Memorandum

SRF No. 15650

To: Lil Leatham, Principal Planner
Dakota County, Physical Development Administration

From: Ken Grieshaber, Project Director

Date: August 31, 2022

Subject: Lebanon Hills Regional Park Sustainable Trails Study

Background/Context

The Lebanon Hills Regional Park Sustainable Trails Study is being undertaken to provide a detailed assessment of existing trail conditions in the 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 and high-quality trail recreation and nature-based experiences. The study is occurring in two phases, Phase I: Trail Assessment and Phase II: Recommendations and Implementation Strategy. This memo is a summary of the Phase I Assessment results. Phase II Recommendations and Implementation Strategy will be based on this assessment and be developed in Fall 2022. Outcomes of this study will help guide priorities, phasing, and funding needs for implementing future trail improvements.

As an initial step for developing trail improvement recommendations for the park, on site field assessments were completed for the approximately fifty miles of existing trails located in the west, middle, and east segments of the park. Field identification of site issues were recorded using hand-held GPS units and photos to document existing trail conditions.

Trail networks serving the needs of hiking, mountain biking, cross-country skiing, and equestrian user groups were all evaluated in three segments of the park, and issues identified in the field for needed improvements. (See Figure 1). To augment the detail field trail assessment, Minnesota Off-Road Cyclists (MORC), Wilderness in the City (WITC), and School of Environmental Studies (SES) are being engaged to provide comment and feedback on existing trail conditions and trail improvement recommendations.

Trail Evaluation Criteria

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. (See Figure 2)

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. 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 fat tire biking has increased in popularity over the last several years. (See Figure 3)

Most of the hiking, equestrian, and ski trails in the park are maintained at an average width of eight feet which allows for maintenance and emergency vehicle access to most of the trail system throughout the park. 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. At the time trails were installed, developed, or inherited, they were not designed with wildlife and habitat requirements in mind. The Phase I assessment evaluated the trail system as a whole to determine how it impacts wildlife and habitat. Phase II recommendations will focus on reducing impacts to natural resources while improving the physical sustainability of the trails. To evaluate how existing trails are impacting natural resources, all trail erosion issues identified within 100 feet of wetlands or lakes were measured. Erosion on trails within 100 feet of wetlands or lakes can negatively influence water quality. In addition to evaluating erosion near lakes and wetlands, the Phase I assessment located all existing steep slopes and highly erodible soils as these areas are more likely to erode overtime (See Figures 4, 5, & 6). Lastly, all significant and sensitive natural resources in the park were identified (See Figure 7). The natural resources identified in the park were grouped into three categories (see list below) to help guide recommendations for trails that currently may be impacting sensitive natural resource areas in the park (See Figure 8).

Natural Resource Category A

- 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

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

Natural Resource Category C

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

General Trail Condition Observations

The following existing trail conditions were observed within each section of the park for trail user groups:

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 9)

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.
- Several 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 improvements. Many features are outdated or in disrepair.
- The current trails system and skills course does not accommodate adaptive biker user needs.
- The trail segment known as the prairie area has constant erosion and needs continual maintenance.
- Embankment turns 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.

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 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.
- Hiking trail network does allow loops of varying distances.

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 10).

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 east segment 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 poorly designed.
- 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 up steep topography in this area the park. Other observations included:

- Hikers, trail runners, and bikers were observed using equestrian trails.
- Some equestrian riders on the trail at the time of field evaluation commented they liked the steeper terrain in this area of the park for training and conditioning their horses.

- 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.

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 in the east segment coincided with fewer severely eroded trail conditions than the west or middle segments of the park (See Figure 11). The east segment also has the most valuable natural resources in the park with the most lakes, wetlands, rare habitat, and rare/remnant plant communities (See Figure 7). As such, the east segment has the highest percentage of trails in a significant natural resource area.

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 can be corrected through sustainable trail design and maintenance methods that diverge water off the trail in more frequent intervals because trails are generally well aligned with the topography.
- 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.
- Decommissioned trails and maintenance roads not clearly identified causing wayfinding confusion.
- Lack of accessible hiking trail loops from Jensen Lake Trailhead 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 travelers going different speeds to easily pass.
- Lack of formal connection to park from neighborhood could cause unofficial trails being developed through the remnant prairie north of Buck Pond.
- High concentration of trails through the sensitive wildlife habitat area.

Equestrian/Classic Ski Trails

- Trails 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 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

Paved Trails

- The paved trails were generally in good condition.
- McDonough Lake trail provides accessible trail loop.
- Some root intrusion of 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.

Assessment Results

Based on observations made in the field, trail lengths and points were mapped identifying conflicts and areas in need of improvement to establish a more sustainable and higher quality trail experience in the park. (See Figures 9, 10, and 11)

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. 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 which will be developed in Phase II this fall. (See Figures 12, 13, and 14)

FIGURE 1: PARK CONTEXT MAP

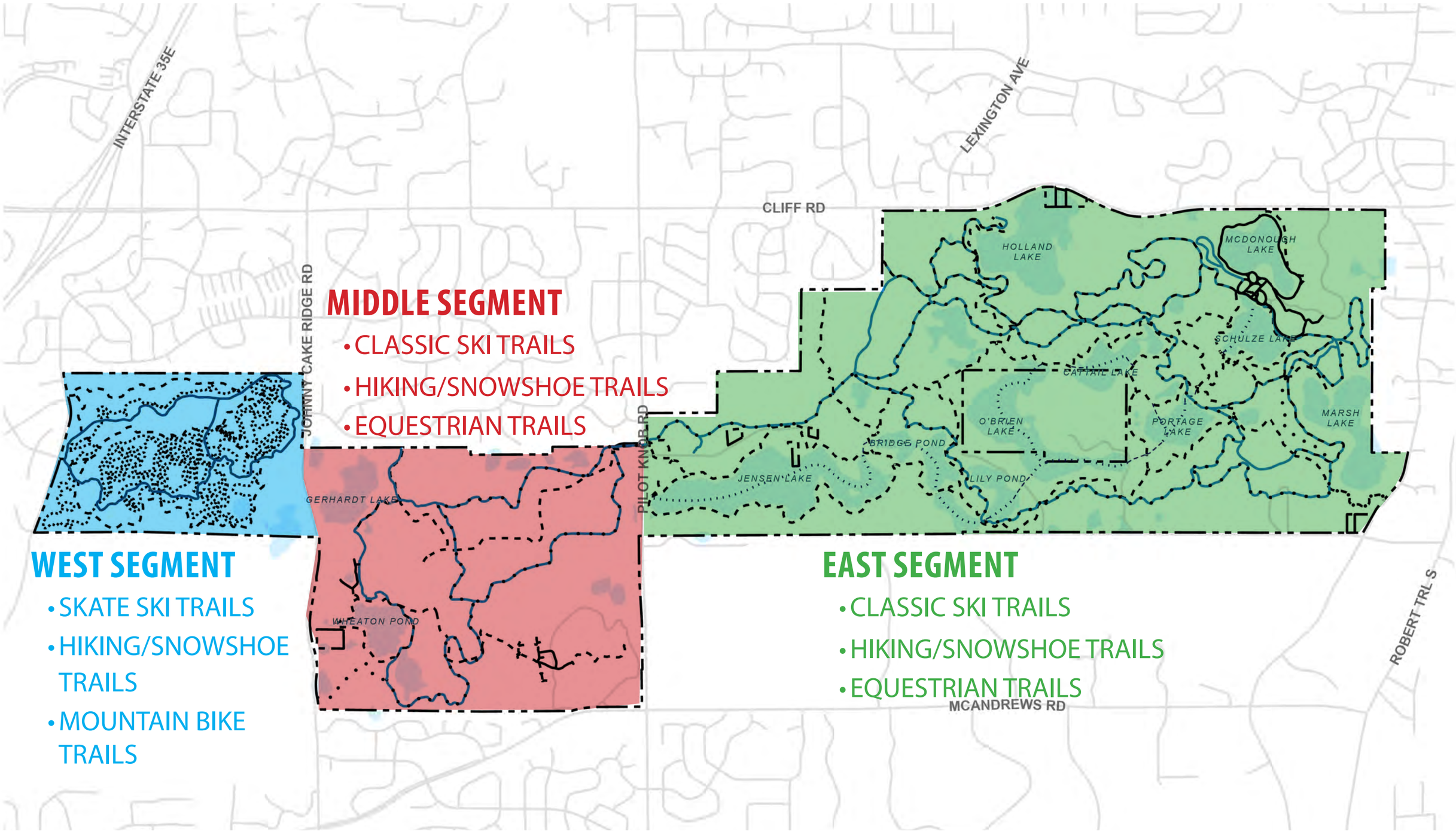


FIGURE 2: TRAIL EROSION

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

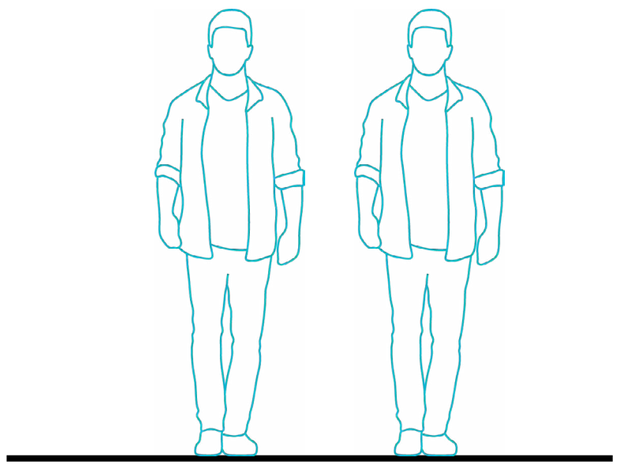
SEVERE TRAIL EROSION

- Trail erosion greater than 10″ deep
- Deep gully erosion present

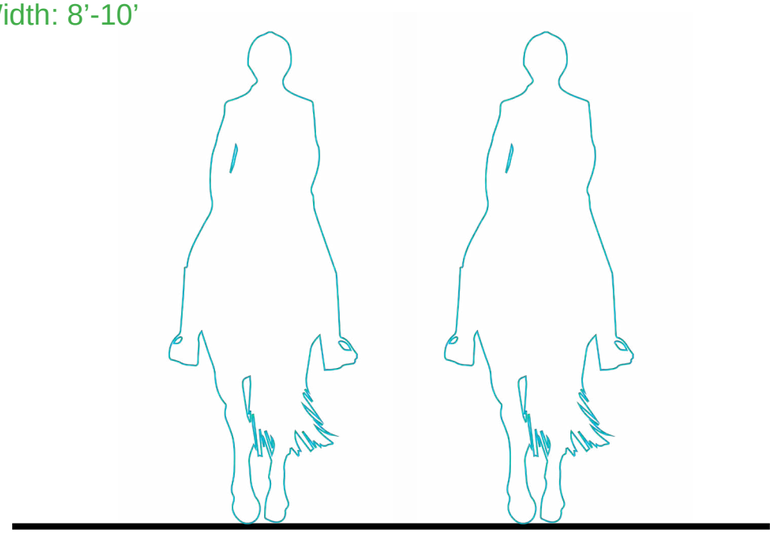
FIGURE 3: EXISTING TRAIL TYPOLOGIES

Summer Use

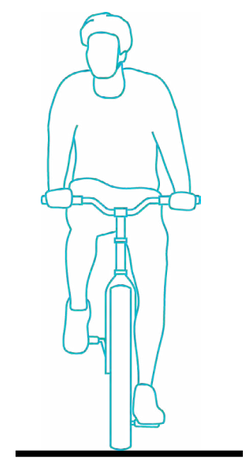
Hiking Trails
Surface: Grass, dirt, gravel
Width: 4’-8’



Equestrian Trails
Surface: Grass, dirt, gravel
Width: 8’-10’

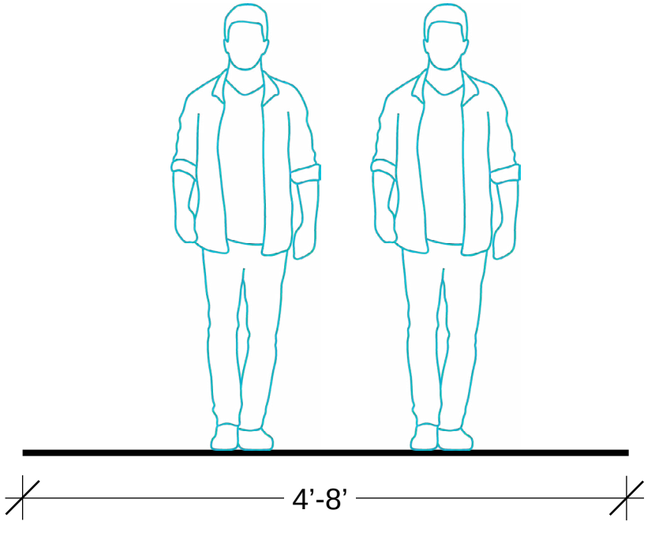


Mountain Bike Trails
Surface: Dirt (summer) or Snow packed (winter)
Width: 30”-36”

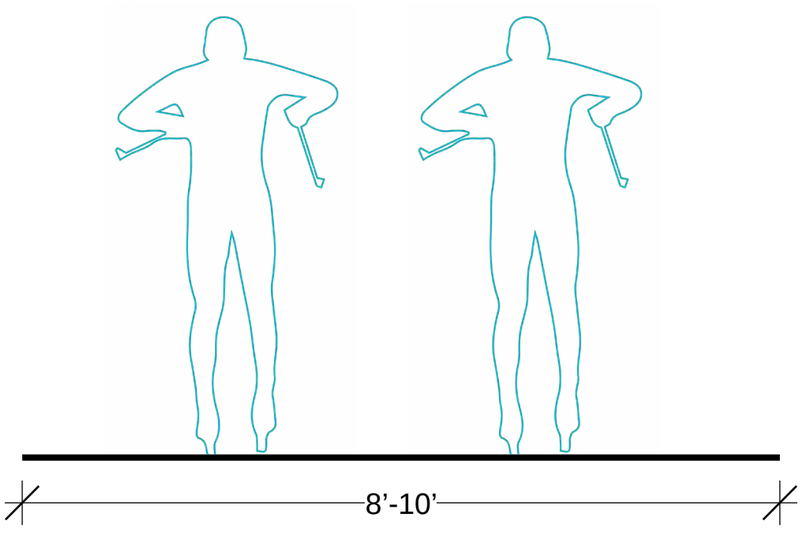


Winter Use

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



Classic Ski Trails
Surface: Snow tracked
Width: 8’-10’



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

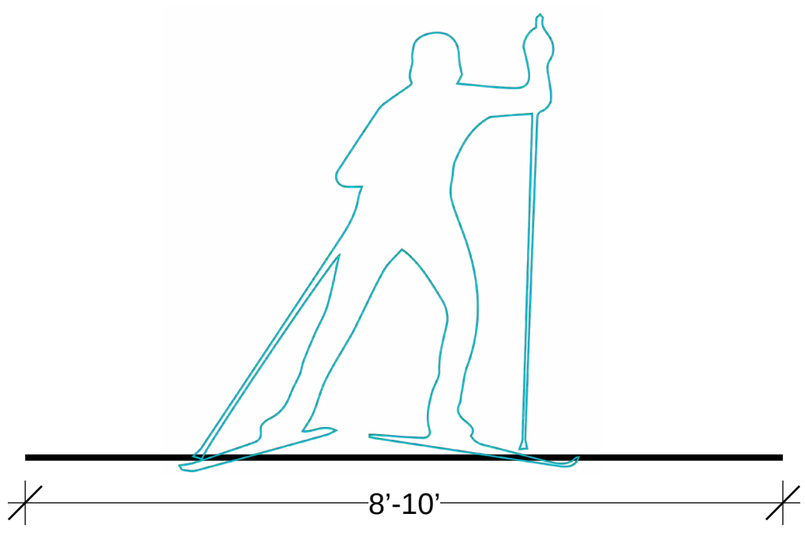


FIGURE 4: SLOPES

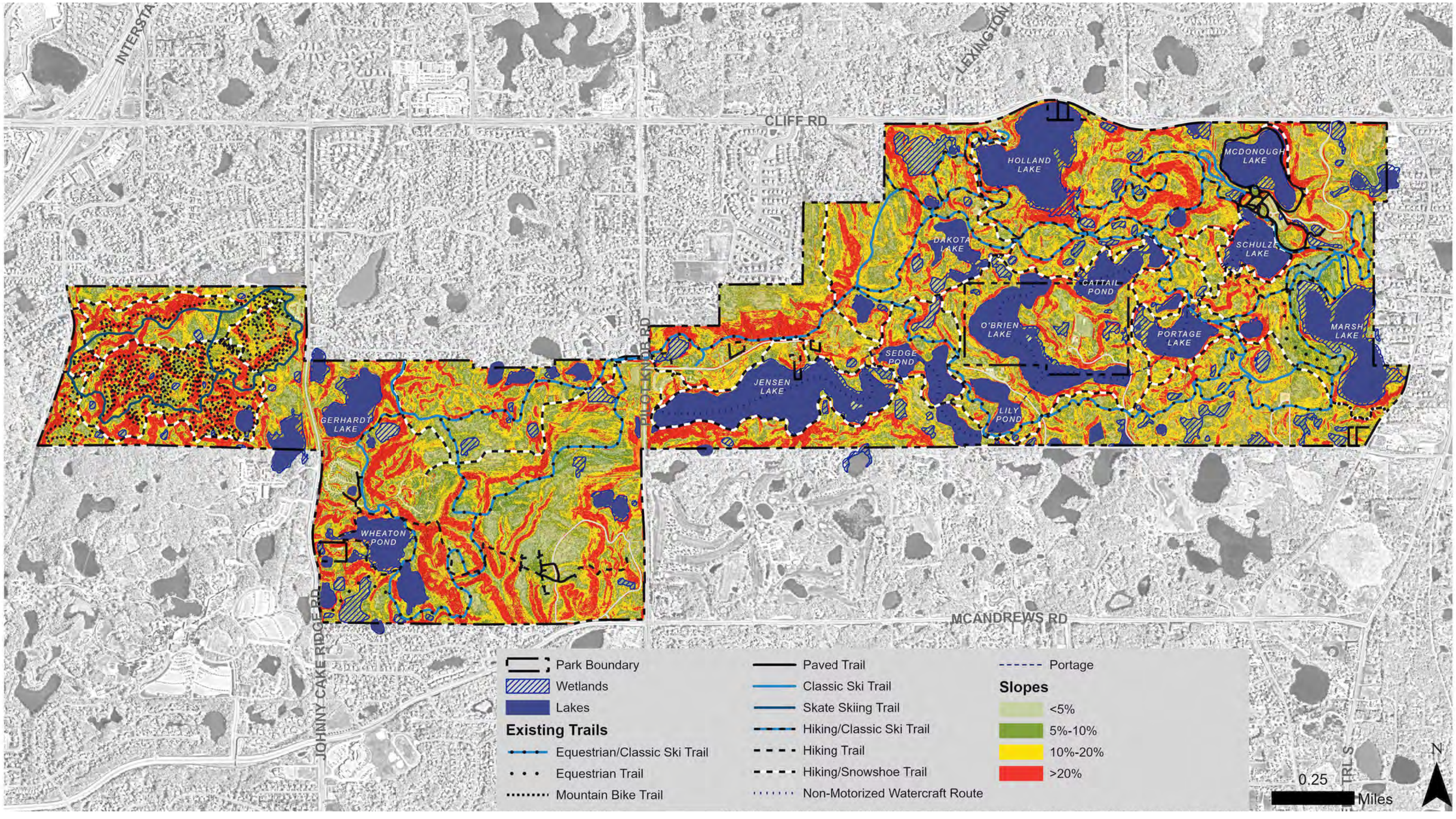


FIGURE 5: SOIL ERODIBILITY (K FACTOR)

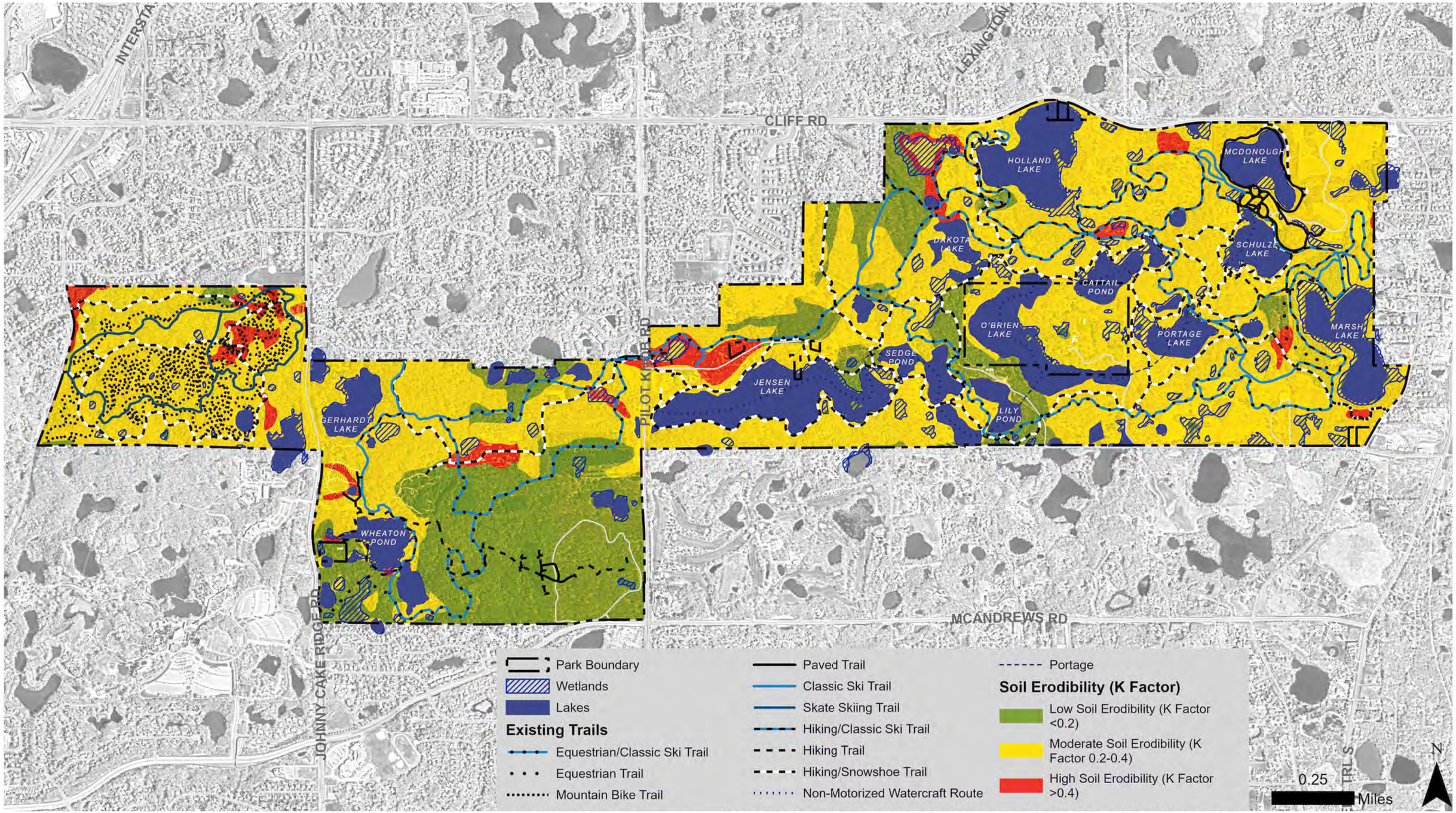
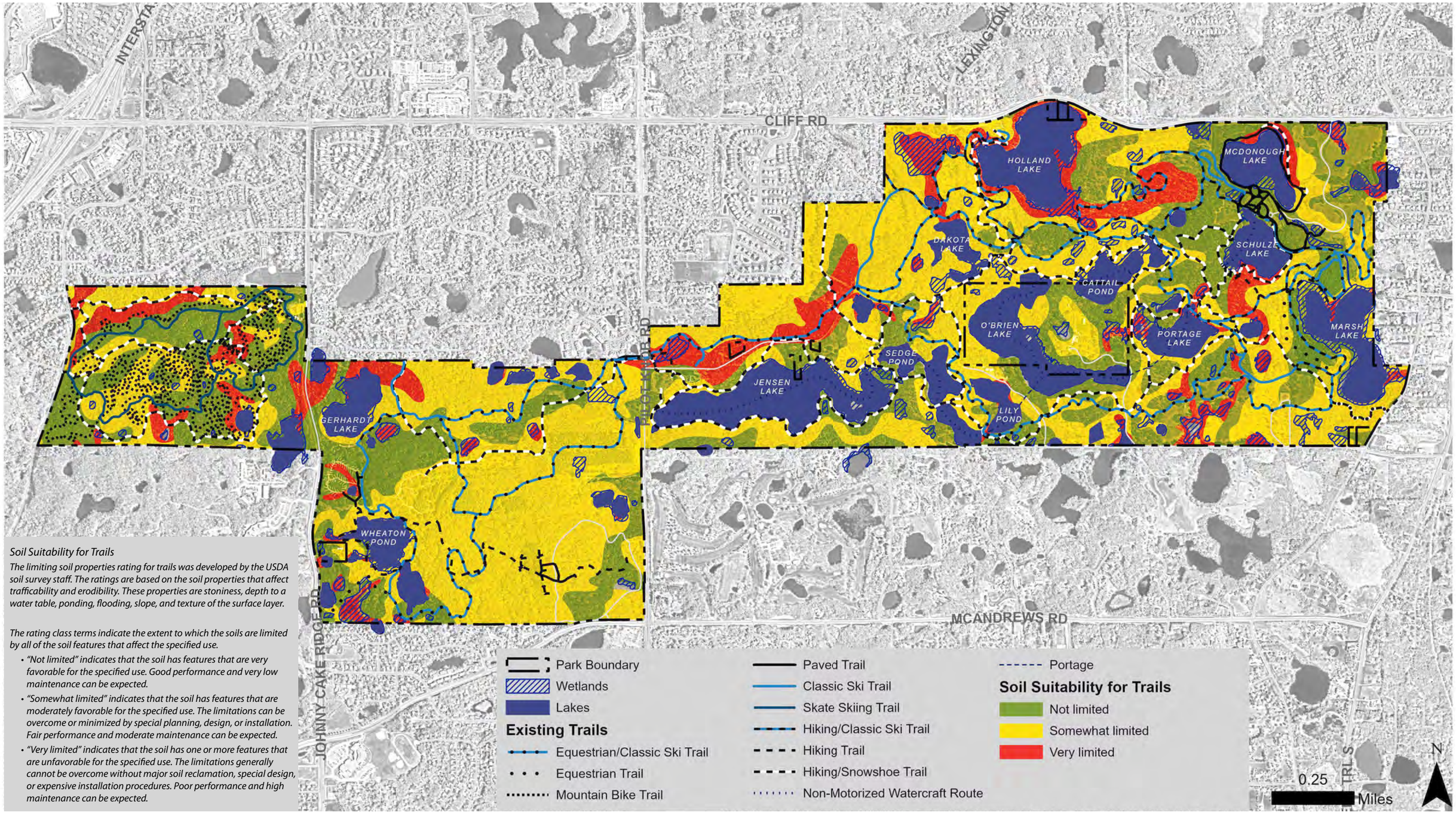


FIGURE 6: SOIL SUITABILITY FOR TRAILS



Soil Suitability 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: SIGNIFICANT NATURAL RESOURCES

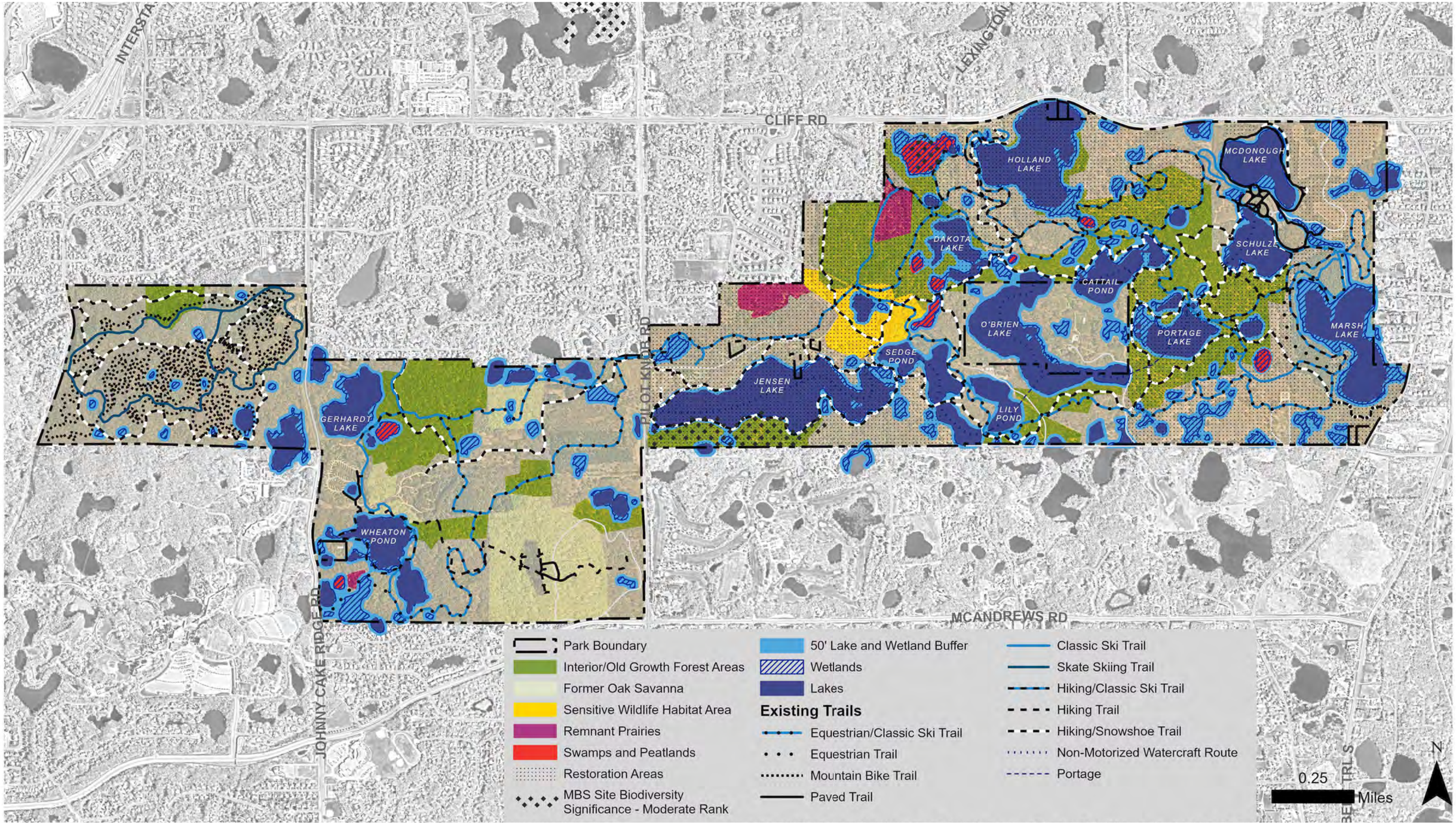


FIGURE 8: NATURAL RESOURCE TYPES

Natural Resource Category A

- *Highly sensitive natural resources*
- *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*

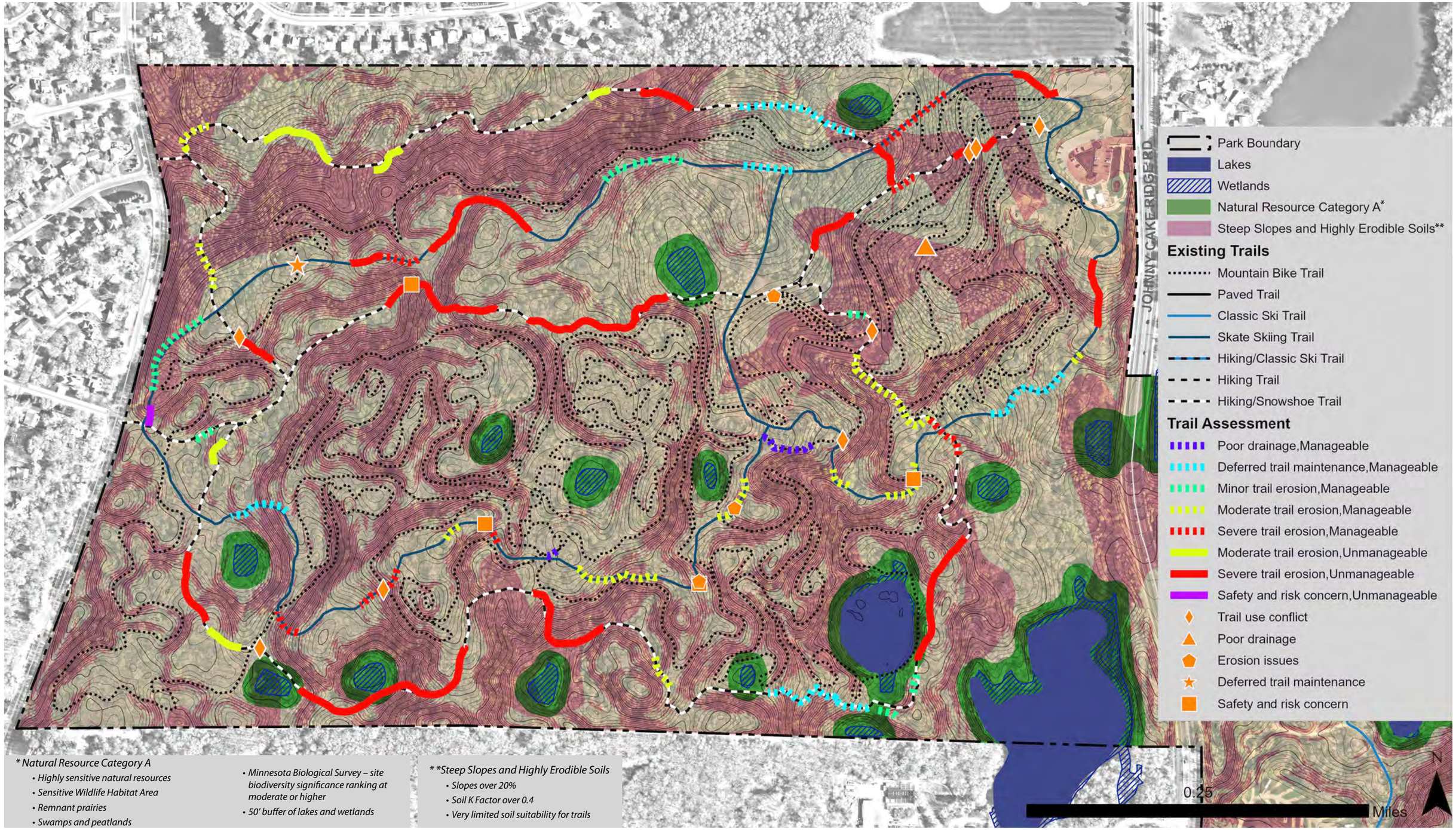
Natural Resource Category B

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

Natural Resource Category C

- *Disturbed natural resource areas*
- *Developed sites*
- *Previously disturbed agricultural land*

FIGURE 9: WEST SEGMENT TRAIL OBSERVATION MAP



** Natural Resource Category A*

- *Highly sensitive natural resources*
- *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*

** *Steep Slopes and Highly Erodible Soils*

- *Slopes over 20%*
- *Soil K Factor over 0.4*
- *Very limited soil suitability for trails*

FIGURE 10: MIDDLE SEGMENT TRAIL OBSERVATION MAP

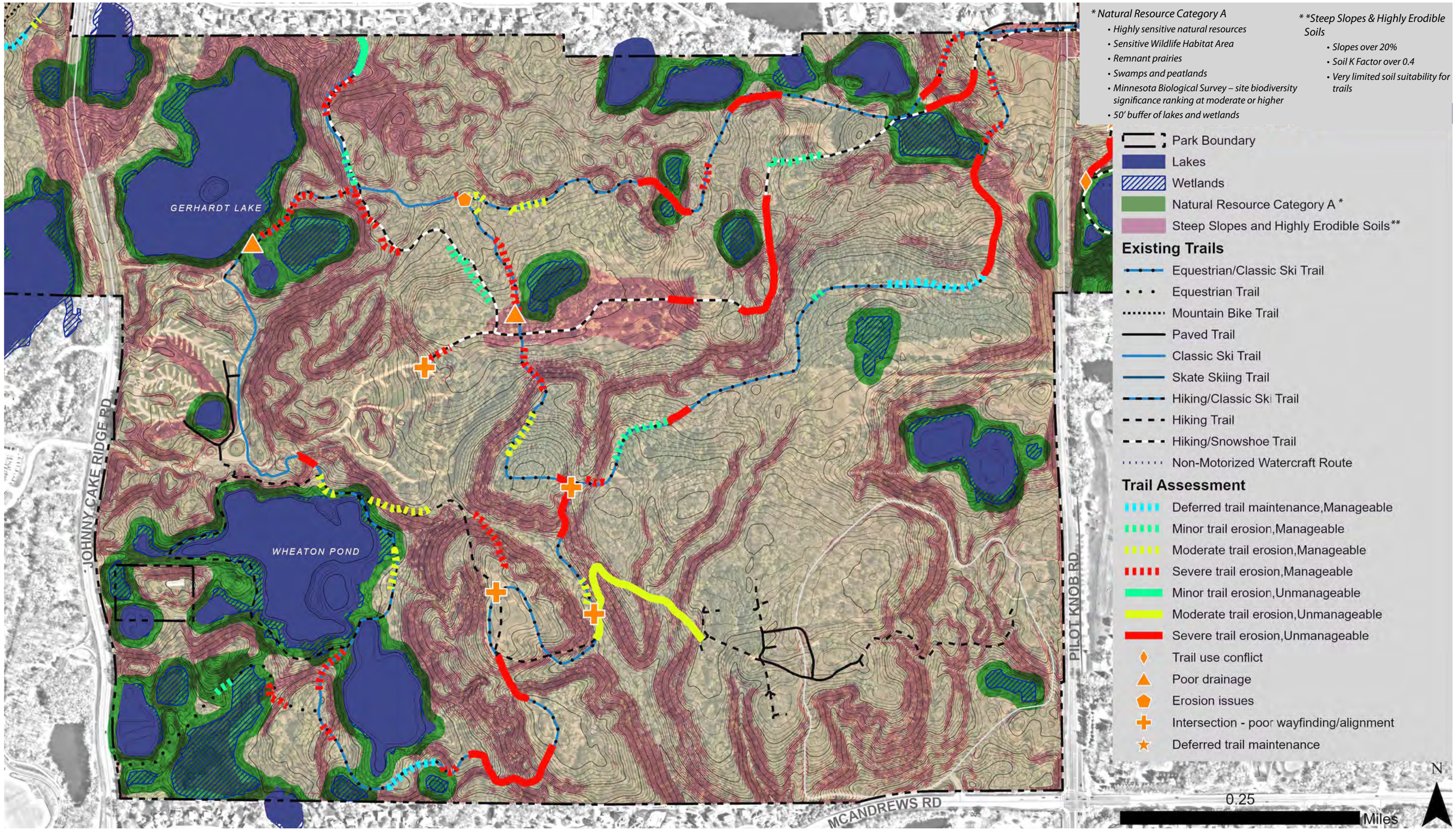


FIGURE 11: EAST SEGMENT TRAIL OBSERVATION MAP

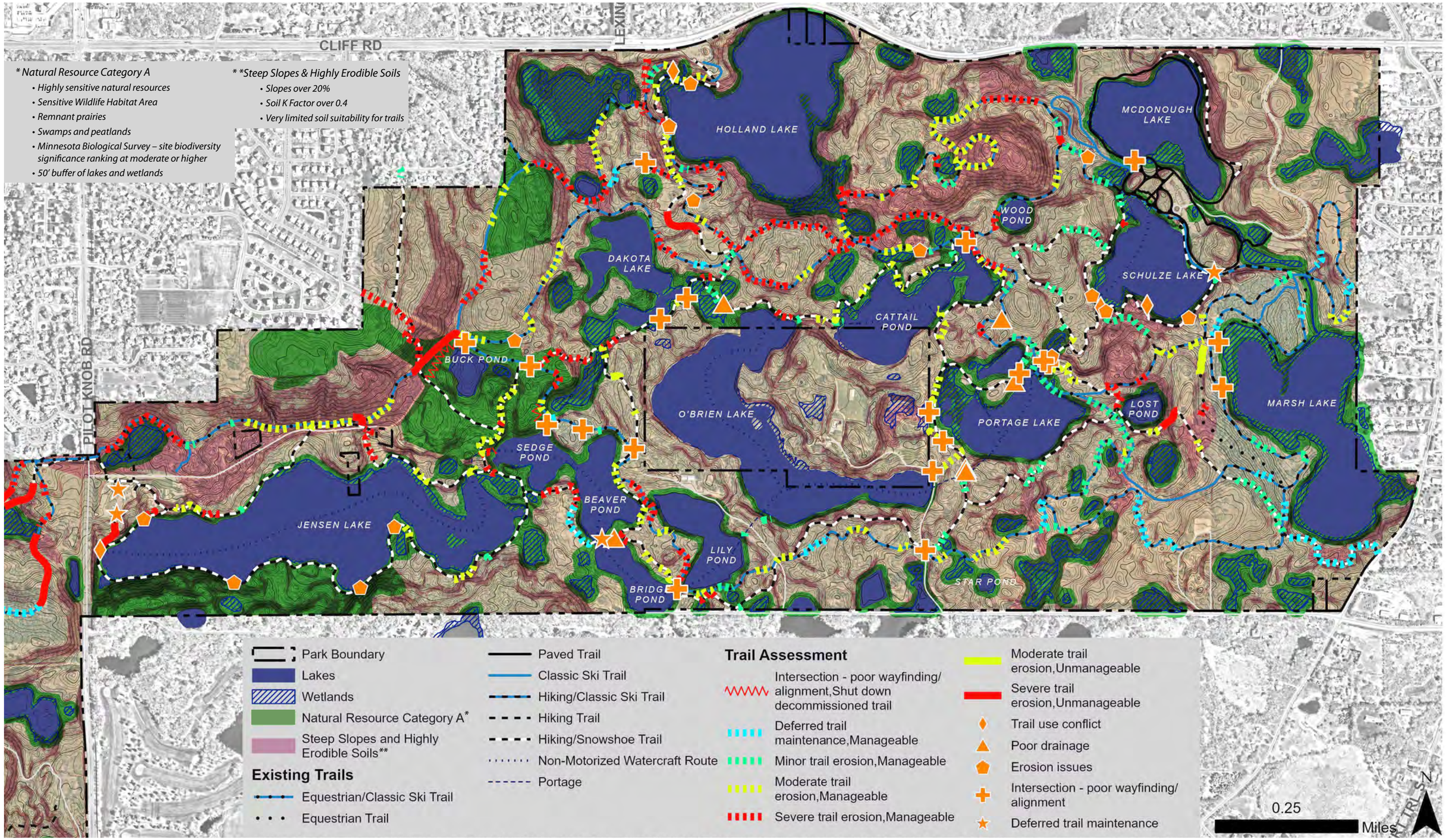


FIGURE 12: WEST SEGMENT TRAIL OBSERVATION SUMMARY TABLE

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 13: MIDDLE SEGMENT TRAIL OBSERVATION SUMMARY TABLE

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: EAST SEGMENT TRAIL OBSERVATION SUMMARY TABLE

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%