor wayfinding/alignment	4			
ADA Accessibility Issues	1			
Safety and Risk Concern				
Trail use Conflict				
General Erosion Issue	1			
Minor Trail Erosion, Manageable		6	643	1.56%
Moderate Trail Erosion, Manageable		8	682	1.66%
Severe Trail Erosion, Manageable		19	1,761	4.28%
Minor Trail Erosion, Unmanageable		1	95	0.23%
Moderate Trail Erosion, Unmanageable		1	501	1.22%
Severe Trail Erosion, Unmanageable		13	1,964	4.77%
TOTALS	**8**	**50**	**6,027**	**14.65%**

**Only includes trail segments showing significant deferred trail maintenance needs. Majority of trail system is in need of some routine maintenance.*

TRAIL NATURAL RESOURCE SUMMARY - MIDDLE TRAIL SYSTEM (41,134 LF or 7.8 mi)		
Category	**Length (FT)**	**Percentage of Middle Trail System**
Trail in highly significant natural resource area (Category A)	5,972	14.52%
Trail in significant natural resource area (Category B)	13,273	32.27%
Trail erosion within 100' of wetland or lake	2,394	5.82%

Figure 14: Middle Segment Trail Assessment Summary Table

EAST SEGMENT

The east segment of the park has the highest concentration of trails that serve the needs of hikers, skiers, and equestrian riders. The gentler topography coupled with trails aligned well with the topography coincided with fewer severely eroded trail conditions than the west or middle segments of the park. The east segment also has the most sensitive natural resource areas in the park with the most lakes, wetlands, rare habitat, and rare/ remnant plant communities. As such, the east segment has the highest percentage of trails in a significant natural resource area. See Figure 15 and Figure 16 for map and table of east segment assessment summary.

Hiking Trails

- Most trail erosion issues were moderate and minor in this segment of the park.
- Trails are well aligned with topography.
- Most trail segments with erosion issues can be corrected through sustainable trail design and maintenance methods that drain water off the trail in more frequent intervals.
- Trail connection transitions to boardwalks need to be improved to minimize tripping hazards.
- Boardwalks are slippery when wet, especially in the winter when ice is present.
- Boardwalks around Jensen Lake have settled creating drainage issues under decking substructure.

- Informal trails have developed that skirt the boardwalks because they are sometimes flooded, especially in the early spring following snow melt, or too slippery to traverse.
- Decommissioned trails and maintenance roads are not clearly defined causing wayfinding challenges for trail users.
- Lack of accessible hiking trail loops from Jensen Lake and Holland Lake Trailhead.
- Lack of accessible trail identification signage.
- Some popular trails such as the Jensen Lake Loop are narrow and do not allow for people to easily pass each other.
- Lack of a formal trail connections to the park from adjacent neighborhoods causes unofficial trails being developed through the remnant prairie north of Buck Pond and on the steep slopes south of Jensen Lake.
- There is a high concentration of trails through sensitive wildlife habitat areas.
- Maintenance vehicles/equipment on trails accelerate soil displacement and erosion.

Equestrian/Classic Ski Trails

- Trails are well aligned with the topography but lack provisions for controlling runoff down or cross slope of trail.
- More equestrian users observed using the east segment than middle segment equestrian trails during the field evaluation.
- Most existing eroded trails segments can be corrected without rerouting.
- Decommissioned trails or maintenance roads look like equestrian trails and cause confusion for users.
- Wayfinding is lacking at some trail intersections.
- Much of trail system located in old growth/ interior forest areas
- Winter hiking trails from neighborhoods connect to the cross country ski trail network within the park. Winter hiking on cross country ski trails is a recurring issue and reduces the quality of the cross country ski experience.

Paved Trails

- The paved trails were generally in good condition.
- McDonough Lake trail provides an accessible trail loop for park visitors.
- Some root intrusion present on paved trail around the Jensen Lake Trailhead.

Portages

- The portage trails were generally in good condition.
- Low use foot traffic on most portages has minimized erosion issues.
- Some steeper trail access alignments to shoreline edges have caused some sediment run-off into lake basins.

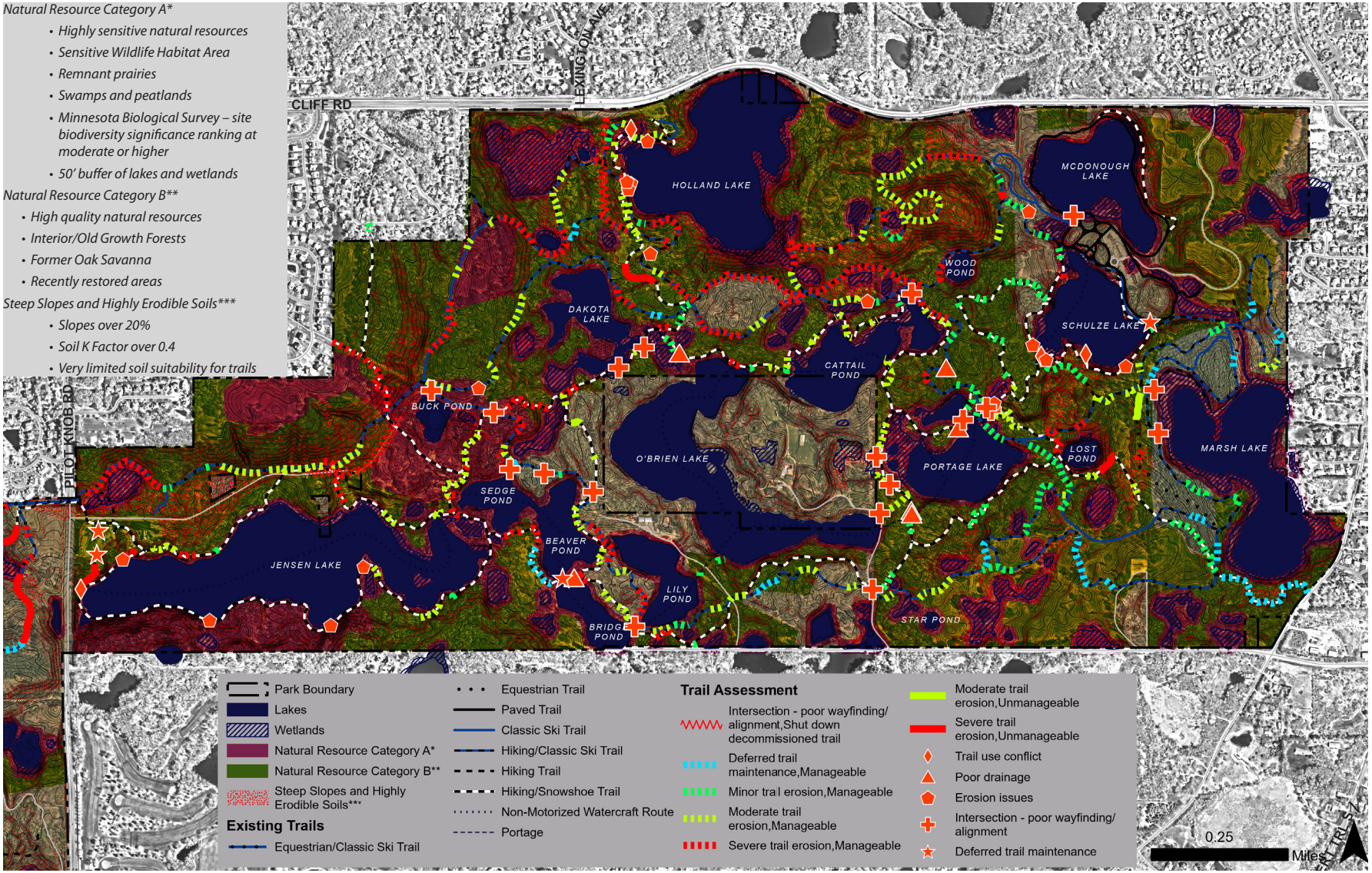


Figure 15: East Segment Trail Assessment Summary Map

TRAIL EVALUATION SUMMARY - EAST TRAIL SYSTEM (134,653 LF or 25.5 mi)				
Observation	**Number of Point Features Collected**	**Number of Line Features Collected**	**Length (FT)**	**Percentage of East Trail System**
Deferred Trail Maintenance*	4	15	1,802	1.34%
Poor Drainage	6			
Intersection - poor wayfinding/alignment	24			
ADA Accessibility Issues	4			
Safety and Risk Concern				
Trail use Conflict				
General Erosion Issue	15			
Minor Trail Erosion, Manageable		54	3,555	2.64%
Moderate Trail Erosion, Manageable		76	6,498	4.83%
Severe Trail Erosion, Manageable		47	6,402	4.75%
Moderate Trail Erosion, Unmanageable		3	173	0.13%
Severe Trail Erosion, Unmanageable		7	788	0.59%
TOTALS	**53**	**202**	**19,219**	**14.27%**

**Only includes trail segments showing significant deferred trail maintenance needs. Majority of trail system is in need of some routine maintenance.*

TRAIL NATURAL RESOURCE SUMMARY - EAST TRAIL SYSTEM (134,653 LF or 25.5 mi)		
Category	**Length (FT)**	**Percentage of East Trail System**
Trail in highly significant natural resource area (Category A)	46,087	34.23%
Trail in significant natural resource area (Category B)	77,715	57.72%
Trail erosion within 100' of wetland or lake	11,414	8.48%

Figure 16: East Segment Trail Assessment Summary Table

SECTION 3 - PHASE II: RECOMMENDATIONS AND IMPLEMENTATION STRATEGY

SUSTAINABLE TRAIL MAINTENANCE PRACTICES

Many trail segments identified with erosion issues can be improved with sustainable trail design best practices. Careful planning and expertise is required by trail builders and maintenance staff to maintain a sustainable trail system. The following recommendations are key for evaluating and maintaining sustainable trail network in the park.

DEBERM

A properly built trail should have good trail outslope (sloped of trail tread from side to side) to direct water off the trail quickly. Overtime, a soft surface trail will form berms on the outside edge of the trail. These berms are cause by normal trail use. If berms on outside edge of trails are not periodically removed, even a once sustainability designed trail will begin to erode. Berms on the outside edge of trails concentrate the flow of water on

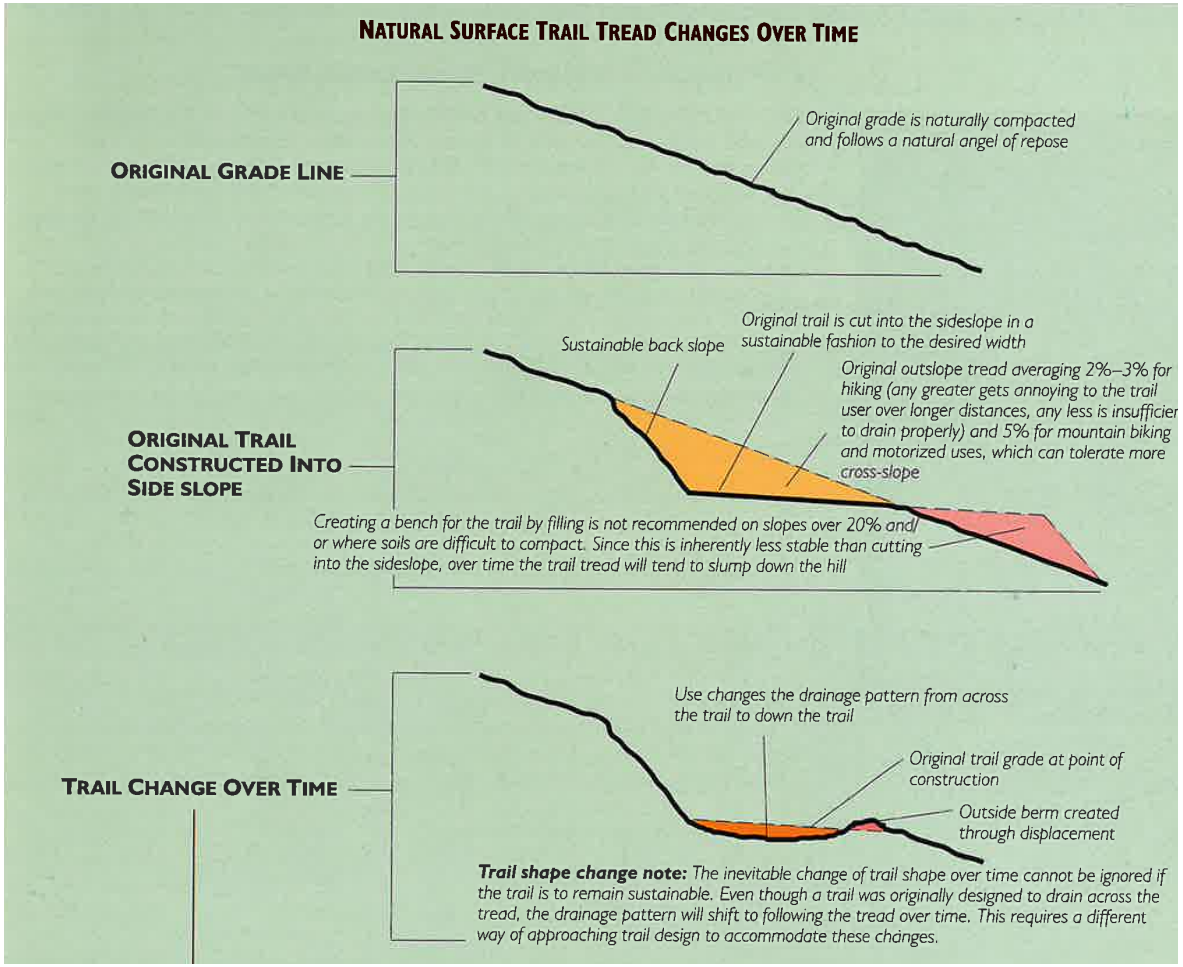
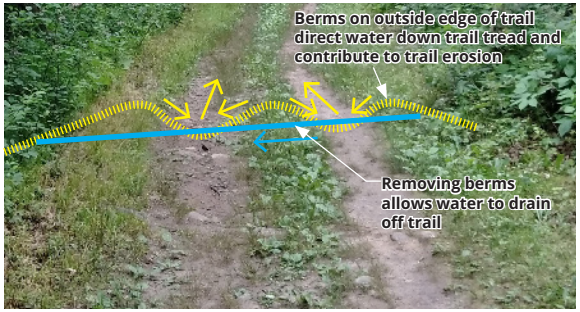


Image source: Trail Planning, Design, and Development Guidelines - MnDNR, 2006



Example of trail in need of deberming at Lebanon Hills Regional Park

the trail tread. The increased water volume and velocity will erode the trail.

ROLLING GRADE & EARTHEN ROLLERS

Having proper outslope is only the start of a sustainable trail design. A trail with any significant longitudinal slope with proper outslope alone will still erode due to gaining water velocity down the slope of a trail. A sustainable trail should roll up and down as

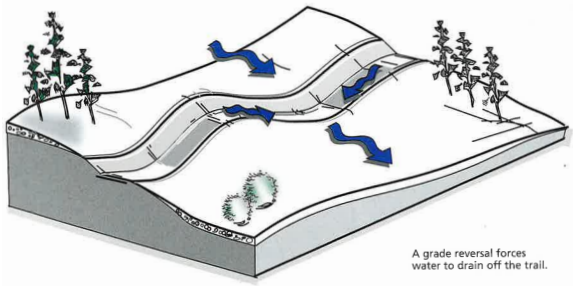
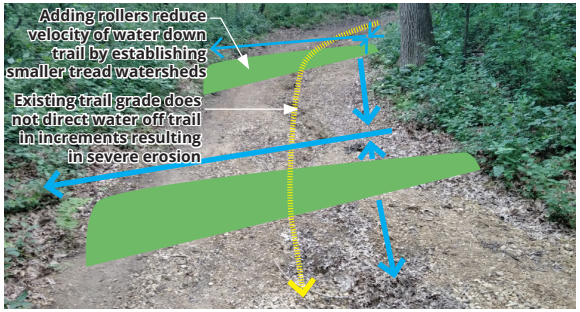


Image source: Managing Mountain Biking. IMBA's Guide to Providing Great Riding, 2007



Example of trail in need of earthen rollers at Lebanon Hills Regional Park

it transcends a slope. A rolling grade design effectively divides a trail segment into smaller tread watersheds where water can drain off a trail before it gains significant water velocity that erodes trail treads.

Earthen rollers can be added to existing trails that were not designed with rolling grades to achieve a similar effect. Earthen rollers are essentially berms that create a short up hill section on a long downhill trail to break the trail segment into smaller tread watersheds.

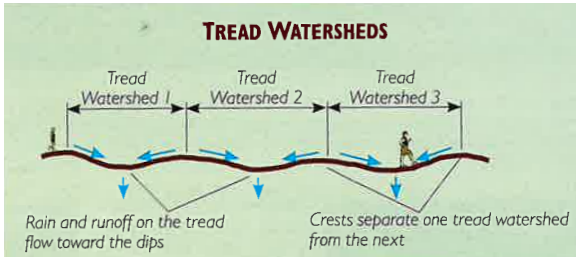
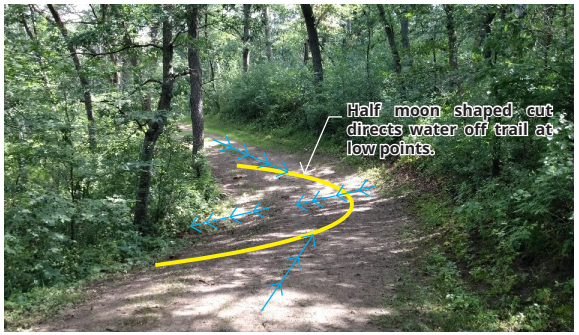


Image source: Trail Planning, Design, and Development Guidelines - MnDNR, 2006

KNICKS

Knicks are used to properly drain water off trails at low points. A knick is a half moon shaped cut that is tilted to the outslope that directs water off trail. For knicks to be effective, the grade adjacent to the trail needs to be lower to provide a place for the water to drain.



Example of knick at Lebanon Hills Regional park

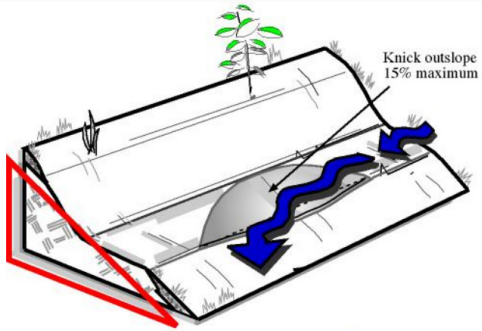


Image source: IMBA Sustainable Trail Development A Guide to Designing and Constructing Native-surface Trails, 2009

REROUTE FALL LINE TRAILS

A trail that is aligned perpendicular to the slope of a hill is considered a fall line trail. Controlling erosion on fall line trails are difficult to control, especially when steep. Erosion can be managed with frequent maintenance on gently sloped fall line trails with good outslope and rollers. However, erosion issues on fall line trail alignments on steep slopes cannot be effectively managed without hardening the trail tread or rerouting with sustainable trail design practices.

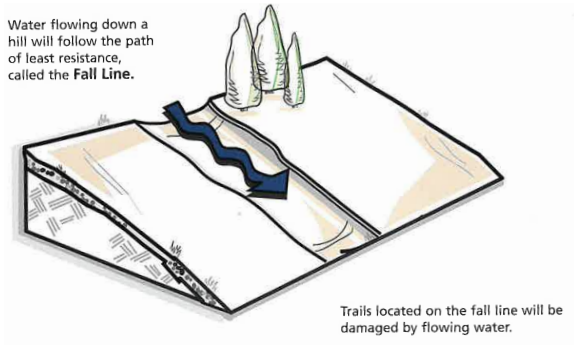


Image source: Trail Solutions. IMBA's Guide to Building Sweet Singletrack, 2004

Example of fall line trail at Lebanon Hills Regional Park

OTHER SUSTAINABLE TRAIL DESIGN BEST PRACTICES

Maintain Sustainable Grades & 10% Average

The slope of a trail is a key component to sustainable trail design. Generally, a slope over 10% will be difficult to manage trail erosion unless the soil is very rocky. A slope of 5% is ideal in sandy soil locations. In general, a the average slope of the trail should not exceed 10%.

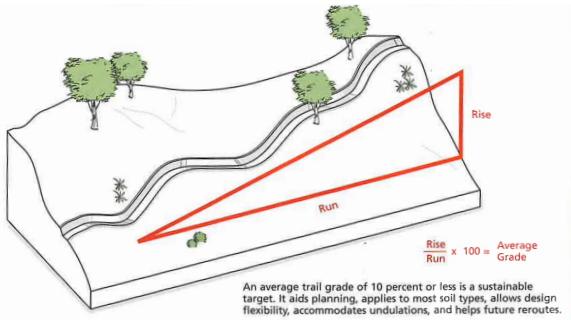


Image source: Managing Mountain Biking. IMBA's Guide to Providing Great Riding, 2007

Side Hill Trails

Sustainable trails should be aligned on the side of a hill. Side hill trail alignments provide good opportunity for outslope drainage. When possible, trails should avoid flat areas as these tend to collect water.

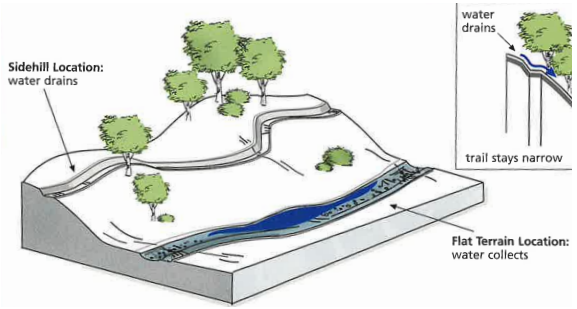


Image source: Managing Mountain Biking. IMBA's Guide to Providing Great Riding, 2007

Example of side hill trail alignment at Lebanon Hills Regional Park

Rule of Half

The rule of half is a sustainable trail building guide to calculate maximum longitudinal slope of a trail based on the sideslope it is traversing. The rule of half says the longitudinal slope of a trail should be no more than half the steepness of the sideslope it follows. For example, a 14% side hill slope would support a maximum trail slope of 7%. No trail slope should exceed 10% even if half the side hill slope is greater than 10%. For example, a 30% side hill slope would still only support a 10% trail slope. Any trail that exceeds the rule of half is considered a fall line trail.

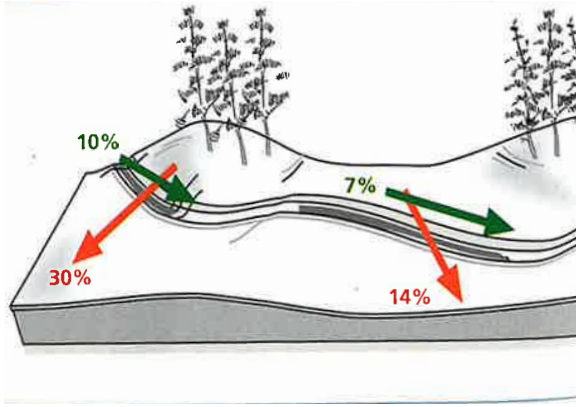


Image source: Managing Mountain Biking. IMBA's Guide to Providing Great Riding, 2007

OTHER MAINTENANCE PRACTICES

Leaf Blowing

Blowing leaves off trail tread is an important maintenance practices that improves the sustainability and functionality of soft surface trails. When left on trails, leaves decompose and add loose organic matter to the trail surface, increasing their susceptibility to erosion over time.

Removing leaves from the trail also improves the user experience. Leaves not removed from ski trail will remain on the surface of the snow and catch on the bottom of skis and reducing glide for skiers, especially during years with minimal snow coverage. Leaves left on hiking trails and mountain bike trails creates a slippery trail surface and increases the time for a wet trail to dry out.

Winter Salt and Sand

The use of salt and sand should be minimized when in proximity to lakes or wetlands. Salt should not be used on any trail within 50 feet of lakes or wetlands to protect the water quality. Salt and sand will only be utilized in Lebanon Hills Regional Park when needed to maintain safe use of the trails during extreme ice conditions. Additional agency coordination efforts should be made for maintaining the new trail corridor along Cliff Road to minimize the use of salt and directing runoff into water bodies from the surrounding park boundary.

Seasonal Trail Closures for Habitat Protection

Lebanon Hills Regional Park provides critical habitat for a wide array of wildlife. Seasonal trail closures may occur on trails extending through sensitive wildlife habitat areas. Seasonal trail closures will be deliberate and selective with the intent to minimize disturbance during key life cycles of sensitive habitat. Closures will be temporary and clear detour signage will be implemented to inform trail users of alternate routes.

TRAIL MAINTENANCE RECOMMENDATIONS AND INITIATIVES

Maintenance recommendations have been provided for all trail segments evaluated during the Phase I field assessment. The maintenance recommendations provided are intended to improve the overall sustainability of the trail system. The development of a phased trail improvement recommendations and implementation strategy will help inform priorities and funding needs for future trail improvement projects.

A priority for the park is addressing deferred maintenance on trails that will not be realigned and implementing a routine maintenance schedule that will keep all trails in high quality condition. However, in many cases, decommissioning of existing trails is needed to sustainability reroute the unmanageable fall line trail segments primarily in the west and middle segments of the park. Minimal decommissioning and realignment of east segment trail are needed but many maintenance recommendations are identified.

Realigned fall line trail segments often require longer trail lengths because they follow the surrounding topography (See Figure 17). However, realigning fall line trails decreases impacts to natural resources even though they often result in longer trail segments. Many times, severely eroded trails result in informal trails as users walk off the designated trail to find stable ground. Often, these informal trails impact the understory vegetation of the adjacent ecosystem. Rerouting the severely eroded trails also reduces the amount of erosion and sediment deposits in lakes and wetlands. A well built sustainable trail directs water off the trail tread before erosion begins.

In addition to decreasing impacts to natural resources, rerouting severely eroded trail segments will not only reduce ongoing erosion of trails but also improve the visitor experience. In many cases, trail users have to walk around deep gullies and are dealing with loose gravel on steep trails. These conditions can be dangerous and unpleasant for trail users.

The alignments shown in the recommendation maps to follow are conceptual and will require additional trail design and engagement to determine final trail realignments.

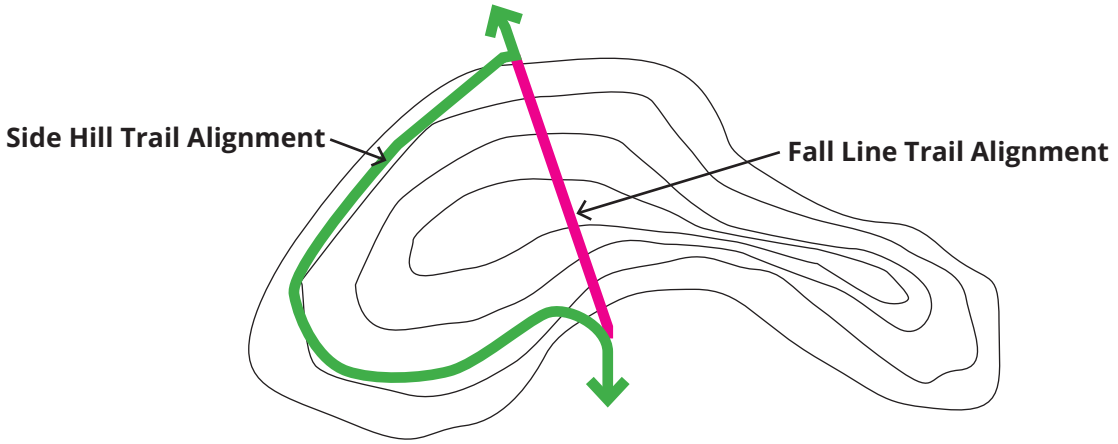


Figure 17: Length Difference Between Fall Line & Side Hill Trail Alignment

WEST SEGMENT TRAIL RECOMMENDATIONS AND INITIATIVES

Based on outcomes of the trail assessment and evaluation of sensitive natural resource and habitat areas the following trail recommendations are proposed in the west segment of the park (Figure 18).

WEST SEGMENT MOUNTAIN BIKE TRAILS		
Recommendations and Initiatives	**Study Goal Accomplished**	**Notes**
Coordinate with MORC on north mountain bike potential expansion area, prairie skills area, and minor reroutes throughout existing system.*	1,7,9	Potential mountain bike expansion area would bolster Lebanon Hills as a premier mountain bike location. Addressing erosion issues identified by MORC will reduce ongoing trail maintenance and improve trail sustainability.
Provide additional maintenance resources to MORC to remove leaves and brush along mountain bike trails.	1,5,7,9	Leaves on trails are slippery when wet and increase the time for trail to dry out. The organic matter created by decomposed leaves increases trail erosion.
Reduce number of mountain bike and hiking trail intersections by combining and realigning sections of hiking and ski trail.	4,5	Hiking and mountain bike trail intersections can cause collisions.
Refurbish mountain bike skills course.	1,8	Current skills course is outdated and in disrepair.
Convert existing mountain bike green trail to accommodate adaptive use mountain bikes. Consider strategies for making adaptive mobility devices available..	6	Providing adaptive trails and rental bikes will provide users of all abilities access to mountain bike trails.

**Requires additional community and stakeholder engagement*

*** 2015 Master Plan recommendation*

**** 2019 Lebanon Hills Regional Park Natural Resource Management Plan recommendation*

Study Goals

1. Preservation of high-quality trail recreation and nature-based experiences
2. Minimization and mitigation of impacts to natural resources
3. Minimization and mitigation of impacts to culturally important sites
4. Identification of trail use conflicts
5. Identification of safety and risk concerns
6. ADA accessibility
7. Reduction of trail related erosion issues
8. Identification of deferred trail maintenance needs
9. Improvement of sustainable maintenance practices

WEST SEGMENT HIKING TRAILS		
Recommendations and Initiatives	**Study Goal Accomplished**	**Notes**
Maintain clear sightlines at mountain bike and hiking trail intersections. Establish features to slow mountain bikers down at intersections.	4,5	Hiking and mountain bike trail intersections can be dangerous when bikers are moving at high speeds.
Consider relocating skate ski trail loop to middle segment. *	1, 5, 7, 9	The skate ski loop in west segment is very challenging and has multiple fall line trails with severe unmanageable erosion.
Realign and decommission severely eroded hiking and skate ski trails utilizing sustainable design principles ***	1,2,5,7,9	Realigning severely eroded unmanageable trail segments will improve user experience, reduce ongoing erosion issues, and reduce sediment runoff into wetlands and lakes.
Perform maintenance recommendations identified on existing trails to remain.	1,2,7,8,9	The trail recommendations identified will minimize impacts to natural resources and improve the trail user experience by reducing erosion issues on the trails.
Remove Buckthorn in west segment. Coordinate with natural resource staff to restore with native vegetation. ***	1,2,9	Removal of Buckthorn will preserve the native vegetation in the park
Identify strategies to address Oak Wilt.	1,2,9	Addressing Oak Wilt will maintain the high quality natural resource users enjoy while using the trails.

**Requires additional community and stakeholder engagement*

*** 2015 Master Plan recommendation*

**** 2019 Lebanon Hills Regional Park Natural Resource Management Plan recommendation*

Study Goals

10. Preservation of high-quality trail recreation and nature-based experiences
11. Minimization and mitigation of impacts to natural resources
12. Minimization and mitigation of impacts to culturally important sites
13. Identification of trail use conflicts
14. Identification of safety and risk concerns
15. ADA accessibility
16. Reduction of trail related erosion issues
17. Identification of deferred trail maintenance needs
18. Improvement of sustainable maintenance practices

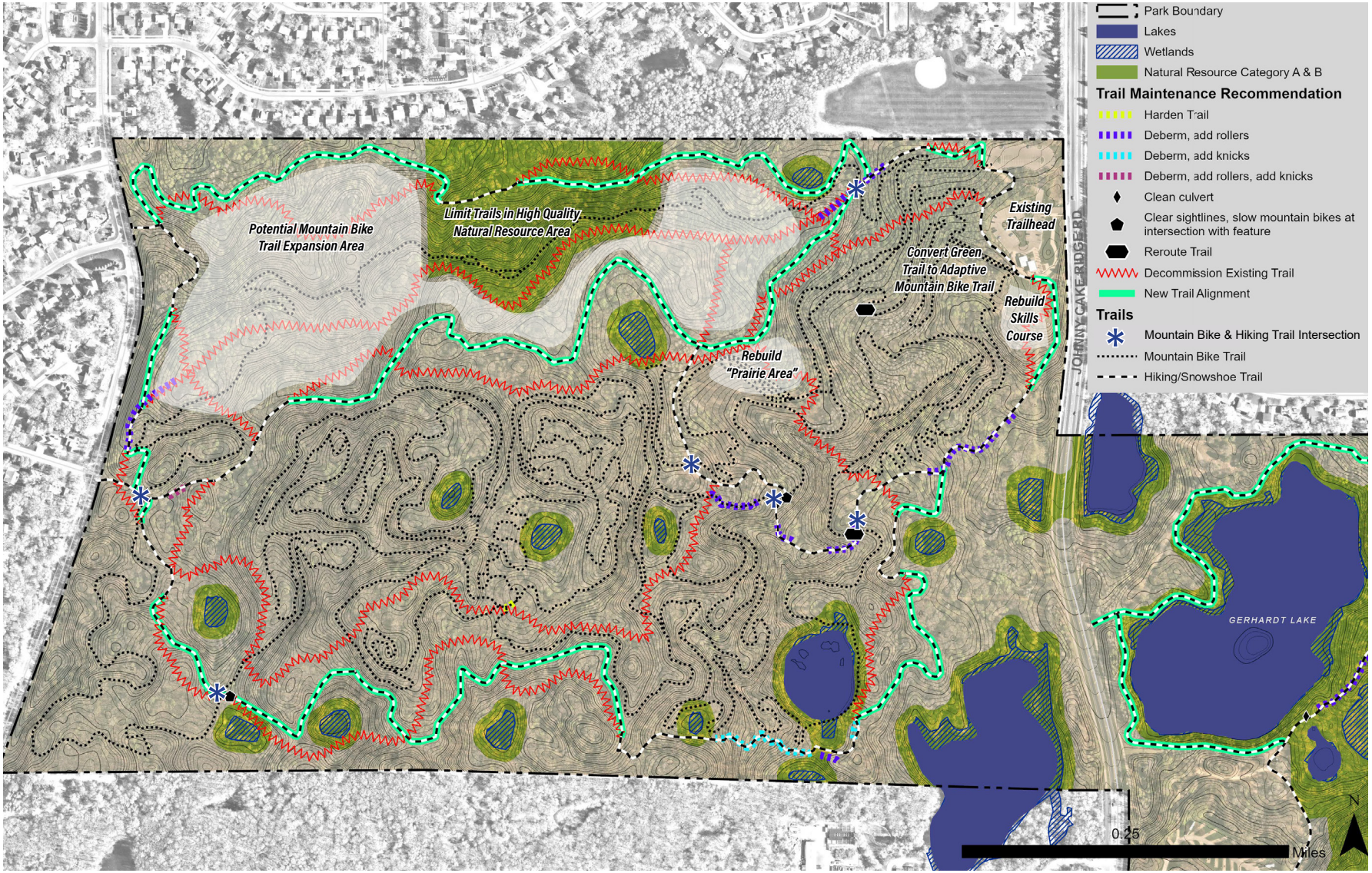


Figure 18: West Segment Trail Recommendations Map

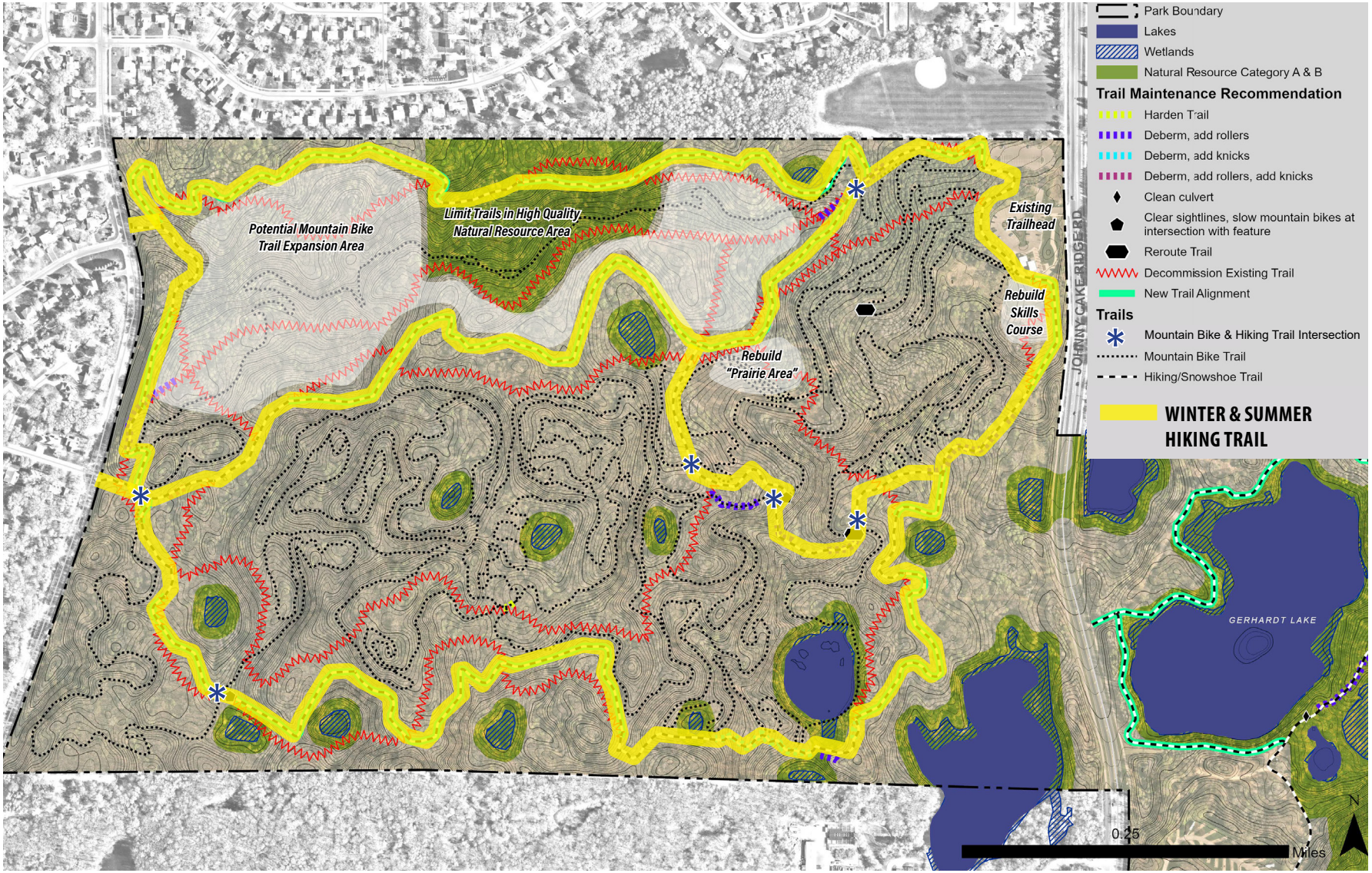


Figure 19: West Segment Recommended Summer/Winter Trail Organization

MIDDLE SEGMENT TRAIL RECOMMENDATIONS AND INITIATIVES

Based on outcomes of the trail assessment and evaluation of sensitive natural resource and habitat areas the following trail recommendations are proposed in the middle segment of the park (See Figure 20).

MIDDLE SEGMENT HIKING TRAILS		
Recommendations and Initiatives	**Study Goal Accomplished**	**Notes**
Conduct impact assessment and feasibility study for accessible trail around Wheaton Pond*	6	Intended to be ADA accessible. Requires feasibility and impact study.
Add hiking loop around Gerhardt Lake and Apple Pond (Not intended to be ADA accessible) **	1	A trail around Gerhardt Lake and Apple Pond will provide park users another opportunity to experience the park's natural resources.
Add more hiking trails in middle segment to provide more trails to campground and other park users.	1	Additional hiking trails will be added mostly by combining hiking and equestrian uses.
Realign and decommission severely eroded trails	1,2,5,7,9	Realigning severely eroded unmanageable trail segments will improve user experience, reduce ongoing erosion issues, and reduce sediment runoff into wetlands and lakes.
Improve wayfinding by establish hiking loop trail network.	1	Improved wayfinding allows users to enjoy the park without feeling lost.
Perform maintenance recommendations identified on existing trails to remain.	1,2,7,8,9	The trail recommendations identified will minimize impacts to natural resources and improve the trail user experience by reducing erosion issues on the trails.

**Requires additional community and stakeholder engagement*

*** 2015 Master Plan recommendation*

**** 2019 Lebanon Hills Regional Park Natural Resource Management Plan recommendation*

Study Goals

19. Preservation of high-quality trail recreation and nature-based experiences
20. Minimization and mitigation of impacts to natural resources
21. Minimization and mitigation of impacts to culturally important sites
22. Identification of trail use conflicts
23. Identification of safety and risk concerns
24. ADA accessibility
25. Reduction of trail related erosion issues
26. Identification of deferred trail maintenance needs
27. Improvement of sustainable maintenance practices

MIDDLE SEGMENT COMBINED EQUESTRIAN, HIKING, AND SKI TRAILS		
Recommendations and Initiatives	**Study Goal Accomplished**	**Notes**
Consider relocating skate ski trail loop from west to middle segment.*	1, 5, 7, 9	Skate ski loop in west segment is very challenging and has multiple fall line trails with severe unmanageable erosion.
Allow for shared use equestrian/hiking trails *	1,2,7,9	Allowing shared use on equestrian trails allows hikers as well as equestrians to enjoy the middle segment of the park without adding duplicative dedicated hiking and equestrian trails.
Initiate middle segment sustainable trail design project to refine trail plan with community and stakeholder engagement * & ***	1,2,7,9	
Coordinate middle segment natural resource restoration along with trail realignment/decommissioning.	1, 2	Restoring the landscape as new trails are developed will bolster the quality of the nature based experience and will improve the overall natural resource by replacing non-native vegetation with native plant communities.
Install signage and boot cleaning area for hikers to clean salt, sand, and invasive plant seeds from their shoes at campground trailhead.	1,2	Installing boot cleaning area will reduce the spread of invasive species carried on boots and shoes and reduce salts and sand from degrading wetlands.

**Requires additional community and stakeholder engagement*

*** 2015 Master Plan recommendation*

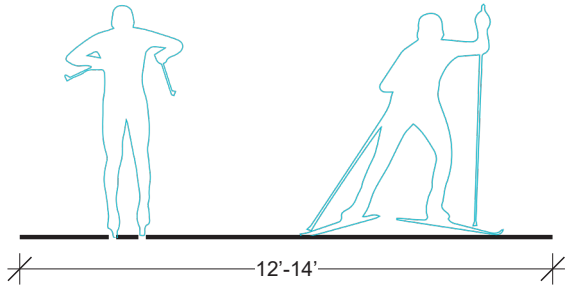
**** 2019 Lebanon Hills Regional Park Natural Resource Management Plan recommendation*

Study Goals

28. Preservation of high-quality trail recreation and nature-based experiences
29. Minimization and mitigation of impacts to natural resources
30. Minimization and mitigation of impacts to culturally important sites
31. Identification of trail use conflicts
32. Identification of safety and risk concerns
33. ADA accessibility
34. Reduction of trail related erosion issues
35. Identification of deferred trail maintenance needs
36. Improvement of sustainable maintenance practices

Proposed Combined Skate and Classic Ski Trails

Summer Use: Hiking and equestrian trails



Proposed section applies to middle segment ski trails only. East segment ski trails to remain at current width (10'-12')

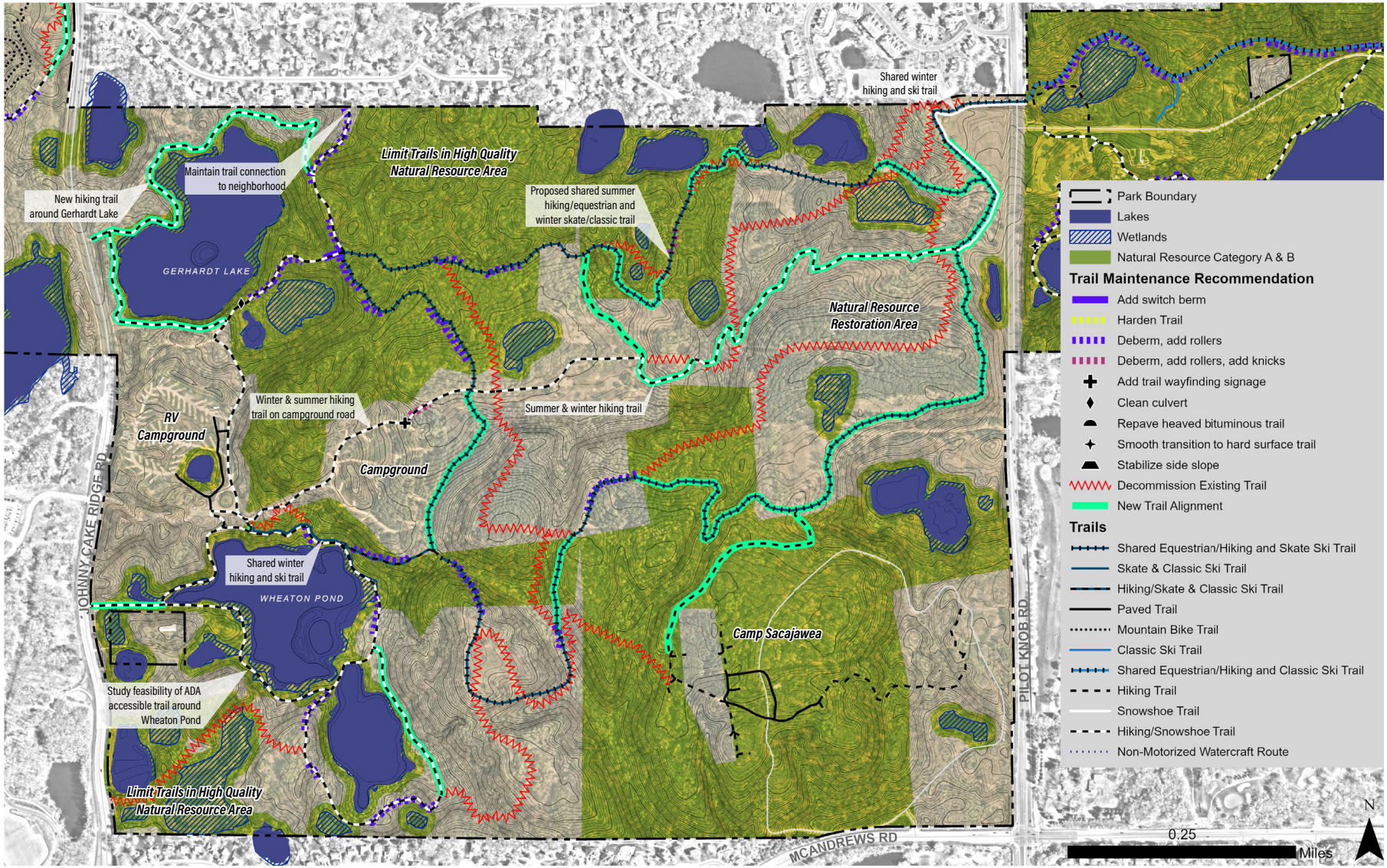


Figure 20: Middle Segment Trail Recommendations Map

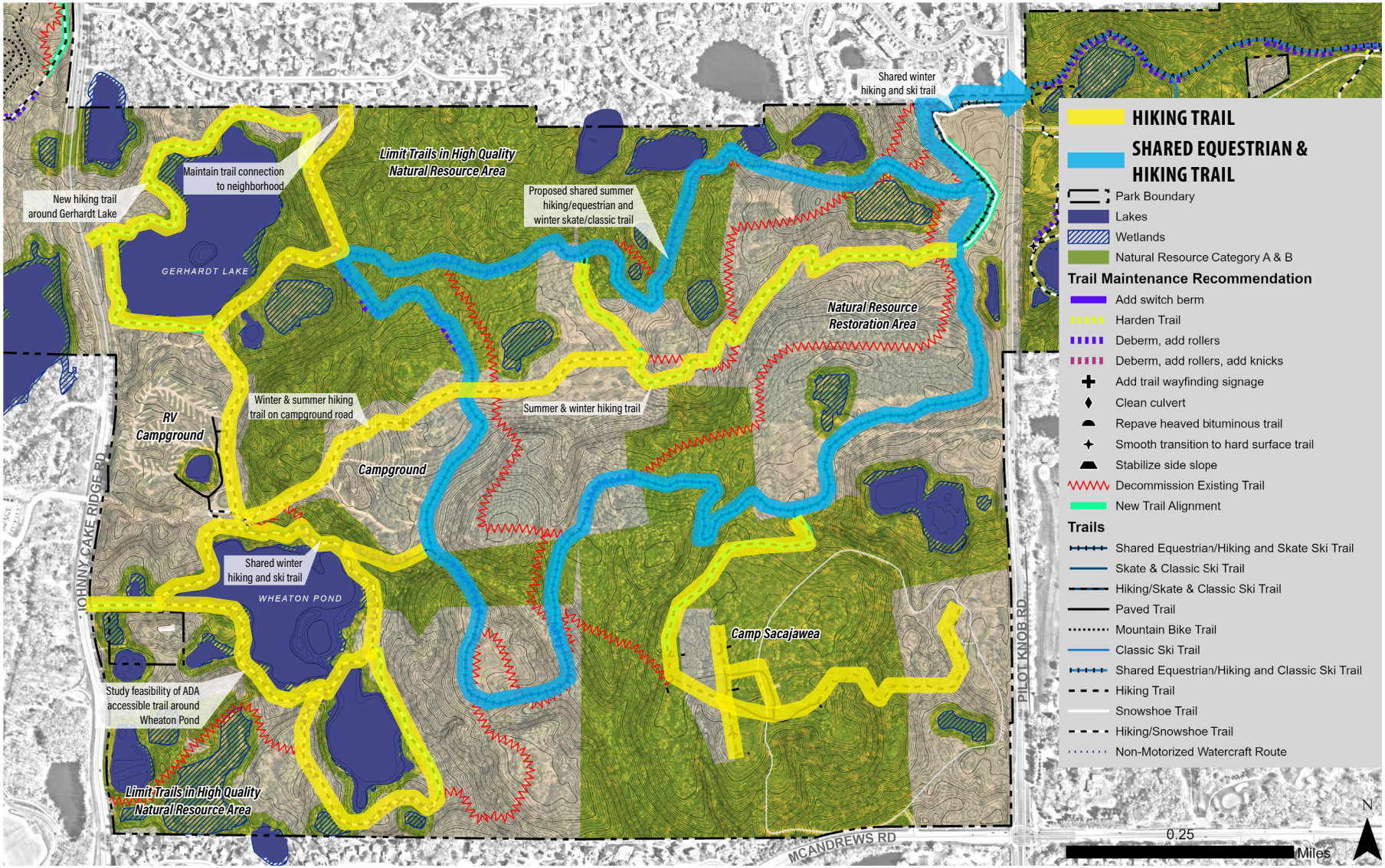


Figure 21: Middle Segment Recommended Summer Trail Organization

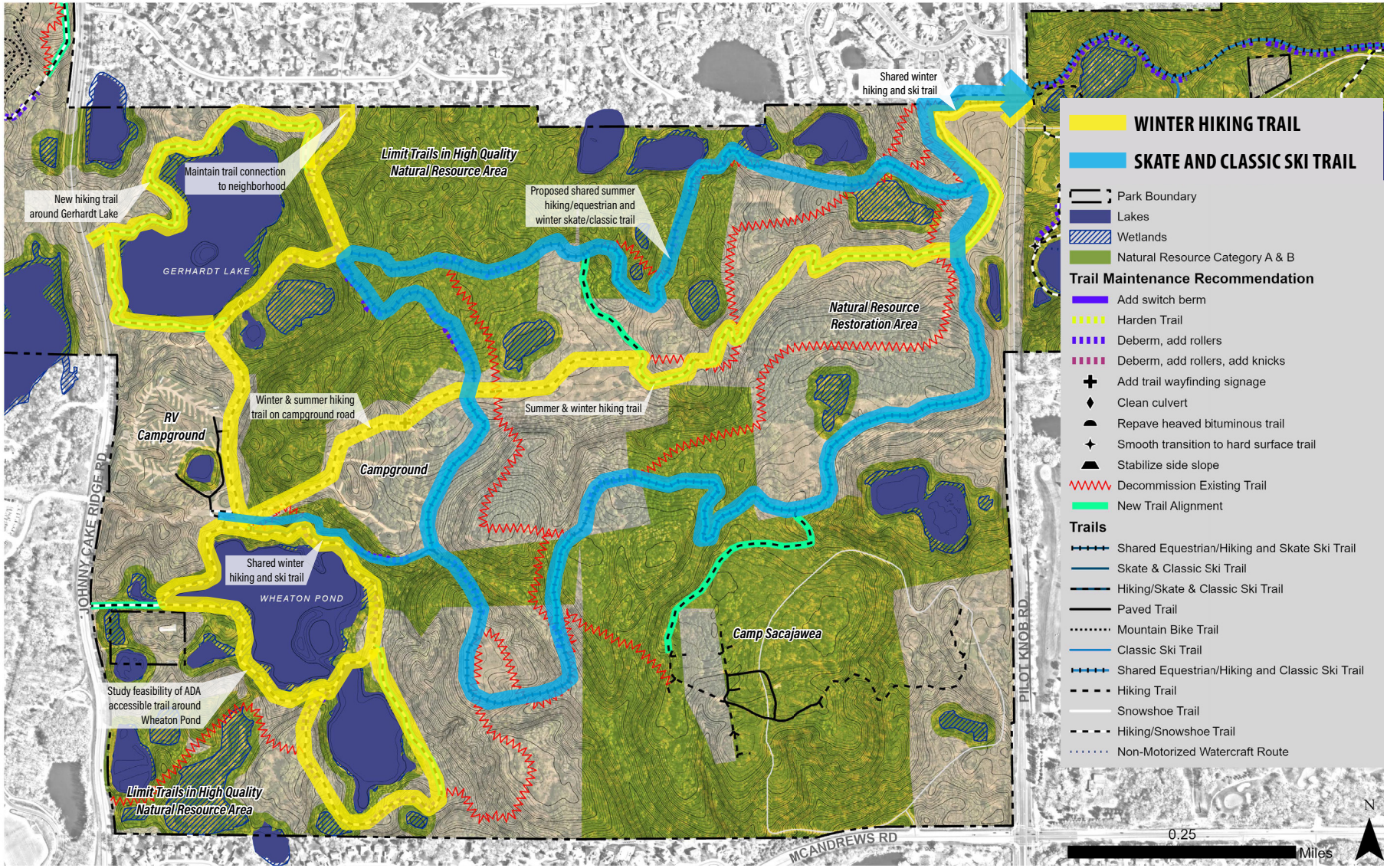


Figure 22: Middle Segment Recommended Winter Trail Organization

EAST SEGMENT TRAIL RECOMMENDATIONS AND INITIATIVES

Based on outcomes of the trail assessment and evaluation of sensitive natural resource and habitat areas the following trail recommendations are proposed in the east segment of the park (See Figure 23).

EAST SEGMENT SUMMER AND WINTER HIKING TRAILS		
Recommendations and Initiatives	**Study Goal Accomplished**	**Notes**
Widen boardwalks and stabilize side slopes on south side of Jensen Lake. (Not intended to be ADA accessible)	1,2,4	Trail users walk off the boardwalks when passing because they are too narrow. Walking off trail damages adjacent vegetation and can cause erosion.
Add south neighborhood connection to Jensen Lake loop trail and decommission informal trails from neighborhood. *	2,4	Multiple inform trails from the neighborhood exist and are not sustainable. Establishing a single connection to the park from the neighborhood will reduce impacts to the natural resource and reduce erosion.
Add hiking loop around Holland Lake (Not intended to be ADA accessible) **	1	A trail around Holland Lake will provide park users another opportunity to experience the park's natural resources.
Improve existing gravel trail around Schulze Lake	6	Intended to be ADA accessible. Requires feasibility and impact study
Consider strategies for making all terrain mobility devices available.	6	Providing all terrain mobility devices will provide users of all abilities access to all hiking trails.

**Requires additional community and stakeholder engagement*

*** 2015 Master Plan recommendation*

**** 2019 Lebanon Hills Regional Park Natural Resource Management Plan recommendation*

Study Goals

37. Preservation of high-quality trail recreation and nature-based experiences
38. Minimization and mitigation of impacts to natural resources
39. Minimization and mitigation of impacts to culturally important sites
40. Identification of trail use conflicts
41. Identification of safety and risk concerns
42. ADA accessibility
43. Reduction of trail related erosion issues
44. Identification of deferred trail maintenance needs
45. Improvement of sustainable maintenance practices

EAST SEGMENT SUMMER AND WINTER HIKING TRAILS		
Provide summer and winter hiking trail connection to equestrian trailhead. **	1	Providing summer and winter hiking option from the equestrian trailhead will increase access to the trail system
Provide year round hiking access from adjacent neighborhoods to avoid conflicts with ski trail use.	1,4	A dedicated winter hiking trail from neighborhoods to the winter hiking trail system will reduce conflicts with winter hikers on ski trails.
Explore reducing Park Ridge neighborhood access trails from 2 to 1.*	1,2	Reducing duplicative trails will minimize impacts to natural resources.
Decommission redundant trails and restore with native vegetation.	1,2	Decommissioning redundant trails improves wayfinding for trail users and reduces the impacts to natural resources.
Improve trail wayfinding signage at confusing intersections. **	1,4	Improving wayfinding reduces navigation confusion for trail users so they can focus on enjoying the park's natural resource.
Realign and decommission severely eroded trails.	1,2,5,7,9	Realigning severely eroded unmanageable trail segments will improve user experience, reduce ongoing erosion issues, and reduce sediment runoff into wetlands and lakes.

**Requires additional community and stakeholder engagement*

*** 2015 Master Plan recommendation*

**** 2019 Lebanon Hills Regional Park Natural Resource Management Plan recommendation*

Study Goals

46. Preservation of high-quality trail recreation and nature-based experiences
47. Minimization and mitigation of impacts to natural resources
48. Minimization and mitigation of impacts to culturally important sites
49. Identification of trail use conflicts
50. Identification of safety and risk concerns
51. ADA accessibility
52. Reduction of trail related erosion issues
53. Identification of deferred trail maintenance needs
54. Improvement of sustainable maintenance practices

EAST SEGMENT SUMMER AND WINTER HIKING TRAILS		
Perform maintenance recommendations identified on existing trails to remain.	1,2,7,8,9	The trail recommendations identified will minimize impacts to natural resources and improve the trail user experience by reducing erosion issues on the trails.
Mitigate trail impacts to Natural Resource Category A areas.	2	This may include trail design, seasonal closures, or other methods.
Add bike racks at Holland Lake and Visitor Center Trailheads	1	Adding bike racks to Holland Lake and Visitor Center Trailheads will provide accommodations to park users arriving by bike.
Install signage and boot cleaning area for hikers to clean salt, sand, and invasive plant seeds from their shoes at Jensen, Holland, and Visitor Center Trailheads.	1,2	Installing boot cleaning area will reduce the spread of invasive species carried on boots and shoes and reduce salts and sand from degrading wetlands.

**Requires additional community and stakeholder engagement*

*** 2015 Master Plan recommendation*

**** 2019 Lebanon Hills Regional Park Natural Resource Management Plan recommendation*

Study Goals

55. Preservation of high-quality trail recreation and nature-based experiences
56. Minimization and mitigation of impacts to natural resources
57. Minimization and mitigation of impacts to culturally important sites
58. Identification of trail use conflicts
59. Identification of safety and risk concerns
60. ADA accessibility
61. Reduction of trail related erosion issues
62. Identification of deferred trail maintenance needs
63. Improvement of sustainable maintenance practices

EAST SEGMENT EQUESTRIAN AND SKI TRAILS		
Recommendations and Initiatives	**Study Goal Accomplished**	**Notes**
Allow limited combined hiking/equestrian trail use on east and west trail spurs. Main equestrian loop to remain equestrian only. **	1,2	Combining uses will reduce the number of trails and thereby minimize impacts to natural resource.
Perform maintenance recommendations identified on existing trails.	1,2,7,8,9	The trail recommendations identified will minimize impacts to natural resources and improve the trail user experience by reducing erosion issues on the trails.

EAST SEGMENT PORTAGE TRAILS		
Recommendations and Initiatives	**Study Goal Accomplished**	**Notes**
Perform maintenance recommendations identified on existing portage trails.	1,2,7,8,9	The trail recommendations identified will minimize impacts to natural resources and improve the trail user experience by reducing erosion issues on the trails.

**Requires additional community and stakeholder engagement*

*** 2015 Master Plan recommendation*

**** 2019 Lebanon Hills Regional Park Natural Resource Management Plan recommendation*

Study Goals

64. Preservation of high-quality trail recreation and nature-based experiences
65. Minimization and mitigation of impacts to natural resources
66. Minimization and mitigation of impacts to culturally important sites
67. Identification of trail use conflicts
68. Identification of safety and risk concerns
69. ADA accessibility
70. Reduction of trail related erosion issues
71. Identification of deferred trail maintenance needs
72. Improvement of sustainable maintenance practices

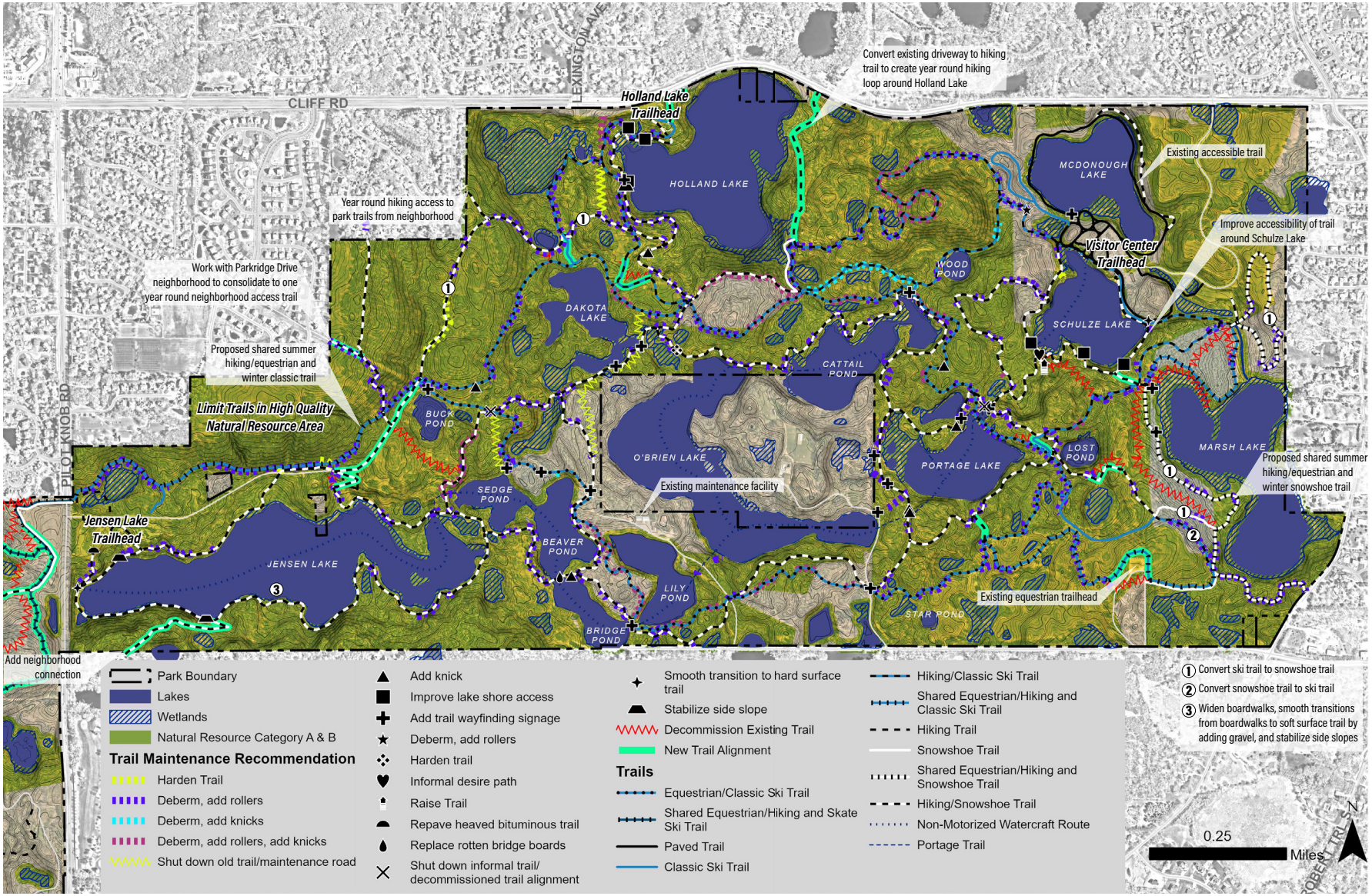


Figure 23: East Segment Trail Recommendations Map

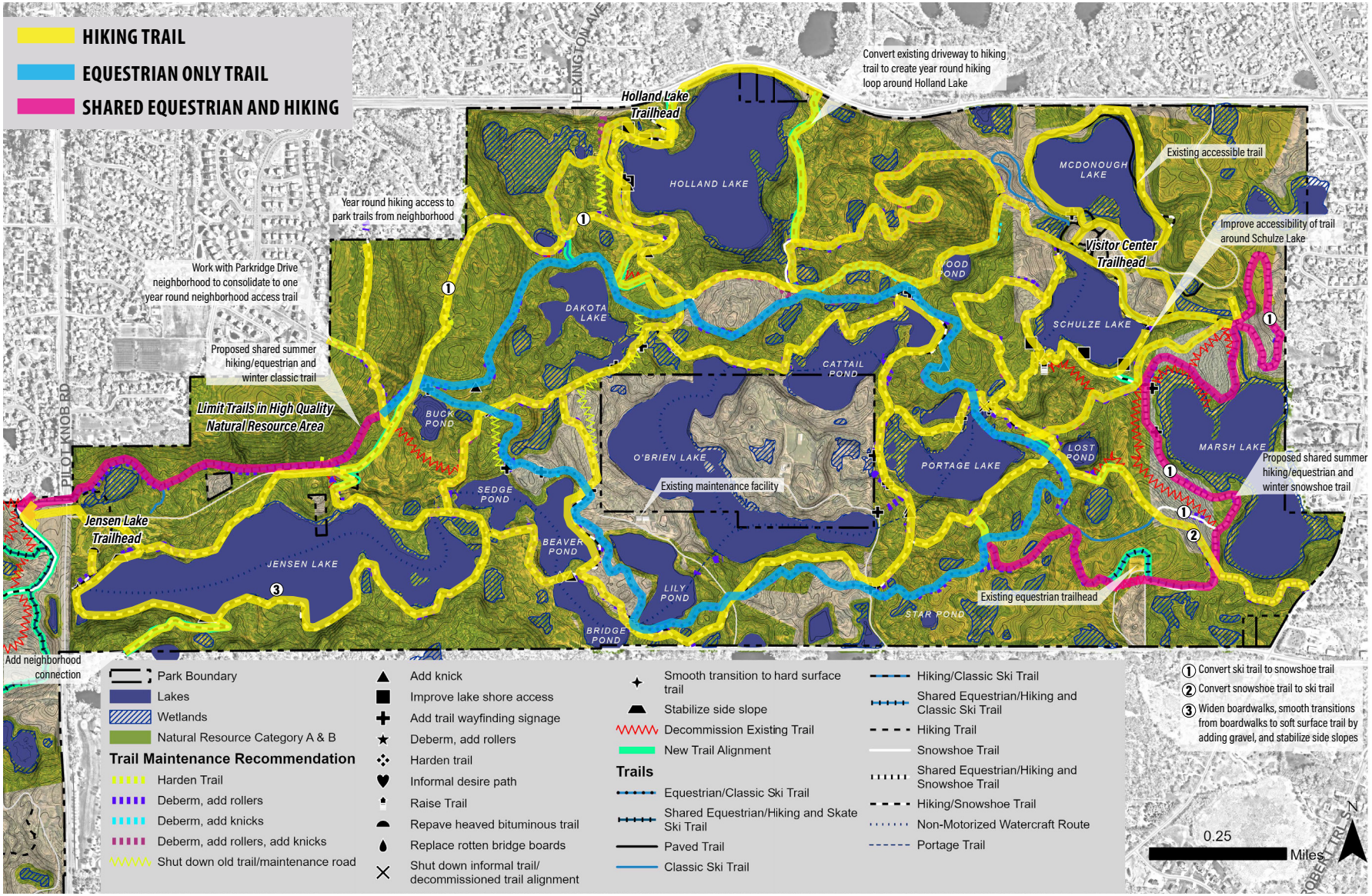


Figure 24: East Segment Recommended Summer Trail Organization

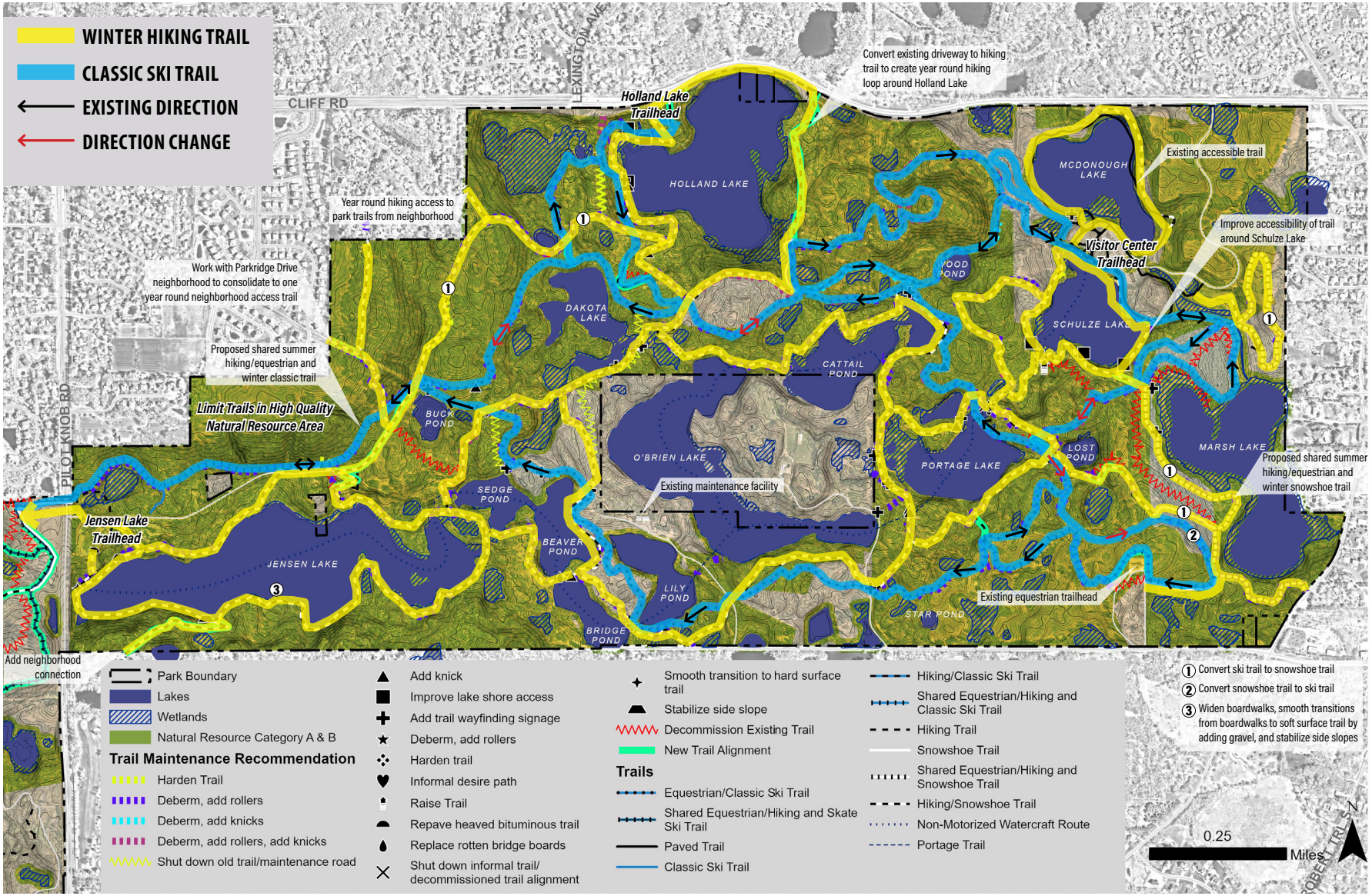


Figure 25: East Segment Recommended Winter Trail Organization

PROPOSED TRAIL SYSTEM SUMMARY

The intent of the study was to maintain the same length of user group trails while reducing the overall length of trails in the park. This intent was achieved by combining some trail uses onto one trail corridor. The total length of trail was reduced in both the west and east segment of the park with slight increase in the middle segment to provide better hiking trail loop accommodations for park users. The proposed trail system increases the miles of hiking and snowshoe trails while maintaining similar miles of equestrian trails. Classic ski trails in the east segment of the park were reduced by two miles in order to reduce winter hiker conflicts with ski trails and to reduce ski trail segments with consistently poor snow conditions.

EXISTING AND PROPOSED TOTAL MILES OF TRAIL COMPARISON			
Segment	**Existing Miles of Trail**	**Proposed Miles of Trail**	**Net Gain**
West*	5.4	4.3	-1.1
Middle	7.9	8.2	0.3
East	25.7	25.6	-0.1
TOTAL	**39.0**	**38.1**	-0.9

**Does not include mountain bike trails*

Figure 26: Existing and Proposed Total Miles of Trail Comparison

EXISTING AND PROPOSED TRAIL COMPARISON (IN MILES)				
Trail System	**West**	**Middle**	**East**	**Total**
Hiking Trail Existing	3.0	4.2	17.7	24.9
Hiking Trail Proposed	4.3	8.2	20.7	33.2
Equestrian Trail Existing	0.0	3.2	6.6	9.8
Equestrian Trail Proposed	0.0	3.0	6.7	9.7
Skate Ski Trail Existing	2.4	0.0	0.0	2.4
Skate Ski Trail Proposed	0.0	3.2	0.0	3.2
Classic Ski Trail Existing	0.0	4.0	11.9	15.9
Classic Ski Trail Proposed	0.0	3.2	9.9	13.1
Snowshoe Trail Existing	3.0	1.6	12.2	16.8
Snowshoe Trail Proposed	4.3	4.0	15.0	23.3

**Total miles do not add up to total trail miles due to shared use segments.*

Figure 27: Existing and Proposed Trail Comparison

ACCESSIBLE TRAIL SURFACING ALTERNATIVES

Providing accessible trails for all user groups is an important component of a regional park facility. In addition to minimizing slope gradients, an accessible trail surface must be firm and stable. While the majority of the trails in the park will not meet ADA accessibility standards, it is important to provide accessible trails in some areas of the park where feasible so that equal access to a trail network can be provided from designated trailhead locations so people of all abilities can enjoy high quality nature based recreation experiences. Determining the feasibility for adding ADA trails will be addressed in subsequent trail phases of design work needed for implementation. This Study has evaluated multiple different accessible trail surfacing options. Maintenance, installation cost, and the environmental aesthetic/impact should considered during the design development phase of any ADA trail. The following list includes a range of ADA surface alternatives that could be considered during the design development phase of ADA trails. All ADA trail alternatives were ranked based on installation cost, maintenance, and environmental aesthetic (See Figure 28).

CLASS II AGGREGATE OR CRUSHED LIMESTONE

Class II aggregate is a very common accessible trail surfacing option. Class II aggregate has the lowest installation cost but will require the most maintenance. Maintenance of aggregate trails will be similar to natural surface trails and will require deberming and removal of sediment build up in rollers. Although higher maintenance, class II aggregate trails blend nicely into the natural resource environment and provide a high quality nature based experience.

CRUSHER FINES

Crusher fines are small particle byproducts of gravel operations. The fine particles interlock tightly and form a firm and stable trail tread that meets ADA requirements. The maintenance of crusher fine trails is slightly less than class II aggregate but cost more than class II. Crusher fines provide high environmental aesthetic qualities and would blend into the natural character of Lebanon Hills Regional Park.

BITUMINOUS PAVEMENT

Bituminous pavement is the most common material used for accessible trails. Bituminous pavement has a moderate installation cost but the maintenance is less frequent than an aggregate trail. The hard bituminous surface is not subtable to erosion like a soft surface trail. However, the environmental aesthetic of a bituminous trail is low and may not always be contextual for creating a high quality nature based experience. Bituminous pavement also creates stormwater runoff, reduces ground water infiltration, and reduces wildlife and habitat value.

CONCRETE PAVEMENT

Concrete pavement is one of the most durable accessible surfaces and has the lowest maintenance. However, the installation cost is high making long trail loops costly to implement. The environmental aesthetic of a concrete trail is also low and in some applications not compatible with creating a high quality nature based experience. Concrete pavement also creates stormwater runoff, reduces ground water infiltration, and reduces wildlife and habitat value.

MODULAR PAVING

Modular paving such as concrete brick pavers come in a wide range of patterns and designs. Modular paving has an average environmental aesthetic but installation cost are extremely high. Furthermore, tree roots often impact the quality of modular paving surfacing resulting in frequent maintenance.

PERMEABLE PAVING

Permeable bituminous, concrete, and modular paving systems are another accessible trail option. The visual aesthetic of permeable paving is very similar to its non-

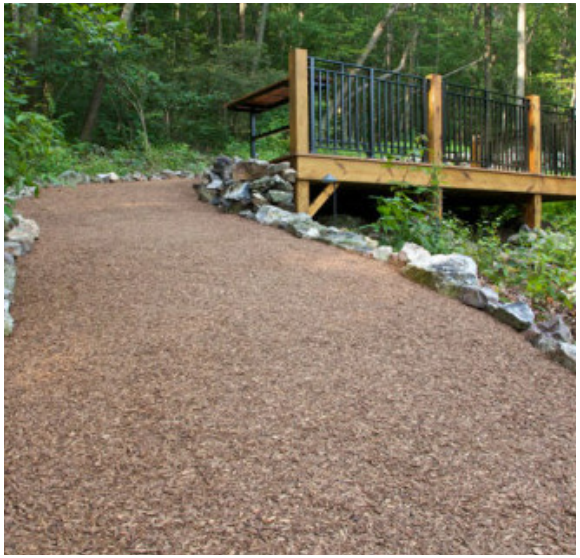
permeable counterpart. However, permeable paving will allow water to infiltrate into the ground reducing the volume of stormwater runoff off into lakes and wetlands. Permeable pavers often fill with sediment overtime and require cleaning to prevent a reduction in their permeability characteristics. Permeable paving also requires deeper pavement sections which results in more impacts to and cutting of tree roots.

BOARDWALKS

Boardwalks are typically used when a trail extends through a wetland or low lying area. However, boardwalks can be used as an accessible trail surface. Although boardwalks are a very expensive trail surfacing alternative, they provide a high quality trail user experience and often blend into the surrounding landscape. Boardwalks also can mitigate natural resource impacts, particularly in wet locations. Boardwalks require periodic replacement of rotting and damaged deck boards.

BONDED HARDWOOD MULCH

Bonded hardwood mulch with binder and engineered wood fiber mulch installed over a compacted aggregate base. The bonded hardwood mulch provides a high environmental aesthetic but has a very high maintenance and installation costs.



ACCESSIBLE TRAIL SURFACING RECOMMENDATION

All of the accessible trail surface options evaluated in this study have advantages and disadvantages for being implemented in the park. Boardwalks were the top performing surface based on the evaluation criteria used. Despite the high score, the high installation cost of boardwalks makes them a cost prohibitive option for all accessible trails. Aggregate trail surfaces (class II or crusher fines) and bituminous pavement had similar scores. Bituminous pavement has a higher installation cost and a poor environmental aesthetic but has lower maintenance cost and is not as susceptible to erosion. In contrast, aggregate trail surface has high maintenance cost and higher susceptibility to erosion but low installation cost and is more compatible with the park's environmental aesthetic. Paved surfaces are most likely to be maintained as accessible throughout the winter and early spring as they are easier to remove snow and remain firm during spring melt. While salt and sand use is not effective or recommended on aggregate trails, they do provide a slip resistant surface when not covered by snow or ice. Based on this assessment, the recommended Wheaton Pond and Schultz Lake ADA accessible trails should be maintained as one of the aggregate surfaces. Other surfacing options may be considered during the design development phase. Dakota County may also pilot study surface options to further evaluate their function and durability for trail user groups.

ADA Surface Comparison

Surface	Maintenance Cost	Susceptibility to Erosion	Installation Cost	Environmental Aesthetic	Surface Smoothness	Infiltration	Tree Root Impact	Winter Maintenance
Crushed Limestone or Class II Aggregate	Poor	Poor	Best	Best	Better	Better	Best	Better
Crusher Fines	Poor	Poor	Best	Best	Better	Better	Best	Better
Bituminous Pavement	Best	Best	Better	Poor	Best	Poor	Poor	Best
Concrete Pavement	Best	Best	Poor	Poor	Best	Poor	Poor	Best
Permeable Pavement	Better	Best	Poor	Better	Better	Best	Poor	Best
Modular Paving	Better	Best	Poor	Poor	Better	Poor	Poor	Best
Boardwalks	Best	Best	Poor	Best	Better	Better	Best	Poor
Bonded Hardwood Mulch	Better	Better	Poor	Best	Better	Poor	Better	Poor

Poor Option Better Option Best Option

Figure 28: Accessible Trail Surface Alternatives Matrix

PHASING PLAN & COST ESTIMATE

PHASING PLAN

A cost estimate and phased implementation plan has been developed based on proposed trail improvement recommendations. Some recommendations will require additional public stakeholder outreach and feasibility to determine final recommendations for implementation in the park. The following sequence of trail improvements are proposed for the park.

2023: PHASE I – OUTREACH AND DESIGN

Community and stakeholder engagement for Phase 1 feasibility and design projects listed below.

West Segment

- Schematic design for hiking trail and relocation of skate ski trails to middle segment
- Work with MORC on design for skills park refurbishment, prairie area, and converting the green trail to an adaptive mountain bike trail
- Natural resource restoration/Buckthorn removal strategy

Middle Segment

- Schematic design for hiking, cross-country skiing, and horseback riding trails
- Natural resource restoration/Buckthorn removal strategy
- Wheaton Pond ADA trail– Feasibility and impact study followed by design (pending feasibility results)

East Segment

- Schulze Lake ADA trail, Holland Lake year-round hiking trail and Jensen Lake Trail access improvements – Feasibility and impact study followed by design (pending feasibility results)

2024: PHASE II – CORRECT EROSION ISSUES AND IMPROVE ACCESSIBILITY

- Coordinate with natural resource restoration strategy (costs not included in study estimates)

West Segment

- Reconfigure the mountain bike skills course
- Reconfigure the mountain bike "prairie area" to reduce ongoing safety and erosion issues
- Convert green trail to adaptive mountain bike trail

Middle Segment

- Improve accessibility around Wheaton Pond (pending feasibility study)

East Segment

- Deberm, add rollers, add knicks, harden trail, and decommission and reroute all identified east segment trails
- Add additional wayfinding signage
- Improve transitions from soft surface to hard surface trails as identified by adding additional gravel to soft surface trail

- Holland Lake hiking trail (pending feasibility study)
- Jensen Lake trail improvements (pending feasibility study)
- Improve accessibility around Schulze Lake (pending feasibility study)

2027: PHASE III – TRAIL REALIGNMENTS AND CORRECT EROSION ISSUES IN MIDDLE AND WEST SECTIONS

- Coordinate with natural resource restoration strategy for Middle and West segments (costs not included in study estimates)

West Segment

- Relocate skate ski loop from west segment to middle segment (pending public and stakeholder engagement during Phase I)
- Final trail design for hiking trail
- Realign recommended trail segments
- Deberm, add rollers, add knicks, harden trail, and decommission and reroute all identified
- Coordinate with MORC on potential mountain bike trail expansion

Middle Segment

- Final trail design and for hiking, cross-country skiing, and horseback riding trails
- Realign recommended trail segments

- Deberm, add rollers, add knicks, harden trail, and decommission and reroute all identified

COST ESTIMATE

A cost estimate was developed that incorporated all recommendations from this study. The cost estimate was broken down by phase (Figure 29 through Figure 31. Costs associated with recommendations requiring additional public stakeholder outreach may change depending

PHASE I COST ESTIMATE				
East Segment				
Description	**QTY**	**Unit**	**Unit Price**	**Total Cost**
Feasibility and impact study for Wheaton and Schulz Lake ADA trails and Holland Lake year-round hiking trail and Jensen Lake Trail access improvements	1	LS	$20,000	$20,000
Final design (pending feasibility results) for Wheaton and Schulz Lake ADA trails and Holland Lake year-round hiking trail and Jensen Lake Trail access improvements	1	LS	$60,000	$60,000
East Segment Total Estimated Cost				**$80,000**
Middle Segment				
Description	**QTY**	**Unit**	**Unit Price**	**Total Cost**
Schematic design for hiking, cross-country skiing, and horseback riding trails	1	LS	$25,000	$25,000
Middle Segment Total Estimated Cost				**$25,000**
West Segment				
Description	**QTY**	**Unit**	**Unit Price**	**Total Cost**
Schematic design for hiking trail and relocation of skate ski trails to middle segment	1	LS	$20,000	$20,000
Work with MORC on design for skills park refurbishment, prairie area, and converting the green trail to an adaptive mountain bike trail	1	LS	$15,000	$15,000
West Segment Total Estimated Cost				**$35,000**
PHASE I TOTAL ESTIMATED COST				**$140,000**

Estimated in 2022 dollars. Assume 5% inflation factor beyond 2023.

Figure 29: Phase I Cost Estimate

PHASE II COST ESTIMATE				
East Segment				
Description	**QTY**	**Unit**	**Unit Price**	**Total Cost**
Decommission trail	7,163	LF	$4	$28,652
Reroute trail	5,733	LF	$20	$114,660
Deberm, add nicks	620	LF	$10	$6,200
Deberm, add rollers	14,277	LF	$10	$142,770
Deberm, add rollers, add nicks	3,298	LF	$10	$32,980
Harden trail	379	LF	$20	$7,580
Shut down old trail/maintenance road	1,262	LF	$4	$5,048
Shut down old trail/maintenance road with signage	1	EA	$1,000	$1,000
Add knick	7	EA	$500	$3,500
Improve lake shore access	6	EA	$10,000	$60,000
Add wayfinding sign	18	EA	$1,000	$18,000
Deberm, add rollers	1	EA	$500	$500
Harden trail	1	EA	$2,000	$2,000
Raise trail segment near Schulze Lake to eliminate water on trail	1	EA	$1,000	$1,000
Improve accessibility around Schulze Lake (pending feasibility study)	1	LS	$50,000	$50,000
Replace rotten deck boards on bridge over Beaver Pond	1	LS	$1,000	$1,000
Smooth transition to hard surface	4	EA	$500	$2,000
Stabilize side slope	3	EA	$10,000	$30,000
Widen boardwalk along Jensen Lake	1	LS	$200,000	$200,000
Repave heaved bituminous trail near Jensen Lake Trailhead	1	EA	$1,500	$1,500
Add bike racks at Holland Lake and Visitor Center Trailhead	12	EA	$500	$6,000
Holland Lake hiking trail (pending feasibility study)	2,065	LF	$20	$41,300
			East Segment Total Estimated Cost	**$708,390**
Middle Segment				
Description	**QTY**	**Unit**	**Unit Price**	**Total Cost**
Improve accessibility around Wheaton Pond (pending feasibility study)	1	LS	$105,000	$105,000
			Middle Segment Total Estimated Cost	**$105,000**
West Segment				
Description	**QTY**	**Unit**	**Unit Price**	**Total Cost**
Expand and rebuild skills course	1	LS	$100,000	$100,000
Rebuild mountain bike "prairie area"	1	LS	$25,000	$25,000
Expand green trail loop to accommodate adaptive use bikes	1	LS	$80,000	$80,000
			West Segment Total Estimated Cost	**$205,000**
			PHASE II TOTAL ESTIMATED COST	**$1,018,390**

Estimated in 2022 dollars. Assume 5% inflation factor beyond 2023.

Figure 30: Phase II Cost Estimate

PHASE III COST ESTIMATE				
Middle Segment				
Description	**QTY**	**Unit**	**Unit Price**	**Total Cost**
Final trail design and for hiking, cross-country skiing, and horseback riding trails	1	LS	$70,000	$70,000
Decommission trail (trail construction)	16,585	LF	$4	$66,340
Reroute trail (trail construction)	19,191	LF	$20	$383,820
Deberm, add rollers	2,080	LF	$10	$20,800
Deberm, add rollers, add nicks	73	LF	$10	$730
Add switch berm	1	LS	$1,000	$1,000
Add wayfinding sign	1	EA	$1,000	$1,000
Clean culvert	1	EA	$1,500	$1,500
Middle Segment Total Estimated Cost				**$545,190**
West Segment				
Description	**QTY**	**Unit**	**Unit Price**	**Total Cost**
Final trail design for hiking trail	1	LS	$55,000	$55,000
Decommission trail (hiking trail construction)	20,901	LF	$4	$83,604
Reroute trail (hiking trail construction)	13,378	LF	$20	$267,560
Deberm, add nicks	240	LF	$10	$2,400
Deberm, add rollers	768	LF	$10	$7,680
Deberm, add rollers, add nicks	40	LF	$10	$400
Harden trail	30	LF	$20	$600
Clear mountain bike and hiking intersection	2	EA	$1,000	$2,000
Expand mountain bike trail system to north	1	LS	$100,000	$100,000
West Segment Total Estimated Cost				**$519,244**
PHASE III TOTAL ESTIMATED COST				**$1,064,434**

Estimated in 2022 dollars. Assume 5% inflation factor beyond 2023.

Figure 31: Phase III Cost Estimate

on outcomes from engagement. Restoration efforts such as Buchthorn removal was not included in the cost estimate.

IMPLEMENTATION AND ONGOING TRAIL OPERATIONS AND MAINTENANCE COST

ONGOING TRAIL OPERATIONS AND MAINTENANCE

Soft surface trails require regular maintenance to ensure long term sustainability. Maintenance actives include deberming all trails and cleaning out any sediment that collects in rollers and knicks. It is recommended that all soft surface trails in Lebanon Hills Park should be put on a five year maintenance schedule. A prescribed maintenance plan for soft surface trails will prevent trails from continual erosion and provide park users a higher quality nature based experience. Budgeting 250-300 ($25,000-$34,000) County staff hours per year for routine trail maintenance will allow for 20% of the trail system to be maintained on a yearly basis. Additional maintenance resources should also be provided to MORC to remove leaves and brush along mountain bike trails.

TRAIL BUILDING & MAINTENANCE EQUIPMENT

Consideration should be given to utilizing lighter weight equipment for trail maintenance throughout the park. Heavy skid loaders and maintenance vehicles cause soil displacement and contribute to erosion. Most trail maintenance activities can be achieved with a mini excavator and a stand on skid loader.

Mini Excavator

- Low ground pressure (3.4-psi to 3.9 psi)

- Adequate horsepower for trail maintenance and development (21 hp)

Stand on skid loader

- Ditch Witch SK 1550 shown
- Low ground pressure (4.1 psi)
- Adequate horsepower for trail maintenance

SECTION 4 - OUTREACH AND ENGAGEMENT

Throughout the process, the project team met with Minnesota Off-Road Cyclists (MORC), and Wilderness in the City (WITC). These stakeholder groups provided valuable feedback on existing trail conditions and trail improvement recommendations as active stewards of the park. In addition to MORC and WITC, the project team engaged with students at the School of Environmental Studies (SES).

MINNESOTA OFF-ROAD CYCLISTS (MORC) ENGAGEMENT SUMMARY

The project team had two meetings with MORC. The first meeting was held during the assessment phase where members from MORC shared their assessment of trail maintenance issues. The second meeting reviewed recommendations. Recommendations received from MORC include rebuilding of the "Prairie Area" and a need for additional maintenance resources to remove leaves and trim brush on trail edges. MORC also shared preliminary ideas to expand the mountain bike trail system. These potential expansion areas will require additional public engagement.

WILDERNESS IN THE CITY (WITC) ENGAGEMENT SUMMARY

The project team also had two meetings with WITC. The project team and WITC discussed many concerns and opportunities including impervious surface in the park, ways to improve trail access without building paved trails, and other strategies for trail sustainability.

A record of meeting notes can be found in Appendix A.

SCHOOL OF ENVIRONMENTAL STUDIES ENGAGEMENT (SES) SUMMARY

The project team had the opportunity to provide multiple learning opportunities for SES students. The students had the opportunity to spend time in the field with the consultants while collecting data during the assessment phase of the project. In fall 2022, the project team and SES teachers organized a day long field day where County Staff and members from the consultant team exposed students to sustainable trail design and preservation of natural resources. This engagement provided senors at SES a view into careers in trail building, Landscape Architecture, Planning, and Natural Resource Management.

APPENDIX A: ENGAGEMENT NOTES

Dakota County Parks
LEBANON HILLS REGIONAL PARK SUSTAINABLE TRAILS STUDY
Wilderness in the City (WITC) and Minnesota Off-road Cyclists (MORC)
August 4, 2022 4:30-5:30 PM
Holland Lake Picnic Shelter

PURPOSE
To introduce the Lebanon Hills Regional Park Sustainable Trails project and discuss mountain bike trail system improvement needs

ATTENDEES

Dakota County Staff
Niki Geisler, Parks Director
Randy Cunningham, Grounds Maintenance Supervisor
Lil Leatham, Principal Planner

Consultant Team
Ken Grieshaber, SRF, Project Manager
Tim Wegner, Applied Trail and Boardwalk Design Consulting

Minnesota Off-road Cyclists
Ryan Panning
David Tait
Ted Wiegandt

DISCUSSION SUMMARY

- The prairie area has the biggest issues and requires maintenance every season. The berm lines hold up, but the left lines may need a boardwalk or professionally built skills feature.

- The green loop was designed wide enough for adaptive equipment. Over time, the trail has narrowed, and vegetation has grown on the sides. It could be restored for adaptive equipment. The middle segment of the park may be a good place for a longer/more extensive adaptive route. The cost of adaptive equipment is a barrier to participation and rental equipment should be considered.
- The main conflicts between uses in the west segment is mountain bicycling on the ski trials and winter hiking on the mountain bike trails. In the summer there are few problems from the perspective of the mountain bikers.
- MORC would like to expand new trails in the north portion of the west segment. A lot of new areas have opened in the state. Features such as jump line, berm line, and gravity flow trails are in high demand. Many of the new areas have lift service.
- Dakota County is a great maintenance partner and Randy takes care of larger trees and other requests. One area that MORC could use maintenance help is in blowing off leaves in the fall and trimming in the summer. Trimming typically happens twice a year. The fall is the hardest time – evenings are short so volunteers must spend their weekends blowing leaves.
- Randy will look into using the Sentence to Serve work crews for fall leaf blowing.
- The current skills park is great and well used. Parents can bring kids there and watch them even if they don't bike. New riders gain confidence. Some elements need replacement/redesign.
- In Winter the skills park is used to allow to ride through and get salt off tires before entering the main trail system.
- There isn't a great place for beginner winter fat tire bikers. The current trails are too difficult what is really needed is a 3' snow sidewalk. Perhaps this is something that could be in the middle of the park.
- MORC is interested in partnering on any mountain bike trail system improvements. They can help with funding. Some volunteer's work places have made cash donations and/or allow volunteers a certain number of 'paid' volunteer hours. For some of the bigger projects a Federal Recreational Trail grants may be a good fit. County could lead with MORC as a community partner.

Dakota County
LEBANON HILLS REGIONAL PARK SUSTAINABLE TRAILS STUDY
Wilderness in the City Meeting– Jensen Lake Picnic Shelter
August 25, 2022 11:00am-12:00pm

MEETING SUMMARY

PURPOSE
To discuss project goals, process, and initial existing trail condition assessment findings

ATTENDEES
Dakota County Staff
Niki Geisler, Parks Director
Joe Walton, Senior Ecologist
Lil Leatham, Principal Planner

Consultant Team
Ken Grieshaber, SRF, Project Manager
Kevin Bigalke, SRF, Project Lead Natural Resources
Tim Wegner, Applied Trail and Boardwalk Design Consulting

Wilderness In The City
Holly Jenkins
Paul Mandell
Maryann Passe
Tom Passe
Mike Fedde
Barry Graham
Hillary Wackman

DISCUSSION SUMMARY

The County Staff and Consultant Team presented an overview of the project.

- The Study is in two phases – Phase I Assessment and Phase 2 Recommendations and Implementation.
- The Study is addressing economic sustainability, physically sustainability, and ecological sustainability related to trails in the park.
- The purpose of Phase I is to collect the technical information needed to understand existing trail and natural resource conditions in the park. The assessment data will be used in Phase 2 to develop recommendations, prioritize projects, identify next steps, and identify projects to be included in the County's Capital Improvement Program.
- The consultant team field evaluated all 50 miles of park trails and has been working closely with County staff to identify the important and sensitive natural resource areas in the park.

Discussion, questions and comments by meeting participants along with responses from the staff and consultant project team (italics) follow.

There was a request to see the RFP and consultant scope. *The RFP and consultant's proposed scope are attached.*

There was a request for the maps presented at the meeting. *The maps will be made available with the County Board agenda materials for the September 13 meeting. Lil Leatham will send a link to the packet information to meeting participants when it is public.*

There was a question about the relationship between the 2019 Natural Resources Management Plan (NRMP) and the 2015 Master Plan (MP). *The two plans are intended to work together, and the 2019 NRMP does not replace the 2015 MP. The MP contains concept level recommendations for the park's trail system. The NRMP also speaks to increasing trail sustainability.*

There was discussion about the importance the park's natural resources:

- There was a comment that the master plan would have been very different if it had been done through the eyes of the NRMP.
- There was a suggestion that the Project Team should study both existing natural resources and the planned plant communities to make sure the recreation and natural resource visions are compatible. *The Project Team responded that they are considering the NRMP future landcover vision as well as existing conditions.*

The Project Team gave a brief synopsis of trail conditions in the west park. The west park has some of the best trail conditions and some of the worst trail conditions. The mountain bike trails are maintained by the Minnesota Off-Road Cyclists (MORC) in partnership with the County. They volunteer at least 20 hours a week for trail maintenance. With high use, the mountain bike trails are in good shape. The ski trails and the hiking trails have areas of severe erosion and are some of the most eroded trails.

Both WITC and the Project Team observed that there are fewer hikers in the west park than in the east.

There was discussion about what type natural resource restoration is possible in the west park. *The project team discussed removal of buckthorn and other invasive and replacement with native shrubs. MORC likes the physical and visual barrier buckthorn provides because it keeps bikers on designated trails. The goal is to replace buckthorn with native shrubs. Because of the intense trail use, the west park is not going to achieve high quality ecologically. There may be some opportunities to build upon remnant native vegetation, for example there is a patch of maidenhair ferns on the northern boundary.*

The Project Team gave an overview of the middle park. The Campground is very popular and there is not a safe connection across Johnny Cake Ridge Road to the mountain bike trail network. There are not a lot of hiking opportunities from the campground or Camp Sacajawea. Trail access and circulation around Wheaton Pond is confusing which has resulted in unofficial trails. The trail near Gerhardt Lake travels through a higher quality ecological area and is experiencing severe erosion.

There was a question about trail use numbers. *The Parks Department has numbers for the total number of park visitors and the numbers of equestrian trail permits sold but does not have other trail use counts.*

The Project Team gave an overview of trail conditions in the east park. Trails in the east segment of the park are in the best condition, with low to moderate levels of erosion and some deferred maintenance.

A comment was made that the east park should be referred to as the Preserve Zone, as it was in the 2001 Master Plan and it is difficult to maintain high quality habitat with high trail use and trails 8'-10'.

There was a discussion the amount of impervious surface in the park:

- Throughout the entire park, there are limited ADA accessible trails.
- Concerns were expressed about the increasing the amount of pavement in the park with paved trails or by building additional recreation facilities that would require an accessible trail access.
- Participants expressed priority for natural resources over recreation in LHRP. There was a suggestion that LHRP be reclassified as a Park Reserve.
- The question was asked if it is possible to provide accessible trails without pavement. Participants expressed preference for allowing more people to experience the park without adding wide paved trails. *The project team responded that accessible trail surface options will be researched in Phase 2.*

There was discussion about ways to improve trail access without building paved trails. Ideas included:

- Different length loops and loops for beginners from trailheads.
- Highlight loop trails with interesting destinations.
- Have adaptive equipment available so more people can experience the more rugged trails in the park, similar to equipment available in Minnesota State Parks.
- Show trail difficulty on maps.
- Add more winter hiking trails. Consider increasing winter trail mileage by designating water trails and portage routes as a winter snowshoe trail.

The group discussed other strategies for trail sustainability such as:

- Formalizing locations for people to get to the water. Now there are limited formal places for visitors to access lakes, which has resulted in many informal trails by use. The group agreed that locating a few places for lake access would be preferable to informal trails.
- Seasonal closures when trail conditions are wet in the spring.
- Not holding or canceling events such as Fun Runs when trail conditions are wet.
- Trail consolidation and narrowing.
- Using smaller maintenance vehicles to limit erosion.

There was discussion about trail-use conflicts. There are winter use conflicts with neighbors walking into the park on neighborhood linking trails and then walking on the cross-country ski trails.

Meeting participants expressed appreciation to the County Board for funding natural resource restoration, for the work of Natural Resources Staff, and for the natural resource restoration in the park over the last 5-10 years.

Dakota County Parks
LEBANON HILLS REGIONAL PARK SUSTAINABLE TRAILS STUDY
Wilderness in the City (WITC) and Minnesota Off-road Cyclists (MORC)
Nov. 2, 2022 4:30-6:30 PM and Nov. 8, 2022 4:30-6:30 PM

MEETING AND EMAIL COMMENTS SUMMARY

PURPOSE
To present and discuss preliminary Lebanon Hills Regional Park Sustainable Study recommendations with MORC and WITC.

ATTENDEES
Unless noted, participants attended both the Nov. 2 and the Nov. 8 meetings.

Dakota County Staff
Niki Geisler, Parks Director
Joe Walton, Senior Ecologist
Randy Cunningham, Grounds Maintenance Supervisor
Lil Leatham, Principal Planner

Consultant Team
Ken Grieshaber, SRF, Project Manager
Tim Wegner, Applied Trail and Boardwalk Design Consulting

Wilderness in the City
Holly Jenkins
Paul Mandell
Maryann Passe
Mike Fedde
Hillary Wackman
Barry Graham (11/2)
Tom Passe (11/2)
Stacy Fleenor (11/2)
Wendy Paulsen (11/2)

Minnesota Off-road Cyclists
Ryan Panning
David Tait
Ted Wiegandt

DISCUSSION SUMMARY

On November 2, the county staff and consultant team reviewed project purpose and goals and the Phase 1 existing conditions assessment summary. The consultant team presented preliminary sustainable trail improvement recommendations, operations and maintenance recommendations, and the phasing and implementation strategy. The presentation was followed by questions and discussion.

Wilderness in the City members requested a follow-up discussion, which was held on November 8. Some participants emailed comments in advance of the November 8 meeting, many of which were also discussed at the meeting. This summary combines comments, concerns, and topics raised at both meetings and via email.

Clarifications

- What does decommission trail mean? *Closure of trail, restoration, and barriers such as brush or logs.*
- What high quality natural resources are being protected in the west section of the park on the north side? There are many dead trees in this area. *There is high quality native ground cover, including a large area with maidenhair ferns.*
- Has the county restored the power line corridor, which was disturbed a few years ago? *Yes.*
- Is the Parks Department still considering providing adaptive wheelchairs in Lebanon Hills Regional Park? Y*es, adaptive wheelchairs will be part of the strategy to improve accessibility in the park.*
- Which trails are being recommended as ADA accessible? *Recommendations for ADA trails will require follow-up feasibility and impact studies. Further evaluation is recommended for ADA accessible trails on Wheaton Pond and Schulze Lake. ADA compliance requires a firm stable surface but does not require the trails to be paved with impervious surfaces. This Study is not recommending new paved trails. The Study includes a recommendation for improvements to Jensen Lake and Gerhardt Lake trails to provide better accessibility, but not necessarily fully ADA compliant. Improvements may include ensuring level surface, reducing slopes when feasible.*
- Combined skate ski and classic ski trails recommended for the middle section be wider than the current classic ski trails*? No, the current width can be maintained. The grooming would be different with a single classic track, typically on the right side of the trail and skate ski area adjacent to it.*

Comments and discussion

General

- The study should identify clear options for hiking loops of varying distances from the trailheads.
- WITC members do not feel the Study has gone far enough to see the park through a habitat lens. They would like to see larger areas of the park identified as habitat reserve areas without trails. There is an overabundance of recreation in the park; it is a nature-based park and more area should be set aside for nature. WITC members expressed desire for:
    - Identification of preserve areas without trails or other recreation. These areas would be managed for natural resources.
    - More effort in this study be spent exploring strategies to reduce trail mileage in the middle and east sections of the park by 10% -15%.
    - Areas where there are redundant trails seem to be on the west and south west sides of Holland Lake.
    - Increasing shared use trails was suggested as an approach to overall trail mileage reduction.
- Parks Natural Resources Staff pointed out some of the areas that the study identified as high-quality habitat.
    - Identification of prairie remnant between the Park Ridge Drive neighborhood and Jensen Lake. The study does not recommend new trail alignments in this area. There was discussion about if the Park Ridge Drive neighborhood trail connections in this area could be reduced to one trail access (there are currently two).
    - Recommendation for a new trail connection to the neighborhood on the south side of Jensen Lake. There are currently multiple 'by use' trails in this area and the hope is that by consolidating into one official trail, the 'by use' trails can be decomissioned.
    - Buck Pond is a sensitive area, there may be the possibility of seasonal trail closures in that area.
    - The area between Holland Lake and Buck Pond is a high-quality area with many existing trails.
    - The northern portion of the middle segment is a high-quality area. Recommended hiking trails are in the more disturbed area to the south.

- WITC members do not support additional loop lake trails. There are already lake loops in the park and no more are needed. The Study recommends new hiking trail segments to complete new loops around Holland Lake, Apple Pond, and Gerhardt Lake, and the wetland northeast of Camp Sacajawea. There are already many lake loops for park visitors to enjoy: Wheaton Pond, Jensen Lake, Schulze Lake, Portage Lake and McDonough Lake. Some lakes should be left as wildlife lakes, and to be enjoyed from afar. The project team responded that currently there are limited hiking trails serving the campground and Camp Sacajawea. Visitors are attracted to water and are creating informal trails in some of these areas.
- WITC does not support the recommendation for conversion of the existing natural surface driveway on the east side of Holland Lake to a trail. Holland Lake is a high-quality lake and any additional trails or use around the lake will degrade the habitat. Habitat is the highest priority for the east side of Holland Lake. They do support a short spur trail along the drive connecting the summer hiking/winter ski trails to an overlook location above southeast side of Holland Lake.
- WITC members raised concern about the ecological impact of accessible and wider trails.
- A comment was made that trails can be used to define natural resource area boundaries and provide natural resource maintenance access.
- WITC members raised concern about winter salt and sand application on trails and impact to waterbodies in the park. They requested that the Study include a strong recommendation that salt and sand not be used in proximity to water. MORC members mentioned that they have installed signage at the mountain bike trailhead and an area for riders to clean their tires from salt before entering the park trails. They suggested that similar signage, along with a boot cleaning area, could be expanded to winter hiking trailheads as well.
- WITC members expressed the desire for the study to provide a recommendation for trail surfaces*. The study will evaluate the pros and cons of various surfaces but will not recommend surfaces individual trails. Surfaces will be identified in future trail design projects.*
- A WITC member expressed concern about the general erosion and chronic failure of crushed limestone and asked that study explore techniques recommended in the 2006 MnDNR Trail Planning, Design, and Development guidelines.
- WITC members agree that most of the natural surface trails in the park experience erosion and that new sustainable trail design and maintenance techniques are needed.
- WITC members expressed concern about cross country ski trail recommendations. A comment was made that there is a 'loss of trail length and dumbed down'. A member expressed concern that there would be conflicts between classic and skate skiers on shared trails and that the county may see fewer skiers on those trails, as a result.

- WITC members questioned why trail management includes blowing leaf litter off trails. Steep hills don't erode with plant cover including trees, their litter, and grass along with rocks and high friction materials. MORC members explained that blowing leaves off the trail is an important safety measure for mountain biking. Having a thick leaf presence on the trail makes it become very slippery, basically acting like loose sand. Any minor turn and your wheels will slip-out right from underneath you. MORC volunteers spend many hours blowing leaves and trimming overgrowth and could use help with these two maintenance practices. County staff explained that leaf litter is blown off ski trails to prepare them for winter. Cleared trails freeze faster and harder and help maintain the snow base. Leaves mixed with snow create an inconsistent ski surface; it is like skiing on sandpaper.
- WITC members suggested that the timeline for presenting the Study to the Physical Development Committee on 11/29 seems rushed and more time may be needed for discussion and refinement.

<u>East Segment</u>

- One of the hiking segments proposed to be decommissioned is the most direct hiking trail from the Visitor Center to the A-Frame, a very popular destination. It is also the portage trail between Schulze Lake and Portage Lake. This trail should not be decommissioned.
- WITC members feel there needs to be more discussion about widening the boardwalks around Jensen Lake from 4'-6'. They expressed concern about available space, proximity to the lake on one side and steep slopes on the other. Staff clarified the rationale for widening the boardwalks to 6' around Jensen includes: quicker and safer emergency medical access, easier maintenance access, adequate width side by side walking and passing. Today there is informal widening because people step off the boardwalks to pass. WITC members suggested creating spaces to step to the side to allow passing or considering one directional travel. *More study and discussion would occur around the impacts and technical feasibility of this during trail design. The LHRP Sustainable Trails Study scope of work does not include design.*
- Concerns were raised about segments of shared hiking/equestrian trails. Specific concerns were raised around mixing horseback riding and dog walking.
- WITC requested that bike racks be installed at the Holland Lake Trailhead now that there is a trail along Cliff Road.

Middle Segment

- WITC members feel that new trail recommendations for Camp Sacajawea should not be included in the Study because the future of use of the area may change.
- A MORC member commented that the trail around the pond north of Camp Sacajawea would be of big help for scout troop education and earning badges related to that type of area.
- WITC members are not supportive of a new campground office/trailhead building at the campground *(2015 Master Plan recommendation).*

West Section

- There was discussion about buckthorn removal in the west segment:
    - WITC members requested that a recommendation be added to the Study that a strategy for buckthorn removal and revegetation be developed prior to any expansion of mountain bike trails.
    - MORC members expressed that buckthorn removal seems like a good objective but would rather not tie the removal planning to further trail development.
    - There was discussion about how removal of buckthorn at the same time as new trail construction makes sense. Trail expansion by its nature would eliminate some buckthorn. New development would not need to have a significant effect on future buckthorn removal. Corridors could be prepared to address buckthorn in the immediate area.
    - MORC members are supportive of buckthorn removal but some planning needs to be done to mitigate trail jumping (buckthorn is an effective barrier). There was a suggestion that a native shrub planted near the Park Ridge neighborhood might be an effective alternative planting.
    - MORC is willing to provide input on west section buckthorn removal as soon as that planning is on the county's schedule.
- MORC members expressed that oak wilt is another item that should be addressed in the west segment. There are areas in the west segment that have die-off. This standing deadfall falls onto the trail with higher wind gusts, requiring chainsaws for removal. There are times when a storm has caused a dozen or more trees to fall on the trail.
- MORC members expressed desire to expand and refresh the mountain bike trails. Many metro trails have opened or been expanded with current design features and trail style. MORC has built in small changes and adjustments to prevent complete stagnation and sees this as an opportunity to realize a goal to freshen up the Lebanon Hills mountain bike network with a state-of-the-art addition.

- MORC members commented that all trail sustainability techniques discussed in the Study are tactics that they already employ on the mountain bike trails. Erosion is something they constantly battle with on the mountain bike trails, but oftentimes it's general wear and tear over water erosion. These issues are either fixed or rerouted to avoid the problem area, with the sustainable trail techniques used to help minimize future erosion.
- MORC members clarified that the green loop mountain bike trail was initially created with accessibility in mind. It would take some work to bring it back to its original form, as nature has reclaimed some width by growing in where unridden and wear and tear shows in some places. A suggestion that is not addressed in the Study is to create new, wider, "less technical/hilly" trail in the middle section to use for ADA accessibility, and use that as a regularly groomed trail in the winter.
- MORC members commented that the reduced ski and hiking trail crossings for the mountain bike trail will be a big help. Generally, mountain bikers tend to keep their speed through most of the trail, so it can be a bit of a surprise when two parties want to cross the opposite trails at the same time. The new hiking trail should be designed to accomodate UTV (side-by-side) access for emergency services. They were on-site once when the fire department needed to get their side-by-side back to a location using the south-east hiking trail (in the west section). The hiking trail was a bit narrow in places, slowing down the response time.
- MORC members commented that in the phasing recommendations, mountain bike improvements are suggested for 2025 and suggested some of the recommendations could happen sooner. The skills course specifically is in dire need of repair/replacement as many features have broken. Green loop widening could be tackled in the next couple years. Perhaps larger segments of new trail will need some time for planning.

From: [Redacted]
Sent: Friday, November 11, 2022 10:05 AM
To: Planning <Planning@CO.DAKOTA.MN.US>
Subject: Lebanon Hills Future Plan

Hi All - I was just reading through the master plan and I'll keep it short. If there is any way to expand the mountain bike trails, either in the area of the park they are currently in, or connecting to other areas with new trails built, that would be the best thing that ever happened to mountain bikers around here.

I live in the area and ride Leb at least twice a week during the season. It is already awesome. With the explosion of mountain biking and things going on at places like Monarch and Cuyuna, I can easily picture Leb doing similar things and becoming even better than it already is. Thanks

From: Leatham, Lil
Sent: Tuesday, November 15, 2022 2:38 PM
To: [Redacted]
Subject: Lebanon Hills Future Plan

[Redacted]
Thank you for your email and glad you enjoy mountain biking at Lebanon Hills!

The Dakota County Parks Department is currently working on a Lebanon Hills Regional Park Sustainable Trails Study which will address improvements to the mountain biking trails in the west section of the park. The study isn't quite complete but will likely include recommendations for reducing existing conflicts with the hiking and ski trails, refurbishing prairie area and skills course, converting the existing green trail to accommodate adaptive use mountain bikes, and a potential future mountain bike trail expansion area in the west section of the park.

Best,

Lil Leatham, PLA, ASLA
Principal Planner

Dakota COUNTY

Physical Development Administration

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A 14955 Galaxie Avenue, Apple Valley, MN 55124
Pronouns: she/her

From: [Redacted]
Sent: Tuesday, November 08, 2022 9:54 AM
To: Planning <Planning@CO.DAKOTA.MN.US>
Subject: General Roadmap - Lebanon Hills upcoming projects

Hello!

(I have combed through the master plan, but I'm not sure what is/isn't moving forward as I understand much park funding is shared throughout the Dakota County Park system and sometimes ideas get tabled, or canceled from original master plans)

This is a general question regarding the next few years of projects in Lebanon Hills. My family is greatly invested with time in the park (5 of us from 4 yrs old to 41 yrs old). We spend so much time during all 4 seasons enjoying the park, and can't help but notice the exciting improvements also though, some items that seems severely outdated or ignored. We love Leb!

Can you share anything upcoming with guaranteed 'go-ahead' dates for projects in Lebanon Hills?

Specifically noticing a 'connector trail' not related to the greenway system... I really, really hope this 'multi-use' trail will allow for off-road leisurely biking as well, I understand the concern for safety but across the globe these kinds of trails are common-place and allow for point to point connections with all trail users in mind. There are so many trail contractors out there now that build beautiful multi-use trails with minimal impact- it is quite a national trend; https://www.facebook.com/rocksolidtrails/ https://www.facebook.com/IMBA.Trail.Solutions/ https://www.dirtcandydesigns.com/ https://www.pathfindertrailbuilding.com/services etc.

Thank You!

On Tue, Nov 15, 2022 at 2:06 PM Leatham, Lil <Lil.Leatham@co.dakota.mn.us> wrote:

[Redacted],

I'm so happy that you enjoy spending time in Lebanon Hills Regional Park! The Dakota County Parks Department intends to make the following improvements over the next few years:

- Sustainable trail improvements for the natural surface hiking, cross country skiing, horseback riding, and mountain biking trails (phased, 2023-2027)
- Mountain bike skills course refurbishment
- Addressing pavement maintenance on the Visitor Center access road, the Camp Sacajawea road, and some areas of the existing paved walking trails (2023)
- Campground accessibility improvements
- Restoration on 70 acres of oak woodland, savanna, and prairie at Star Pond (2023-2024)
- Restoration on 65 acres of oak woodland near the Discovery Loop trail (2028)
- Pollinator prairie and pollinator garden projects near the Visitor Center and the Holland Lake Trailhead (2023-2024)
- Installation of small animal tunnels for turtles, frogs, toads, mink, etc. to cross under Cliff Road (recently completed)

At this time, the multi-use connector trail included in the 2015 Master Plan is not programmed.

Best,

Lil Leatham, PLA, ASLA
Principal Planner

Dakota COUNTY

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From: [Redacted]
Sent: Tuesday, November 15, 2022 2:19 PM
To: Leatham, Lil <Lil.Leatham@CO.DAKOTA.MN.US>
Subject: Re: FW: General Roadmap - Lebanon Hills upcoming projects

Thanks for the response!

I didn't see mention of moving the maintenance facility, is there still hopes to have that done in the next few years?

any more detail on mtn bike skills / trail improvements would be awesome (if possible)?
Thanks!

From: Leatham, Lil
Sent: Wednesday, November 16, 2022 4:25 PM
To: [Redacted]
Subject: RE: General Roadmap - Lebanon Hills upcoming projects

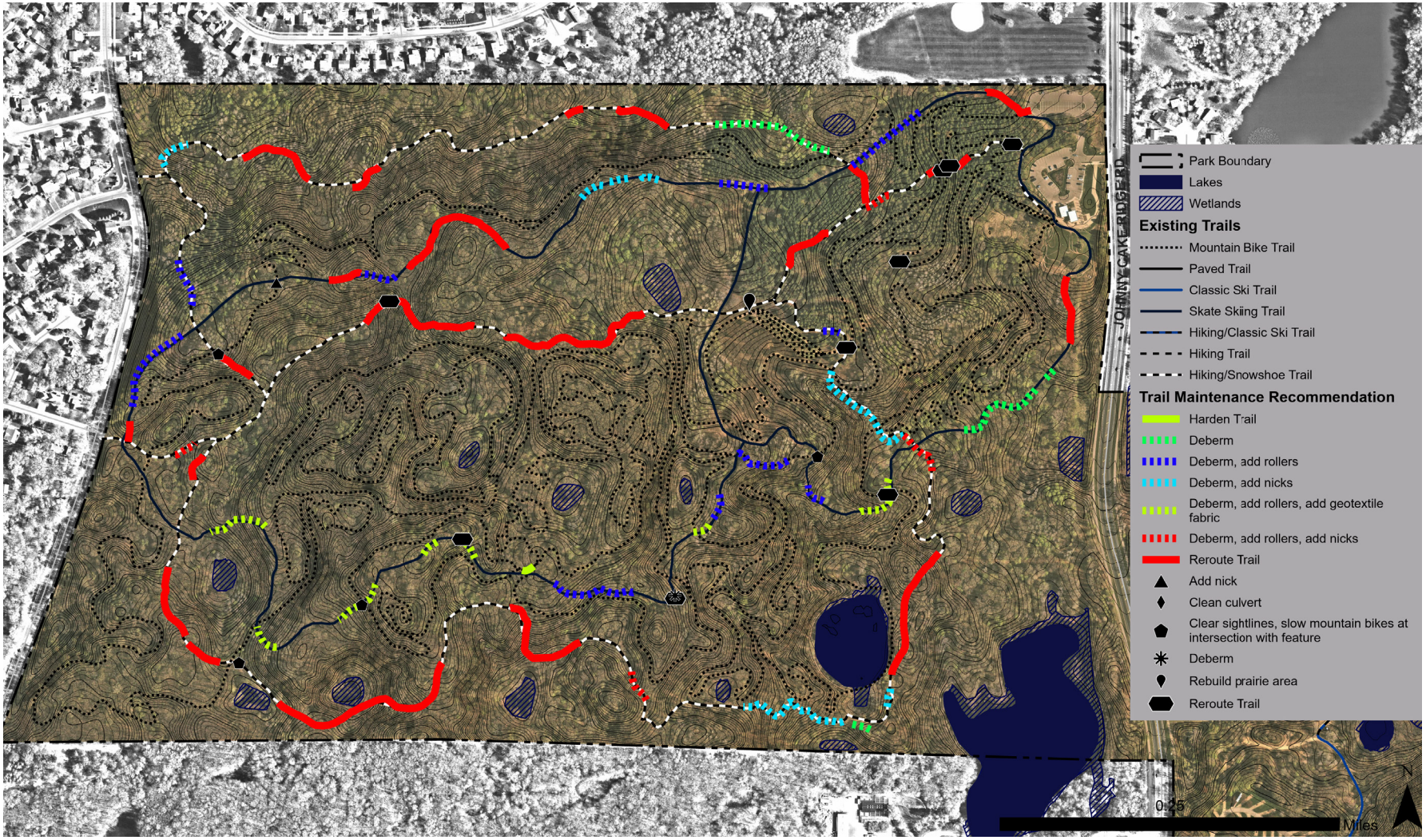
[Redacted],
Yes, there are still hopes to move the maintenance facility. It is programmed in the Draft Capital Improvement Program for design in 2024 and construction in 2025. We are currently working on a sustainable trails study for Lebanon Hills Regional Park – which is almost complete. The study will include general recommendations and phasing for natural surface mountain biking, hiking, horseback riding, and cross-country skiing trail projects over the next 5 years. We would work closely with MORC on the details related to skills course refurbishment and other recommendations to the mountain bike trails – so we don't have the details yet!

Let me know if you have other questions!
Lil

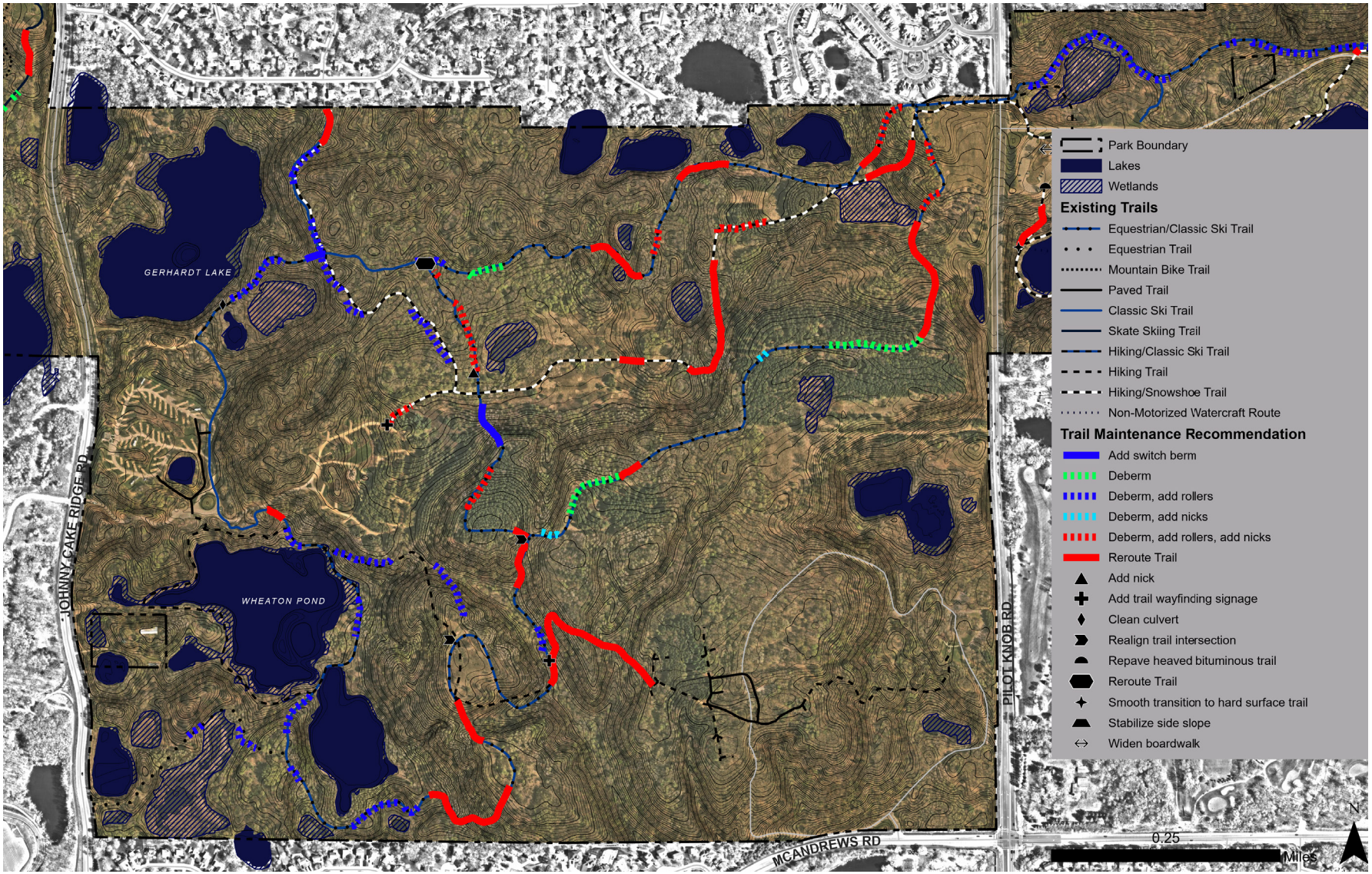
Phone Comment
Wednesday November 22, 2022

Resident who lives adjacent to the west section of Lebanon Hills Regional Park called to express concern about the potential changes to the skate-ski trails in the west section. They skate ski in the park on a regular basis and support keeping the skate ski trails in the current location. They have spoken to others who have the same view. They are concerned about the county parks department making decisions at the request of a limited number of stakeholders.

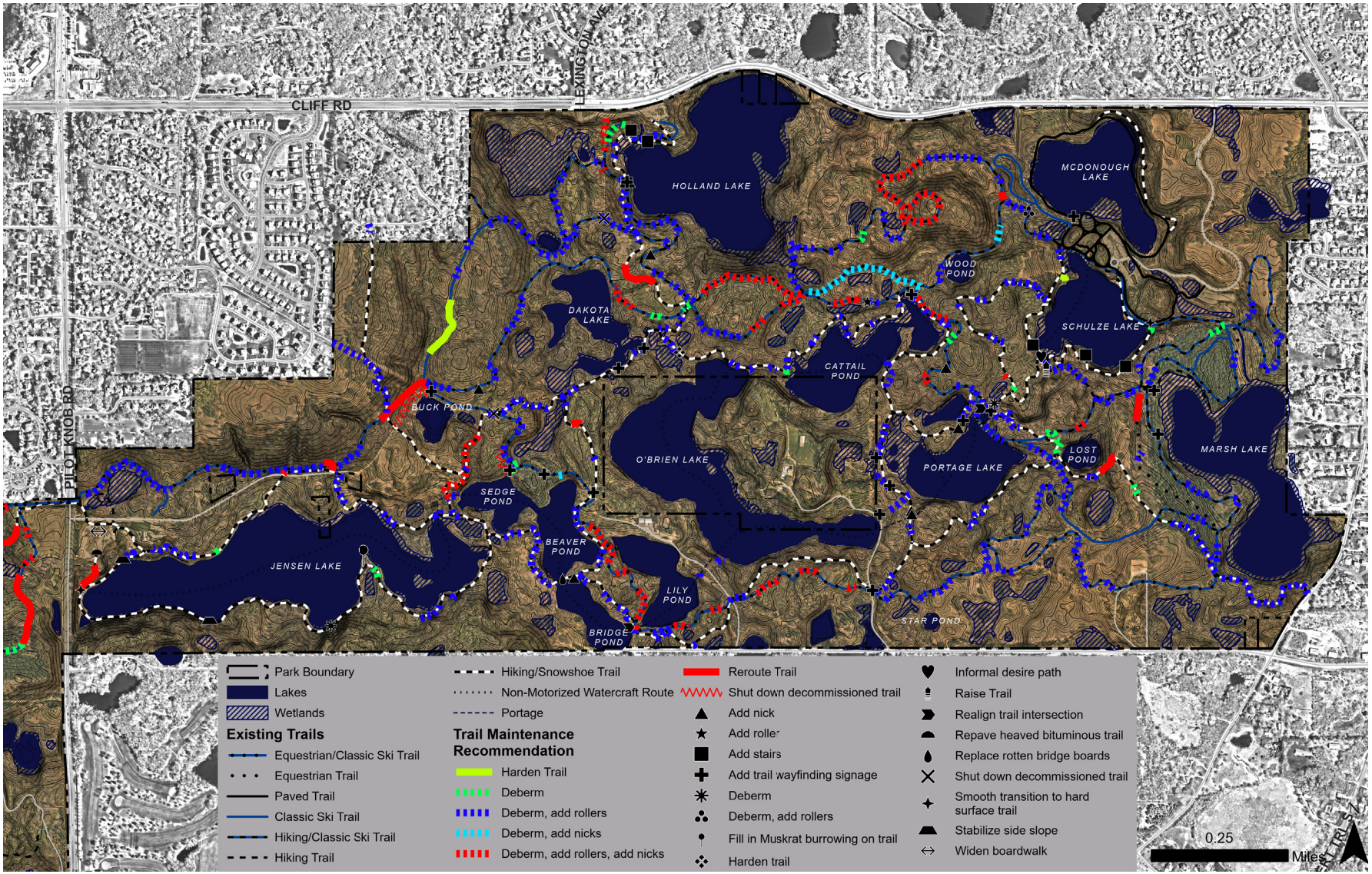
APPENDIX B: TRAIL MAINTENANCE RECOMMENDATION



West Segment Trail Maintenance Recommendations without Proposed Alignment Changes



Middle Segment Trail Maintenance Recommendations without Proposed Alignment Changes



East Segment Trail Maintenance Recommendations without Proposed Alignment Changes