Leelanau Scenic Heritage Route Trailway Plan and Environmental Assessment

Sleeping Bear Dunes National Lakeshore, Leelanau County, MI

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March 2009

A C K N O W L E D G E M E N T S

SPECIAL THANKS TO:

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LEELANAU SCENIC HERITAGE ROUTE COMMITTEE

NATIONAL PARK SERVICE - SLEEPING BEAR DUNES NATIONAL LAKESHORE

NATIONAL PARK SERVICE – RIVERS, TRAILS AND CONSERVATION ASSISTANCE PROGRAM

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MICHIGAN DEPARTMENT OF TRANSPORTATION

FRIENDS OF SLEEPING BEAR DUNES

TRAVERSE AREA RECREATION AND TRANSPORTATION TRAILS, INC.

LEELANAU COUNTY ROAD COMMISSION

VILLAGE OF EMPIRE

EMPIRE TOWNSHIP

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CLEVELAND TOWNSHIP

CENTERVILLE TOWNSHIP

CHERRY REPUBLIC, INC.

THE AMERICANA FOUNDATION

CITIZENS

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1.1 Introduction

The Leelanau Scenic Heritage Route Trailway Project falls under the umbrella of the Leelanau Scenic Heritage Route (LSHR) that was designated in 2001 under the Michigan Department of Transportation State Heritage Route Program and is coordinated by the Northwest Michigan Council of Governments (NWMCOG). The Leelanau Scenic Heritage Route Committee, which meets monthly oversees the Heritage Route Management Plan and has representatives from the twelve (12) municipalities in the Corridor, the Sleeping Bear Dunes National Lakeshore (Lakeshore), the Michigan Department of Transportation (MDOT), the Grand Traverse Band of Ottawa and Chippewa Indians, the Leelanau Conservancy, the Leelanau County Road Commission, the Leelanau County Planning Commission, chambers of commerce, interested organizations, and citizens. The Trailway project is listed as a priority in the Heritage Route Management Plan, which was developed through an extensive two-year public planning process. Information on the Leelanau Scenic Heritage Route can be found at www.nwm.org/lshr.asp. The multi-use trail would begin at Manning Road (Leelanau County line) and extend approximately 27 miles to County Road 651 along M-22 and M-109 through the Sleeping Bear Dunes National Lakeshore.

The Trailway Work Group was formed by the Leelanau Scenic Heritage Route Committee. The following list outlines the key stakeholders that have been integral to the trailway planning process. .

- National Park Service – Sleeping Bear Dunes National Lakeshore
- National Park Service – Rivers, Trails and Conservation Assistance Program
- Michigan Department of Transportation
- Northwest Michigan Council of Governments
- Friends of Sleeping Bear Dunes
- Traverse Area Recreational and Transportation Trails, Inc. (TART, Inc.)
- Citizens

Governmental Units
- Leelanau County Planning Commission
- Leelanau County Road Commission
- Centerville Township
- Cleveland Township
- Glen Arbor Township
- Empire Township
- Village of Empire

1.2 DEFINING THE VISION AND GUIDING PRINCIPLES

The Trailway work group developed a vision and set of guiding principles to help direct the planning process.

> *Create a non-motorized linear trailway system that is connected to historical, cultural, recreational, and environmental points of interest throughout the Lakeshore and surrounding communities; a Trailway that promotes health, environmental, social, and economic benefits and provides a safe alternative for walking, biking, running, and cross-country skiing; and is universally accessible wherever possible.*

The Guiding Principles:

1. Promote and encourage people to engage in healthy lifestyles benefiting from non-motorized trails.
2. Strengthen trail connections to existing trail heads, communities, and points of interest within the project boundary.
3. Enhance the recreational experience within the Sleeping Bear Dunes National Lakeshore (Lakeshore) and project area.
4. Incorporate universal design principles with regard to trail alignment, cross-sectional design, and trail head development.
5. Consider the impacts that could occur to the environment and existing ecosystems.
6. Consider the impacts that could occur to historic properties and archeological resources.
7. Design a trail cross-section and trail alignment that is sustainable with regard to materials.
8. Provide a safe non-motorized trail facility.

The Trailway Work Group investigated and identified preliminary trail routes and options. The conceptual route included the road right-of-way owned and managed by the Michigan Department of Transportation, and lands owned and managed by the National Park Service. It also passes through several jurisdictions, including Empire Township, Village of Empire, Glen Arbor Township, Cleveland Township, and Centerville Township.

1.3 BACKGROUND AND SCOPE

Preliminary dialogue with the National Park Service (NPS) staff had indicated the suggested concept would need further investigation, planning, and an environmental assessment, where it affected lands managed by the NPS. The Northwest Michigan Council of Governments on behalf of the Leelanau Scenic Heritage Route Committee requested proposals for an Environmental Assessment and Preliminary Engineering Report for the Trailway with funding provided by Cherry Republic, Inc. and The Americana Foundation. The Environmental Assessment and Preliminary Engineering Report addressed the following minimum design requirements:

Minimum Design Requirements for the Trailway:

1. Meet all Michigan Department of Transportation and American Association of State Highway Transportation Officials (AASHTO) design requirements for development of a non-motorized bicycle and pedestrian trailway. Minimum capacity shall accommodate non-motorized modes of use.
2. Comply with all environmental rules and regulations.
3. Meet the Americans with Disabilities Act (ADA) requirements for pedestrian and non-motorized use when designing trailway where feasible.
4. Review safety issues and recommend proposed treatments for slopes, intersections with active traffic routes, driveways and other potential hazards along the proposed trail route.
5. Review and report on any drainage issues and any work required by the proposed project. This would include river and stream crossings, wetland crossings, etc.
6. Determine trailway width to accommodate modes of non-motorized use and concurrent use of different modes during the seasons. Trailway width (should at a minimum) meet requirements outlined by MDOT and AASHTO.
7. Determine surface material to accommodate all modes of non-motorized use including a hardened surface for bicycling on all primary routes. Also provide anticipated operation and maintenance cost data for the top two alternatives selected.

1.4 RELATIONSHIP TO OTHER PLANNING PROJECTS

Michigan Department of Transportation's M-22 widening project
The Michigan Department of Transportation has developed an M-22 Non-motorized Corridor Improvement Plan for Benzie and Leelanau Counties that identifies and targets shoulder widening and pavement improvement projects in the M-22 and M-109 right-of-way. (Please see Appendix - Map Exhibit A).

Lakeshore General Management Plan / Wilderness Study / Environmental Impact Statement (EIS)
The National Park Service completed a Record of Decision for the General Management Plan for the Sleeping Bear Dunes National Lakeshore that was signed on January 6, 2009. The Trailway project is addressed in this document.

Port Oneida Rural Historic District Plans
It is evident that any alternative will likely pass through the Port Oneida Rural Historic District due to its location along M-22 (please see Appendix – Map Exhibit B and C). A Port Oneida Environmental Assessment was prepared and completed with the signing of the Finding of No Significant Impact on June 30, 2008.

Glen Haven Village Rehabilitation Plan
The NPS completed a report in October of 2006 for the Historic Glen Haven Village. The report, Glen Haven Village – Stabilize and Rehabilitate Buildings in the Glen Haven Village Historic District, identified schematic design alternatives for the possibility of constructing additional car and bus parking, installing new sidewalks, upgrades to the Cannery Building, dune stabilization, installation of an historic outhouse, making general improvements to provide barrier-free accessibility, changes to existing overhead

utilities, improving picnic facilities near the Cannery Building, and stabilizing historical structures in the Village (see Appendix – map Exhibit D). The visible relationships to the Trailway Plan include parking and possible trailhead considerations, sidewalk improvements, signage and other wayfinding structures, and picnic facilities.

Leelanau Scenic Heritage Route Management Plan Update 2006

Prepared in March 2000 and updated in 2006, this document focuses on transportation-related issues including the need for bike lanes along the scenic corridor. The Plan goals include:

- Preserve and enhance the natural, historic and cultural resources along the route
- Preserve the scenic qualities of the corridor and encourage development that will not detract from these qualities
- Encourage community involvement in monitoring of the route
- Encourage interpretive programs that describe the natural, historical, and cultural features along the corridor
- Promote the maintenance of the unique and rural feel of the villages and countryside along the Leelanau Scenic Heritage Route

Leelanau General Plan

The Leelanau General Management Plan included several transportation-related issues that include:

- The need to address a long-term road development and multi-modal transportation plan;
- The need to construct paved shoulders on all new roads;
- The need to move people and goods along key corridors and meet mass transit needs;
- The need to review the current county road funding sources;
- The need to secure the land necessary to construct future roads;
- The need to protect the scenic quality of key corridors; and
- To review the transportation modes used within the peninsula and reduce transportation costs.

Benzie County 2020 Comprehensive Plan

The County 2020 Plan is not directly related to this Trailway Plan given that this plan does not extend beyond Leelanau County; however, it is important to mention that the 2020 Plan points out the need for providing interconnected open space for recreation activities such as walking, biking, and cross-country skiing on trails.

Department of Interior / Federal Highway Administration Transportation Needs Study (3039 Study)

The Department of Interior performed a study directly related to the Sleeping Bear Dunes National Lakeshore and transportation related issues. The major issues in the document that are directly related to the Trailway Plan are as follows:

- The need to address vehicular traffic needs throughout the park; and
- The need to provide bicycle lanes along M-22.

Transportation Study – Sleeping Bear Dunes National Lakeshore

Completed in 2001, the Transportation Study was conducted as part of the General Management Planning process. The study identified the lack of adequate opportunities for bicyclists, especially off-road opportunities. Specific non-motorized trail development recommendations included the development of a coordinated bicycle route network within the Lakeshore that connects the Port Oneida area with the Platte River area of the park without having to travel on M-22, except in a few relatively short sections. The linear trail would increase visitor access, provide an alternative to vehicular transportation, and connect the various points of interest in the park.

Northwest Michigan Greenways Report

The Greenways Report was prepared in 1998 and included significant information with regard to identifying areas around the park that could be designated as "greenways." The report identified the following areas as possible and/or existing "greenways":

- The Betsie Valley Trail
- The Shore to Shore Trail
- The Leelanau Trail

Miscellaneous Planning / Design / Regulatory Considerations

A. National Park Service – Director's Order #12 (DO-12), Design Standards
B. Michigan Department of Transportation design standards
C. American Association of State Highway Transportation Officials Standards
D. Americans with Disabilities Act of 1990

CHAPTER 2 – Environmental Assessment

Leelanau Scenic Heritage Route Trailway Plan

2.1 PURPOSE AND NEED

The proposed Trailway plan and environmental assessment for a multi-use trail is intended to assist in the creation of a non-motorized trailway that will provide a continuous scenic pathway from M-22 and Manning Road at the south boundary of Leelanau County to the north boundary of the Lakeshore at Good Harbor Bay, County Road 651, all within Leelanau County.

The approximate 27-mile non-motorized multi-use trail will generally parallel M-22 and M-109, the major roads through the Lakeshore. The trail will be on public land, either Lakeshore lands or within the MDOT or Leelanau County road rights-of-way. The trail will be separated from the roadways wherever possible and will provide a safe, alternative transportation opportunity for park visitors and residents. It will connect the park's primary visitor sites and facilities; including the popular Dune Climb, Visitor Center, Pierce Stocking Scenic Drive, D.H. Day Campground, Glen Haven Village, the Port Oneida Rural Historic District, Lake Michigan beaches, trailheads, and other points of interest within the Lakeshore. It will also provide a non-motorized trail connection between popular park sites and the village of Empire and the community of Glen Arbor.

Over 1.1 million people visit Sleeping Bear Dunes National Lakeshore annually. The Lakeshore seeks to develop a multi-modal transportation system that will meet the park's current and future needs. This includes the development of a cohesive non-motorized multi-use trail network within the Lakeshore that connects and provides non-motorized access to the park's main visitor facilities, such as the Dune Climb (330,000+ visitors/year), Pierce Stocking Scenic Drive (430,000+ visitors/year), and Visitor Center (130,000+ visitors/year). The majority of the Lakeshore's visitation occurs between the months of June and September. These facilities would be connected by the proposed multi-use trail, which will provide park visitors with safe non-motorized access and help relieve traffic and parking congestion at these facilities. Trail use projections are estimated for the first three years at approximately 350,000 – 400,000 visitors/year.

Current and future traffic is conveyed in several ways: State Highway M-22, a two-lane paved highway, is the major corridor through the park and carries the greatest traffic volumes. It is also the main road connection between the communities of Empire, Glen Arbor, and Leland. Traffic volume (2003) for M-22 north of Empire is under 2500 vehicles/day. Traffic volume south of Empire is between 2500 and 5000 vehicles/day. Traffic also utilizes M-109 which splits off from M-22 and provides access to other areas of the park and Glen Arbor. The proposed trailway would occur along this corridor as well.

The Environmental Assessment (EA) focuses primarily on describing and comparing the opportunities and challenges of a no-action alternative with action alternatives to develop a trailway. Although this EA has been prepared together with the overall multi-use trailway plan, it has been formatted to comply with NPS guidelines and National Environmental Policy Act (NEPA) of 1969, as amended.

2.2 APPLYING PRELIMINARY IMPACTS TO OPTIONAL ROUTES

For the purposes of analyzing the Trailway in smaller sections, the approximate 27-mile long Trailway Project Area was divided into nine geographic trail ***segments*** beginning at the Benzie-Leelanau County line (Manning Road) and ending at Good Harbor Trail (County Road 651), near the northern boundary of the Lakeshore. Optional routes, proposed by planning team members and interested citizens, were mapped for each segment. The number of options within each segment varies from as few as one in

Segment 3, to as many as 15 in Segment 5. On the following page is a map depicting the geographic placement of the nine segments used to analyze the possible Trailway routing. (Please see the Appendix - Optional Trail Route Maps).

For this preliminary analysis, the environmental impacts and feasibility for construction of possible trail options were described. Nine preliminary impact topics were selected for analysis of environmental impacts and five preliminary impact topics were selected for analysis of impact to feasibility. Each topic was described in terms of impact and given a relative score from 0 to 3, to provide a basis of comparison between options within each trail segment (negligible-0, minor-1, moderate-2, and major-3). For operations and maintenance, no numeric score was identified, but this impact topic is analyzed in the "Environmental Consequences" chapter.

This methodology provided a comparative evaluation of impact, helped the planning team eliminate some of the earlier trail route options, and ultimately assisted in constructing the draft alternatives described in Section 2.3. Final impact topics, described in Section 2.4, have been applied to the identified alternatives for comparison, in the Environmental Consequences section (2.5).

OVERALL TRAILWAY SEGMENTS MAP

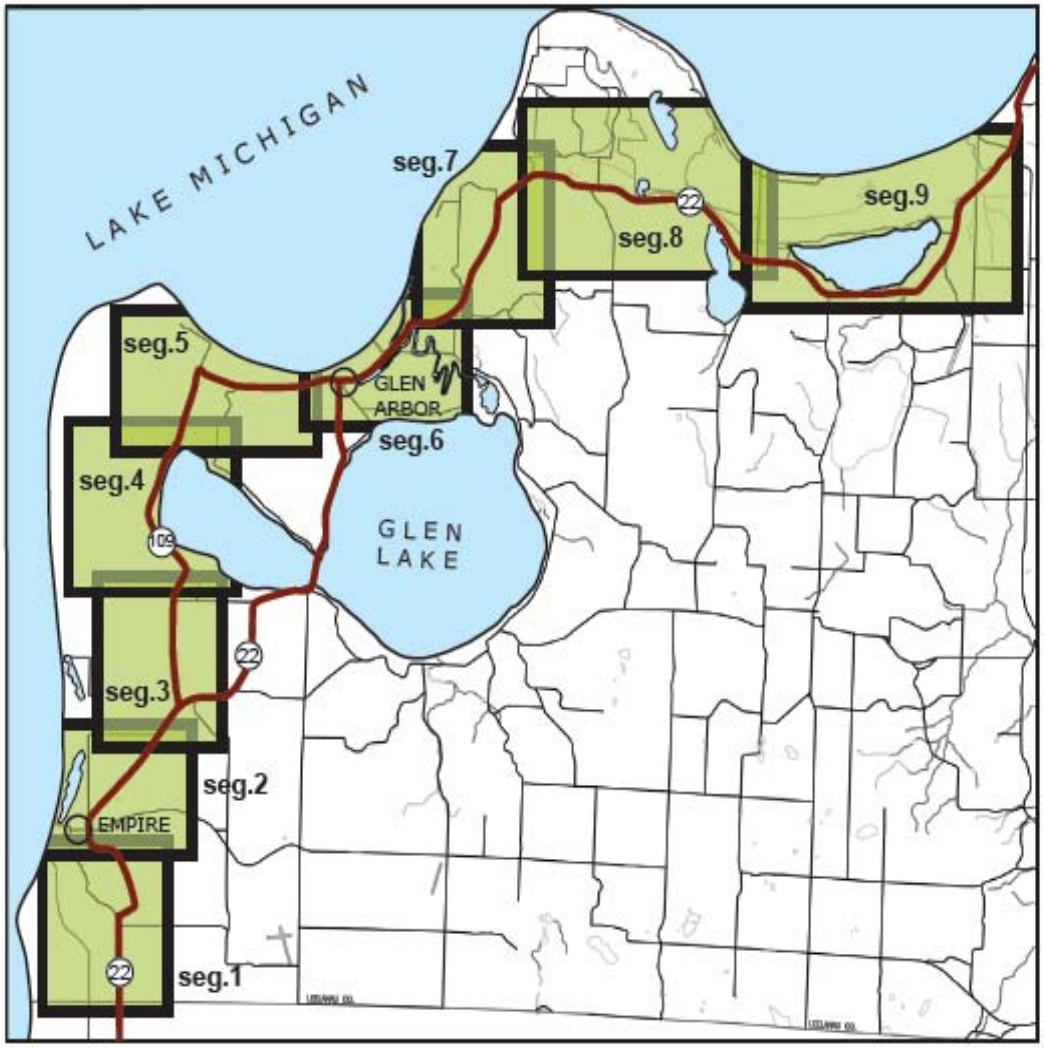


FIGURE 1:
OVERALL TRAILWAY SEGMENTS MAP
LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN

Map Data: Base GIS Data provided by MAP 1983 UTM Zone 16N. Gosling Czubak Engineering Sciences, Inc.

Gosling Czubak engineering sciences, inc.

2.3 ALTERNATIVES

The following section outlines two action alternatives that were derived for the proposed Trailway, and a no-action alternative that would continue current conditions and management. The no-action alternative would not fulfill the objectives of the Trailway Work Group as previously described in the Purpose and Needs section; however, it is used as a basis of comparison to the action alternatives.

Opportunities and constraints of various proposed trail routing options were analyzed through a series of working meetings and field evaluations by Trailway Work Group members, Lakeshore and other NPS staff, and the consultants. Several options were eliminated during this process as they were not feasible or fell within proposed wilderness areas identified in the *Sleeping Bear Dunes National Lakeshore General Management Plan*.

2.3.1 NO-ACTION ALTERNATIVE – Continue Current Conditions and Management

In the no-action alternative, there are no non-motorized, hardened surface trails within the M-22/M-109 corridors. The current Lakeshore trail system (in Leelanau County) offers hiking trails with trailheads at Empire Bluffs, Windy Moraine, Shauger Hill, Cottonwood (Pierce Stocking Scenic Drive), Dune Climb, Alligator Hill, Bay View, Pyramid Point, and Good Harbor Bay. Only the paved Pierce Stocking Scenic Drive is designated for bicycle use, with a shared lane adjacent the road surface. Currently, bicyclists are limited to the road shoulder along M-22, M-109, and county roads and there is a growing demand for a safe non-motorized facility within the Lakeshore that connects park facilities, points of interest, and local communities.

In an effort to upgrade and maintain traffic through the Lakeshore, the Michigan Department of Transportation (MDOT) is in the process of upgrading M-22 with pavement and shoulder improvements. These improvements, however, are scheduled in phases sequentially over the next 5-10 years and might only serve to provide some improved roadside non-motorized access along the corridor. The first phase of the MDOT improved shoulder work within the project area is occurring along the M-22 right-of-way in and near the Port Oneida Rural Historic District.

An evaluation of opportunities and constraints within the Lakeshore for a multi-use, non-motorized trail linkage identified a series of factors limiting visitor trail experience and impacting safe access within the park. These were documented by the Trailway Work Group from their initial field work and mapping:

- Steep gradient (topography) within the M-22 and M-109 rights-of-way
- Narrow, limited shoulder widths often constricted by guardrail
- Unimproved or undesignated pedestrian/bicycle roadway crossing areas
- Visual impairment at roadway curves, driveways and local road intersections
- Limited linkages to existing trail loops and trailheads
- Cultural and natural feature limitations such as historic structures or wetlands

The no-action alternative provides the basis for comparing existing conditions and current management with the action alternatives. For the purposes of the proposed Trailway analysis, alternative comparisons will be made on a segment by segment basis (Segments 1 – 9 as previously defined) and compared to the no-action alternative.

2.3.2 ALTERNATIVE A

Under Alternative A, a non-motorized trail would be constructed in the M-22/M-109 rights-of-way to the extent possible, only deviating where necessary due to physical or environmental constraints. It would be a contiguous non-motorized trail of over 27 miles commencing from the southern Leelanau County line at Manning Road to County Road 651 at Good Harbor Beach (Please see Figure 2. Map A). Disturbance of interior vegetated areas, or areas with steep side slope and gradients would be avoided, but the trail user experience would be closely associated with the highway right-of-way.

Access to the Trailway would be made at the existing Lakeshore trailheads and designated visitor parking areas, including the Pierce Stocking Scenic Drive lower parking area, Dune Climb, Glen Haven, Bay View Trailhead, and Lake Michigan beaches at Bohemian Road and Good Harbor Trail, and in conjunction with the Port Oneida Rural Historic District Plan and Glen Haven Rehabilitation Plan. Some new trailheads may also be proposed. Such trailheads and parking areas may be augmented with Trailway "wayfinding" maps and information and may provide bike racks, benches, picnic tables, potable water/drinking fountains, interpretive information, and restroom facilities. Universal Accessibility signage and amenities as well as trail segment, trail challenge level information and mileage markers would also be used.

The proposed routing for Alternative A is described in terms of ***Segments 1-9*****.** Please See Alternative A Segment Maps which follow this section.

Segment 1:
The west side of M-22 would be used to establish a 10' crushed limestone pathway from Manning Road north to Stormer Road. A new trailhead should be located near Manning Road. Consideration for the Tweddle-Treat cultural landscape would be made through use of this trail material and a width variation. A crushed limestone surfacing would be utilized to have the Trailway integrate with the cultural and historical character of the landscape and be visually less distracting than a modern asphalt surface. A variation from the right-of-way would be made to descend a steep gradient along M-22.

The route north of Stormer Road would continue within the right-of-way on the west side. Several areas of steep side slope would necessitate excavation and possible retaining walls before and after the Lakeshore entrance sign. MDOT is implementing a transportation enhancement project to develop 5' paved shoulders from Manning Road to the Village of Empire. The Trailway segment provides access to the Empire Bluffs Trail from Wilco Road. Wayfinding information would be added at an appropriate location to assist Trailway users wishing to hike the Empire Bluffs Trail.

Segment 2:
The Trailway would enter the Village of Empire along the M-22 right-of-way. The Village Council would determine the trail route within the Village of Empire, but access to the Lakeshore Visitor Center, the downtown area, and the beach should all be considered in route planning. For purposes of this alternative however, the following possible trail route is described:

The Trailway routing could continue within the Village of Empire by using existing road right-of-way through the Quercus Alba (New Neighborhood) and Beaver Creek neighborhoods. With oversight from MDOT, a north-south oriented M-22 crossing could be implemented, and a north-south oriented M-72 crossing accessing Trailway users to the Visitor Center. The facility provides public restrooms, information, interpretive displays, and other support facilities open to the public during regular business hours. Trailway users could also have direct access to the Village of Empire. Continuing through the Beaver Creek development, the Trailway could use Ottawa Street as a crossing location at M-22 at the north end of the Village.

A new paved section in the right-of-way along the northwest side of M-22 could be developed to LaCore Road, then north to Fisher Street. From there the Trailway could travel along the east side of LaCore to Bar Lake Road in the county road right-of-way. The Trailway would cross to the north side of Voice Road and continue east to the intersection at M-22. This section would require a minor creek/wetland crossing along LaCore Road and address several side slope and grading challenges along Voice Road, including at the corner of Voice Road and M-22 where Segment 3 begins.

The Trailway segment provides a direct link to the North Bar Lake public beach access, although the existing access on Bar Lake Road is gravel. Wayfinding information could be added at the Voice Road-Bar Lake Road intersection to assist Trailway users with accessing North Bar Lake facilities.

Segment 3:
The grade falls away at the intersection of Voice Road and M-22 and includes roadway guardrail and overhead utilities. MDOT would need to approve some additional fill material and trail grading at the corner within the utility right-of-way, as well as the alignment of the trail to allow safe access around this corner. The Trailway continues from Voice Road and along M-22 to M-109 in the right-of-way on the west side of the road. The Trailway would include a new 10’ wide asphalt cross-section from Voice Road to Pierce Stocking Scenic Drive. Considerations for Trailway construction in this area include side slopes, existing mature trees, and proximity to the road (see Chapter 4 - Trail Cross-section Development).

The Trailway segment provides access to hiking trailheads, loops and support facilities at Pierce Stocking Scenic Drive and the Windy Moraine Trail parking area. Wayfinding information would be added to assist Trailway users in recognizing other existing facilities in the area. Trailway users would be able to use the parking area at Pierce Stocking Scenic Drive as a trailhead. Information would be provided regarding the challenge level and safety considerations for riders interested in using the Pierce Stocking Scenic Drive, since it is a very challenging bicycling experience. A connecting trailhead link would connect the parking area to the main Trailway along M-109.

Segment 4:
From Pierce Stocking Scenic Drive, the Trailway would continue to use the M-109 right-of-way on the west side and continue to Hunter Road at the Dune Climb. Trailway users would be able to use the parking area at the Dune Climb to access this portion of the Trailway.

Several unique factors would be considered in this segment. The M-109 Corridor descends a fairly steep hill on a wide curve creating challenges to create appropriate trail gradient and visibility. Some tree removal and grading may need to occur to accomplish this route. In addition, on the northern half of the trail segment private driveways bisect the Trailway, as well as some

landscaping encroachments into the right-of-way. Cooperation with MDOT and land owners will be necessary to develop safe and viable routing through this area to Hunter Road.

Segment 5:
Alternative A would use Hunter Road as a Trailway link to the Dune Climb and the Dune Center, but it would not be the primary Trailway route. The route would follow the northwest side of the M-109 right-of-way on boardwalk. The boardwalk would continue northwest (1725 feet) to just before the Glen Lake Picnic Area, then use the historic narrow gauge railway bed that bisects the emergent wetland at the base of the dune (approximately another 1,500 feet). The initial segment would be constructed with special interpretive pavement and signage similar to that at Glen Haven. A 10' wide crushed limestone path would continue to Harwood Drive. From there, the route would continue on the old narrow gauge rail bed and connect north to Dune Valley Road and continuing into the Glen Haven Historic District (see Appendix MAP Exhibit D).

A special trail cross-section would be implemented as the Trailway approaches the Historic Village (Map 2.5.1). The crushed limestone path would change over to a concrete and timber cross-section evoking and interpreting the historic narrow gauge rail bed that once linked Glen Haven to Glen Lake. Interpretive and wayfinding signage would be placed to provide information about the Historic District and Trailway routing. The alternative allows the Trailway user to use sidewalks and crosswalks integral to the Historic District plan but introduces them into what can be a congested area. Signage would direct users to the primary Trailway link near the public restrooms across from the Sleeping Bear Inn garage. Continuing due east, the Trailway would be a 10' wide crushed limestone path utilizing an existing county road (two-track) access to D.H. Day Campground.

The Trailway would use the existing campground gravel road and connect with the M-109 corridor to the south. With oversight from MDOT, a north-south oriented M-109 crossing in alignment with Stocking Road would be developed with striped pavement markings, advance warning, and safety signage. Consideration of potential conflicts between campground traffic and trail users is warranted in this area. The Trailway would then continue on the south side of M-109 running east-west from Stocking Drive to South Forest Haven Drive, connecting to Glen Arbor (Trailway *Segment 6*). Private home driveway crossings, tree removal and grading are factors to consider in this part of the routing option.

This Trailway segment provides access to hiking trailheads, loops and support facilities at the Sleeping Bear Point Trail, Glen Haven Maritime Museum, Glen Haven Village, D.H. Day Campground, and Alligator Hill. Wayfinding information would be added to assist Trailway users in recognizing other existing facilities in the area.

Segment 6:
The Glen Arbor Township Board would determine the best way through Glen Arbor. For purposes of this alternative however, the following trail route possibility is described:

From Sylvan Street the Trailway could use the existing paved shoulder at a minimum width of 5' on both sides of M-109. Designated parallel parking exists on both sides of M-22 in Glen Arbor, creating significant safety concerns for bike lane users from door swings, and vehicles access and egress from numerous drive cuts.

From Oak Street, trail users could travel along M-22 using the 5' paved shoulder. If conditions allow the Trailway could then widen to a 10' pathway within the existing M-22 right-of-way on the southeast side of the road. A boardwalk section could be installed for several hundred feet in the vicinity of the bicycle club rest area across from the gasoline service station.

Several design challenges exist near the intersection of West Crystal View Road (CR 675) and M-22. The skewed intersection with large radii entices high traveling speeds for cars going through or making turns in any direction. A long crossing distance for walkers or bikers is also hazardous. Private residences very close to the right-of-way on the south side create a pinch point just before the intersection at West Crystal View Road. Each would need detailed design with significant safety considerations for implementation to best occur.

Once across West Crystal View Road, the Trailway would continue along M-22 on the south side as a 10' asphalt pathway within the existing M-22 right of way. A boardwalk would be installed for 330 feet along a very narrow pinch point on the approach to the auto/pedestrian bridge. From the bridge, the Trailway would continue as an off-road 10' wide asphalt path located on the south side of the right-of-way. The Trailway would then pass the entrance of The Homestead Resort to cross to the north side of M-22 near Westman Road.

Segment 7:
From Westman Road the Trailway would use the M-22 right-of-way on the west side of the road as an off-road 10' asphalt section to the intersection of M-22 and Thoreson Road. Near the split at M-22 "Y' intersection, the Trailway would leave M-22 and continue a short distance north on Thoreson Road to access to part of the Bay View Trail from Thoreson Road to Port Oneida Road where it would be maintained as a 10' crushed limestone path. The Trailway would provide access to the historic Olsen and Kelderhouse farms, the Kelderhouse cemetery, the schoolhouse, and many other properties in the Port Oneida Rural Historic District.

Segment 8:
The proposed Trailway would connect south back to M-22 along the Port Oneida road right-of-way. Wayfinding signage would guide trail users to reconnect with the primary Trailway route along M-22 and indicate to trail users that they are within the Port Oneida Rural Historic District.

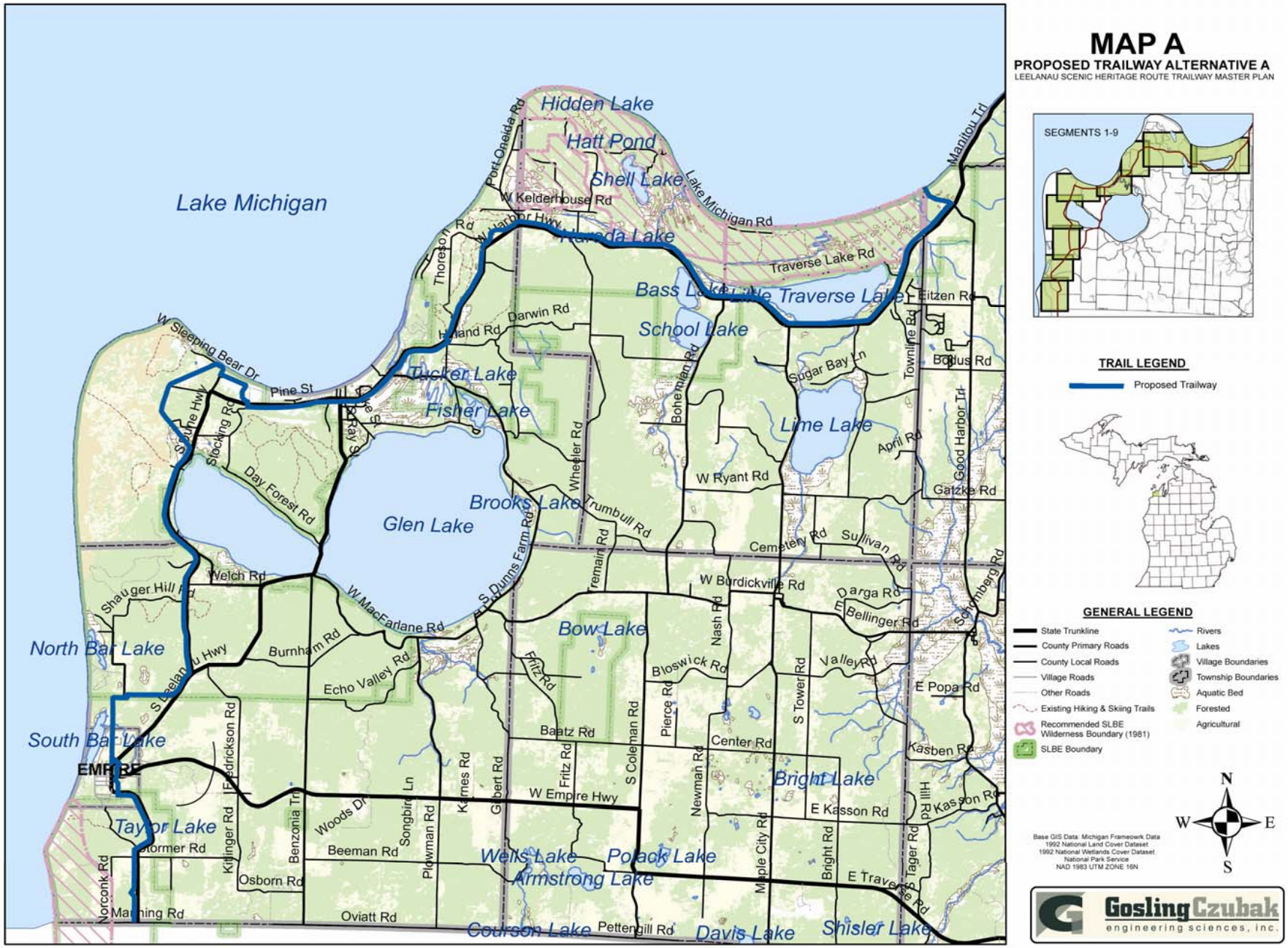
From the intersection of Port Oneida Road, the Trailway would be on the north side of the M-22 right-of-way and continue as a 10' wide crushed limestone path. It would use the M-22 right-of-way past South Basch Road and North Unity School. The Trailway would then align along the M-22 right-of-way below the road embankment and guardrail at Narada Lake. A boardwalk (approximately 265 feet long) would provide a unique nature experience along this water resource, avoiding the hazardous proximity and the tight right-of-way of a roadside route.

From Narada Lake, the Trailway would continue and change to a 10' off road asphalt section on the north side of the right-of-way to the Bohemian Road (CR 669) and M-22 intersection. This Trailway segment provides access to the Good Harbor swimming beach and other Lakeshore facilities. Wayfinding information would be added along the route to assist Trailway users in recognizing the Lake Michigan beach access and facilities at the end of Bohemian Road.

Segment 9:
The Trailway continues as a 10' off-road asphalt section on the north side of M-22 up to Traverse Lake Road, past Bartunek Road and along the M-22 right-of-way to the east end of Traverse Lake Road. Difficult aspects for the Trailway alignment with this routing include a number of private driveway crossings and a stream crossing at Shetland Creek.

A crossing would occur at Traverse Lake Road and as the Trailway passes the Bufka Farm on the north side of the road, surfacing would change to crushed limestone. The Trailway would route past the Bufka property and would remain in the M-22 right-of-way, to the extent possible, only using the glacial ridges and valleys below the M-22 corridor when necessary. The steep embankment and narrow right-of-way with guardrails on both sides would be avoided with this routing; however, the lowland areas present some challenge for Trailway construction. The Trailway ends at Good Harbor Trail (CR 651) and Lake Michigan.

This Trailway segment provides access to Good Harbor Trail (CR 651) and Good Harbor Beach. Wayfinding information would be added to assist Trailway users in recognizing the existing Lakeshore facilities at the end of Good Harbor Trail. A trailhead could be located at the parking facility with improvements such as safe crossings with pavement striping, advanced warning and wayfinding signage.


MAP A
PROPOSED TRAILWAY ALTERNATIVE A
LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN
SEGMENTS 1-9
TRAIL LEGEND
Proposed Trailway
GENERAL LEGEND
State Trunkline
County Primary Roads
County Local Roads
Village Roads
Other Roads
Existing Hiking & Skiing Trails
Recommended SLBE Wilderness Boundary (1981)
SLBE Boundary
Rivers
Lakes
Village Boundaries
Township Boundaries
Aquatic Bed
Forested
Agricultural
Lake Michigan
Hidden Lake
Hatt Pond
Shell Lake
Lake Michigan Rd
Port Oneida Rd
W Kelderhouse Rd
W Harbor Hwy
Traverse Lake Rd
Manitou Trl
Thoreson Rd
Bass Lake
Little Traverse Lake
School Lake
Darwin Rd
Eitzen Rd
Townline Rd
Bohus Rd
Sugar Bay Ln
Good Harbor Trl
April Rd
Gatzke Rd
W Sleeping Bear Dr
Pine St
Tucker Lake
Fisher Lake
Lime Lake
Stocking Rd
Day Forest Rd
Bohemian Rd
Wheeler Rd
W Ryant Rd
Brooks Lake
Glen Lake
Trumbull Rd
Cemetery Rd
Sullivan Rd
Schomberg Rd
Welch Rd
W Burdickville Rd
Darga Rd
E Bellinger Rd
W MacFarlane Rd
S Dunns Farm Rd
Tremain Rd
Bow Lake
North Bar Lake
Burnham Rd
Echo Valley Rd
Nash Rd
Bloswick Rd
Valley Rd
E Popa Rd
Fritz Rd
Baatz Rd
Pierce Rd
S Tower Rd
Center Rd
Kasben Rd
South Bar Lake
EMPIRE
Bright Lake
W Empire Hwy
E Kasson Rd
Taylor Lake
Woods Dr
Songbird Ln
Plowman Rd
Karnes Rd
Gilbert Rd
S Coleman Rd
Newman Rd
Maple City Rd
Bright Rd
Hill Rd
Tager Rd
E Traverse Rd
Beeman Rd
Osborn Rd
Oviatt Rd
Wells Lake
Polack Lake
Armstrong Lake
Courson Lake
Pettengill Rd
Davis Lake
Shisler Lake
Benzonia Trl
Kitzinger Rd
Norconk Rd
Base GIS Data: Michigan Framework Data
1992 National Land Cover Dataset
1992 National Wetlands Cover Dataset
National Park Service
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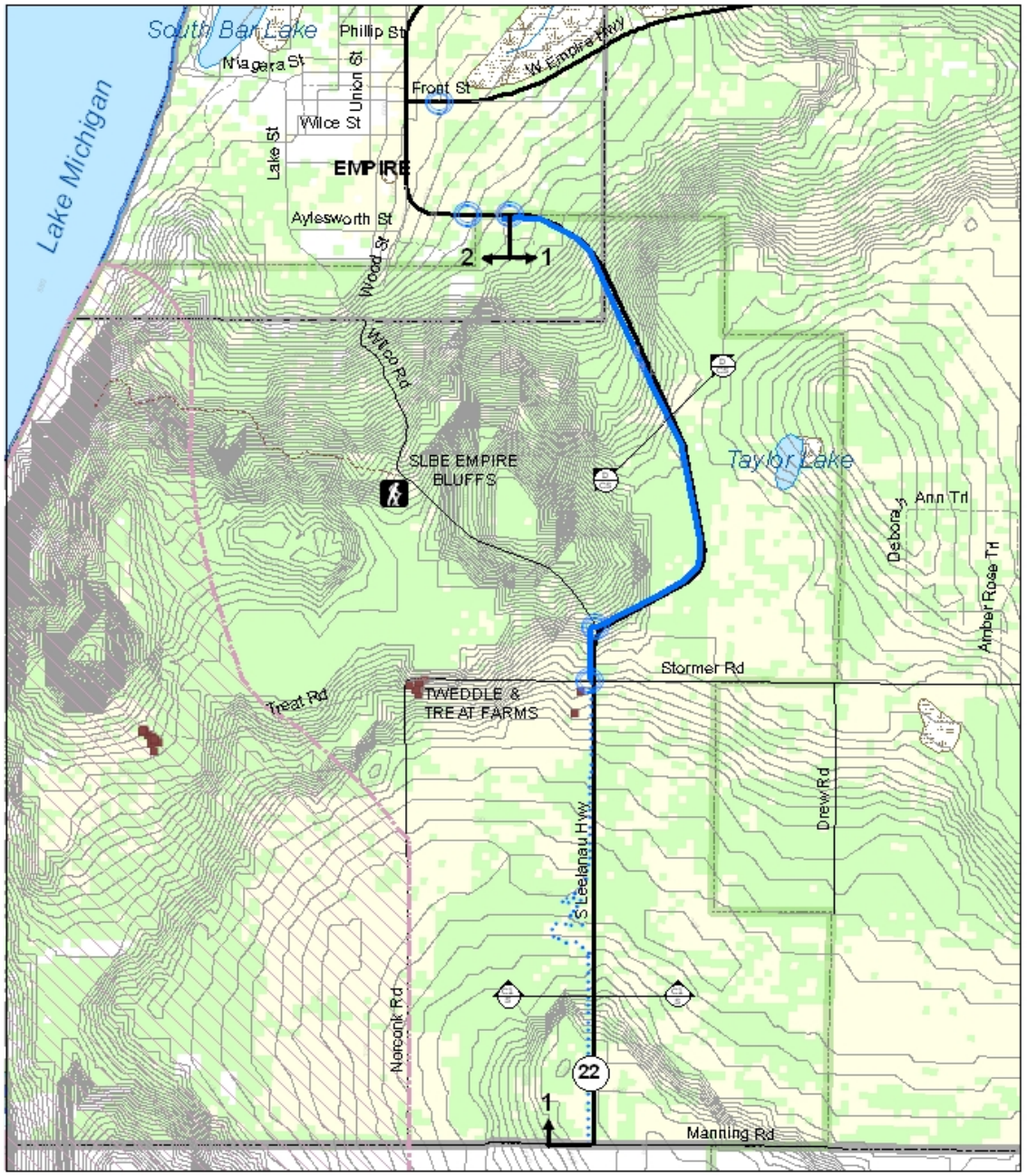
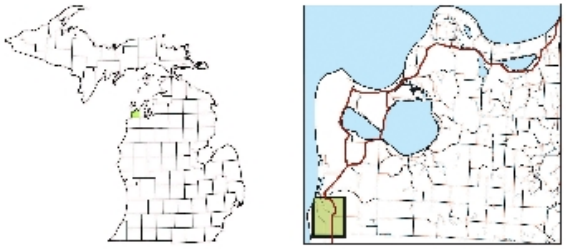
engineering sciences, inc.



MAP 2.1 - PROPOSED TRAILWAY ALTERNATIVES
SEGMENT 1: ALTERNATIVE A
LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN

TRAIL SURFACE LEGEND

- Asphalt
- Crushed Limestone
- Boardwalk
- On-Road Bike Lane
- Existing Gravel Road
- Road Crossing Location



GENERAL LEGEND

- State Trunkline
- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
- Recommended SLBE Wilderness Boundary **(1981)**
- SLBE Boundary
- Rivers
- Lakes
- Village Boundaries
- Township Boundaries
- Aquatic Bed
- Forested
- Agricultural

0 375 750 1,500 2,250 3,000 Feet

N W E S

Base GIS Data: Michigan Framework Data
1992 National Land Cover Dataset
1992 National Wetlands Cover Dataset
National Park Service
NAD 1983 UTM ZONE 16N

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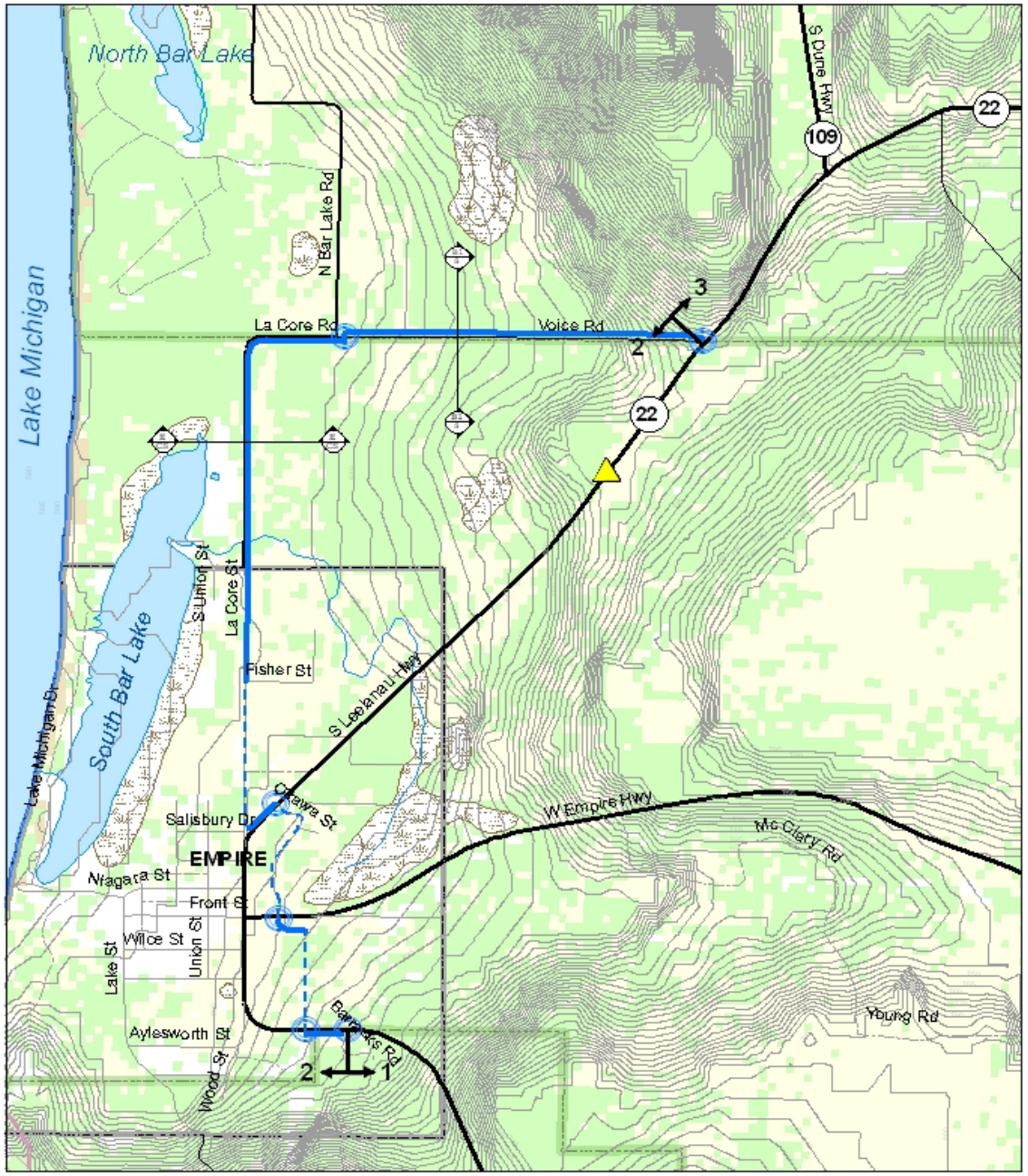
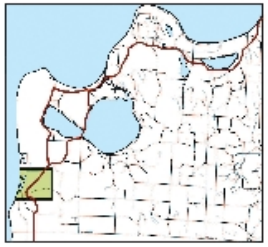


MAP 2.2 - PROPOSED TRAILWAY ALTERNATIVES
SEGMENT 2: ALTERNATIVE A
LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN

TRAIL SURFACE LEGEND

- Asphalt
- Crushed Limestone
- Boardwalk
- On-Road Bike Lane
- Existing Gravel Road
- Road Crossing Location



GENERAL LEGEND

- State Trunkline
- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
- Recommended SLBE Wilderness Boundary **(1981)**
- SLBE Boundary
- Rivers
- Lakes
- Village Boundaries
- Township Boundaries
- Aquatic Bed
- Forested
- Agricultural

0 375 750 1,500 2,250 3,000 Feet

N W E S

Base GIS Data: Michigan Framework Data
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1992 National Wetlands Cover Dataset
National Park Service
NAD 1983 UTM ZONE 16N

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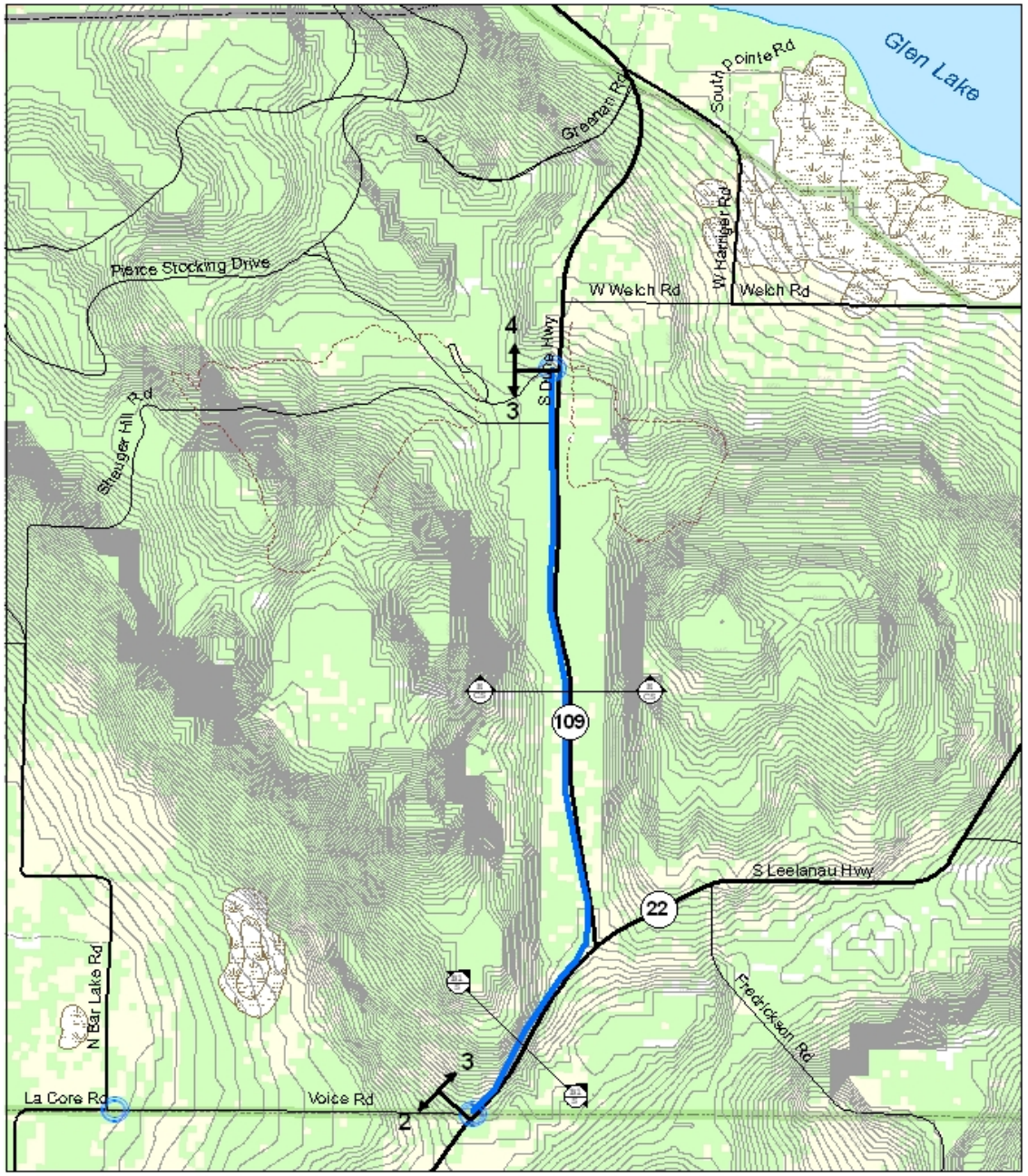
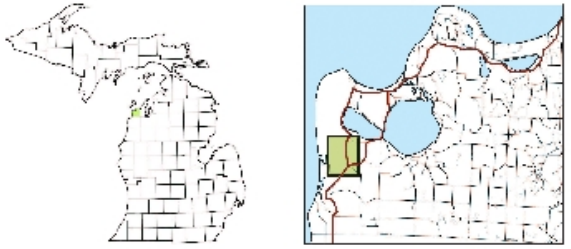


MAP 2.3 - PROPOSED TRAILWAY ALTERNATIVES
SEGMENT 3: ALTERNATIVE A
LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN

TRAIL SURFACE LEGEND

- Asphalt
- Crushed Limestone
- Boardwalk
- On-Road Bike Lane
- Existing Gravel Road
- Road Crossing Location



GENERAL LEGEND

- State Trunkline
- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
- Recommended SLBE Wilderness Boundary **(1981)**
- SLBE Boundary
- Rivers
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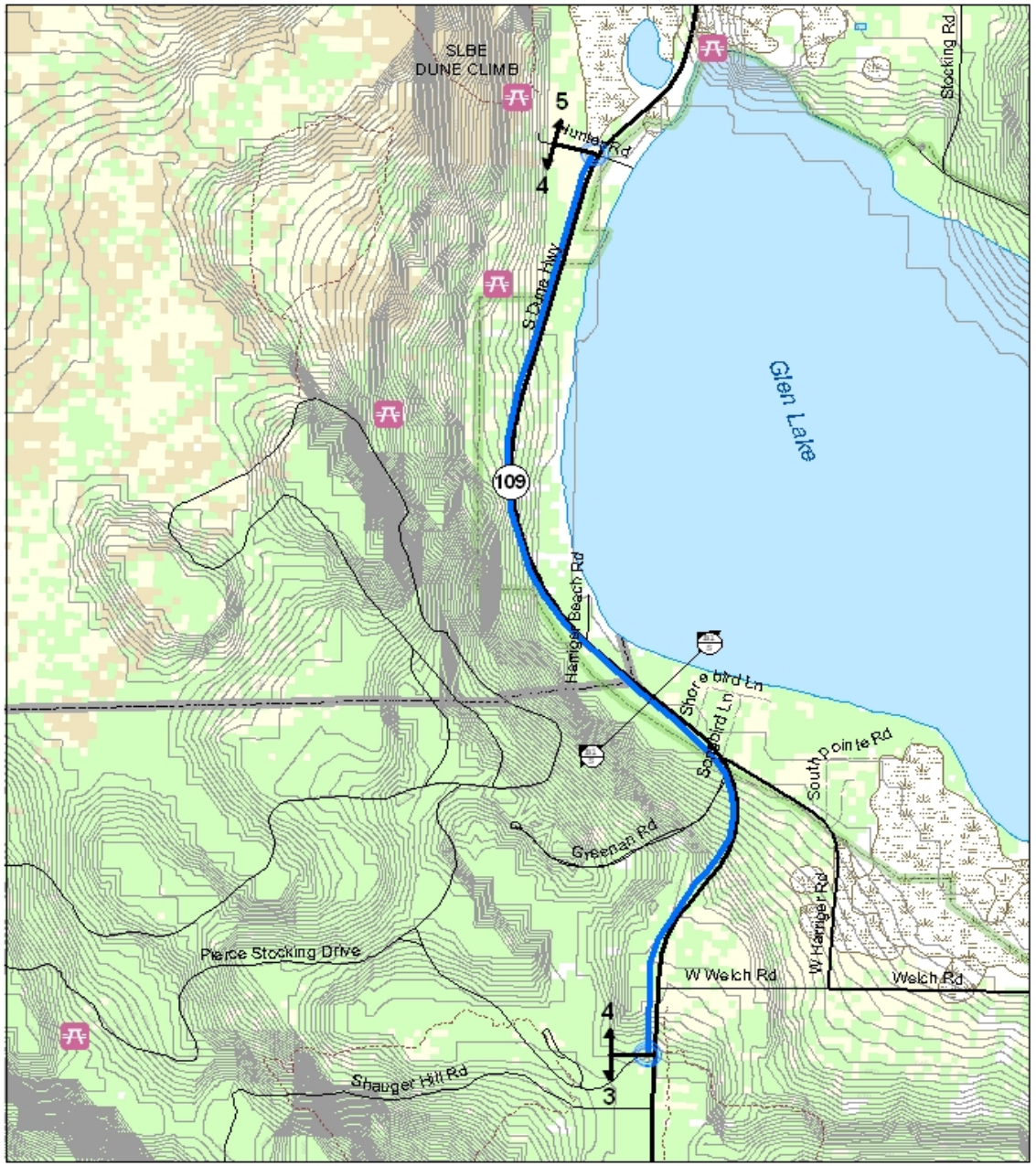
- Village Boundaries
- Township Boundaries
- Aquatic Bed
- Forested
- Agricultural

0 375 750 1,500 2,250 3,000 Feet

N W E S

Base GIS Data: Michigan Framework Data
1992 National Land Cover Dataset
1992 National Wetlands Cover Dataset
National Park Service
NAD 1983 UTM ZONE 16N

GoslingCzubak engineering & design

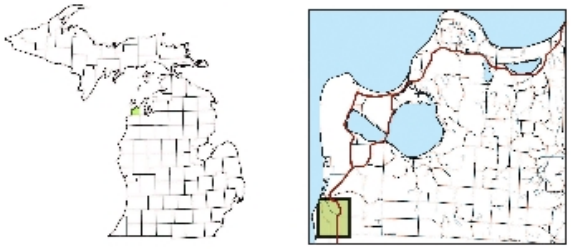


MAP 2.4 - PROPOSED TRAILWAY ALTERNATIVES SEGMENT 4: ALTERNATIVE A

LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN

TRAIL SURFACE LEGEND

- Asphalt
- Crushed Limestone
- Boardwalk
- On-Road Bike Lane
- Existing Gravel Road
- Road Crossing Location



GENERAL LEGEND

- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
- Recommended SLBE Wilderness Boundary **(1981)**
- SLBE Boundary
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- Aquatic Bed
- Forested
- Agricultural

0 375 750 1,500 2,250 3,000 Feet

N W E S

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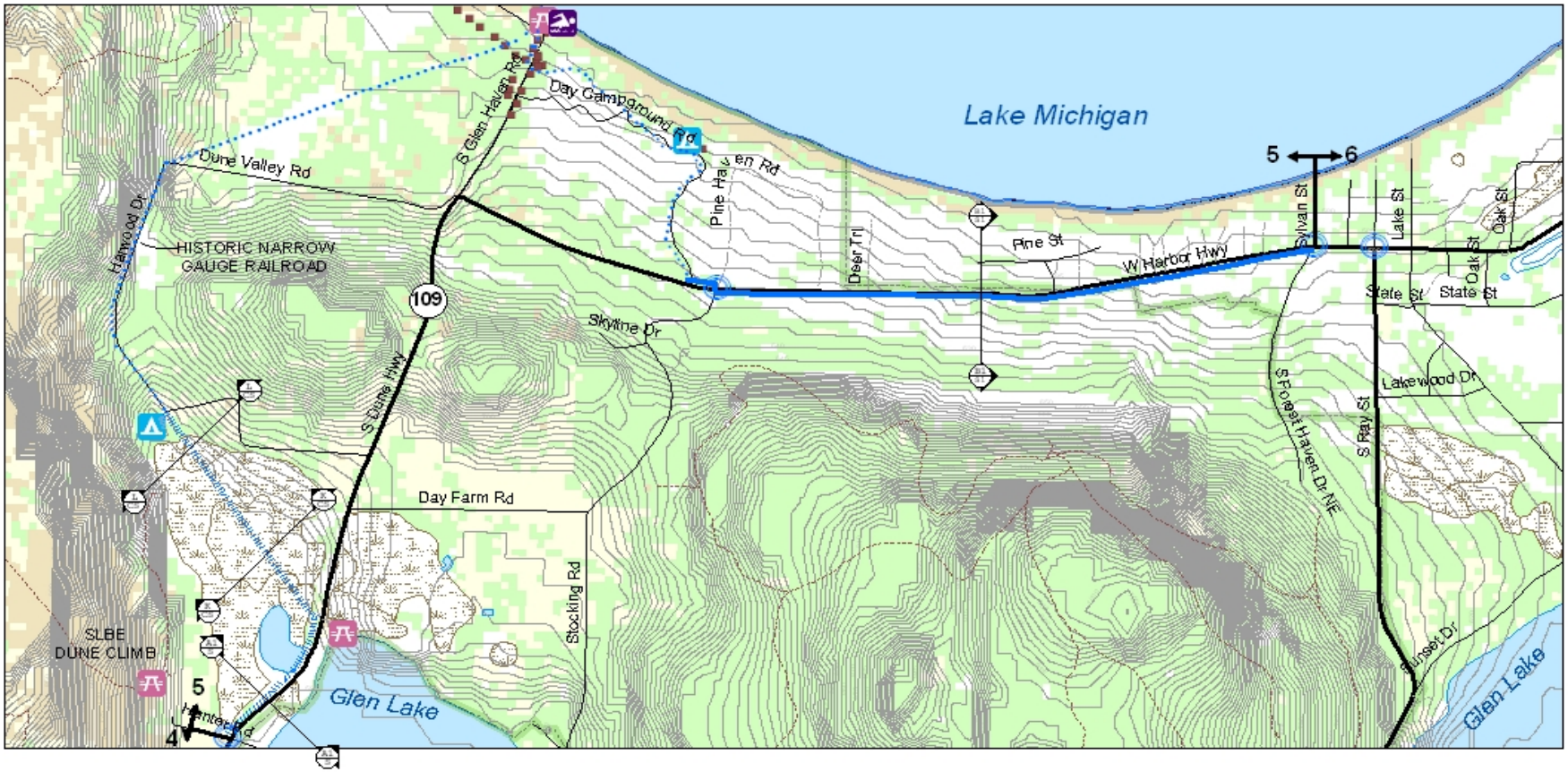
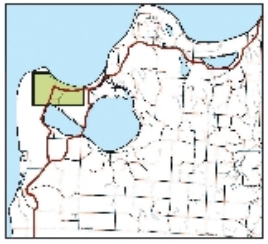
1992 National Wetlands Cover Dataset
National Park Service
NAD 1983 UTM ZONE 16N

GoslingCzubak engineering associates inc.



MAP 2.5 - PROPOSED TRAILWAY ALTERNATIVES
SEGMENT 5: ALTERNATIVE A
LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN



GENERAL LEGEND

- State Trunkline
- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
- Recommended SLBE Wilderness Boundary **(1981)**
- SLBE Boundary
- Rivers
- Lakes
- Village Boundaries
- Township Boundaries
- Aquatic Bed
- Forested
- Agricultural

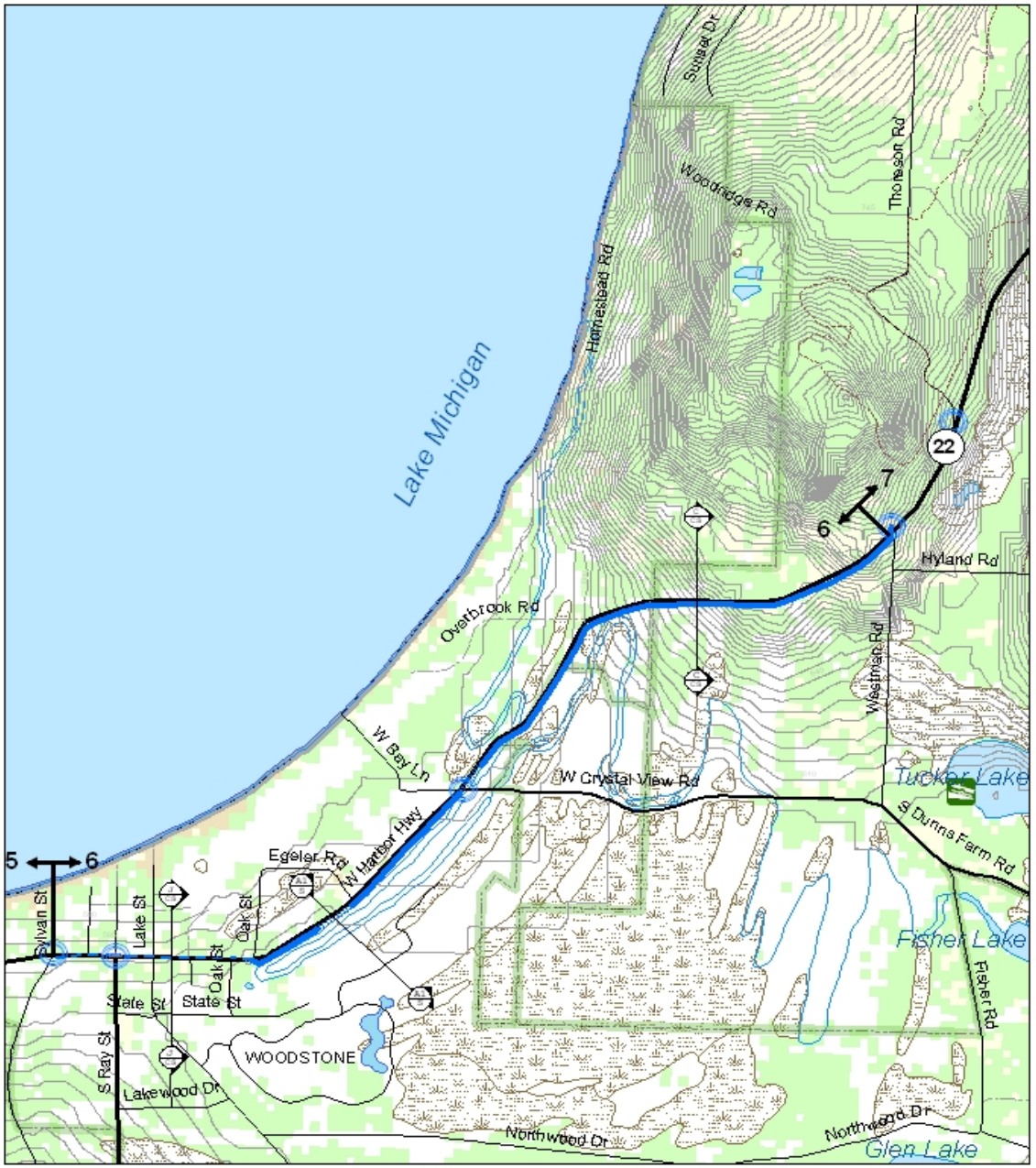
N W E S

TRAIL SURFACE LEGEND

- Asphalt
- Crushed Limestone
- Boardwalk
- On-Road Bike Lane
- Existing Gravel Road
- Road Crossing Location

0 375 750 1,500 2,250 3,000 Feet

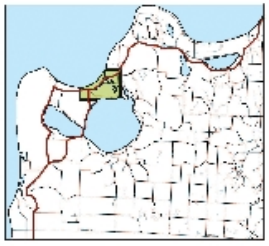
GoslingCzubak engineering & design, inc.



MAP 2.6 - PROPOSED TRAILWAY ALTERNATIVES
SEGMENT 6: ALTERNATE A
LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN

TRAIL SURFACE LEGEND

- Asphalt
- Crushed Limestone
- Boardwalk
- On-Road Bike Lane
- Existing Gravel Road
- Road Crossing Location



GENERAL LEGEND

- State Trunkline
- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
- Recommended SLBE Wilderness Boundary **(1981)**
- SLBE Boundary
- Rivers
- Lakes
- Village Boundaries
- Township Boundaries
- Aquatic Bed
- Forested
- Agricultural

0 375 750 1,500 2,250 3,000 Feet

N W E S

Base GIS Data : Michigan Framework Data
1992 National Land Cover Dataset
1992 National Wetlands Cover Dataset
National Park Service
NAD 1983 UTM ZONE 16N

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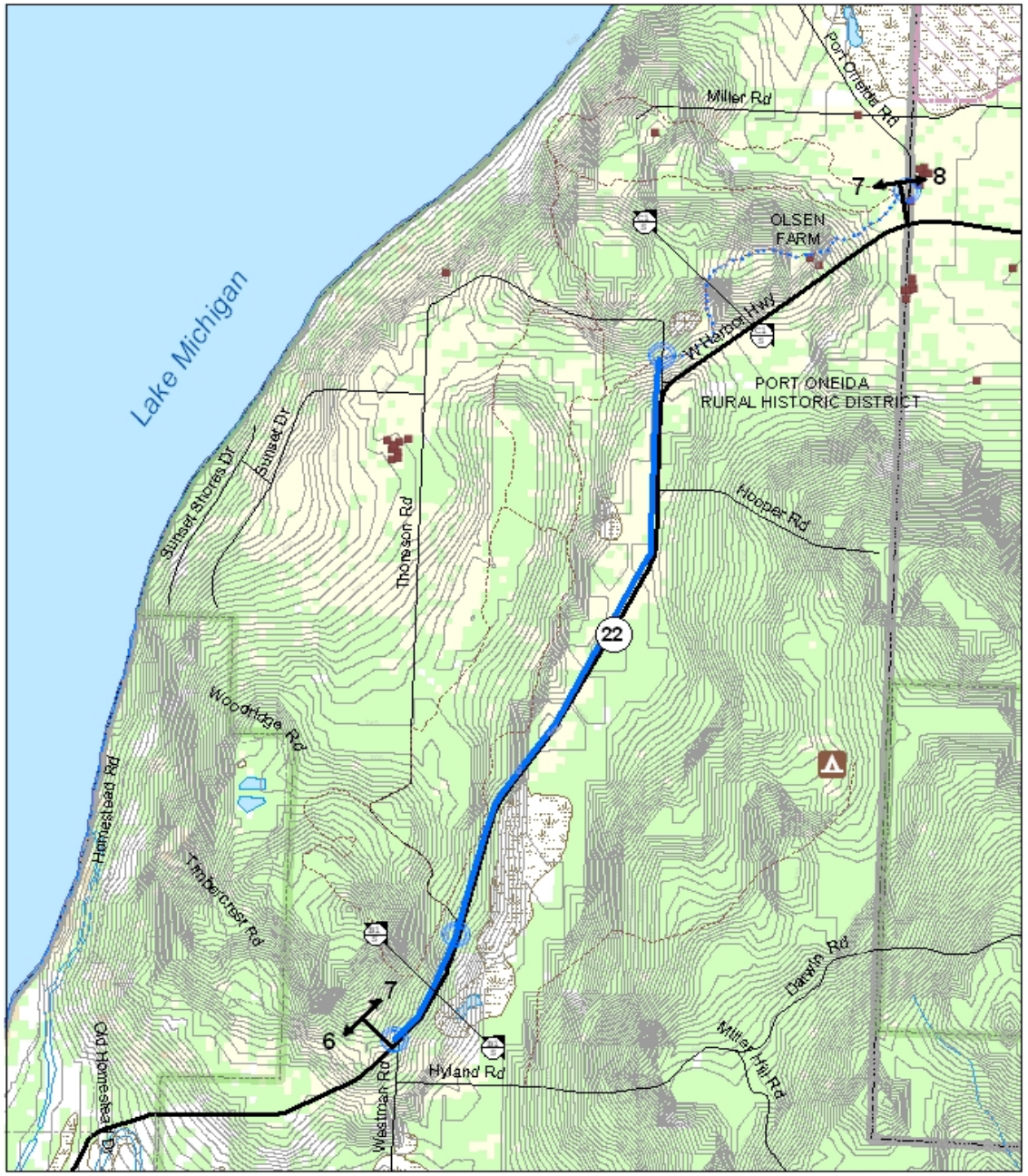
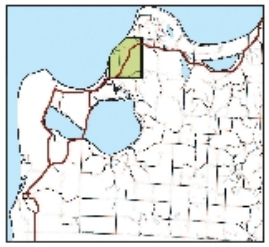
engineering & design



MAP 2.7 - PROPOSED TRAILWAY ALTERNATIVES
SEGMENT 7: ALTERNATIVE A
LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN

TRAIL SURFACE LEGEND

- Asphalt
- Crushed Limestone
- Boardwalk
- On-Road Bike Lane
- Existing Gravel Road
- Road Crossing Location



GENERAL LEGEND

- State Trunkline
- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
- Recommended SLBE Wilderness Boundary **(1981)**
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- Village Boundaries
- Township Boundaries
- Aquatic Bed
- Forested
- Agricultural

0 375 750 1,500 2,250 3,000 Feet

N W E S

Base GIS Data: Michigan Framework Data
1992 National Land Cover Dataset
1992 National Wetlands Cover Dataset
National Park Service
NAD 1983 UTM ZONE 16N

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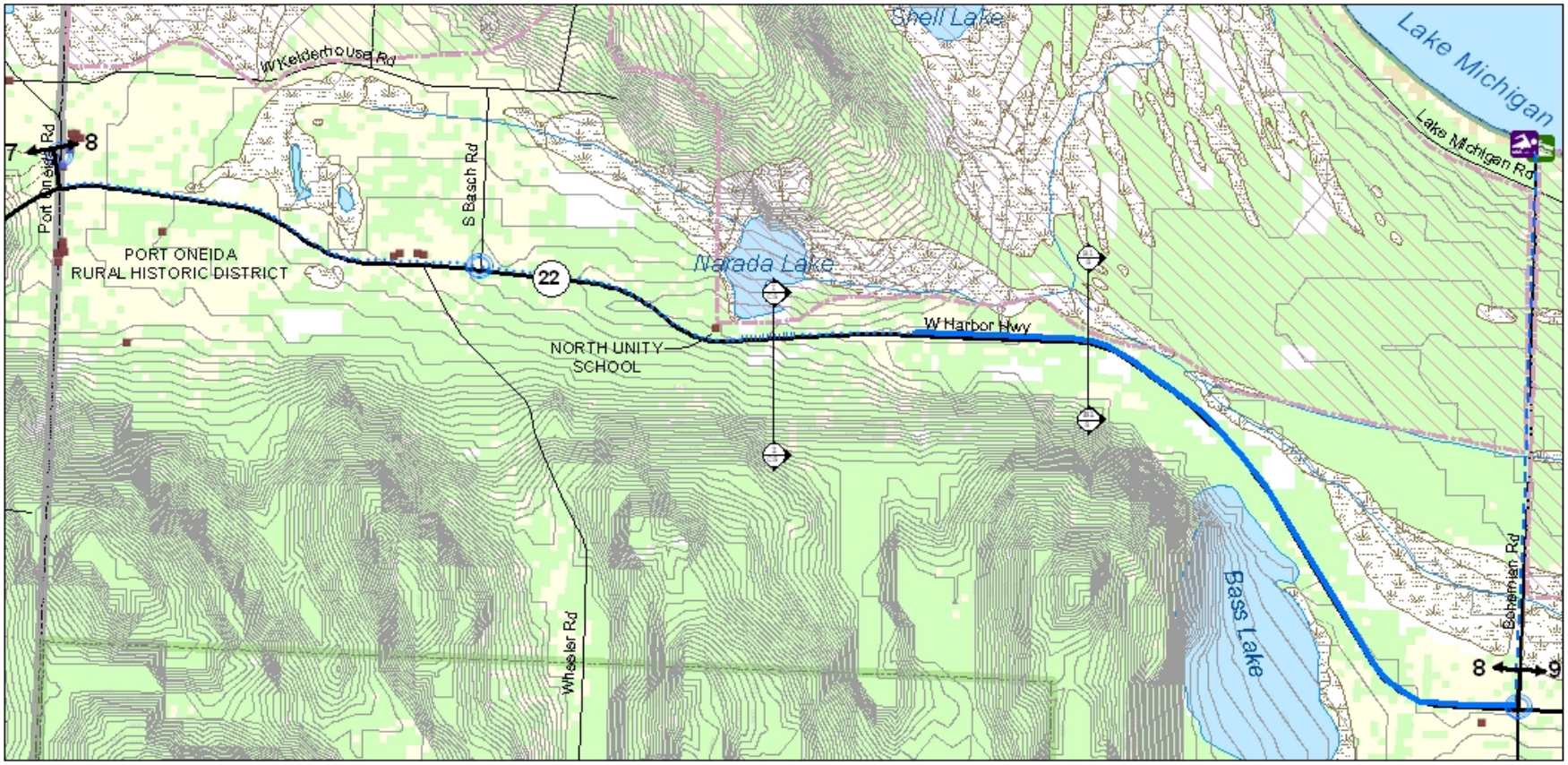
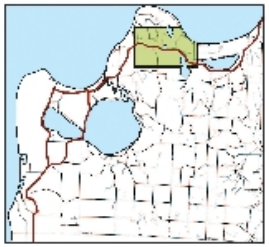
engineering associates inc.



MAP 2.8 - PROPOSED TRAILWAY ALTERNATIVES
SEGMENT 8: ALTERNATIVE A
LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN



GENERAL LEGEND

- State Trunkline
- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
- Recommended SLBE Wilderness Boundary **(1981)**
- SLBE Boundary
- Rivers
- Lakes
- Village Boundaries
- Township Boundaries
- Aquatic Bed
- Forested
- Agricultural

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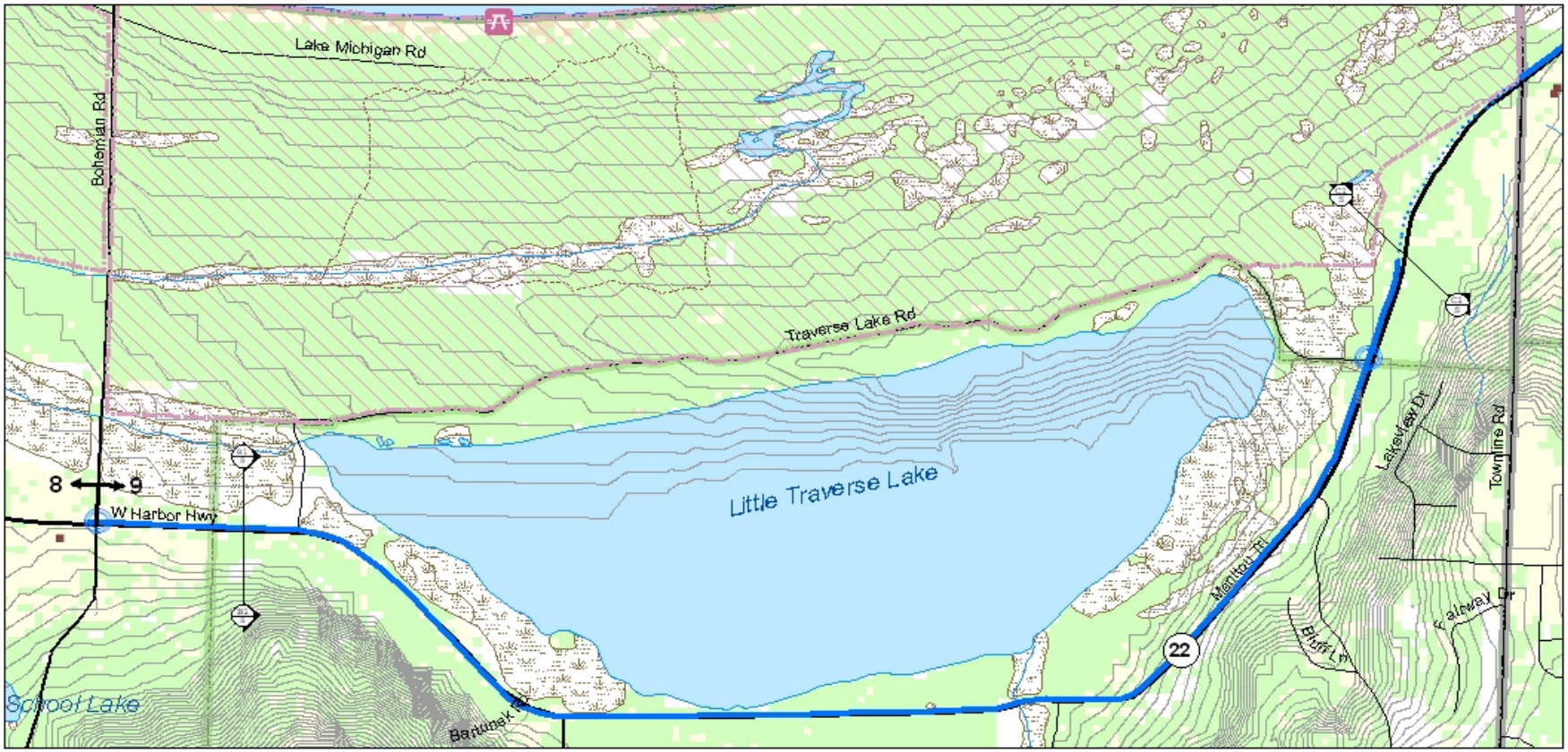
TRAIL SURFACE LEGEND

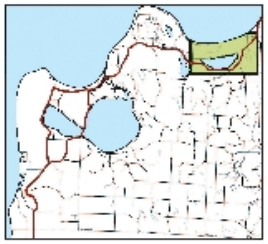
- Asphalt
- Crushed Limestone
- Boardwalk
- On-Road Bike Lane
- Existing Gravel Road
- Road Crossing Location

0 375 750 1,500 2,250 3,000
Feet

GoslingCzubak
engineering services inc.



MAP 2.9a - PROPOSED TRAILWAY ALTERNATIVES
SEGMENT 9: ALTERNATIVE A
LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN



GENERAL LEGEND

- State Trunkline
- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
- Recommended SLBE Wilderness Boundary **(1981)**
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- Lakes
- Village Boundaries
- Township Boundaries
- Aquatic Bed
- Forested
- Agricultural

N W E S

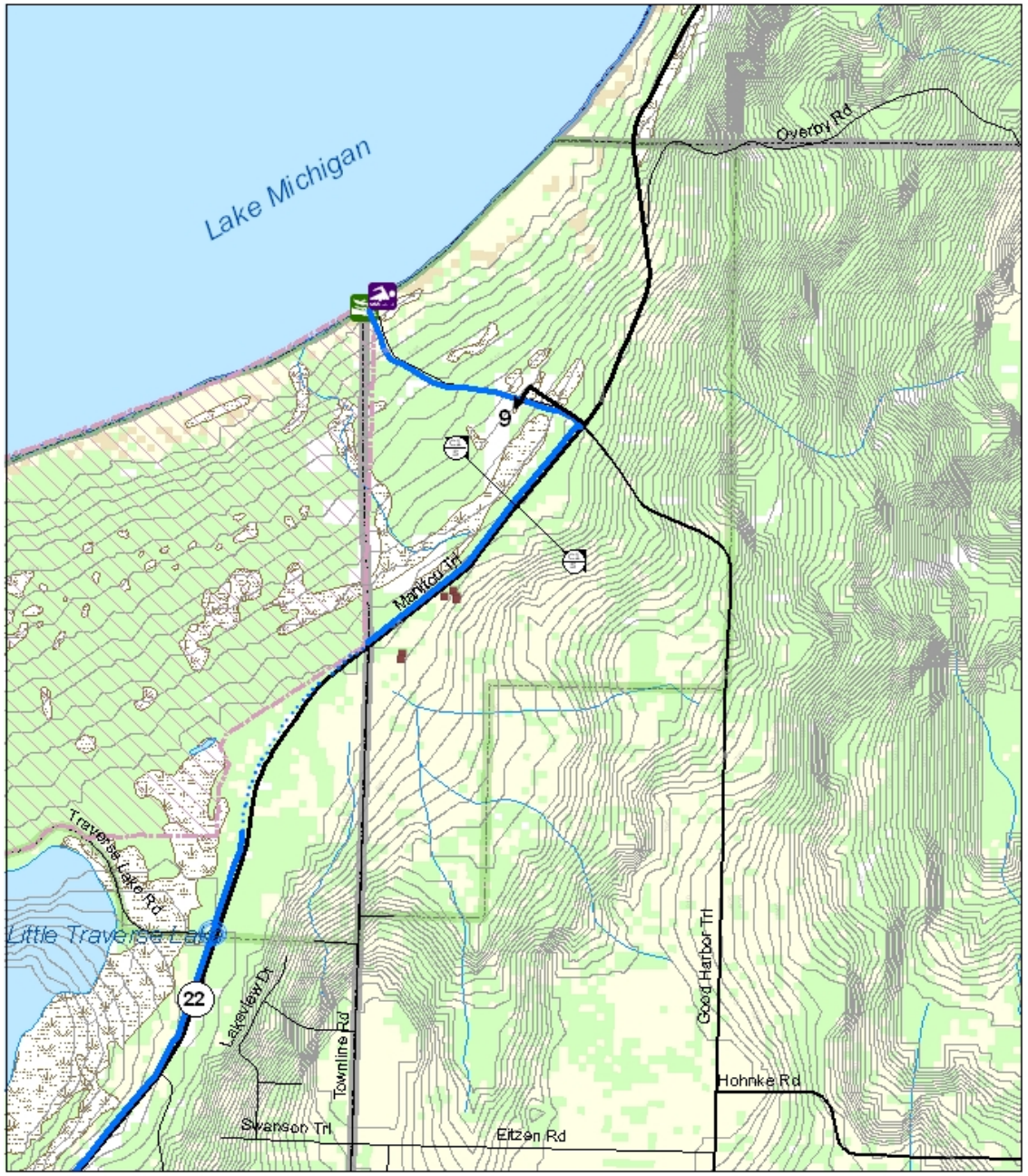
Base GIS Data : Michigan Framework Data
1992 National Land Cover Dataset
1992 National Wetland Cover Dataset
National Park Service
NAD 1983 UTM ZONE 16N

TRAIL SURFACE LEGEND

- Asphalt
- Crushed Limestone
- Boardwalk
- On-Road Bike Lane
- Existing Gravel Road
- Road Crossing Location

0 375 750 1,500 2,250 3,000
Feet

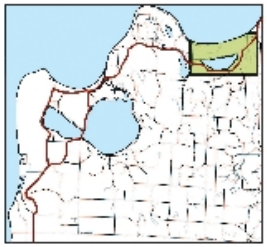
GoslingCzubak
engineering associates inc.



MAP 2.9b - PROPOSED TRAILWAY ALTERNATIVES
SEGMENT 9: ALTERNATIVE A
LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN

TRAIL SURFACE LEGEND

- Asphalt
- Crushed Limestone
- Boardwalk
- On-Road Bike Lane
- Existing Gravel Road
- Road Crossing Location



GENERAL LEGEND

- State Trunkline
- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
- Recommended SLBE Wilderness Boundary **(1981)**
- SLBE Boundary
- Rivers
- Lakes
- Village Boundaries
- Township Boundaries
- Aquatic Bed
- Forested
- Agricultural

0 375 750 1,500 2,250 3,000 Feet

N W E S

Base GIS Data: Michigan Framework Data
1992 National Land Cover Dataset
1992 National Wetlands Cover Dataset
National Park Service
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2.3.3 ALTERNATIVE B: THE PREFERRED ALTERNATIVE

Under Alternative B, a non-motorized trail would be constructed in the M-22/M-109 right-of-way, in many areas, but deviating from the highway corridor where possible to avoid physical or environmental constraints, provide access to natural, cultural, or recreation resources, and to promote a broader variety of experiences for the Trailway user. It would be a contiguous non-motorized trail of over 27 miles commencing from the southern Leelanau County line at Manning Road to County Road 651 at Good Harbor Beach (Please see Figure 3. Map B). Disturbance of interior vegetated areas, steep slopes, and difficult soils would be minimized and sensitively planned. Trail user experience would be less closely associated with the highway or road right-of-way.

Access to the Trailway would be made at existing Lakeshore trailheads and designated visitor parking areas located along or near M-22 and M-109, including the Pierce Stocking Scenic Drive lower parking area, Dune Climb, Glen Haven, Bay View Trailhead, Port Oneida, and Lake Michigan beaches at Bohemian Road (CR 669) and Good Harbor Trail (CR 651). Some new trailheads may also be proposed, especially at either end of the Trailway. Such trailheads and parking areas may be augmented with Trailway "wayfinding" maps and information as well as provide bike racks, benches, picnic tables, potable water/drinking fountains, interpretive information, and restroom facilities. Universal accessibility signage and amenities as well as trail segment, trail challenge level information and mileage markers would also be used.

The proposed routing for Alternative B is described in terms of ***Segments 1-9***, which were previously identified for evaluation and assessment.

Segment 1:
The trail would start at the intersection of Manning Road and Norconk Road. A new trailhead would be located near this intersection. The trail would head north following Norconk Road on the west side as a 10' separated crushed limestone path. The trail turns and heads east along the north side of Stormer Road. A crushed limestone surface would be utilized in this segment to integrate with the historic Tweddle-Treat Farms and cultural landscape.

As the Trailway leaves Stormer Road, it changes to a 10' wide asphalt cross section and follows an existing utility right-of-way, crossing Wilco Road. The route then deviates into the wooded area on the west side of M-22 using some ridgelines and relatively gentle gradient to emerge back in the M-22 right-of-way before the Lakeshore entrance sign. Steep side slope areas would necessitate excavation and possible retaining walls before and after the entrance sign. An M-22 crossing could be located at the New Neighborhood.

This segment of the Trailway would provide an open vista of the historic fields and buildings of the Tweddle-Treat cultural landscape. Wayfinding information would be developed at an appropriate location to assist Trailway users in accessing the Empire Bluffs Trail (hiking only) and the cultural landscape.

Segment 2:
The Trailway would enter the Village of Empire along the M-22 right-of-way. The Village Council would determine the trail route within the Village of Empire, but access to the Lakeshore Visitor Center, the downtown area, and the beach should all be considered in route planning. For purposes of this alternative however, the following possible trail route is described:

The Trailway routing could continue within the Village of Empire by using existing road right-of-way through the Quercus Alba (New neighborhood) and Beaver Creek neighborhoods. With oversight from MDOT, a north-south oriented M-22 crossing could be implemented and a north-south oriented M-72 crossing accessing Trailway users to the Visitor Center. The facility provides public restrooms, information, interpretive displays, and other support facilities open to the public during regular business hours. Trailway users could also have direct access to the Village of Empire. Continuing through the Beaver Creek development, the Trailway could use Ottawa Street as a crossing location at M-22 at the north end of the Village.

A new paved section in the right-of-way along the northwest side of M-22 could be developed to LaCore Road in the Village of Empire, then north to the Village limits. From there the Trailway could travel along the west side of LaCore to Bar Lake Road in the county road right-of-way. The Trailway would continue along the north side of Voice Road on Lakeshore property to avoid impacts to the designated Natural Beauty Road and continue east to the intersection at M-22. This section would require a minor creek/wetland crossing along LaCore Road and addressing several side slope and grading challenges north of Voice Road, including near the Trailway's intersection with M-22 where Segment 3 begins.

The Trailway segment provides a direct link to the North Bar Lake public beach access, although the existing access on Bar Lake Road is gravel. Wayfinding information could be added at the Voice Road-Bar Lake Road intersection to assist Trailway users with accessing North Bar Lake facilities.

Segment 3:
The grade falls away near the intersection of Voice Road and M-22 and includes roadway guardrail and overhead utilities. MDOT would need to approve some additional fill material and trail grading at the corner within the utility right-of-way, as well as the alignment of the trail to allow safe access around this corner. The Trailway continues from its intersection with M-22 to M-109 in the right-of-way on the west side of the road. The Trailway would include a new 10' wide asphalt cross-section from Voice Road to Pierce Stocking Scenic Drive. Considerations for Trailway construction in this area include side slopes, existing mature trees, and proximity to the road (see Chapter 4 - Trail Cross-section Development).

The Trailway segment provides access to hiking trailheads, loops and support facilities at Pierce Stocking Scenic Drive and the Windy Moraine Trail parking area. Wayfinding information would be added to assist Trailway users in recognizing other existing facilities in the area. Trailway users would be able to use the parking area at Pierce Stocking Scenic Drive as a trailhead. Information would be provided regarding the challenge level and safety considerations for riders interested in using the Pierce Stocking Scenic Drive, since it is a very challenging bicycling experience. A connecting trailhead link would connect the parking area to the main Trailway along M-109.

Segment 4:
North of the Pierce Stocking Scenic Drive, the Trailway would veer to the northwest on an old logging road outside of the right-of-way, which allows a more gradual decent and avoids highway curves hazardous in the right-of-way of M-109. A 10' asphalt section would take the trail user through a wooded area and emerge on Greenan Road. An adjacent 10' wide pathway along this gravel county road could be paved to the M-109 right-of-way where it would continue along M-109 until Hunter Road.

Several unique factors would be considered in this segment. Greenan Road is already frequented by walkers and hikers and

warrants consideration of mixed modes of non-motorized traffic using the Trailway. In addition, on the northern half of the segment private driveways bisect the Trailway, as well as some landscaping encroachments into the right-of-way. Cooperation with MDOT and landowners will be necessary to develop safe and viable routing through the area to Hunter Road.

Segment 5:
Hunter Road links the Trailway to the Dune Climb, a major attraction within the Lakeshore. The Trailway would cross the perimeter of the parking area. A wide cleared area to the east of the parking area would allow for a 10' paved trail to be developed adjacent to, but separate from, the Duneside Accessible Trail, a 6' wide universally accessible crushed limestone path that provides about a ¾-mile round trip hike with accessible surface, interpretive signage and seating. The Trailway continues as a 10' wide paved trail along the east side of the Duneside Accessible Trail and extends another 1000' to Harwood Drive. Trailway users would also be directed to the Dune Center and public restrooms that serve the Dune Climb.

From Harwood Drive, near the D.H. Day Group Campground, the former narrow gauge rail bed would be used for continuation of a 10' wide crushed limestone path connecting north to Dune Valley Road and then continuing into the Glen Haven Historic District. (Map 2.14.1)

The Trailway would follow an existing two-track road to connect the railroad grade route with M-209 in Glen Haven. An M-209 crossing would be developed near the Dean and Rude houses and in the vicinity of the Blacksmith Shop. Continuing east, the Trailway would continue as a 10' crushed limestone path and utilize an existing county road (two-track) to access to D.H. Day Campground.

The Trailway (Map 2.14) would then use Pine Haven Road right-of-way as a separate paved 10' asphalt path to avoid the user conflicts associated with the D.H. Day Campground access road. With oversight from MDOT, a north-south oriented M-109 crossing would be aligned at Pine Haven Road and Stocking Road, creating a safe crossing. The road grade and slight curve in this area dictate careful consideration of clear vision and advanced warning by MDOT for an at-grade crossing in this vicinity.

The Trailway would then use an existing unmarked two-track trail running east-west along the base of the Alligator Hill escarpment from Stocking Road to South Forest Haven Drive, connecting to Glen Arbor. A 10' asphalt cross-section is proposed for this section and continues on the west side of the South Forest Haven Drive right-of-way to emerge back in the M-109 right-of-way at Sylvan Street.

This Trailway segment provides access to hiking trailheads and support facilities at the Glen Haven Maritime Museum, Glen Haven Village, D.H. Day Campground, and Alligator Hill. Wayfinding information would be added to assist Trailway users in recognizing the other facilities in the area.

Segment 6:
From Sylvan Street, the Trailway would enter downtown Glen Arbor. The Glen Arbor Township Board would determine the best way through the town. For purposes of this alternative however, the following trail route possibility is described:

The Trailway would be a paved shoulder at a minimum width of 5' on both sides of M-109. To circumvent heavy summer traffic, the route would turn south on Ray Street (M-22), one block to State Street at the Township Park, then east to Oak Street, and then north

on Oak Street back to the M-22 right-of-way. Trailway signage could guide trail users through Glen Arbor on existing streets via 5' paved shoulders on both sides of the local streets.

From Oak Street, trail users would travel along M-22 using the 5' paved shoulder. If conditions allow the Trailway would then widen to a 10' pathway within the existing M-22 right-of-way on the southeast side of the road. A boardwalk section could be installed for several hundred feet in the vicinity of the bicycle club rest area across from the gasoline service station. The Trailway then turns east at the intersection onto West Crystal View Road.

A 10' asphalt path would be installed along the south side of West Crystal View Road. Three river crossings would occur at existing culvert locations on the Crystal River, two immediately after M-22 and a third just before Westman Road. Boardwalk sections would be needed for several hundred feet in multiple areas, in particular along the Crystal River bend. Trail users would cross the Crystal River on a separate pedestrian bridge which would span the river on the south side of the road and continue to Westman Road on an off-road 10' asphalt path on the east side. Another boardwalk as long as 1,000' would be necessary to traverse wetlands on the west side of Westman Road, near Tucker Lake.

From that point, the Trailway would continue north as an off-road 10' wide asphalt path located on the west side of the M-22 right-of-way up to the entrance of The Homestead Resort near Westman Road. With oversight from MDOT, a north-south oriented M-22 crossing at Westman Road would be implemented with striped pavement markings, advance warning, and safety signage.

Segment 7:
The Trailway would use the west side of the M-22 right-of-way as an off-road 10' asphalt section from The Homestead Resort to the intersection of M-22 and Thoreson Road. The Trailway would then divert north on Thoreson Road to access the lower section of the Bay View Hiking Trail and be a 10' crushed limestone path. The Trailway would then again cross Thoreson Road at a safe distance past the "Y" intersection, and continue on the Bay View Trail. This section of the Bay View Trail would also be a 10' crushed limestone path from Thoreson Road to Port Oneida and provide access to the Olsen farm, Kelderhouse farm and cemetery, and other properties in the Port Oneida Rural Historic District. Wayfinding signage could guide trail users through the Port Oneida Rural Historic District.

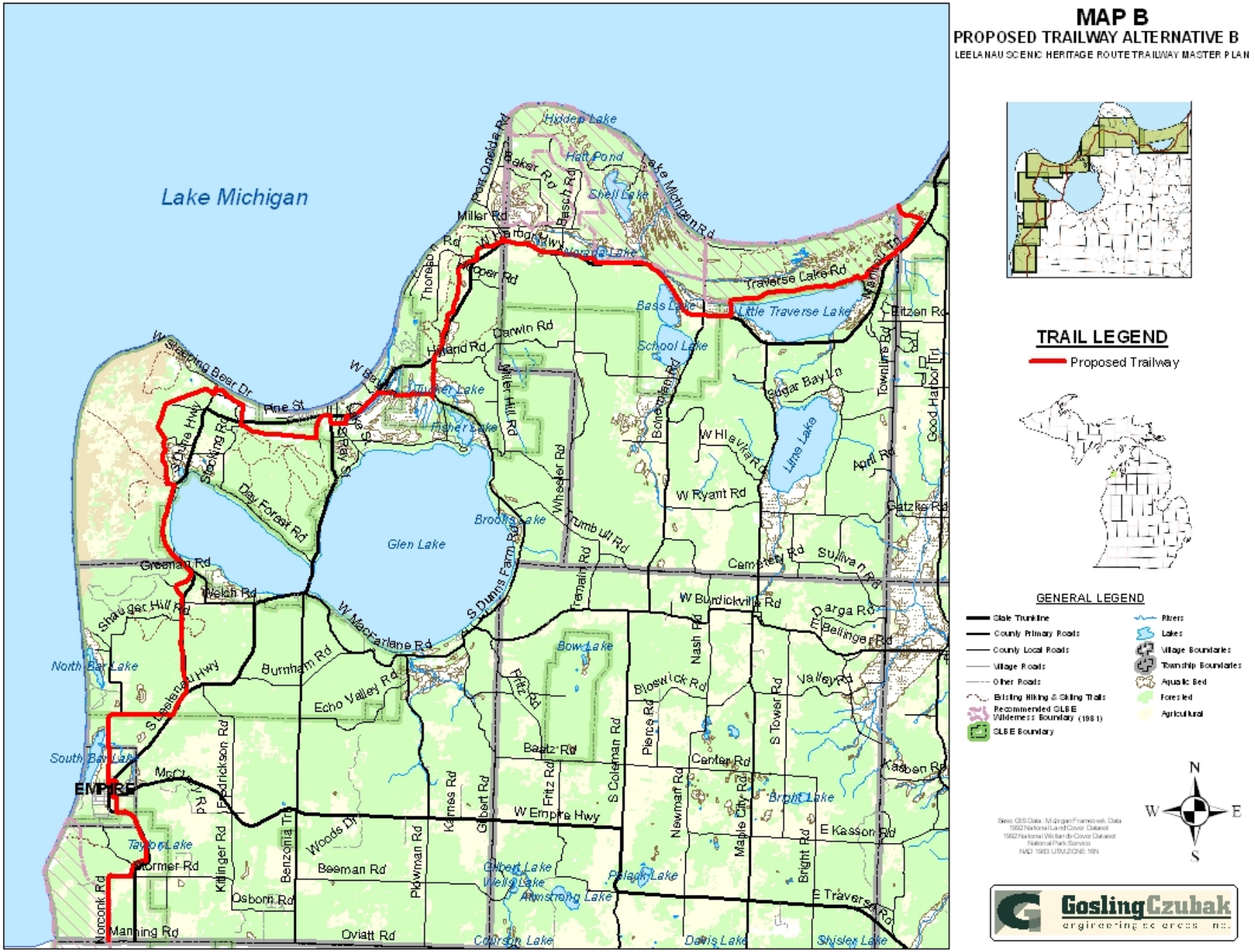
Segment 8:
The Trailway connects back to M-22 along the Port Oneida Road. It continues as a 10' off-road crushed limestone path along M-22 from Port Oneida Road to the Port Oneida Rural Historic District boundary just east Narada Lake. It would deviate from the right-of-way to approach the North Unity School from an interior aspect. A gradient change would align the Trailway along the M-22 right-of-way below the embankment and guardrail at Narada Lake. A boardwalk (approximately 265 feet long) would provide a unique nature experience along this water resource, avoiding the hazardous proximity and the tight right-of-way of a roadside route.

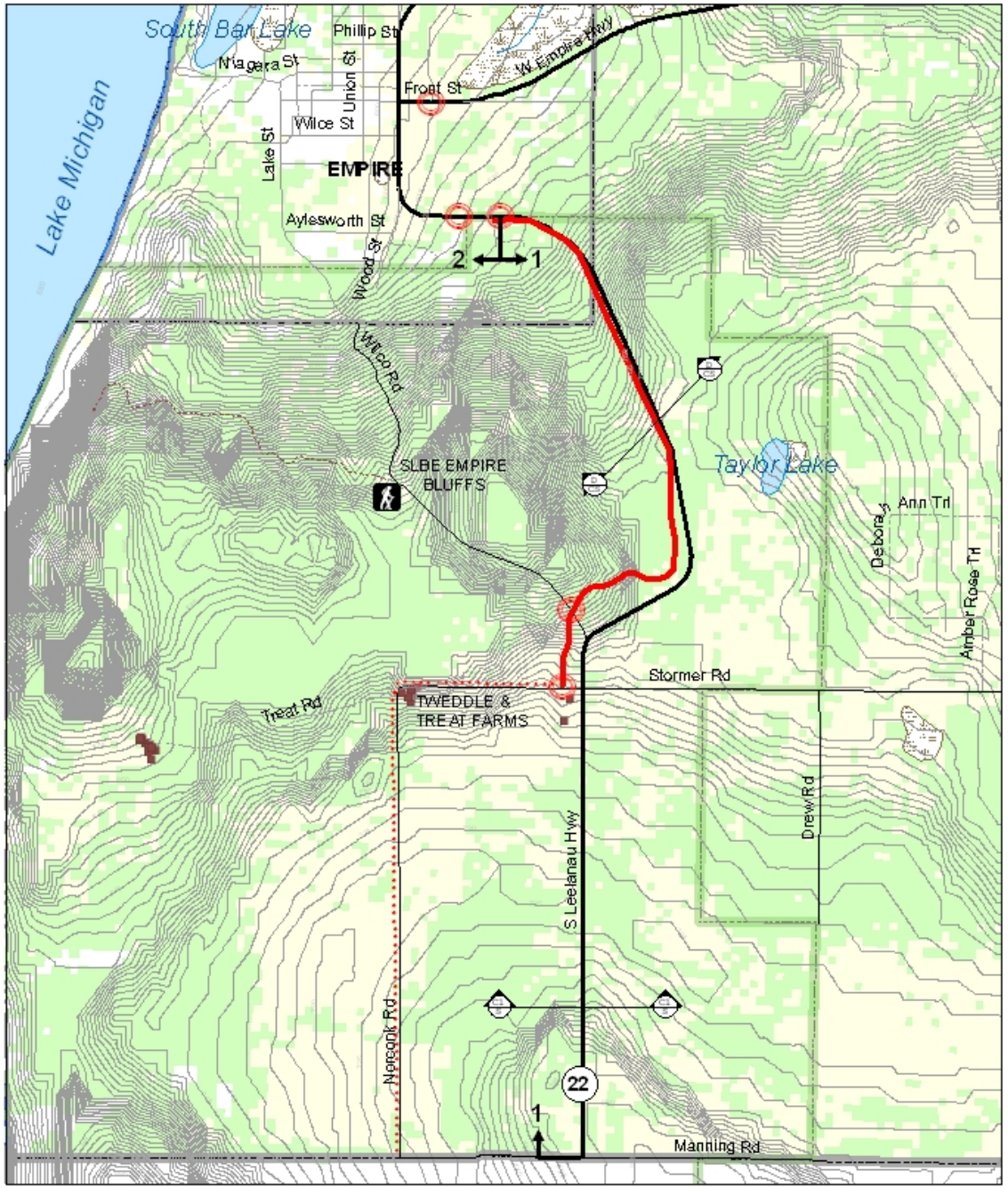
From the Port Oneida Rural Historic District boundary, the Trailway would continue as a 10' off-road asphalt section on the north side of the right-of-way to the Bohemian Road (CR 669) and M-22 intersection. This Trailway segment provides access to the Good Harbor Bay swimming beach and other Lakeshore facilities at CR 669. Wayfinding information would be added along the route to assist Trailway users in recognizing the Lake Michigan Beach access and other facilities at the end of Bohemian Road (CR 669).

Segment 9:
The Trailway would be a 10' off-road asphalt section on the north side of M-22 up to Traverse Lake Road. The Trailway turns north on the west side of Traverse Lake Road onto an off road boardwalk within the county road right of way. It continues as a separate 10' off road asphalt path on the north side of Traverse Lake Road either within the county road right-of-way or on Lakeshore property south of proposed wilderness. The Trailway would then follow an old two track road that runs from the northeast end of Little Traverse Lake becoming a crushed limestone path behind the Bufka Farmstead.

After the farm, the Trailway becomes an asphalt surface and would stay below the M-22 right-of-way, to the extent possible, using the glacial ridges and valleys below the M-22 corridor. The steep embankment and narrow right-of-way with guardrails on both sides would be avoided with this routing; however, the lowland areas present some challenge for Trailway construction. The Trailway ends at Good Harbor Trail (CR 651) and Lake Michigan.

This Trailway segment provides access to Good Harbor Trail (CR 651) and Good Harbor Beach. Wayfinding information would be added to assist Trailway users in recognizing the existing Lakeshore facilities at the end of Good Harbor Trail. A trailhead could be located at the parking facility with improvements such as safe crossings with pavement striping, advanced warning and wayfinding signage.


MAP B
PROPOSED TRAILWAY ALTERNATIVE B
LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN
Lake Michigan
EMPIRE
TRAIL LEGEND
Proposed Trailway
GENERAL LEGEND
State Trunkline
County Primary Roads
County Local Roads
Village Roads
Other Roads
Existing Hiking & Skiing Trails
Recommended SLBE Wilderness Boundary (1981)
SLBE Boundary
Rivers
Lakes
Village Boundaries
Township Boundaries
Aquatic Bed
Forested
Agricultural
N
S
E
W
GoslingCzubak
engineering associates inc.



MAP 2.10 - PROPOSED TRAILWAY ALTERNATIVES
SEGMENT 1: ALTERNATIVE B
LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN

TRAIL SURFACE LEGEND

- Asphalt
- Crushed Limestone
- Boardwalk
- On-Road Bike Lane
- Existing Gravel Road
- Road Crossing Location

GENERAL LEGEND

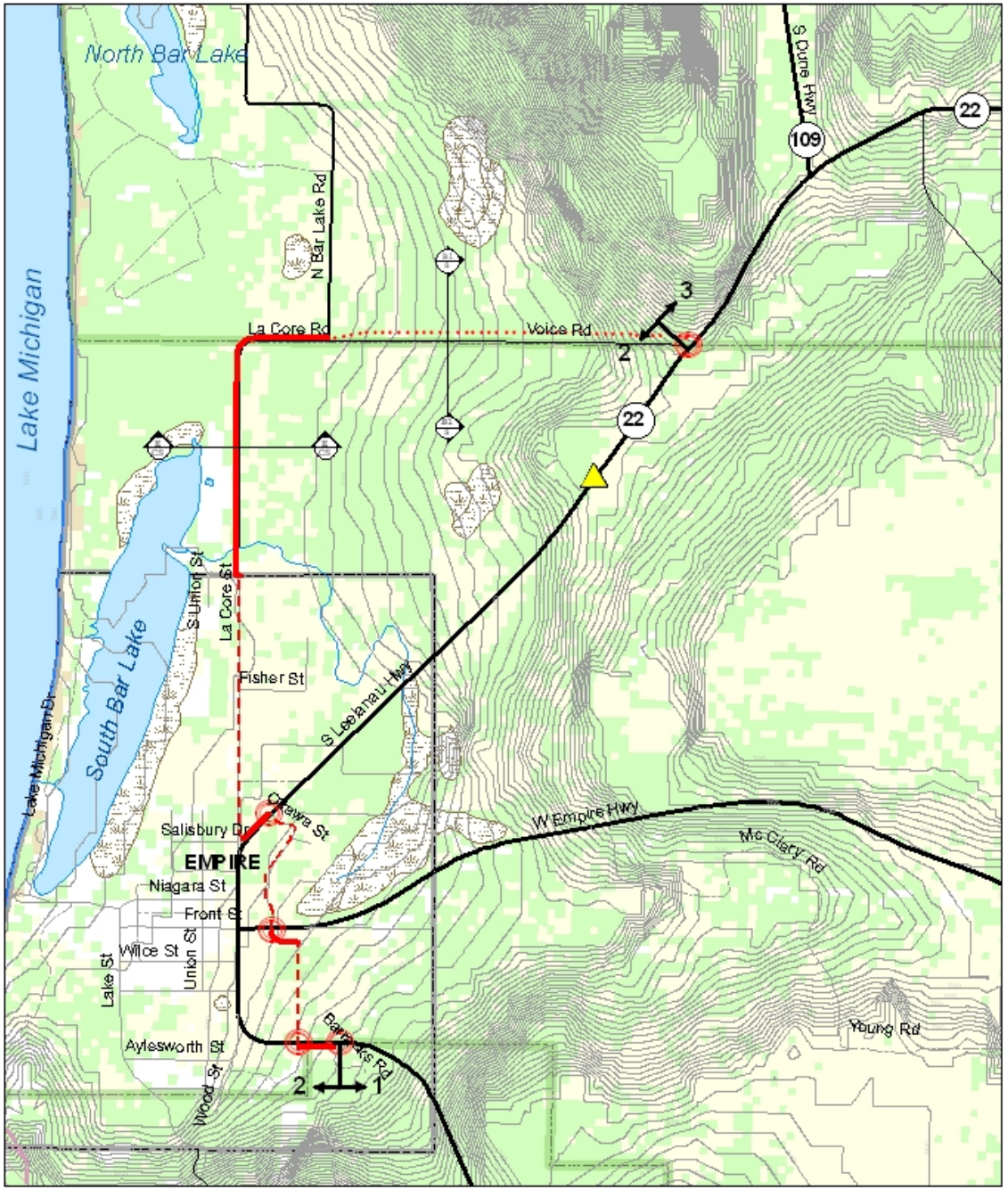
- State Trunkline
- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
- Recommended SLBE Wilderness Boundary (1981)
- SLBE Boundary
- Rivers
- Lakes
- Village Boundaries
- Township Boundaries
- Aquatic Bed
- Forested
- Agricultural

0 375 750 1,500 2,250 3,000 Feet

N W E S

Base GIS Data: Michigan Framework Data
1992 National Land Cover Dataset
1992 National Wetlands Cover Dataset
National Park Service
NAD 1983 UTM ZONE 16N

GoslingCzubak engineering associates inc.



MAP 2.11 - PROPOSED TRAILWAY ALTERNATIVES
SEGMENT 2: ALTERNATIVE B
LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN

TRAIL SURFACE LEGEND

- Asphalt
- Crushed Limestone
- Boardwalk
- On-Road Bike Lane
- Existing Gravel Road
- Road Crossing Location

GENERAL LEGEND

- State Trunkline
- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
- Recommended SLBE Wilderness Boundary **(1981)**
- SLBE Boundary
- Rivers
- Lakes
- Village Boundaries
- Township Boundaries
- Aquatic Bed
- Forested
- Agricultural

0 375 750 1,500 2,250 3,000 Feet

N W E S

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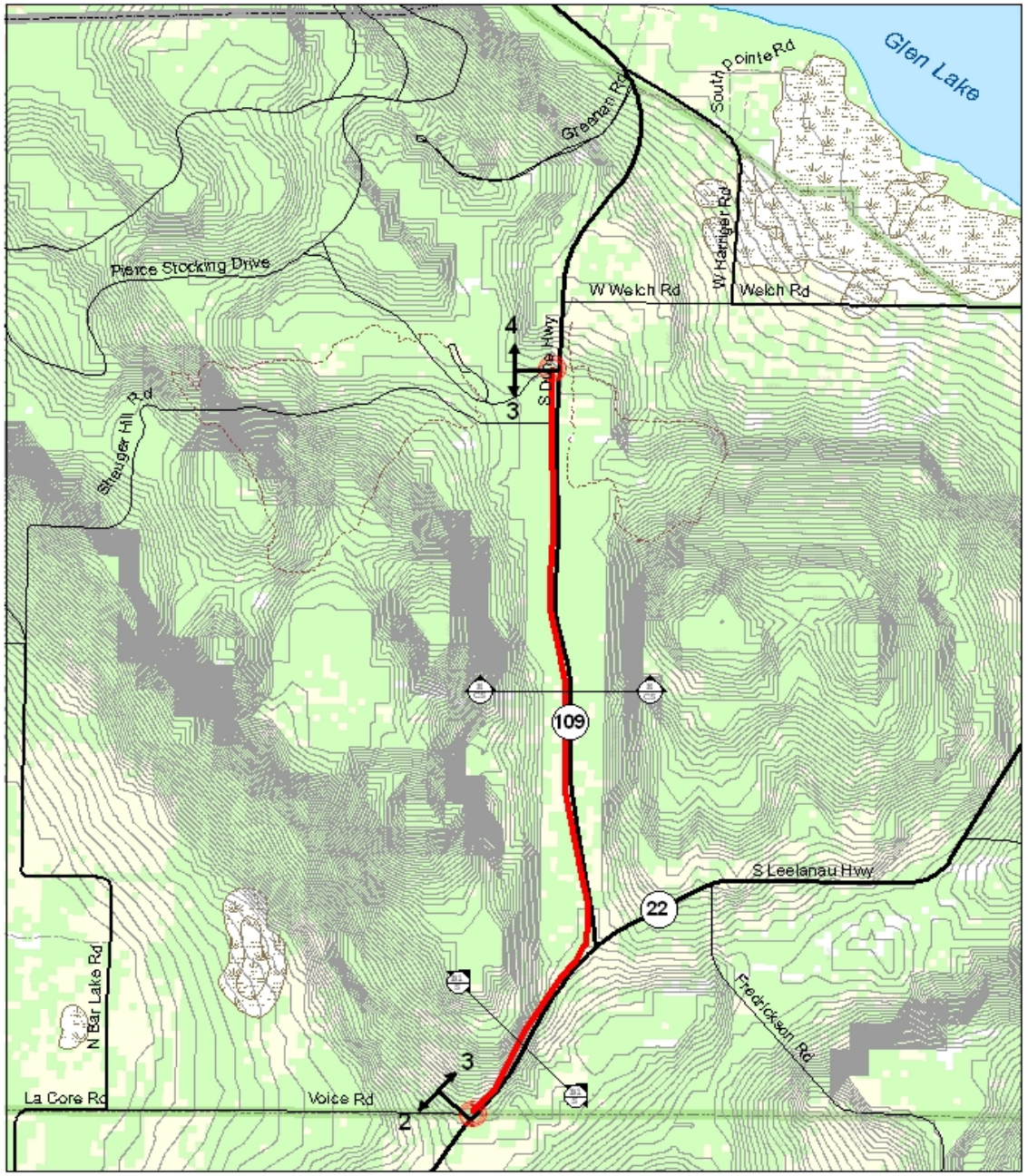
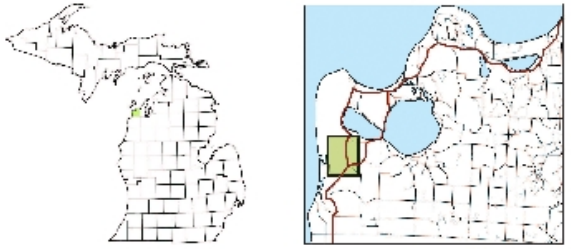


MAP 2.12 - PROPOSED TRAILWAY ALTERNATIVES
SEGMENT 3: ALTERNATIVE B
LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN

TRAIL SURFACE LEGEND

- Asphalt
- Crushed Limestone
- Boardwalk
- On-Road Bike Lane
- Existing Gravel Road
- Road Crossing Location



GENERAL LEGEND

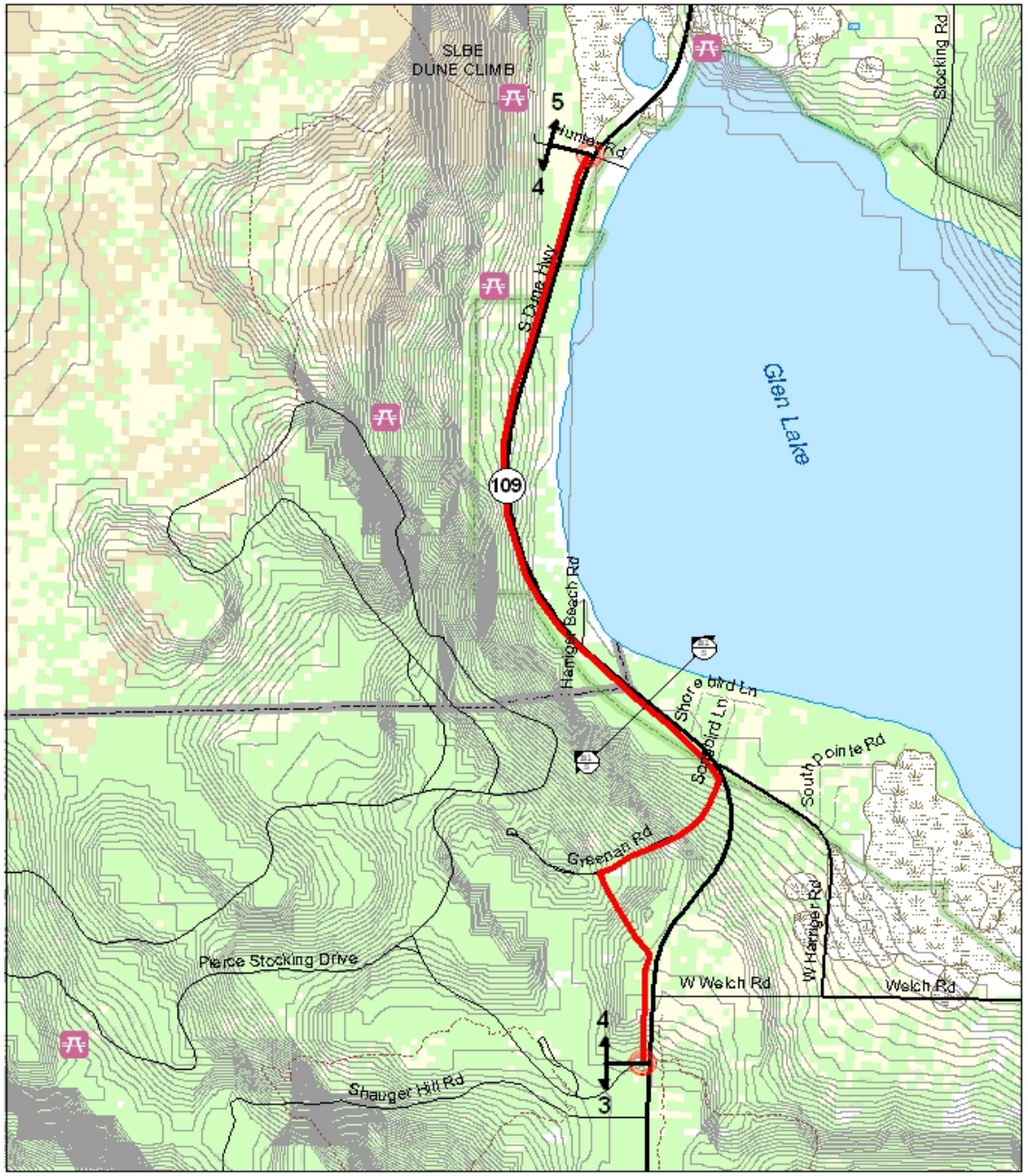
- State Trunkline
- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
- Recommended SLBE Wilderness Boundary **(1981)**
- SLBE Boundary
- Rivers
- Lakes
- Village Boundaries
- Township Boundaries
- Aquatic Bed
- Forested
- Agricultural

0 375 750 1,500 2,250 3,000 Feet

N W E S

Base GIS Data: Michigan Framework Data
1992 National Land Cover Dataset
1992 National Wetlands Cover Dataset
National Park Service
NAD 1983 UTM ZONE 16N

GoslingCzubak engineering services inc.

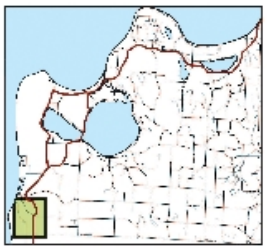


MAP 2.13 - PROPOSED TRAILWAY ALTERNATIVES
SEGMENT 4: ALTERNATIVE B

LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN

TRAIL SURFACE LEGEND

- Asphalt
- Crushed Limestone
- Boardwalk
- On-Road Bike Lane
- Existing Gravel Road
- Road Crossing Location



GENERAL LEGEND

- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
- Recommended SLBE Wilderness Boundary **(1981)**
- SLBE Boundary
- Rivers
- Lakes
- Village Boundaries
- Township Boundaries
- Aquatic Bed
- Forested
- Agricultural

0 375 750 1,500 2,250 3,000 Feet

N W E S

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1992 National Land Cover Dataset
1992 National Wetlands Cover Dataset
National Park Service
NAD 1983 UTM ZONE 16N

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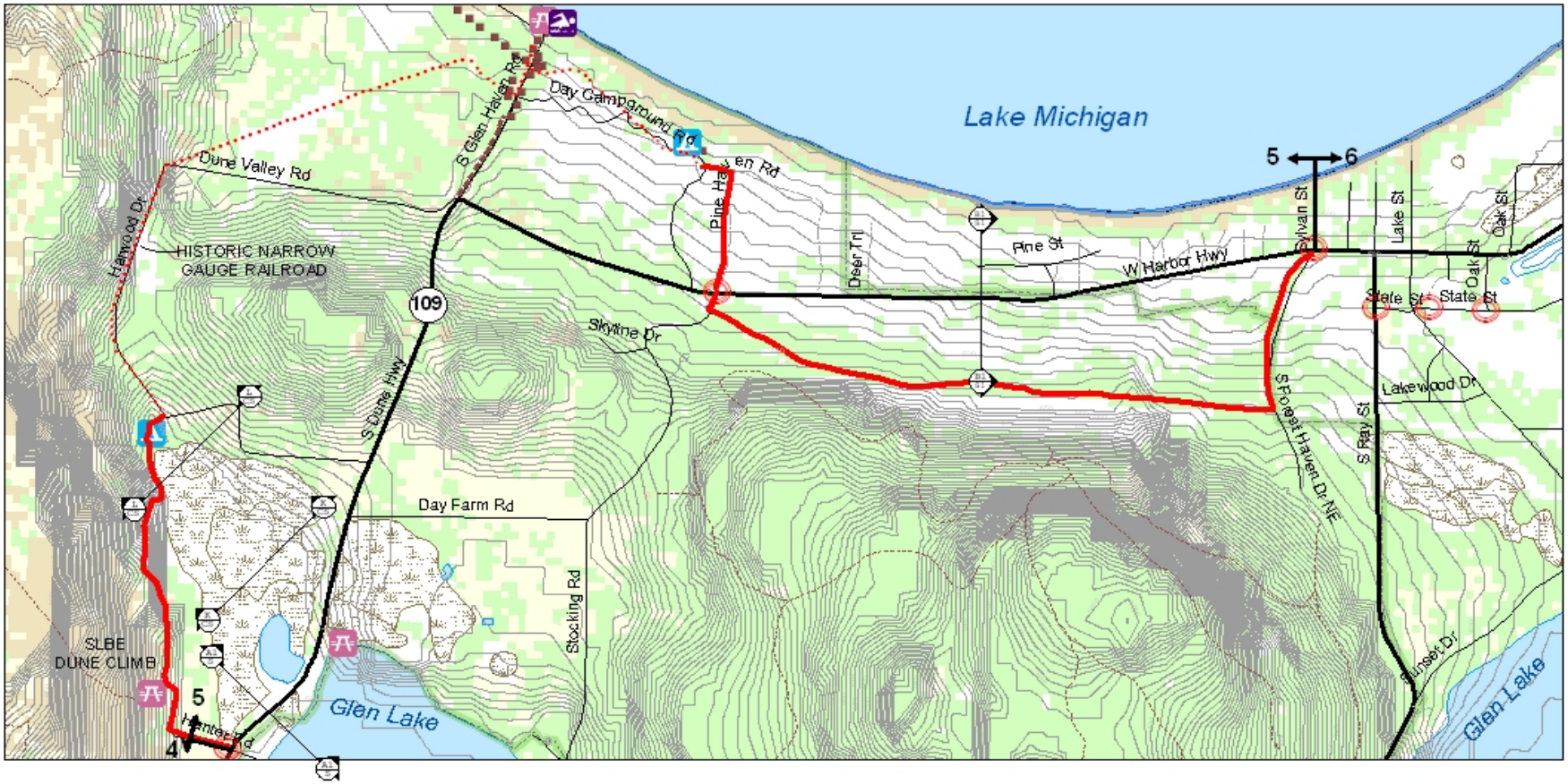
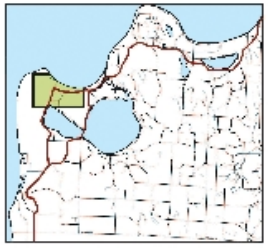
engineering associates inc.



MAP 2.14 - PROPOSED TRAILWAY ALTERNATIVES
SEGMENT 5: ALTERNATIVE B
LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN



GENERAL LEGEND

- State Trunkline
- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
- Recommended SLBE Wilderness Boundary **(1981)**
- SLBE Boundary
- Rivers
- Lakes
- Village Boundaries
- Township Boundaries
- Aquatic Bed
- Forested
- Agricultural

N W E S

Base GIS Data: Michigan Framework Data
1992 National Land Cover Dataset
1992 National Wetlands Cover Dataset
National Park Service
NAD 1983 UTM ZONE 16N

TRAIL SURFACE LEGEND

- Asphalt
- Crushed Limestone
- Boardwalk
- On-Road Bike Lane
- Existing Gravel Road
- Road Crossing Location

0 375 750 1,500 2,250 3,000 Feet

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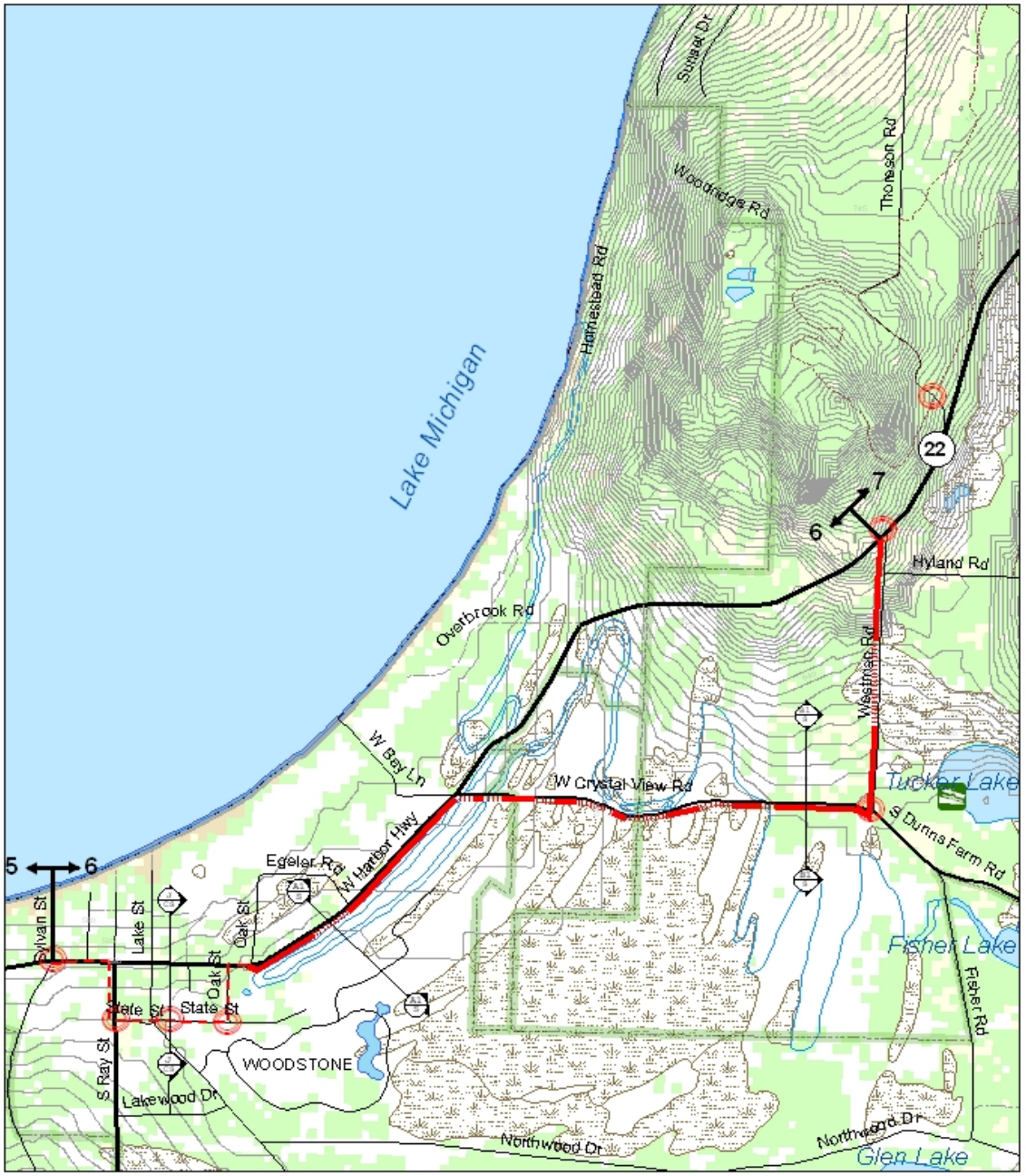
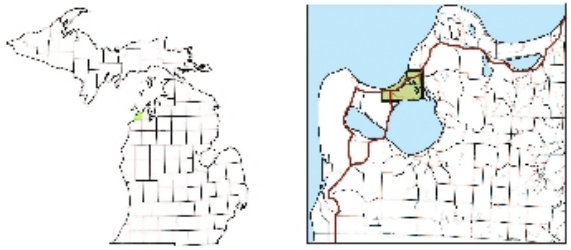
engineering & design



MAP 2.15 - PROPOSED TRAILWAY ALTERNATIVES
SEGMENT 6: ALTERNATE B
LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN

TRAIL SURFACE LEGEND

- Asphalt
- Crushed Limestone
- Boardwalk
- On-Road Bike Lane
- Existing Gravel Road
- Road Crossing Location



GENERAL LEGEND

- State Trunkline
- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
- Recommended SLBE Wilderness Boundary **(1981)**
- SLBE Boundary
- Rivers
- Lakes
- Village Boundaries
- Township Boundaries
- Aquatic Bed
- Forested
- Agricultural

0 375 750 1,500 2,250 3,000 Feet

N W E S

Base GIS Data: Michigan Framework Data
1992 National Land Cover Dataset
1992 National Wetlands Cover Dataset
National Park Service
NAD 1983 UTM ZONE 16N

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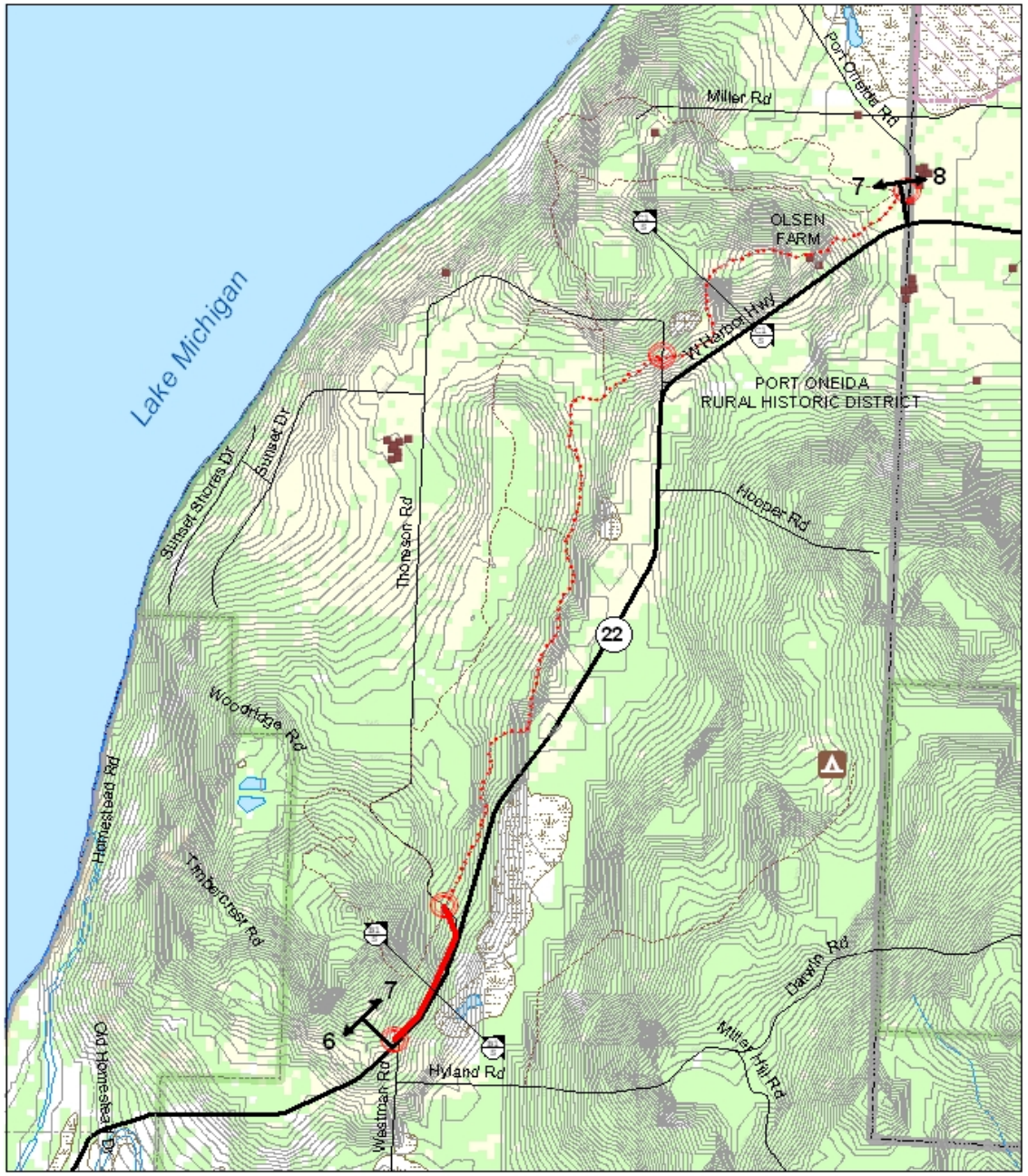
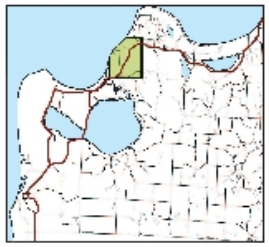


MAP 2.16 - PROPOSED TRAILWAY ALTERNATIVES
SEGMENT 7: ALTERNATIVE B

LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN

TRAIL SURFACE LEGEND

- Asphalt
- Crushed Limestone
- Boardwalk
- On-Road Bike Lane
- Existing Gravel Road
- Road Crossing Location



GENERAL LEGEND

- State Trunkline
- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
- Recommended SLBE Wilderness Boundary **(1981)**
- SLBE Boundary
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- Village Boundaries
- Township Boundaries
- Aquatic Bed
- Forested
- Agricultural

0 375 750 1,500 2,250 3,000 Feet

N W E S

Base GIS Data: Michigan Framework Data
1992 National Land Cover Dataset
1992 National Wetlands Cover Dataset
National Park Service
NAD 1983 UTM ZONE 16N

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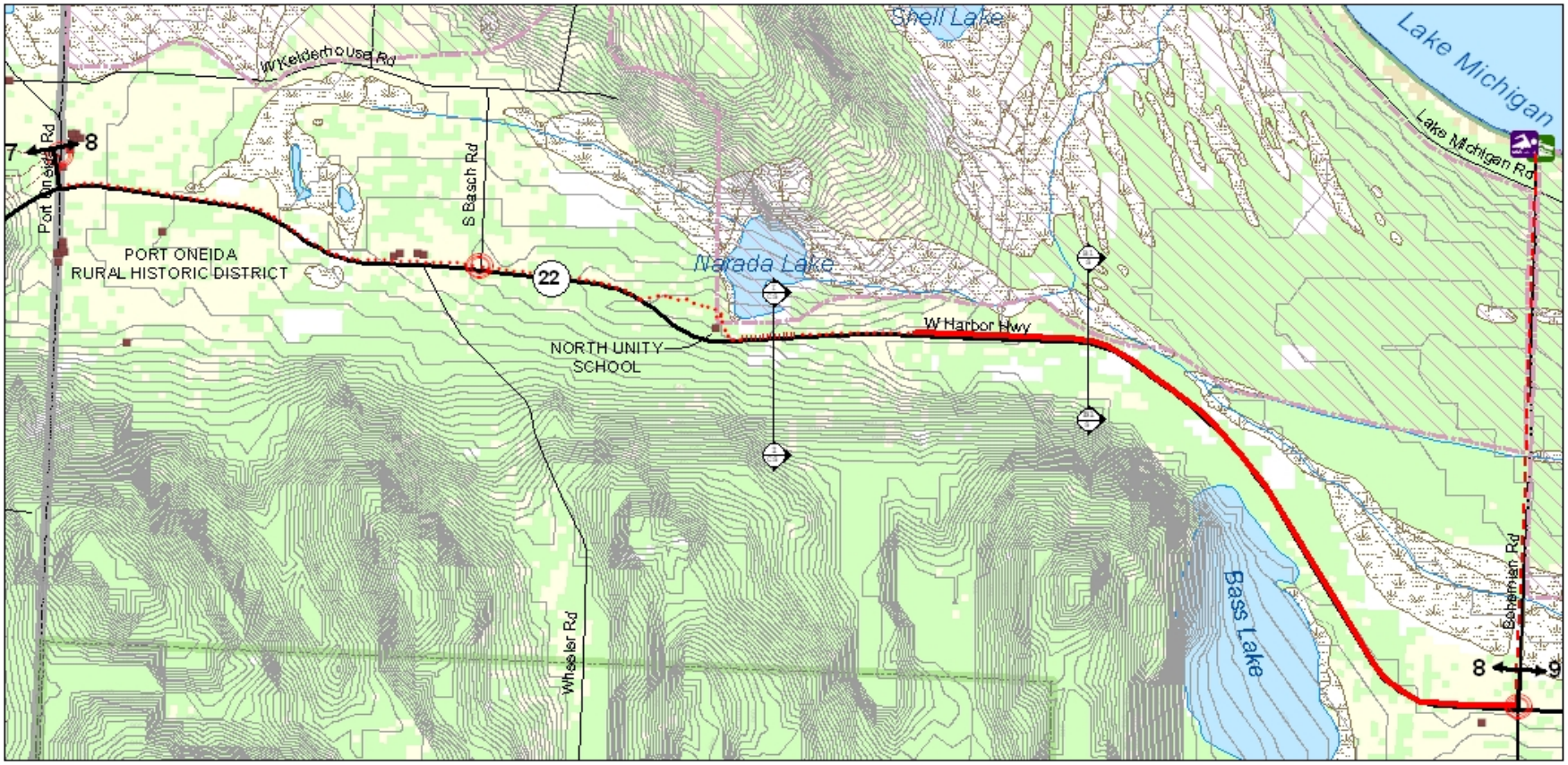
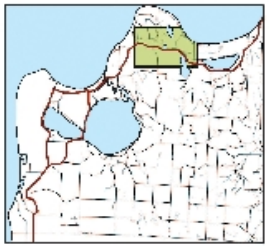


MAP 2.17 - PROPOSED TRAILWAY ALTERNATIVES
SEGMENT 8: ALTERNATIVE B
LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN



GENERAL LEGEND

- State Trunkline
- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
- Recommended SLBE Wilderness Boundary **(1981)**
- SLBE Boundary
- Rivers
- Lakes
- Village Boundaries
- Township Boundaries
- Aquatic Bed
- Forested
- Agricultural

N W E S

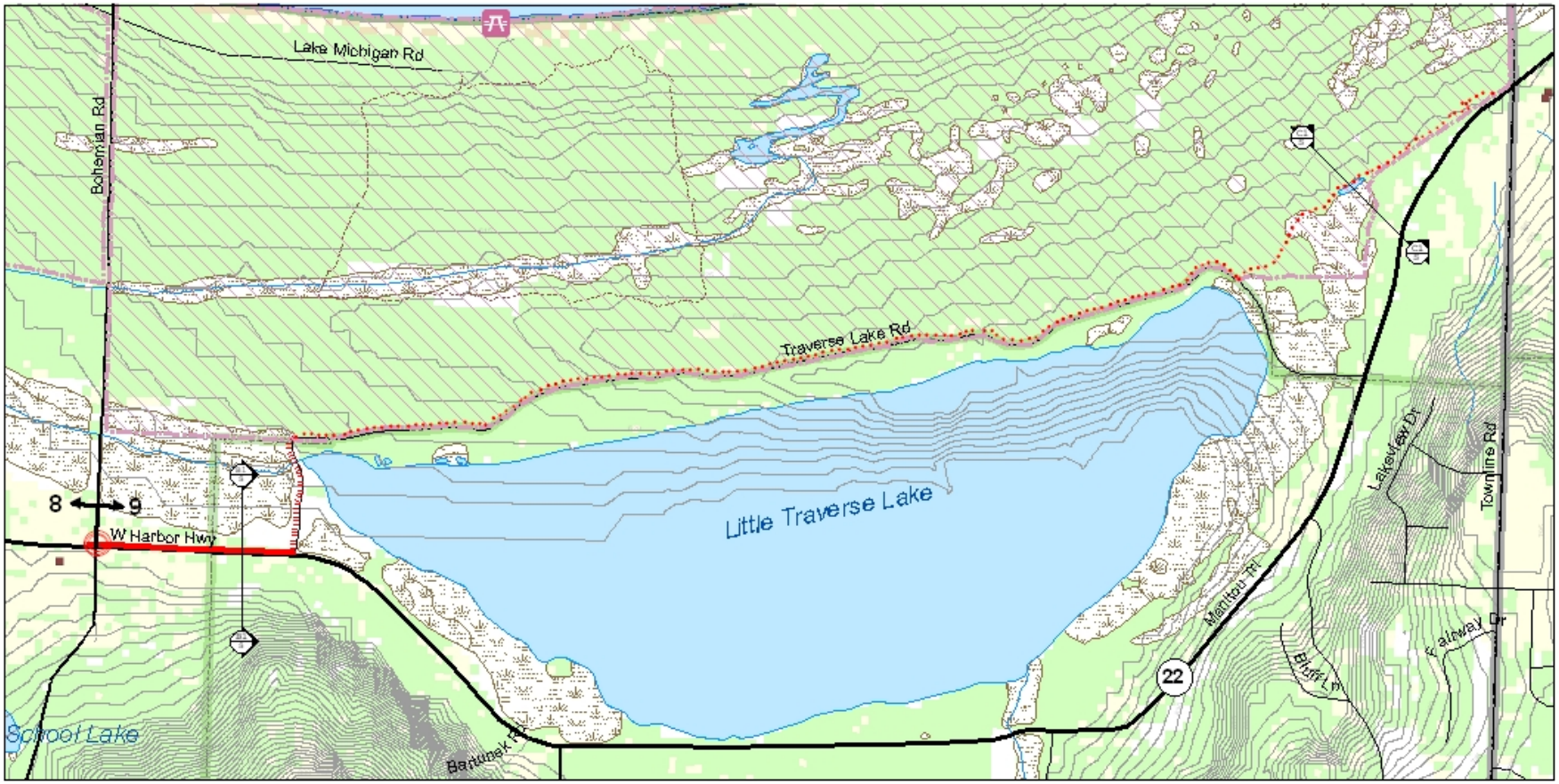
Base GIS Data: Michigan Framework Data
1992 National Land Cover Dataset
1992 National Wetlands Cover Dataset
National Park Service
NAD 1983 UTM ZONE 16N

TRAIL SURFACE LEGEND

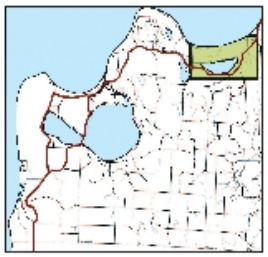
- Asphalt
- Crushed Limestone
- Boardwalk
- On-Road Bike Lane
- Existing Gravel Road
- Road Crossing Location

0 375 750 1,500 2,250 3,000
Feet

GoslingCzubak
engineering services inc.



MAP 2.18a - PROPOSED TRAILWAY ALTERNATIVES
SEGMENT 9: ALTERNATIVE B
LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN



GENERAL LEGEND

- State Trunkline
- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
- Recommended SLBE Wilderness Boundary **(1981)**
- SLBE Boundary
- Rivers
- Lakes
- Village Boundaries
- Township Boundaries
- Aquatic Bed
- Forested
- Agricultural

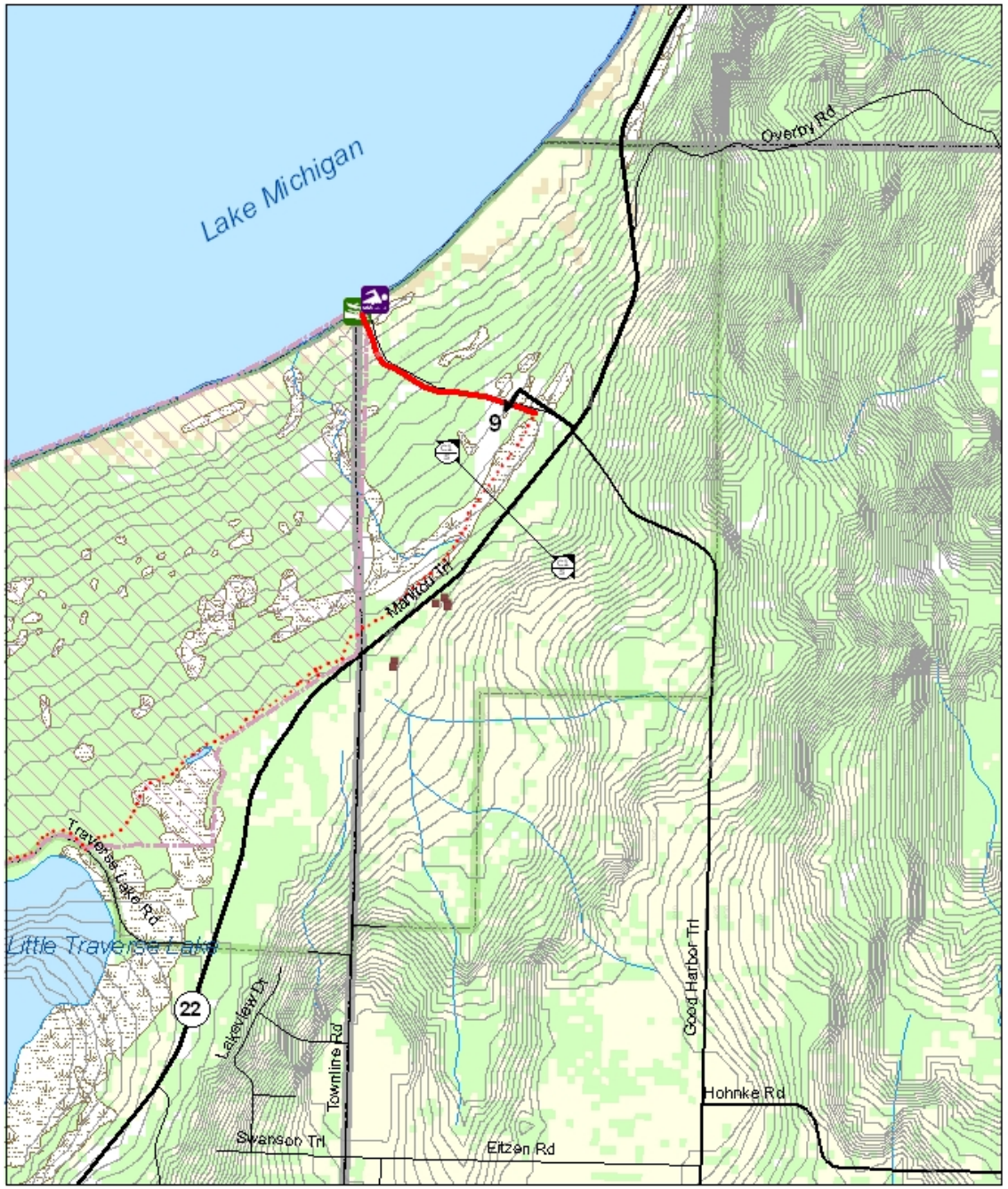
N
W E
S

TRAIL SURFACE LEGEND

- Asphalt
- Crushed Limestone
- Boardwalk
- On-Road Bike Lane
- Existing Gravel Road
- Road Crossing Location

0 375 750 1,500 2,250 3,000
Feet

GoslingCzubak
engineering services inc.

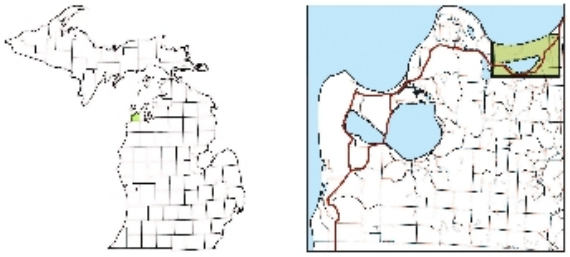


MAP 2.18b - PROPOSED TRAILWAY ALTERNATIVES
SEGMENT 9: ALTERNATIVE B

LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN

TRAIL SURFACE LEGEND

- Asphalt
- Crushed Limestone
- Boardwalk
- On-Road Bike Lane
- Existing Gravel Road
- Road Crossing Location



GENERAL LEGEND

- State Trunkline
- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
- Recommended SLBE Wilderness Boundary **(1981)**
- SLBE Boundary
- Rivers
- Lakes
- Village Boundaries
- Township Boundaries
- Aquatic Bed
- Forested
- Agricultural

0 375 750 1,500 2,250 3,000 Feet

N W E S

Base GIS Data: Michigan Framework Data
1992 National Land Cover Dataset
1992 National Wetlands Cover Dataset
National Park Service
NAD 1983 UTM ZONE 16N

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2.3.4 ENVIRONMENTALLY PREFERABLE ALTERNATIVE

The Environmentally Preferable Alternative is defined as the alternative that causes the least damage to the biological and physical environment and would best preserve, protect, and enhance historic, cultural, and natural resources. The National Environmental Policy Act (NEPA) – Section 101(b) identifies six criteria to help define the Environmentally Preferable Alternative. The Act directs that federal plans should:

1. Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.
2. Assure for all Americans, safe, healthful, productive, and aesthetically and culturally pleasing surroundings.
3. Attain the widest range of beneficial uses of the environment without degradation, risk to health and safety, or other undesirable and unintended consequences.
4. Preserve important historical, cultural, and natural aspects of our natural heritage, and maintain, whenever possible, an environment which supports diversity and variety of individual choice.
5. Achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities.
6. Enhance the quality of renewable resources and approach the maximum attainable recycling of resources.

The No-Action alternative, which represents "business as usual," would cause the least damage to the biological and physical environment, since no new construction would be implemented (realizes criterion 1). Lakeshore visitors, mostly bicyclists, would continue to use existing state highways and county roads. Hiking would continue on existing trails. The No-Action alternative would not fully realize criteria 2, 3, 4, and 5 to the same extent as alternatives A and B (the preferred) because it offers fewer recreational opportunities. It would not realize criterion 2 because visitors would use road shoulders (where available) and safety concerns would be paramount. It also would not realize criterion 6 because no resource recycling would occur, such as the use of renewable, sustainable construction materials.

Alternative A would cause some damage to the biological and physical environment due to new construction. Non-native plants may establish and follow routes of new construction. However, much of the construction would occur in disturbed areas in the highway right-of-way, so any impact would be reduced. Criterion 2 would be realized, because most of the trail would be separate from the highway surface to provide a safe experience. Only in a few instances, because of physical limitations, would the road shoulder be used as the trail. Criteria 3-5 would be fully realized. This alternative would provide additional access to natural, cultural, and recreational resources; would provide alternative modes of transportation; and provide greater opportunities for interpretation (e.g., narrow gauge railroad, Glen Haven, and ponds and wetlands). Renewable, sustainable construction materials would be used to the extent possible.

Alternative B, the preferred alternative, would cause some damage to the biological and physical environment due to new construction. Non-native plants may establish and follow routes of new construction. However, much of the construction would occur in disturbed areas in the highway right-of-way, so impact would be reduced. In keeping with the concept of this alternative, however, in some areas the trail would diverge from the highway right-of-way and, in some cases, would be constructed in areas of very little previous disturbance. Criteria 2-5 would be realized, to an even greater extent than alternative A, since the divergent route locations would provide an array of recreational, cultural, and interpretive opportunities. Renewable, sustainable construction materials would be used to the extent possible.

Overall, the No-Action alternative is the one that causes the least damage to the biological and physical environment and would best preserve, protect, and enhance historic, cultural, and natural resources; it is the environmentally preferred alternative.

2.3.5 ALTERNATIVES AND/OR OPTIONS THAT WERE ELIMINATED (Appendix – Optional Trail Route Maps)

Trail Segment 1 - Option 1.1 (east side of M-22) was not considered due to excessive wooded gradient and a private residence within the potential trail routing.

Trail Segment 4 - Option 4.4 was considered initially as an alternative to allow a safer access route from Segment 4 around the steep gradient and curving right-of-way north of Welch Road. With field assessment of Option 4.3 and input from the NPS staff it was determined that 4.4 would not be feasible, practical or necessary when option 4.3 would be superior.

Trail Segment 6 - Option 6.3 was considered initially as a possible link from the Glen Arbor urbanized area but required significant procurement of private right-of-way and/or property although the NPS temporarily designated a recreational easement along logging road/trail accessing from West Crystal View Road.

An alternative that kept the trail only on road rights-of-way was dismissed, as this was not physically feasible in some locations or the safety concerns were too great.

2.3.6 BEST MANAGEMENT PRACTICES AND MITIGATION FOR THE ACTION ALTERNATIVES

Best Management Practices (BMP's) are recommended for each action alternative in order to minimize potential adverse effects associated with Trailway implementation. The BMP's would be incorporated into construction bid packages and specifications in order to reduce potential adverse effects on Trailway project sites. The following BMP's would be utilized along with more project-specific measures during the implementation of the Trailway construction phase. These BMP's were also considered to be in effect when conducting the impact analysis in the Environmental Consequences section (see section 2.6).

National Park Service BMP's and more specific BMP's for trail systems should be further explored, adapted, and/or created to meet specific needs of the Alternative Trail segments implemented for the Trailway. The following list is not intended to be comprehensive nor project specific but provides an example framework that should be further developed.

Resource Protection Measures / Best Management Practice Framework	
Resource Category	**BMP Goals and general description**
Topography; Soils	In order to minimize significant earthwork, landform change construction limits would be marked prior to beginning any work under the proposed contract. Every effort would be made to utilize native soils and prevent establishment of non-native plants. Imported soils will be sterilized or otherwise treated to be weed free. Standard erosion control best management practices, including silt fencing, would be used in areas of steep topography. Erosion control would also include prompt temporary / permanent restoration to disturbed areas in order to reduce destructive erosion. Stock piling and placement of fill material and/or existing soil would be verified by NPS staff and private consultant.
Wetlands; **Streams / Creeks**	The contractor would be required to use best management practices, as well as follow and comply with all federal, state and local ordinances and guidelines when working in or near regulated wetlands. Standard practices would include sediment control fencing, limited construction area, and other suitable measures to protect wetlands.
Wildlife	Workers would maintain a defined work area perimeter and would keep all construction – related effects within construction limits. Construction activities would not be allowed at night in order to allow wildlife to return to their roosts or dens, and forage in areas within the project vicinity. A construction schedule would be required by the contractor indicating progress and operating hours in order to limit construction activities to a desired time frame.
Vegetation	In order to minimize significant earthwork, landform change construction limits would be marked prior to beginning any work under the proposed contract. Standard erosion control best management practices, including silt fencing, would be used in areas of steep topography. A professional biologist or NPS staff would prepare a list of native plant species that would be affected by the project and identify a plan for relocating plants. If required, other plant species within the construction vicinity would be marked and flagged with protective fencing. Weed free mulch will be sterilized if required. At the completion of the project, restoration would occur, which would include soil preparation and native seeding and planting.
Land Use	A project schedule would be required in order to limit disturbance to private housing developments and commercial businesses within the vicinity of the Village of Empire and Glen Arbor. Provide adequate orientation to construction personnel prior to construction to limit potential conflicts with existing land use.
Cultural Landscape/ **Historic Resources;** **Viewsheds**	Implement ground-disturbing actions that avoid potential disturbance to existing cultural landscapes and historic sites. Include resource protection measures in the construction documents to protect existing resources. Set construction limits that are clearly marked and instruct workers to avoid conducting activities beyond the construction limits. To ensure a safe working environment and protection of existing resources a safety supervisor and/or quality control officer would be required of the contractor. Provide adequate orientation to construction personnel prior to construction to limit potential conflicts with existing land use.
Safety; Lakeshore Visitor Experience; Park Operations	The contractor would be required to schedule activities in consultation with NPS staff to minimize conflicts with daily park operations and other park projects. Include resource protection measures in the construction documents to protect existing resources. Set construction limits that are clearly marked and instruct workers to avoid conducting activities beyond the construction limits. To ensure a safe working environment and protection of existing resources a safety supervisor and/or quality control officer would be required of the contractor. Provide adequate orientation to construction personnel prior to construction to limit potential conflicts with existing land use.

2.3.7 COMPARISON OF ALTERNATIVES

The following chart compares the Trailway alternatives to objectives in Purpose and Need Section 2.1.

Comparison of Trailway Alternatives			
ALTERNATIVE	**NO-ACTION**	**A**	**B (THE PREFERRED)**
ALTERNATIVE CONCEPT	There are no non-motorized, hardened surface trails within the M-22/M-109 corridors. Only the Pierce Stocking Scenic Drive is designated for bicycle use, with a shared lane adjacent the road surface. Currently, bicyclists are limited to the road shoulder along M-22, M-109, and county roads.	A separate off road non-motorized trail would be constructed in the M-22/M-109 rights-of-way to the extent possible, only deviating where necessary due to physical or environmental constraints. It would be a contiguous non-motorized trail of over 27 miles commencing from the southern Leelanau County line at Manning Road to County Road 651 at Good Harbor Beach. Access to the trail would be made at the existing Lakeshore trailheads and designated visitor parking areas.	A separate off road non-motorized trail would be constructed in the M-22/M-109 right-of-way, in many areas, but deviating from the highway corridor where possible to avoid physical or environmental constraints, provide access to natural, cultural, or recreation resources, and to promote a broader variety of experiences for the Trailway user. It would be a contiguous non-motorized trail of over 27 miles commencing from the southern Leelanau County line at Manning Road to County Road 651 at Good Harbor Beach. Access to the trail would be made at the existing Lakeshore trailheads and designated visitor parking areas.
SEGMENT 1	Not applicable	The west side of M-22 would be used to establish a crushed limestone pathway from Manning Road north to Stormer Road. A new trailhead would be located near Manning Road. A variation from the right-of-way would be made to descend a steep gradient along M-22 where an old gravel pit (Scussel pit) has been restored by the NPS. The route north of Stormer Road would continue within the right-of-way on the west side. The Trailway segment provides access to the Empire Bluffs Trail from Wilco Road.	The trail would start at the intersection of Manning Road and Norconk Road. A new trailhead would be located near this location intersection. The trail would head north following Norconk Road on the west side as a 10' separated crushed limestone path. The trail turns and heads east along the north side of Stormer Road. A crushed limestone surface would be utilized in this segment to integrate with the historic Tweddle-Treat Farms and cultural landscape. As the Trailway leaves Stormer Road, it changes to a 10' wide asphalt cross section and follows an existing utility right-of-way, crossing Wilco Road. The route then deviates into the wooded area on the west side of M-22 using some ridgelines and relatively gentle gradient to emerge back in the M-22 right-of-way before the Lakeshore entrance sign. Steep side slope areas would necessitate excavation and possible retaining walls before and after the entrance sign. An M-22 crossing could be located at the New Neighborhood. This segment of the Trailway would provide an open vista of the historic fields and buildings of the Tweddle-Treat cultural landscape. Wayfinding information would be developed at an appropriate location to assist Trailway users in accessing the Empire Bluffs Trail (hiking only) and the cultural landscape.

ALTERNATIVE	NO-ACTION	A	B (THE PREFERRED)
SEGMENT 2	Not applicable	The Trailway would enter the Village of Empire along the M-22 right-of-way. The Village Council would determine the trail route within the Village of Empire, but access to the Lakeshore Visitor Center, the downtown area, and the beach should all be considered in route planning. For purposes of this alternative, the following possible trail route is described: The Trailway routing would continue within the Village of Empire using existing road right-of-way through the Quercus Alba (New Neighborhood) and Beaver Creek neighborhoods. The Lakeshore Visitor Center would provide restrooms and information. Trailway users would also have direct access to the Village of Empire via streetscape sidewalk and streets immediately to the east of the Visitor Center. The Trailway would use Ottawa Street as a crossing location at M-22 at the north end of the Village. A new paved section in the right-of-way along the northwest side of M-22 would be developed to LaCore Road, then north to Fisher Street via striped and signed bike lanes on both sides. From there the Trailway would be an adjacent doubled striped bike-lane along the east side of LaCore to Bar Lake Road in the county road right-of-way. The Trailway would cross to the north side of Voice Road and continue east to the intersection at M-22 as an off-road asphalt path. The Trailway segment provides a direct link to the North Bar Lake public beach access.	The Trailway routing could continue within the Village of Empire by using existing road right-of-way through the Quercus Alba (New neighborhood) and Beaver Creek neighborhoods. With oversight from MDOT, a north-south oriented M-22 crossing could be implemented and a north-south oriented M-72 crossing accessing Trailway users to the Visitor Center. The facility provides public restrooms, information, interpretive displays, and other support facilities open to the public during regular business hours. Trailway users could also have direct access to the Village of Empire. Continuing through the Beaver Creek development, the Trailway could use Ottawa Street as a crossing location at M-22 at the north end of the Village. A new paved section in the right-of-way along the northwest side of M-22 could be developed to LaCore Road in the Village of Empire, then north to the Village limits. From there the Trailway could travel along the west side of LaCore to Bar Lake Road in the county road right-of-way. The Trailway would continue along the north side of Voice Road on Lakeshore property to avoid impacts to the designated Natural Beauty Road and continue east to the intersection at M-22. This section would require a minor creek/wetland crossing along LaCore Road and addressing several side slope and grading challenges north of Voice Road, including near the Trailway's intersection with M-22 where Segment 3 begins. The Trailway segment provides a direct link to the North Bar Lake public beach access, although the existing access on Bar Lake Road is gravel. Wayfinding information could be added at the Voice Road-Bar Lake Road intersection to assist Trailway users with accessing North Bar Lake facilities.

ALTERNATIVE	NO-ACTION	A	B (THE PREFERRED)
SEGMENT 3	Not applicable	The Trailway continues from Voice Road at M-22 and along the M-22 and M-109 right-of-way on the west side of the road. The Trailway would include a new asphalt path from Voice Road to Pierce Stocking Scenic Drive. This segment provides access to hiking trailheads, loops and support facilities at Pierce Stocking Scenic Drive and the Windy Moraine Trail parking area. Information would be provided regarding the challenge level and safety considerations for riders interested in using Pierce Stocking Scenic Drive, since it is a very challenging bicycling experience.	The grade falls away near the intersection of Voice Road and M-22 and includes roadway guardrail and overhead utilities. MDOT would need to approve some additional fill material and trail grading at the corner within the utility right-of-way, as well as the alignment of the trail to allow safe access around this corner. The Trailway continues from its intersection with M-22 to M-109 in the right-of-way on the west side of the road. The Trailway would include a new 10' wide asphalt cross-section from Voice Road to Pierce Stocking Scenic Drive. Considerations for Trailway construction in this area include side slopes, existing mature trees, and proximity to the road (see Chapter 4 - Trail Cross-section Development). The Trailway segment provides access to hiking trailheads, loops and support facilities at Pierce Stocking Scenic Drive and the Windy Moraine Trail parking area. Wayfinding information would be added to assist Trailway users in recognizing other existing facilities in the area. Trailway users would be able to use the parking area at Pierce Stocking Scenic Drive as a trailhead. Information would be provided regarding the challenge level and safety considerations for riders interested in using the Pierce Stocking Scenic Drive, since it is a very challenging bicycling experience. A connecting trailhead link would connect the parking area to the main Trailway along M-109.
SEGMENT 4	Not applicable	The Trailway continues on the west side of the M-109 right-of-way to Hunter Road at the Dune Climb.	North of the Scenic Drive, the Trailway would veer to the northwest on an old logging road outside of the right-of-way. An asphalt path would take the trail user through a wooded area and emerge on Greenan Road. An adjacent pathway along this gravel county road would be paved to the M-109 right-of-way where it would continue along M-109 until Hunter Road.

ALTERNATIVE	NO-ACTION	A	B (THE PREFERRED)
SEGMENT 5	Not applicable	Hunter Road is used as a Trailway link to the Dune Climb and the Dune Center. The Trailway would follow a boardwalk constructed on the northwest side of the M-109 right-of-way. The boardwalk would continue northwest, then use the historic narrow gauge railway bed that bisects the shrub-scrub wetland at the base of the dune. An asphalt path would continue to Harwood Road. From there, the old narrow gauge rail bed would be used for continuation of a 10" limestone path connecting north to Dune Valley Road and continuing into the Glen Haven Historic District. Continuing due east, the Trailway would be a 10' limestone path using an existing county road (two-track) access to D.H. Day Campground. The Trailway would use the existing campground gravel road and connect with the M-109 corridor to the south. The Trailway would then continue as an asphalt path on the south side of M-109 running east-west from Stocking Drive to South Forest Haven Drive, connecting to Glen Arbor. The Trailway segment provides access to hiking trailheads, loops and support facilities at the Glen Haven Maritime Museum, Glen Haven Village, D.H. Day Campground, and Alligator Hill.	Hunter Road links the Trailway to the Dune Climb, a major attraction within the Lakeshore. The Trailway would cross the perimeter of the parking area. A wide cleared area to the east of the parking area would allow for an asphalt path to be developed adjacent to, but separate from, the Duneside Accessible Trail. The route then utilizes the historic narrow gauge railway that extends to Harwood Drive. From Harwood Drive, near the D.H. Day Group Campground, the narrow gauge rail bed would be used for continuation of a 10' limestone path connecting north to Dune Valley Road and continuing into the Glen Haven Historic District. An existing two-track road would be used to connect the railroad grade route with M-209 in Glen Haven. A limestone path using an existing county road (two-track) would provide access to D.H. Day Campground. The Trailway would then use Pine Haven Road right-of-way as an separate paved path to avoid the user conflicts associated with the D.H. Day Campground access road. After crossing M-109, asphalt Trailway would use an existing unmarked two-track trail running east-west along the base of the Alligator Hill escarpment from Stocking Road to South Forest Haven Drive, connecting to Glen Arbor.

ALTERNATIVE	NO-ACTION	A	B (THE PREFERRED)
SEGMENT 6	Not applicable	The Glen Arbor Township Board would be counseled to determine the best way through Glen Arbor. For purposes of this alternative, the following trail route possibility is described: From Sylvan Street the Trailway would use the existing paved shoulder of M-109. It would continue four blocks east to Oak Street, with bike lanes on both sides of M-22. Trailway signage would guide trail users through Glen Arbor on existing streets. The Trailway would widen to an asphalt pathway within the existing M-22 and/or utility right-of-way on the southeast side of the road along the Crystal River to West Crystal View Road (CR 675). A boardwalk section would be installed for several hundred feet in the vicinity of the bicycle club rest area across from the gasoline service station. Once across West Crystal View Road, the Trailway would continue along M-22 on the south side as an asphalt pathway within the existing M-22 roadway. A boardwalk would be installed along a very narrow pinch point on the approach to the auto/pedestrian bridge. From the bridge, the Trailway would continue as an off-road asphalt path located on the south side of the right-of-way. The Trailway would then pass the entrance of The Homestead and cross to the north side of M-22 near Westman Road.	The Glen Arbor Township Board would be counseled to determine the best way through Glen Arbor. For purposes of this alternative, the following trail route possibility is described: Through Glen Arbor, the Trailway would be a paved shoulder on both sides of M-109. It would continue two blocks east to Ray Street (M-22), then south one block to State Street at the Township Park, then east to Oak Street, and then north on Oak Street, back to the M-22 right-of-way. Trailway signage would guide trail users through Glen Arbor on existing streets. The Trailway would widen to an asphalt pathway within the existing M-22 and/or utility right-of-way on the southeast side of the road along the Crystal River to West Crystal View Road (CR 675). A boardwalk section would be installed for several hundred feet in the vicinity of the bicycle club rest area across from the gasoline service station. An asphalt path would be installed along the south side of West Crystal View Road. A river crossing would occur at three existing culvert locations on the Crystal River. Boardwalk sections would be needed for several hundred feet in multiple areas, in particular along the Crystal River bend. Trail users would cross the Crystal River on a separate pedestrian bridge, which would span the river on the south side of the road and continue to Westman Road on an off-road asphalt path on the east side. Another boardwalk (as long as 1000') would be necessary to traverse wetlands on the west side of Westman Road, near Tucker Lake. From that point, the Trailway would continue north as an off-road asphalt path located on the west side of the right-of-way up to the entrance of The Homestead, near Westman Road.

ALTERNATIVE	NO-ACTION	A	B (THE PREFERRED)
SEGMENT 7	Not applicable	From Westman Road, the Trailway would use the M-22 right-of-way on the west side of the road as an off-road asphalt path to the intersection of M-22 and Thoreson Road, near the split at M-22 "Y' intersection. The Trailway would leave M-22 and continue a short distance north on Thoreson Road to access to the Bay View Trail. Here it would be maintained as a crushed limestone path from Thoreson Road to Port Oneida Road.	As with alternative A, the Trailway would use the M-22 right-of-way on the west side of the road as an off-road asphalt path from The Homestead to the intersection of M-22 and Thoreson Road. The Trailway would then divert north on Thoreson Road to access the lower section of the Bay View Trail, currently not open for bicycle use. The Trailway would then cross Thoreson Road at a safe distance past the "Y" intersection, and continue on the Bay View Trail. This section of the Bay View Trail would be a 10' crushed limestone path from Thoreson Road to Port Oneida Road.
SEGMENT 8	Not applicable	Trailway connects south back to M-22 along the Port Oneida Road right-of-way. From the intersection of Port Oneida Road, the Trailway would be on the north side of the M-22 right-of-way as an off road 10' crushed limestone path. It would use the M-22 right-of-way past South Basch Road and North Unity School. The Trailway would then align along the M-22 right-of-way below the road embankment and guardrail at Narada Lake. A boardwalk would provide a unique nature experience along this water resource, avoiding the hazardous proximity and tight right-of-way of a roadside route. From Narada Lake, the Trailway would continue as an off road asphalt section on the north side of the right-of-way to the Bohemian Road (CR 669) and M-22 intersection.	Trailway connects south back to M-22 along the Port Oneida Road right-of-way. From Port Oneida Road to the Port Oneida Rural Historic District boundary just east of Narada Lake, the Trailway would be an off-road 10' crushed limestone path. It would deviate from the right-of-way to approach the North Unity School from an interior aspect. A boardwalk along the M-22 bridge would provide a unique nature experience along Narada Lake. From the Port Oneida Rural Historic District boundary, the Trailway would continue as an off-road asphalt section on the north side of the right-of-way to the Bohemian Road (CR 669) and M-22 intersection.

ALTERNATIVE	NO-ACTION	A	B (THE PREFERRED)
SEGMENT 9	Not applicable	The Trailway would be an off-road asphalt path on the north side of M-22 up to Traverse Lake Road, past Bartunek Road and continue along the M-22 right-of-way to the east end of Traverse Lake Road. A crossing would occur at Traverse Lake Road and the Trailway route then proceeds as an off-road crushed limestone trail to the Bufka Farm. The proposed Trailway would route past the Bufka property along the north side of M-22, using the glacial ridges and valleys below the M-22 corridor as needed. It would end at the Good Harbor Trail/Townline Road (CR 651) and M-22 intersection. The Trailway provides access from there to Good Harbor Beach (CR 651) swimming beach and other Lakeshore facilities. A trailhead would be located on the SE corner of the intersection of Townline Road and M-22. A more formal parking area and safe crossings with pavement striping, advanced warning, and wayfinding signage would be developed.	The Trailway would be a 10' off-road asphalt section on the north side of M-22 up to Traverse Lake Road. The Trailway turns north on the west side of Traverse Lake Road onto an off road boardwalk within the county road right of way. It continues as a separate 10' off road path on the north side of Traverse Lake Road either within the county road right-of-way or on Lakeshore property south of proposed wilderness. The trail would then follow an old two track road that runs from the northeast end of Little Traverse Lake to behind the Bufka Farmstead. After the farm, the Trailway would stay below the M-22 right-of-way, to the extent possible, using the glacial ridges and valleys below the M-22 corridor. The steep embankment and narrow right-of-way with guardrails on both sides would be avoided with this routing; however, the lowland areas present some challenge for Trailway construction. The Trailway ends at the Good Harbor Beach parking facility at the end of County Road 651. The Trailway segment provides access to Good Harbor Trail (CR 651) and Good Harbor Beach. Wayfinding information would be added to assist Trailway users in recognizing the existing Lakeshore facilities at the end of Good Harbor Trail. A trailhead could be located at the parking facility with improvements such as safe crossings with pavement striping, advanced warning and signage.

2.3.8 IMPACTS OF THE TRAILWAY ALTERNATIVES

The following table identifies the impacts of the alternatives on the nine impact topics described in Section 2.4, "Affected Environment." Detailed impact analyses are found in Section 2.5, "Environmental Consequences."

Impacts of the Trailway Alternatives

IMPACT TOPIC	NO-ACTION ALTERNATIVE	ALTERNATIVE A	ALTERNATIVE B (PREFERRED)
TOPOGRAPHY	Short-term and long-term: none Cumulative: short-term minor adverse; long-term minor to moderate beneficial	Short-term and long-term minor adverse Cumulative: short-term minor to moderate adverse, long-term minor adverse	Short-term and long-term minor adverse Cumulative: short-term and long-term minor adverse
WETLANDS AND WATER QUALITY	Short-term and long-term: none Cumulative: short-term and long-term minor adverse	Short-term and long-term minor adverse Cumulative: Short-term and long-term minor adverse	Short-term and long-term minor adverse Cumulative: Short-term and long-term minor adverse
VEGETATION AND WILDLIFE	Short-term and long-term: none Cumulative: short-term and long-term minor adverse	Short-term and long-term minor adverse Cumulative: short-term and long-term minor adverse	Short-term moderate adverse, long-term minor adverse Cumulative: short-term and long-term minor adverse
MICHIGAN STATE-LISTED SPECIES	Short-term and long-term: none Cumulative: short-term and long-term minor adverse	Short-term moderate adverse, long-term minor adverse Cumulative: short-term and long-term minor adverse	Short-term moderate adverse, long-term minor adverse Cumulative: short-term and long-term minor adverse
SOILS	Short-term and long-term: none Cumulative: short-term and long-term minor adverse	Short-term and long-term minor adverse Cumulative: short-term and long-term minor adverse	Short-term moderate adverse, long-term minor adverse Cumulative: short-term and long-term minor adverse
SOCIOECONOMICS	Short-term and long-term: none Cumulative: short-term and long-term negligible beneficial	Short-term and long-term negligible to minor adverse and beneficial Cumulative: short-term and long-term negligible beneficial	Short-term and long-term negligible adverse and beneficial Cumulative: short-term and long-term negligible beneficial
CULTURAL RESOURCES	Short-term and long-term: none Cumulative: none	Short-term and long-term: none Cumulative: none	Short-term and long-term: none Cumulative: none
VISITOR OPPORTUNITIES AND USE	Short-term and long-term: none Cumulative: short-term and long-term minor beneficial	Short-term and long-term moderate beneficial Cumulative: short-term and long-term minor beneficial	Short-term and long-term moderate beneficial Cumulative: short-term and long-term minor beneficial
OPERATIONS AND MAINTENANCE	Short-term and long-term: none Cumulative: short-term and long-term minor adverse	Short-term and long-term major adverse Cumulative: short-term and long-term minor adverse	Short-term and long-term major adverse Cumulative: short-term and long-term minor adverse

2.4 AFFECTED ENVIRONMENT

This chapter describes the existing environment in the vicinity of the Trailway. Because of the linear nature of this project, many different environments are encountered. The focus here is on elements (e.g. natural and cultural resources, visitor use) that would be impacted by the trail alternatives, should they be implemented. These topics, called "impact topics," were selected on the basis of federal law, regulations, executive orders, NPS expertise, and concerns expressed by other agencies, the Trailway committee, or members of the public during project scoping.

Described below is a brief explanation for the selection of each impact topic, as well as rationale for dismissing specific topics from further consideration.

2.4.1 IMPACT TOPICS SELECTED FOR ANALYSIS

The preliminary impact topics identified and evaluated early in the planning process assisted in developing the array of alternatives. These preliminary impact topics were evaluated against possible trail alignment options (see Appendix - Trail Route Option Maps) to help define problem areas at an early stage in the process. Nine impact topics were originally selected for analysis on *Impact to the Environment* while five were selected for analysis for *Impact to Feasibility*. Due to consolidation and other factors, the following impact topics are carried forward in the Environmental Consequences (section 2.5) of this document:

Topography was retained due to the extensive relief of the Lakeshore. Topography is a key factor when planning a trail system, for accessibility as well as constructability considerations. In addition, many popular park features relate to topographic land forms.

Wetlands and Water Quality is a new impact topic that combines preliminary impact topics ***Wetlands*** and ***Streams and Creeks.*** Wetlands exist within the project area, and some alternatives cross areas of wetlands. The action alternatives would require stream crossings at some locations, using boardwalks or bridges.

Vegetation and Wildlife also were combined. Because a discussion of potential impacts to wildlife necessarily involves discussion of wildlife habitat, which is primarily the vegetation communities within the park, vegetation and wildlife are addressed together. Preliminary analysis of potential impacts to the vegetation and wildlife resources of the Lakeshore indicated that impacts could be associated with two primary activities: visitor use and development of infrastructure.

Michigan State-Listed Species was separated from the ***Wildlife*** impact topic and is retained since some Michigan state-listed species may be impacted by the action alternatives.

Soils was retained as an impact topic due to the importance of existing soil type and the relationship to trail constructability and susceptibility during and after construction. Soil associations were considered for soil type (hydric, silty, sandy), permeability, gradient (slope), and erosion factors.

Socioeconomics is a new topic that includes ***Land Use***, as well as information on population, economics, demographics, and highway traffic.

Cultural Resources is retained as an impact topic because a number of these resources have the potential to be affected by the alternatives considered. It has been renamed.

Visitor Opportunities and Use was selected as an impact topic because of increased opportunities for visitors, as well as possible negative impacts to other visitor uses. This topic incorporates the ***Recreational Experience, Visitor Experience, Safety,*** and ***Viewsheds*** preliminary impact topics.

Operation and Maintenance was retained as an impact topic because it is expected the Trailway has the potential to affect park operations and management, MDOT, and local jurisdictions. Operation and Maintenance was used as a preliminary impact topic to compare trail routing options and decide which options would be used to form an alternative.

2.4.2 TOPOGRAPHY

Landforms of the park were shaped by the continental glaciation of the Wisconsin stage as well as earlier glacial periods of the Pleistocene Era. Additionally, fluctuating water levels of the ancient lakes that preceded Lake Michigan, along with wave and wind action, created the National Lakeshore's truncated headlands and fashioned the perched dunes and embayment lakes of the park.

The glacial ice of some 50,000 years ago followed ancient drainage patterns and excavated the basins that now form the lakes along the coastal area of this region. During the final advances of the Wisconsin stage of Pleistocene glaciation, the ice deposited large terminal and lateral moraines that form contemporary dunes and high points of the local geography. Ice Age glaciers, combined with enormous quantities of melt water and huge stranded blocks of ice, created entire valleys and left kettles or ice block lakes and depressions.

As the glaciers retreated, massive volumes of water either filled the Lake Michigan basin or were drained from it – depending upon the extent of glaciation and the development of drainage channels that allowed the waters of ancient Lake Michigan (Lake Algonquin, Lake Nipissing, Lake Algoma, and Lake Chippewa) to deepen or drain away. New beaches were cut into the shorelines when the lake levels were high. As levels of Lake Michigan waters lowered, a succession of beaches was formed. These remnant beaches, examples of which can be seen at the Platte Basin, the Good Harbor Bay Region, and the Bay portion of South Manitou Island, reflect the shape of the ancient shorelines some distance from today's shoreline. The oldest of these ancient beaches are farthest from the present lake shoreline.

Later, rising lake levels combined with wind erosion of headlands that had once resisted glacial forces, directing ice flow with its sculpting action into the lowlands, thus forming many lakes. The steep bluffs of the National Lakeshore coastline (with such landmarks as the Empire Bluffs, Sleeping Bear Bluffs, Pyramid Point, the western bluffs of North and South Manitou Islands) are these headlands, now truncated and continually eroding through slumping and mass wasting.

These headlands also provided the materials that wind and wave action transformed into the sandbars cutting off the embayment lakes (such as Platte Lakes, North and South Bar Lakes, Glen Lake, Shell Lake, and Little Traverse Lake) from the parent ancient lakes. The exposed sand and gravel in these truncated morainal headlands was separated by the winds. The sand was blown to the top of high glacial moraines and created even higher "perched dunes" on top of the glacial moraines. Sleeping Bear Dunes, Empire Bluffs, Pyramid Point and the island dunes are examples of these perched dunes. Lower dunes between the headlands and moraines are found in the Platte Plains and Good Harbor areas.

Because of the effects of glaciation, and water and wind erosion, the topography within the project area varies greatly. Generally, the topography within the project vicinity has slopes of 5% or less; however, several localized areas do exceed 5% and range from moderate to steep slopes. The steepest slopes occur more in the southern segments, including in Segment 1 between Barracks Road and Stormer Road, a small section in Segment 2 along Voice Road, a section between W. Welch Road and Greenan Road in Segment 4, and a section between W. Crystal View Road and Westman Road near the Homestead in Segment 6.

2.4.3 WETLANDS AND WATER QUALITY

Wetlands

The National Lakeshore can be roughly categorized into three groups: classic bogs, interdunal wetlands, and wetlands associated with lakes or streams. The Lakeshore contains about 750 acres (300 hectares) of wetlands.

The Lakeshore contains a few classic bogs with good examples of floating mats. The plant species of these bogs include sphagnum peat moss (*Sphagnum* sp.), black spruce, water sedge (*Carex aquatilis*), cottongrass (*Eriophorum* sp.), speckled alder (*Alnus incana*), pitcher plant (*Sarracenia purperea*), Labrador tea (*Ledium groenlandicum*), bog laurel (*Kalmia polifolia*) leatherleaf (*Chamaedaphne calyculata*), cranberry (*Vaccinium macrocarpon*), and sundew (*Drosera* sp.). Examples of such bogs can be found in the Bow Lakes area.

Interdunal wetlands occur in the low areas or swales between the ancient beach ridges, remain wet much of the year, and are a component of the dune and swale complex. These wetlands contain an association of rushes (*Juncus* spp.) and sedges (*Carex* spp.), willows (*Salix* spp.), gray dogwood (*Cornus racemosa*), Joe-pye weed (*Eupatorium* sp.), and cardinal flower (*Lobelia cardinalis*) (NPS 2005a, NatureServe 2007). The dune and swale complex is one of the dominant physiographic and vegetative features of the Lakeshore, paralleling the shoreline and extending 1 to 2 miles inland in many areas. The dune and swale complex comprises most of the area from Otter Creek to the southernmost border of the Lakeshore.

Finally, wetlands are often found along the margins of streams, ponds, and lakes. Wetland plants in these settings may be submerged, emergent, or floating. Plants typical of these wetlands include cattail (*Typha latifolia*), pondweeds (*Potamogeton* spp.), arrowhead (*Sagittaria* sp.), bulrushes (*Schoenoplectus* sp.), sedges (*Carex* spp.), yellow pond-lily (*Nuphar lutea*), grass of Parnassus (*Parnassia glauca*), marsh cinquefoil (*Comarum palustre*), fringed gentian (*Gentianopsis crinita*), and bladderwort (*Utricularia* sp.) (NPS 2005a, NatureServe 2007).

There are four wetland areas associated with the proposed Trailway: 1) A small section of the former narrow gauge railroad associated with the Mill Pond near the Dune Climb. The former railroad runs through forested wetlands and limited areas of emergent and scrub-shrub wetlands. 2) In the vicinity of Glen Arbor and includes the floodplains of the Crystal River. 3) From the Narada Lake area east to Little Traverse Lake and beyond to Townline Road. The majority of wetlands are forested. 4) From Townline Road to Good Harbor Highway. These ridge and swale forested wetlands exist below an escarpment that runs along M-22 between the road corridor and the Lake Michigan shoreline.

Water Quality

The National Lakeshore waters include 26 named inland lakes of varying size and character; four sizable streams (all of Otter Creek and parts of the Platte River, Crystal River, and Shalda Creek); and many bogs, springs, and interdunal wetlands. All water bodies in the Lakeshore are designated Outstanding State Resource Waters. This designation indicates that no lowering of water quality is allowed for the designated high-quality water body.

During the mid-1980s, the U.S. Geological Survey collected water quality data on the Lakeshore's waters. It was found that the National Lakeshore had extremely good water quality with little or no excessive minerals or heavy metals. A biological study undertaken by NPS staff in 1988 showed that Lakeshore rivers and streams had all pollution-sensitive invertebrates present, indicating good water quality.

Three surface waters could be affected by the proposed Trailway: Crystal River, Narada Lake, and Shalda Creek. Various sections of the Trailway north of Glen Arbor either cross or parallel the Crystal River. All Trailway alternatives traverse the south shore of Narada Lake. Alternative B crosses Shalda Creek on Traverse Lake Road.

2.4.4 VEGETATION AND WILDLIFE

Vegetation

Pleistocene-era glaciers, glacial melt water, and subsequent wind and water erosion all shaped the landforms — including beaches, moraines, dunes, kettles, and embayment lakes — upon or around which plant communities are established. Lake Michigan moderates temperature fluctuations, influencing the climate, and therefore the vegetation, of the National Lakeshore. Winters are milder and summers are cooler along the shore of Lake Michigan than in more inland areas. The moderating effect of Lake Michigan, combined with regional air circulation patterns, provide a growing period of approximately 150 days near the shore — 50 days longer than areas several miles inland. Another lake effect on the National Lakeshore's climate is increased cloudiness in late fall and early winter. The cold, winter air mixing with warmer, moist air from the lake frequently produces greater amounts of snow, rain, and fog near the lake. This relatively temperate and humid climate of the near-shore environment strongly influences the plant communities within the Lakeshore.

Former land uses and resource exploitation or extraction have also impacted the Lakeshore's landforms and vegetative cover. The Lakeshore's protected landscapes and vegetation communities provide sanctuary to several threatened and endangered species as well as representative regional species of flora and fauna. At least 900 species of vascular plants, representing more than 100 taxonomic families, occur in the National Lakeshore. Major plant communities occurring in the Lakeshore are described below within broader vegetation resource categories, which are generally presented from the

shoreline landward.

Shoreline Vegetation. Beaches and sand dunes present harsh growing conditions characterized by strong winds, shifting sand, seasonally high surface temperatures, and dry conditions. Approximately 4,800 acres (1,920 hectares) of beaches and sand dunes occur in the Lakeshore. Vegetation starts just behind the “storm beach” of Lake Michigan. No vascular plants grow on the "storm beach" proper because of high waves, ice, and moving sand. The first dunes behind this beach support some pioneer plants, including beach or Marram grass (*Ammophila breviligulata*), Pitcher’s thistle (*Cirsium pitcheri*), sand cherry (*Prunus pumila*), and beach pea (*Lathyrus japonicus*). Further landward in more stabilized areas of the dunes, grass, forb and shrub species such as little bluestem (*Schizachyrium scoparium*), hoary pucoon (*Lithospernum cansescens*), and creeping juniper (*Junipernus horizontalis*) become established. **The Trailway route does not traverse this zone.**

Forest Resources. Landward of the grass and shrub dominated dunes area is typically a dynamic zone where the dunes and neighboring woodland or forest move back and forth as conditions change. In some sites containing actively moving dunes, the dunes zone encroaches directly onto the mature hardwood forest. More often, however, the dunes zone integrates with an open pine forest which includes red pine (*Pinus resinosa*), white pine (*Pinus strobus*), jack pine (*Pinus banksiana*), creeping juniper, and common juniper (*Juniperus communis*). Alternatively, the dunes zone may grade into an oak-aspen woodland that is comprised of bigtooth aspen (*Populus grandidentata*), quaking aspen (*Populus tremuloides*), red oak (*Quercus rubra*), white oak (*Quercus alba*), birch species such as yellow birch (*Betula alleghaniensis*) or paper birch (*Betula papyrifera*), and ground vegetation composed of bracken fern (*Pteridium aquilinum*), prince's pine (*Chimaphila* sp.), trailing arbutus (*Epigaea repens*), wintergreen (*Pyrola* sp.), blueberry (*Vaccinium* sp.), and partridgeberry (*Mitchella repens*). When lake levels go down and the beach and dune area is increased on the lakeward side of the zone, wind speed and sand abrasion at the forest or woodland edge decreases, permitting forest development. Oak-aspen woods cover about 3,300 acres (1,320 hectares) of the National Lakeshore, and “coastal forest,” of which oak-pine and birch-maple-aspen are two subtypes, covers an additional 11,000 acres (4,400 hectares).

Further inland, beyond the dynamic zone, a more mature forest is found. The climax forest of this region is primarily a beech-maple hardwood forest, known as the northern hardwood forest community (a subtype of the northern mesic forest). The trees are predominantly American beech (*Fagus grandifolia*) and sugar maple (*Acer saccharum*), but also include black cherry (*Prunus serotina*), white ash (*Fraxinus americana*), red oak, yellow birch, and green ash (*Fraxinus pennsylvanica*). Dwarf or bunchberry dogwood (*Cornus canadensis*), Canada mayflower (*Maianthemum canadense*), sweet cicely (*Osmorhiza berteroi*), columbine (*Aquilegia* sp.), trillium (*Trillium* sp.), and wild leeks (*Allium burdickii*) are represented in the understory and on the forest floor. Approximately 24,000 acres (9,600 hectares), or 42% of the Lakeshore’s land surface area, are covered with northern hardwood forest. **Much of the Trailway traverses this zone.**

Approximately 578 acres (234 hectares) of the Lakeshore are in plantations of conifers, including the native white pine and red pine, the uncertain native jack pine, and non-natives such as Douglas fir (*Pseudotsuga menziesii*), black spruce (*Picea mariana*), Scotch pine (*Pinus sylvestris*), Austrian pine (*Pinus nigra*), blue spruce (*Picea pungens*), and Norway spruce (*Picea abies*) (NPS 2005a, MNFI 2006a, USDA 2007).

Agricultural Landscapes. The Lakeshore includes open areas consisting of former farm fields and road edges. Native plants occasionally found in these areas include: goldenrod (*Solidago* sp.); pussytoes (*Antennaria* sp.); common milkweed (*Asclepias syriaca*); staghorn sumac (*Rhus typhina*); and several grasses; some non-native vegetation includes black-eyed Susan (*Rudbeckia hirta*), pearly everlasting (*Anaphalis margaritacea*), yarrow (*Achillea millefolium*).. Fields cover almost 7,900 acres (3,160 hectares) of the Lakeshore, or about 14% of its land surface area. **Some of the Trailway traverses this zone.**

Wildlife

Michigan wildlife is well represented at the Lakeshore, reflecting the variety of habitats. Documented wildlife include 74 species of fish, 18 species of amphibians, 17 species of reptiles, 46 species of mammals, and 247 species of birds. The following discussion provides a brief description of common inhabitants in the various habitats found within the Lakeshore and is not intended as an exhaustive list of species present.

Beaver (*Castor canadensis*), otter (*Lontra canadensis*), mink (*Neovison vison*), and muskrat (*Ondatra zibethicus*) occur in the Lakeshore's aquatic areas. Ducks and geese nest in the Lakeshore. Snapping turtles (*Chelydra serpentine*), painted turtles (*Chrysemys pictis*), leopard frogs (*Rana pipiens*), and spring peepers (*Pseudacris crucifer*) are some of the reptiles and amphibians found in and near aquatic and wetland habitats.

Common forest wildlife includes the white-tailed deer (*Odocoileus virginianus*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), fox squirrel (*Sciurus niger*), flying squirrel (*Glaucomys sabrinus*), eastern chipmunk (*Tamias striatus*), and the deermouse (*Peromyscus maniculatus*). Typical forest-dwelling birds include the ruffed grouse (*Bonasa umbellus*), pileated woodpecker (*Dryocopus pileatus*), downy and hairy woodpeckers (*Picoides pubescens* and *Picoides villosus*, respectively), red-breasted and white-breasted nuthatches (*Sitta canadensis* and *Sitta carolinensis*, respectively), black-capped chickadees (*Poecile atricapillus*), brown creepers (*Certhia americana*), barred owls (*Strix varia*), and great horned owls (*Bubo virginianus*). Wild turkeys (*Meleagris gallopavo*) are also present, but this is probably due to feeding programs by the state, because the Lakeshore is north of their native range. Garter snakes (*Thamnophis* spp.) and salamanders (*Ambystoma* spp.) occur in the forest as well.

In the meadows, fields, and dunes, representative birds include bobolinks (*Dolichonyx oryzivorus*), bluebirds (*Sialia sialis*), killdeer (*Charadrius vociferous*), meadowlarks (*Sturnella* spp.), horned larks (*Eremophila alpestris*), and northern harriers (*Circus cyaneus)*. Common mammals are deer, fox, and meadow voles (*Microtus pennsylvanicus*). The Lakeshore's open fields (several abandoned farms) provide valuable habitat for grassland nesting birds in the summer and for other wildlife throughout the year. Throughout much of North America, populations of open land (grassland-shrubland-early successional forests) birds have been declining dramatically, primarily in response to the loss of available habitat. The Lakeshore's approximately 160 species of nesting birds is one of the larger numbers among national park system units. This is because of the wide variety of undisturbed habitat and the lack of agriculture, grazing, and major development. The Lakeshore is an important area for the protection of nesting sites for vulnerable bird species and for stopover sites and resting for migratory birds. Migrant shorebirds like the semipalmated plover (*Charadrius semipalmatus*), ruddy turnstone (*Arenaria interpres*), sanderling (*Calidris alba*), and others can be found on Lakeshore beaches.

Trapping is prohibited In the Lakeshore. As a result, sightings of fox, coyote (*Canis latrans*), otter, and bobcat (*Lynx rufus*) have increased. In recent years, cougar (*Puma concolor*) sightings have been reported with increasing regularity.

The Lakeshore's aquatic habitats contain a number of fish species, including non-native rainbow trout (*Oncorhynchus mykiss*), brook trout (*Salvelinus fontinalis*), suckers (*Catostomus* spp.), several genera of shiners, and rock bass (*Ambloplites rupestris*), among others. Smelt (*Osmerus mordax*), sea lamprey (*Petromyzon marinus*), alewife (*Alosa pseudoharengus*), and zebra mussels (*Dreissena polymorpha*), are nonnative species that have a pronounced impact on the aquatic environment and native biota. The invasion of the sea lamprey, a nonnative species to the Great Lakes, has harmed the native lake trout (*Salvelinus namaycush)* stock. The alewife invasion of the Great Lakes has also caused major biological and shoreline fouling problems. A recent invader to the Great Lakes, the round goby (*Neogobius melanostomus)* is believed to be a prime factor in the 2006 and 2007 waterfowl die-offs (which were attributed to type E botulism) along Lake Michigan beaches within the Lakeshore.

The introduction of the coho (*Oncorhynchus kisutch*) and other species of salmon, such as the chinook to the area has resulted in a large seasonal supply of these fish in area streams, providing for a large sport fishery every late summer and fall. Fishing for coho salmon is concentrated near the mouth of the Platte River and Platte Bay, but sport-fishing activity occurs in other bays of Lake Michigan and also in the inland lakes.

2.4.5 MICHIGAN STATE-LISTED SPECIES

Plant and animal species listed as threatened, endangered, or species of special concern by the state are not afforded the same formal protection provided by the federal Endangered Species Act, but they are monitored and may one day become candidates for the federal list if their numbers continue to trend downwards. Those state-listed species that may be affected by the Trailway, and that are analyzed in the "Environmental Consequences" chapter, are described below:

Fascicled Broom-Rape. Fascicled broom-rape (*Orobanche fasciculata*) is listed as threatened in Michigan. This parasitic species reaches its easternmost distribution in the Great Lakes region, and in Michigan, is restricted to the Lake Michigan shore from Charlevoix to Oceana counties. Most occurrences are in Leelanau and Benzie counties. Fascicled broom-rape occurs in near-shore habitat in all three mainland units of the Lakeshore and on South Manitou Island.

Ginseng. Ginseng (*Panax quinquefolius*) is listed as threatened in Michigan. It is found in cool moist woods, in shade with rich soil. It has been documented in the Lakeshore and other areas in Benzie and Leelanau counties.

Prairie Warbler. The prairie warbler (*Dendroica discolor*) is listed as endangered in Michigan. This species is typically associated with old fields, shrub lands, and coniferous woodlands, as well as coastal dune areas. In the park, prairie warblers have been documented in the shrubby dune-forest interface along the mainland shoreline. Within the context of the dynamics natural to this tension zone between shifting dunes and encroaching forest, this habitat is thought to have been "stable" for thousands of years.

Common Loon. The common loon (*Gavia immer*) is listed as threatened in Michigan. Common loons are known to breed throughout northern North America and northern Europe, reflecting the general distribution of boreal coniferous and northern hardwood forests. Common loons breed on inland lakes that have an abundant population of fish and a large proportion of undeveloped shoreline. They prefer lakes with a small island or bog mat where it can hold the nest inaccessible to raccoons and other egg-eating predators and it is in an area of little or no high speed boat traffic. In Michigan, common loons are now known to breed only in the Upper Peninsula and the very northern portions of the Lower Peninsula. They are most common on Isle Royale and western portions of the Upper Peninsula. Adult common loons are easily disturbed and stressed and may desert their nest if approached too closely by a person, boat, or other water vehicles, or even the wake from such a vehicle.

Bald Eagle. The bald eagle (*Haliaeetus leucocephalus*), although recently delisted under the Endangered Species Act, is still listed as threatened by the state. The reason for historic declines in bald eagle populations in the 1950s and 1960s included hazardous chemicals as well as disturbance and displacement by humans. DDT was the primary cause, and the banning of DDT in the early 1970s led to resurgence in bald eagle numbers throughout the United States including the Great Lakes region. Although bald eagles are seen throughout almost all counties of Michigan during the winter, they nest mainly in the Upper Peninsula (especially the western portion) and the northern portion of the Lower Peninsula. Because its primary diet consists of fish, bald eagles tend to feed, roost, and nest near water bodies. The nest is usually located in the tallest tree in the area, often a white pine or dead snag. Eagles in some parts of the country are particularly sensitive to human disturbance. Adult birds appear to flush more quickly when foraging than when on the nest. Bald eagles have been documented in all but the central mainland portion of the Lakeshore, and nests have been identified in the northern and southern mainland portions of the Lakeshore as well as on both North and South Manitou islands.

Least Bittern. The least bittern (*Lxobrychus exilis*) is listed as threatened in Michigan. This species occupies a variety of freshwater and brackish marshes with dense, tall growths of aquatic or semi-aquatic vegetation interspersed with clumps of woody vegetation and open water. They have been documented in the Lakeshore.

2.4.6 SOILS

The National Lakeshore's soils are predominantly sandy or sand mixed with gravel and are well-drained. These soils are often found on steep slopes. In most areas soils are covered with a thin topsoil layer that was depleted in many instances by unsustainable farming practices after the land was logged in the early 1900's. Duff layers covering the soils are extremely variable ranging from none to a foot or more.

The soils in the project area that are most susceptible and pose the highest limitations are those with steep slopes, high organic matter, clay, and/or hydric soils. These soils, including Alcona sandy loam, Roscommon sand-Markey muck, and Mancelona-East Lake loamy sands will have the highest potential to be affected and occur together in areas where there is steep topography and wetlands. In addition, the erodability of the soil type as measured by the Soil Survey, or K factor, was considered in relation to Trailway development (see Table 21 - Soils Characteristics and Proposed Trailway Segments).

The majority of the soils within the vicinity of the Trailway are sandy loams, which are particularly well suited for trail construction with regard to drainage, freeze and thaw, and erosion. Soils within much of the M-22/M-109 rights-of-way, on two-track roads, trails, and the railroad grade near the Dune Climb have been disturbed by previous construction activities.

2.4.7 SOCIOECONOMICS

The influence area for economic and social considerations associated with the Sleeping Bear Dunes National Lakeshore encompasses Benzie, Leelanau and Grand Traverse Counties in the northwest region of Michigan's Lower Peninsula. Benzie and Leelanau are directly affected as portions of the Lakeshore are located within their boundaries, whereas Grand Traverse is indirectly affected due to its role as a regional trade and service center and a center of seasonal migration and tourism for the entire region. The region is largely rural, though along with neighboring Kalkaska County, the three counties comprise the Traverse City "micropolitan" statistical area. Traverse City, the largest community in the region (2006 pop. 14,407), is located about 25 miles east of the Lakeshore. The communities of Empire, Glen Arbor, Leland, Beulah and others are located in nearby areas surrounding the Lakeshore. Timber, maritime commerce, agriculture, and light manufacturing were important in the region's economic development with tourism and outdoor recreation emerging as economic drivers more recently.

Population

All three counties have experienced long-term population growth, characterized by relatively rapid growth in the 1970s, tempered by state and national economic slowdowns in the early/mid 1980s, with growth resuming thereafter. Between 1990 and 2006, net population growth of 45%, 32% and 34% occurred in Benzie, Grand Traverse and Leelanau counties, respectively, out-pacing the statewide growth of 9% for the same period. The pace of population growth has moderated in recent years. The three counties had a combined total of 124,716 residents in 2006, more than two-thirds of which lived in Grand Traverse County. Benzie County's population of 17,652 accounted for 14% of the total with Leelanau County having 18% of the total.

Most of the region's year-round residents live in rural, unincorporated areas. In addition to Traverse City, only Kingsley (Grand Traverse) and Frankfort (Benzie) have more than 1,000 residents. The remaining communities generally range from 250 to 650 residents. Community-based population has remained relatively constant in recent years as most of the new development and population growth has been in the outlying areas.

Empire, Glen Arbor and Leland, all in Leelanau County, are the three communities most directly affected by the Lakeshore; the first two resulting from proximity to key visitor use/activity centers in the Park. Leland is the base for the ferry to the Manitou Islands. In Benzie County, the communities of Honor, Beulah and Frankfort are also affected by the park, as they are near and located along highway corridors accessing the Lakeshore.

Economic Overview
Strong economic growth accompanied the region's population growth. Total full and part-time employment in Benzie County was 8,611 in 2005, compared to 5,539 in 1995; a gain of 3,072 jobs or 55%. Employment gains in Grand Traverse County during the 10 years totaled 10,302 jobs, or 19%, and raising total employment to 65,301 jobs in 2005. Leelanau County saw an increase of 2,350 jobs, or 30%, between 1995 and 2005.

Recent economic growth and development has brought about differences in the economic structures of the individual counties. Employment data for 2005 highlight those differences. Benzie County's economy tends to be more industrial, that of Grand Traverse more trade and services oriented, and that of Leelanau more dependent on agriculture, government and services. Public sector employment, particularly local government employment, is important across the region, but particularly in Leelanau County. The latter reflects the substantial workforce employed by the Grand Traverse Band of Ottawa and Chippewa Indians.

Local employment and unemployment generally follow statewide trends, likely indicative of a correlation between statewide economic health and people's vacation/travel patterns and spending. That pattern is evident over the past seven years as local unemployment rates climbed from 2000 through 2003/04, then stabilized or declined. However, unemployment rates are generally below the statewide averages in Leelanau and Grand Traverse counties, while those in Benzie County tend to be higher.

Demographics
Residents of the region tend to be older than the general population statewide, with median ages ranging from 37.7 years in Grand Traverse County, to 40.8 years in Benzie County, to 42.6 years in Leelanau County. Leelanau and Benzie counties have relatively higher proportions of residents 55 years and older, many of whom are retired or semi-retired.

Highway Traffic
The NPS owns and maintains about 25 miles of road within the Lakeshore. All are two-lane roadways, with the exception of Pierce Stocking Scenic Drive and numerous one-way segments within campgrounds.

The primary highway access to and through the Lakeshore is Michigan State Route 22 (M-22), which runs north-south through or adjacent to the full length of the Park. Two other state routes, M-109 and M-72, are of particular importance to the Lakeshore. M-109, branching from M-22 in Glen Arbor and reconnecting north of Empire, accesses Glen Haven, the Dune Climb, and Pierce Stocking Scenic Drive. M-72 provides the most direct highway connection between Empire and the Traverse City area. Both are two-lane, paved facilities.

Leelanau and Benzie Counties both have public road rights-of-way within the Lakeshore boundaries. These roads access private properties as well as providing access for many Lakeshore recreational activities.

Traffic on the major state roads in the region is heaviest in the northern portion of the Lakeshore and near Lakeshore headquarters in Empire. Traffic is highly seasonal, with peak traffic volumes of 40% to 50% above the annual average occurring in July and August during peak visitor use. Winter time traffic volumes are 30% to 40% below the annual averages.

Land Use and Ownership
The predominant land uses in the study area include agriculture, forested areas, natural areas supporting wildlife, rural residential, residential, commercial and industrial lands. The latter are concentrated in and near Traverse City, other communities in the area, and along the major highway corridors through the region.

Land use adjacent to the Lakeshore is a combination of private forested and farm lands and rural residential development, the latter including clustered developments around private inland lakes.

Trailway sections with the highest potential to conflict with existing land use includes those sections crossing private and public land, running adjacent to private land (in the right-of-way), and sections running through existing communities and residential and commercial neighborhoods. The Village of Empire, the community of Glen Arbor, and a few isolated rural residential areas near the Dune Climb and Little Traverse Lake have been identified as potential conflict areas.

2.4.8 CULTURAL RESOURCES

Cultural resources are defined as archeological resources, ethnographic resources, prehistoric structures, and historic properties. The selected Trailway route will be surveyed prior to construction for any archeological resources or prehistoric structures. Ethnographic resources have not yet been identified by the NPS; an ethnographic resource study has been proposed for the Lakeshore in the future.

Only the historic properties (i.e. buildings, sites, structures, objects, districts, and landscapes) will be analyzed in this document. Historic properties in the vicinity of the project, and which may be affected by any action alternative, include the Tweddle/Treat Cultural Landscape, Glen Haven Historic Village, D.H. Day Farm, D.H. Day Campground and Log Cabin Landscape, the Port Oneida Rural Historic District, the Shalda Log Cabin, and the Bufka/Kropp/Eizen Cultural Landscape. Currently, of the resources on this list, only the Glen Haven Historic Village and Port Oneida Rural Historic District are listed on the National Register of Historic Places. The other resources have been determined eligible for the National Register by the State Historic Preservation Officer but the nomination processes are not complete for these properties.

Tweddle/Treat Cultural Landscape. The Tweddle/Treat landscape includes the Tweddle School, the Tweddle, Treat, Schmidt, and Manning farmsteads, and the Pelky Barn. They are exemplary of vernacular farms that once existed throughout the Midwest. They are modest farms with an array of specialized agricultural structures demonstrating a progressive attitude toward agricultural improvement. This landscape is located south of Empire, at the intersection of highway M-22 and Norconk Road. This landscape has been determined locally significant by the State Historic Preservation Officer.

Glen Haven Historic Village, D.H. Day Farm. Maritime, agriculture, and recreational landscapes combine in the nationally significant Historic Glen Haven Village. Developed as a company owned steamboat landing, Glen Haven remains the best surviving example of a Great Lakes port village, a vital link of transportation, timber, agriculture, and the recreational pursuits of thousands of visitors a year. Park planning documents have identified it to become the focal point for the park's cultural interpretation.

D.H. Day Campground and Log Cabin Landscape. The log cabin was built in 1923-24 at D.H. Day State Park; the first state park in Michigan, on lands donated by D.H. Day and is significant at the State level. Day, an entrepreneur, had conservationist leanings and his efforts represent the first attempt at preserving the Lakeshore. Day was the first State Parks Commissioner for Michigan. This landscape is located east of Glen Haven on highway M-109.

Port Oneida Rural Historic District. The nationally significant Port Oneida Rural Historic District is the largest intact agricultural district in the National Park System and the largest historic agricultural district in public ownership in the country. It is representative of late 19th and early 20th century farms of the Midwest, and was added to the National Register of Historic Places in 1997. The District includes 18 farmsteads with over 100 historic structures on over 3,400 acres of land. It is located north of Glen Arbor on Highway M-22.

Shalda Log Cabin. One of the few pioneer cabins remaining in Leelanau, Benzie and Grand Traverse Counties is locally significant. It was built of hand hewn squared timbers in the late 1850's or early 60's by one of the Bohemian families that settled North Unity and Shalda Corners. It is located near the intersection of Highway M-22 and County Road 669. This cabin has been determined locally significant by the State Historic Preservation Officer.

Bufka/Kropp/Eitzen Cultural Landscape. This locally significant landscape is comprised of four farms adjacent to a church and cemetery. The Bufka farmstead is the most complete in the landscape. The original cabin is still present as well as numerous farm structures significant for their type, number, and condition. The landscape is located near the intersection of highway M-22 and Townline Road.

2.4.9 VISITOR OPPORTUNITIES AND USE

Visitor Opportunities

In addition to providing a variety of recreational activities, the Lakeshore is managed to provide a number of important opportunities for visitors, including:

- Dune climbing
- Scenic driving
- Scenic views
- North and South Manitou Island experiences
- Opportunities for quiet, solitude, naturalness
- River experiences
- Learning about the natural and cultural heritage of the area (glacial phenomena, diverse habitats, human history)
- The opportunity for visitors to understand the complex and rapidly disappearing natural history of the ecosystems that evolved along the Great Lakes shoreline.

Visitor Use

Visitor use at the Lakeshore has been relatively steady over time, though with some positive correlation to overall economic conditions in the broader Great Lakes region and to local population growth. Thus, visitor use at Sleeping Bear Dunes in the

future will be primarily a function of population growth and continuing rural residential development in the vicinity of Empire, Beulah, Glen Arbor and Cedar, increases in the region's seasonal population and long-term growth across the Great Lakes.

1,134,314 recreation visits occurred at the Lakeshore in 2007. Of that total, more than 1.1 million were day-visits and 118,722 included an overnight stay in the park. The latter includes 22,516 backcountry camping visits, many of those on North Manitou and South Manitou Islands.

Recreation visitation at the Lakeshore has been relatively consistent over time. Since 1990 the lowest level of visitor use of 1.09 million visits occurred in 1996, with the high of 1.36 million visits recorded in 1999. The 17-year average of 1.19 million recreation visits, including about 110,000 overnight stays, nearly matches the visitation in 2007.

Recreation visitation to the Lakeshore is highly seasonal. Peak monthly visitation, averaging 388,200 visits over the past 17 years (33% of annual average), occurs in July, followed by August (338,100 visits or 28%). The lowest use occurs during the winter with average monthly visitor use of 4,600 in January and 5,600 in December. The Trailway will result in more off season use in the Lakeshore and trail use projections are estimated to be approximately 350,000 to 400,000 visits per year.

Recent visitor origin data are not available for the Lakeshore. Visitor origin data for the region indicate that most travelers (70% to 80%) to the area are from Michigan. Other major origin states include Illinois, Indiana, Ohio, Missouri and California.

Origin of Visitors and Length of Stay. The vast majority of use at the Lakeshore is day use; an estimated 91%. Day use visitors include residents of the area, as well as Michigan residents from outside the immediate area and from out-of-state. Residents of the area account for an estimated 25% of all use. Many of the day visitors to the National Lakeshore do spend one or more nights in the area, either with friends or relatives, at vacation homes, or in local lodging accommodations. It is estimated that those spending at least one night in the area comprise approximately 46% of all users, with the remaining 20% accounted for by day users from outside the area or non-local who continue their travels and spend the night outside of the area. Approximately 9% of the use is overnight use, primarily at the Platte River and D.H. Day Campgrounds, but also including backcountry camping on the mainland and on the islands.

Primary Destinations Within Sleeping Bear Dunes National Lakeshore. Vehicle counters and ticket sales for the ferry provide insights into the primary destinations for visitor use at the National Lakeshore. These monitors show visitor use at the Lakeshore is heavily concentrated at the Dune Climb, Pierce Stocking Scenic Drive, Philip Hart Visitor Center and the Platte River area. Vehicle counts for August 2007 tallied 20,000 or more vehicles at each of those locations. Overnight camping at the Platte River and D.H. Day campgrounds and other locations also received substantial use.

2.4.10 OPERATIONS AND MAINTENANCE

NATIONAL PARK SERVICE OPERATIONS

Sleeping Bear Dunes National Lakeshore is administered by a superintendent, assistant superintendent, and several division chiefs. Management of the park is organized into the superintendent's office and five functional divisions. The functional

divisions are discussed in the sections that follow. As of 2007, there were 66 full time equivalent staff members (FTEs) at the Lakeshore.

The superintendent is directly responsible for the assistant superintendent, the environmental protection specialist, the public information officer, the superintendent's secretary, and indirectly the five division chiefs. In addition to responsibilities for overall park leadership and coordination, the superintendent's staff (5 FTE in 2006) is responsible for public and external affairs, planning and compliance, and safety. The main base of operations for the superintendent's office is the leased visitor/administrative center building in Empire.

Interpretation and Visitor Services
Interpretation and visitor services includes education services for diverse audiences, interpretation of park themes, staffing the visitor center, providing information and orientation for park visitors through personal (guided) and non-personal services (e.g., park Web site, publications, exhibits, and Volunteer-In-The-Parks program). This division is also responsible for management of the park library, fee collection, campground management, and museum collections. The main base of operations for interpretive and visitor services staff is the visitor/administrative center building in Empire. As of 2007, there were 14 FTEs in interpretation and visitor services.

Resource and Visitor Protection Division
The resource and visitor protection division is responsible for visitor and employee safety, resource protection, emergency response, park and facility patrols, security, emergency medical services, search and rescue, structural fire, law enforcement, air operations, resource protection education, dispatch, and concession operations in the park. As of 2007, there were 12 FTEs in this division. The main base of operations for this division is the visitor/administration center building in Empire, with district ranger offices at the Platte River Campground (Platte River District) and the D.H. Day Store in Glen Haven (Leelanau District). The Leelanau District has responsibility for protection operations on the Manitou islands.

Facility Maintenance
The facility maintenance division is responsible for operation and maintenance of park facilities and equipment, including structures and grounds, utilities, roads and parking areas, trails and trailheads, picnic areas, signs, and vehicles. The facility maintenance division is also responsible for management of cultural resources (archeological sites, historic structures, cultural landscapes, and ethnographic resources). The main base of operations for the division is the maintenance area located about a mile south of Empire. As of 2007, there were 26 FTEs in this division.

Natural Resources Management Division
The natural resources management division is responsible for management of natural resources, including managing natural resource research, protecting threatened and endangered species, restoring disturbed sites, managing invasive non-native species, monitoring water quality, and managing wild land fires. This division is operated out of the visitor/administrative center in Empire. Biological technicians work out of a rehabilitated structure in the central part of the park. As of 2007, there were 5 FTEs in this division.

Administration
The administration division is responsible for park budget, fiscal, and property management activities. Administration also has responsibility for human resources, information technology, communications, and park housing. The main base of operations for administrative staff is the visitor/administrative center building in Empire. As of 2007, there were 4 FTEs in this division.

MICHIGAN DEPARTMENT OF TRANSPORTATION OPERATIONS
The Michigan Department of Transportation is a member of the Leelanau Scenic Heritage Route Committee and a partner landowner in the Trailway project. They will be the project manager for the Planning and Engineering phase of the project with funding from the National Scenic Byways Program. MDOT also provides technical assistance on transportation issues, design and engineering, and funding programs and opportunities. MDOT and NPS have worked cooperatively in the past on transportation issues and projects within the Park.

TRAILWAY MANAGEMENT TEAM
The Leelanau Scenic Heritage Route Trailway Work Group will develop a trail management team under the Leelanau Scenic Heritage Route Committee that will include representatives from stakeholder governments, non-profit organizations, and businesses. The team will research and review possible joint operating agreements and other multi-jurisdictional authorities that should be considered for Trailway development, management and maintenance. The LSHR will facilitate the designation and development of an agreed upon management entity for the Trailway which would be responsible for fundraising and development and long-term management and maintenance.

2.4.11 IMPACT TOPICS ELIMINATED FROM FURTHER ANALYSIS

Federal Threatened and Endangered Species. Section 7 of the Endangered Species Act requires federal agencies to consult with U. S. Fish and Wildlife Service (USFWS) when any activity permitted, funded, or conducted by that agency may affect a listed species or designated critical habitat, or is likely to jeopardize proposed species or adversely modify proposed critical habitat. The National Park Service has a close relationship with the USFWS and routinely discusses threatened and endangered species issues in the Lakeshore.

The USFWS has identified three threatened and endangered species within the Lakeshore: the endangered piping plover (*Charadrius melodus*), the endangered Michigan monkey flower (*Mimulus glabratus* var*. michiganensis*), and the threatened Pitcher's thistle (*Cirseum pitcheri*). Additionally, the breeding range of the Indiana bat (*Myotis sodalist*) occurs within the southern half and western coastal counties of the Lower Peninsula of Michigan, including Benzie and Leelanau counties. However, even with suitable habitat in the Lakeshore (highly variable forested landscapes in riparian, bottomland, and upland areas that have roosting trees with crevices or exfoliating bark), this species has not been confirmed within the Lakeshore. None of the listed species are in the vicinity of the proposed Trailway, nor would be affected by it.

Piping Plover. The Great Lakes population of the piping plover is a federally endangered species. In Michigan, piping plovers prefer wide, sandy, open beaches along the shores of the Great Lakes. Nesting territories generally have sparse vegetation and scattered cobblestones and may include river, lagoon, or other wetland habitat to provide additional food for chicks. Much of the beach along Lake Michigan within the Lakeshore has been designated Critical Habitat for this species.

Michigan Monkey Flower. The endangered Michigan monkey flower, an aquatic to semi-aquatic plant, is known from only 15 extant occurrences in northern Michigan, 12 of which are currently considered viable. There is a large, exemplary occurrence in the Lakeshore. Critical habitat has not been designated for this species.

Pitcher's Thistle. The threatened Pitcher's thistle is endemic to beach and dune habitats around Lakes Huron, Michigan, and Superior and requires active sand dune processes to maintain its early successional habitat. The range of this Great Lakes thistle falls primarily within Michigan's borders, occurring along the entire shoreline of Lake Michigan. Critical habitat has not been designated for this species.

Proposed Wilderness. Trail routes in both action alternatives have been identified to avoid conflicts with lands proposed as wilderness in the 2009 General Management Plan/Wilderness Study/Environmental Impact Statement. No Trailway developments could occur on lands proposed for wilderness in the 1981 Wilderness Recommendation unless and until Congress acts upon a recommendation.

2.5 ENVIRONMENTAL CONSEQUENCES

The National Environmental Policy Act of 1969 (NEPA) mandates that environmental assessments disclose the environmental impacts of a proposed federal action. In this case, the proposed federal action is implementation of the Trailway plan.

The first part of this section discusses terms and assumptions used in the discussions of impacts. The next two parts cover policy and terminology related to cumulative impacts and impairment of park resources. Then, for each impact topic, there is an explanation of threshold intensity, followed by a description of the impacts of the alternative (no-action, alternative A, and alternative B-the preferred), a discussion of cumulative effects, and a conclusion.

2.5.1 TERMS AND ASSUMPTIONS

Each impact topic area includes a discussion of impacts, including the intensity, duration, and type of impact. *Intensity* of impact describes the degree, level, or strength of an impact as negligible, minor, moderate, or major. Because definitions of intensity vary by resource topic, separate intensity definitions are provided for each impact topic. *Duration* of impact considers whether the impact would occur over the short term or long term. *Short-term* impacts are those that, within a short period of time, generally less than 5 years, would no longer be detectable as the resource or value returns to its pre-disturbance condition or appearance. *Long-term* impacts refer to a change in a resource or value that is expected to persist for 5 or more years. The *type* of impact refers to whether the impact on the resource or value would be *beneficial* (positive), or *adverse* (negative).

The impact analyses for the action alternatives (alternative A and alternative B) describe the difference between implementing the no-action alternative and implementing the action alternative. In other words, to understand the consequences of any action alternative, the reader must also consider what would happen if no action were taken.

2.5.2 CUMULATIVE IMPACTS

The federal Council on Environmental Quality regulations, which implement NEPA, require assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of who undertakes such other actions. Cumulative impacts can result from individually minor but collectively important actions taking place over a period of time.

Cumulative impacts are considered for both the no-action and the action alternatives. These impacts were determined by combining the impacts of the alternatives with the impacts of other past, present, and reasonably foreseeable future actions. To do this, it was necessary to identify other such projects or actions at Sleeping Bear Dunes National Lakeshore and in the surrounding area. For the purposes of most impact topics in this document, the cumulative impact analysis area was Leelanau County, Michigan. The time horizon for the cumulative impacts analysis was generally plus or minus five years.

The following completed or ongoing projects, or projects planned for the near future, were identified for the purposes of conducting the cumulative effects analysis:

- Improvements to Parking Areas—Road Ends of Leelanau County Roads 651 and 669
- Glen Haven Village Improvements (Future)
- Lake Michigan Overlooks Improvements—Pierce Stocking Scenic Drive (Future)
- Dune Climb Parking Area—Paving and Other Minor Improvements (Future)
- MDOT road widening on M-22 (Future)

2.5.3 IMPAIRMENT OF NATIONAL PARK RESOURCES

In addition to determining the environmental consequences of implementing the preferred and other alternatives, NPS Management Policies 2006 (section 1.4) requires analysis of potential effects to determine whether or not proposed actions would *impair* park resources and values.

The fundamental purpose of the national park system, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values. NPS managers must seek ways to avoid, or to minimize to the greatest degree practicable, adverse impacts on park resources and values. However, the laws do give the National Park Service the management discretion to allow impacts on park resources and values when necessary and appropriate to fulfill the purposes of the park, as long as the impact does not constitute impairment of the affected resources and values. Although Congress has given the National Park Service the management discretion to allow certain impacts within a park, that discretion is limited by the statutory requirement that the National Park Service must leave resources and values unimpaired unless a particular law directly and specifically provides otherwise.

The prohibited impairment is an impact that would, in the professional judgment of the responsible NPS manager, harm the integrity of park resources and or values, and violate the 1916 NPS Organic Act's mandate (NPS Management Policies 2006 1.4.5). An impact on a park resource or value may, but does not necessarily, constitute an impairment. An impact is more likely to constitute impairment to the extent that it affects a resource or value whose conservation is:

- necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, or
- key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or
- identified in the park's general management plan or other relevant NPS planning documents as being of significance.

Impairment may result from visitor activities; NPS administrative activities; or activities undertaken by concessioners, contractors, and others operating in the park. Impairment may also result from sources or activities outside the park. A determination on impairment is made in the "Environmental Consequences" section in the conclusion section for each impact topic related to the park's cultural and natural resources. A determination of impairment is not required for impact topics such as visitor opportunities and use, NPS operations, and socioeconomics.

2.5.4 IMPACT TOPICS AND ENVIRONMENTAL ANALYSIS

TOPOGRAPHY

Because of the effects of glaciation, and water and wind erosion, the topography within the project area varies greatly. Generally, the topography within the project vicinity has slopes of 5% or less; however, several localized areas do exceed 5% and range from moderate to steep slopes. The steepest slopes occur more in the southern segments, including in Segment 1 between Barrack Road and Stormer Road, a small section in Segment 2 along Voice Road, a section between W. Welch Road and Greenan Road in Segment 4, and a section between West Crystal View Road and Westman Road near the Homestead in Segment 6.

For the purposes of this assessment, topography is defined as a natural or human-made landscape condition where existing contours of the land create a condition that would require grading with a landform change to develop the Trailway. The thresholds to determine impacts on topography are defined as follows:

Negligible: Grades on existing trails, railroad grades, or two-track roads are **less than a 5% slope.**

Minor: Average grades in potential new trail development areas are **less than a 5% slope;** or, if on an existing trail, railroad grade, or two-track road, are **5% to 10% slopes.**

Moderate: Average grades in potential new trail development areas are a **5% to 15% slope;** or, if on an existing trail, railroad grade, or two-track road, are **10% to 15% slopes.**

Major: Average grades in potential new trail development areas are **greater than 15%.**

No-Action Alternative
Under the no-action alternative, no new non-motorized trail would be constructed on or near the M-22/M-109 rights-of way. Bicyclists and other users would continue to use the travel surface or shoulder of the state highways. Since there would be no new soil disturbance, there would be no impact on topography in the vicinity of these highways.

Cumulative effects. Past, present, and anticipated future projects that contribute to impacts on topography include improvements to the road ends on Lake Michigan at county roads 669 and 651, Glen Haven Village improvements, Lake Michigan overlooks improvements (Pierce Stocking Scenic Drive), and MDOT M-22 shoulder improvements. While each of these projects would likely result in short-term, minor adverse impacts to topography during the construction phase, the net result is anticipated to be long-term, minor to moderate beneficial impacts. The no-action alternative would contribute nothing to these impacts.

Conclusions. The no-action alternative would have no impact on the topography of the area since no soils would be disturbed. Cumulative impacts would be anticipated to be short-term minor adverse and long-term minor to moderate beneficial. There would be no *impairment* of topography from implementation of the no-action alternative (see specific definition of impairment in section 2.6.3 “Impairment of National Park Resources”).

Alternative A
Under Alternative A, a non-motorized trail would be constructed in the M-22/M-109 rights-of-way to the extent possible, only deviating where necessary due to physical or environmental constraints. Disturbance of areas with steep side slopes and gradients would be avoided where possible. In Segments 1, 2, 4, and 6 some minor, short-term adverse impacts and long-term, minor adverse impacts to topography would occur.

Cumulative effects. Past, present, and anticipated future projects that contribute to impacts on topography include improvements to the road ends on Lake Michigan at county roads 669 and 651, Glen Haven Village improvements, Lake Michigan overlooks improvements (Pierce Stocking Scenic Drive), and MDOT M-22 shoulder improvements. Each of these projects would likely result in short-term and long-term, minor adverse impacts to topography. Alternative A would contribute short-term and long-term, minor adverse impacts to topography. The impacts of the other actions described above, would result in short-term and long-term, minor adverse cumulative impacts. Alternative A's contribution to these cumulative impacts would be moderate.

Conclusions. Alternative A would likely have short- and long-term minor adverse impacts on topography of the Lakeshore. Cumulative impacts would be anticipated to be short-term, minor to moderate adverse impacts and long-term, minor adverse impacts. There would be no *impairment* of topography from implementation of the alternative A (see specific definition of impairment in section 2.6.3 "Impairment of National Park Resources").

Alternative B: the Preferred Alternative
Under Alternative B, a non-motorized trail would be constructed in the M-22/M-109 rights-of-way, in many areas, but deviating from the highway corridor where possible to avoid physical or environmental constraints, provide access to natural, cultural, or recreation resources, and to promote a broader variety of experiences for the Trailway user. Disturbance of areas with steep side slopes and gradients would be avoided where possible. In Segments 1, 2, and 4 some short-term and long-term, minor adverse impacts to topography would occur. The steep area on M-22 near The Homestead Resort would be averted by routing the Trailway on West Crystal View Road (CR 675) and Westman Road.

Cumulative effects. Past, present, and anticipated future projects that contribute to impacts on topography include improvements to the road ends on Lake Michigan at county roads 669 and 651, Glen Haven Village improvements, Lake Michigan overlooks improvements (Pierce Stocking Scenic Drive), and MDOT M-22 shoulder improvements. Each of these projects would likely result in short-term and long-term, minor adverse impacts to topography. Alternative B would contribute short-term and long-term, minor adverse impacts to topography. The impacts of the other actions described above, would result in short-term, minor adverse cumulative impacts and long-term, minor adverse cumulative impacts. Alternative B's contribution to these cumulative impacts would be moderate.

Conclusions. Alternative B would likely have short-term and long-term, minor adverse impacts on topography of the Lakeshore. Cumulative impacts would be anticipated to be short-term and long-term, minor and adverse. There would be no *impairment* of topography from implementation of Alternative B (see specific definition of impairment in section 2.6.3 "Impairment of National Park Resources").

WETLANDS AND WATER QUALITY

Wetlands, in addition to the biodiversity they support (addressed under Vegetation and Wildlife, and Michigan State Listed Species), serve critical roles as water purifiers, facilitating settling of particulates out of the water column and filtering remaining impurities. Because of the importance of wetlands to water quality, potential impacts to wetlands and water quality will be addressed together.

Wetlands and water quality can be impacted by two major types of activities: visitor use and development of infrastructure. Visitor use probably has a greater potential to impact wetlands and water quality along riparian areas (e.g. the Crystal River) and around lakes (e.g. Narada Lake). When a visitor walks through a wetland, the vegetation is trampled into the mud, and invertebrates living in the wetland can be crushed or buried in muck from which they cannot escape. If there is standing water, sediments from the bottom get stirred up into the water column. This ***re-suspension of sediments*** reduces water quality and its suitability for biota dependent upon it. The overall physical nature of the wetland is altered in a way that typically reduces its ability to filter water. Thus wetland ***trampling*** impacts a wetland and its function at a variety of levels and ends up impacting not only the wetland but the resultant water quality in any water body serviced by that wetland.

Trail construction activities have the potential to impact wetlands and water quality, which may result in ***pollution*** of wetlands and water bodies with petroleum products and other substances. This pollution of the wetlands can lead to loss of both structure and function over time, and thus further reduced water quality.

Development actions proposed in the alternatives of this plan, such as boardwalks or hardened trail surfaces, would be located to the extent feasible to avoid direct dredging or filling of wetlands and other Waters of the U.S. However, ***runoff*** from such development activities would have the potential to change the hydrology (quality or amount of water) entering adjacent wetlands and waterways. Additionally, under the right conditions, ***dust*** from packed dirt or trail edges can blow onto and impact adjacent wetlands and waterways.

Wetlands are a protected resource managed under federal executive and director's orders:
Executive Order 11990 was issued in 1977 "to avoid to the extent possible the long- and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative." This order directs the National Park Service to: (1) provide leadership and to take action to minimize the destruction, loss, or degradation of wetlands; (2) preserve and enhance the natural and beneficial values of wetlands; and (3) to avoid direct or indirect support of new construction in wetlands unless there are no practicable alternatives to such construction and the proposed action includes all practicable measures to minimize harm to wetlands.

Approved in 1998, Director's Order 77-1: *Wetland Protection* (NPS 1998) was developed for use by the National Park Service in carrying out its responsibilities under Executive Order 11990. The general policies, requirements, and standards included in the manual are: (1) no net loss of wetlands and a long-term goal of net wetlands gain, (2) park wide wetlands inventories, (3) restoration and enhancement of degraded wetlands habitats, (4) planning and siting facilities to avoid or minimize effects to

wetlands, (5) restoration of degraded wetlands as compensation for adverse effects to wetlands, and (6) compliance with federal environmental regulations.

Impacts to wetlands and water quality were evaluated by comparing projected changes resulting from plan alternatives to the no-action alternative. The thresholds to determine wetlands and water quality impacts are defined as follows:

Negligible: The impact is barely detectable and/or would result in no measurable or perceptible changes to wetlands or water quality.

Minor: The impact is slight, but detectable, and/or would result in small but measurable changes in wetlands or water quality; the effects would be localized to one area in a drainage basin.

Moderate: The impact is readily apparent and would result in easily detectable changes to wetlands or water quality; the effects would be localized to a drainage basin.

Major: The impact is severely adverse or exceptionally beneficial and/or would result in appreciable changes to wetlands or water quality; the effects would be regionally important.

No-Action Alternative
Under the no-action alternative, no new non-motorized trail would be constructed on or near the M-22/M-109 rights-of way. Bicyclists and other users would continue to use the travel surface or shoulder of the state highways. There would be no impacts to wetlands or water quality from this activity.

Cumulative effects. Past, present, and anticipated future projects that contribute to impacts on wetlands and water quality include improvements to the road ends on Lake Michigan at county roads 669 and 651, and MDOT M-22 shoulder improvements. Each of these projects would likely result in short-term and long-term, minor adverse impacts to wetlands and/or water quality. The no-action alternative would contribute nothing to these impacts.

Conclusions. There would be no impacts to wetlands or water quality from this alternative. Cumulative impacts would be anticipated to be short-term and long-term, minor and adverse. There would be no *impairment* of wetlands and water quality from implementation of the no-action alternative (see specific definition of impairment in section 2.6.3 “Impairment of National Park Resources”).

Alternative A
Under Alternative A, a non-motorized trail would be constructed in the M-22/M-109 rights-of-way to the extent possible, only deviating where necessary due to physical or environmental constraints. There are four wetland areas that could be impacted by this alternative:

1) A section of the former narrow gauge railroad grade between the Dune Climb and Glen Haven. The former railroad grade runs through forested wetlands and limited areas of emergent and scrub-shrub wetlands.
2) In the vicinity of Glen Arbor and includes the floodplains of the Crystal River.

3) From the Narada Lake area east to Little Traverse Lake and beyond to Townline Road. The majority of wetlands are forested within smaller bands of emergent and scrub-shrub.
4) From Townline Road to Good Harbor Highway. These ridge and swale forested and scrub-shrub wetlands exist below an escarpment that runs along M-22 between the road corridor and the Lake Michigan shoreline.

Assuming use of standard best management practices during construction and careful monitoring of impacts during use, the overall impacts would likely be short-term and long-term, minor and adverse.

Cumulative effects. Past, present, and anticipated future projects that contribute to impacts on wetlands and water quality include improvements to the road ends on Lake Michigan at county roads 669 and 651, Lake Michigan overlooks improvements (Pierce Stocking Scenic Drive), and MDOT M-22 shoulder improvements. Each of these projects would likely result in short-term and long-term, minor adverse impacts to wetlands and/or water quality. Alternative A would contribute short-term and long-term, minor adverse impacts. The impacts of the other actions described above, would result in short-term and long-term, minor adverse cumulative impacts. Alternative A's contribution to these cumulative impacts would be moderate.

Conclusions. Alternative A would likely have short-term and long-term minor adverse impacts on wetlands and water quality of the Lakeshore. Cumulative impacts would be anticipated to be short-term and long-term, minor adverse impacts. There would be no *impairment* of wetlands and water quality from implementation of Alternative A (see specific definition of impairment in section 2.6.3 "Impairment of National Park Resources").

Alternative B: the Preferred Alternative
Under alternative B, a non-motorized trail would be constructed in the M-22/M-109 rights-of-way, in many areas, but deviating from the highway corridor where possible to avoid physical or environmental constraints, provide access to natural, cultural, or recreation resources, and to promote a broader variety of experiences for the Trailway user. There are four wetland areas that could be impacted by this alternative:

1) A section of the former narrow gauge railroad grade between the Dune Climb and Glen Haven. The former railroad grade runs through forested wetlands and limited areas of emergent and scrub-shrub wetlands.
2) In the vicinity of Glen Arbor and includes the floodplains of the Crystal River.
3) From the Narada Lake area east to Little Traverse Lake and beyond to Townline Road. The majority of wetlands are forested within smaller bands of emergent and scrub-shrub.
4) From Townline Road to Good Harbor Highway. These ridge and swale forested and scrub-shrub wetlands exist below an escarpment that runs along M-22 between the road corridor and the Lake Michigan shoreline.

Assuming use of standard best management practices during construction and careful monitoring of impacts during use, the overall impacts would likely be short-term and long-term, minor and adverse.

Cumulative effects. Past, present, and anticipated future projects that contribute to impacts on wetlands and water quality include improvements to the road ends on Lake Michigan at county roads 669 and 651, Lake Michigan overlooks improvements (Pierce Stocking Scenic Drive), and MDOT M-22 shoulder improvements. Each of these projects would likely

result in short-term and long-term, minor adverse impacts to wetlands and/or water quality. The impacts of the other actions described above, would result in short-term, moderate adverse cumulative impacts and long-term, minor adverse cumulative impacts. Alternative B's contribution to these cumulative impacts would be moderate.

Conclusions. Alternative B would likely have short-term and long-term minor adverse impacts on wetlands and water quality of the Lakeshore. Cumulative impacts would be anticipated to be short-term and long-term, minor adverse impacts. There would be no *impairment* of wetlands and water quality from implementation of alternative B (see specific definition of impairment in section 2.6.3 "Impairment of National Park Resources").

VEGETATION AND WILDLIFE

Because a discussion of potential impacts to wildlife necessarily involves discussion of wildlife habitat, which is primarily the vegetation communities within the park, vegetation and wildlife are addressed together in this section. Preliminary analysis of potential impacts to the vegetation and wildlife resources of the Lakeshore indicated that impacts could be associated with two primary activities: visitor use and development of infrastructure.

Visitor use can impact vegetation and wildlife through a number of mechanisms. Obvious and direct impacts include ***trampling*** of vegetation when hiking off trail. Repeated trampling of the vegetation along a path can lead to changes in the vegetation which results in ***habitat alteration***. Introduction or spread of ***invasive species*** can also result from visitor activities. Establishment of invasive species often results in change in both the plant and wildlife composition of the infested area. Visitors often unwittingly introduce or spread propagules (e.g. seeds or larvae) of invasive species during recreational activities. Under both action alternatives, steps will be taken to prevent the establishment of non-native plants (see table 19).

Although the potential to disturb wildlife when hiking off-trail is apparent to most, even when hiking or bicycling on established trails or roads, visitors can disturb wildlife with loud or unusual noises, or even just the sight or scent of visitors. Disturbance of wildlife due to noises, sights, or scents associated with visitor use is referred to as ***sensory-based disturbance***.

Development of infrastructure can also impact vegetation and wildlife. The most obvious impact is the direct removal or loss of vegetation that serves as wildlife habitat (i.e. ***habitat loss***). Consider development of a new trail through an area of relatively native forest where a swath of vegetation that is removed to construct the trail would represent habitat loss. That would not, however, be the only impact to the wildlife habitat. Opening of the forest canopy where the trail is constructed now creates an edge effect, and consequent changes to forest composition. In some cases this can cascade into changes in wildlife species utilization. Further, new use of this trail would increase sensory-based disturbance to wildlife along the new trail corridor. Obviously, the larger the corridor required for the trail, the greater these impacts can be. The placement of a trail within the area of forest is also important. Trails established through the middle of a habitat tend to fracture the habitat, making it less usable for some wildlife species. Alternatively, placing the road or trail close to another road or a natural habitat boundary may lessen this impact. The more indirect impacts of infrastructure development described above are referred to as ***habitat degradation***.

The thresholds to determine impacts on vegetation and wildlife are defined as follows:

Negligible: Impacts are barely detectable and/or would affect a minimal area of vegetation. Impacts to the plant and wildlife communities at key organizational levels are not detectable.

Minor: Impacts are slight, but detectable, and/or would affect a small area of vegetation or few members of the wildlife community. The severity and timing of changes are not expected to be outside natural variability spatially or temporally. Key ecosystem processes and community structure are retained at the local level.

Moderate: Impacts are readily apparent and/or would affect a large area of vegetation and/or a large portion of the wildlife community. The severity and timing of changes are expected to be outside natural variability spatially and/or temporally; however, key ecosystem processes and community structure are retained at the landscape level.

Major: Impacts are severely adverse or exceptionally beneficial and/or would affect a substantial area of vegetation and/or the majority of the inhabiting wildlife community. The severity and timing of changes are expected to be outside natural variability both spatially and temporally. Key ecosystem processes and community structure may be disrupted. Habitat for wildlife species may be rendered non-functional at the landscape level.

No-Action Alternative
Under the no-action alternative, no new non-motorized trail would be constructed on or near the M-22/M-109 rights-of way. Bicyclists and other users would continue to use the travel surface or shoulder of the state highways. There would be no impacts to vegetation from this activity and impacts to wildlife (sensory-based disturbance) would be negligible, since the highways are already being used by motor vehicles.

Cumulative effects. Past, present, and anticipated future projects that contribute to impacts on vegetation and wildlife include improvements to the road ends on Lake Michigan at county roads 669 and 651, Glen Haven Village improvements, Lake Michigan overlooks improvements (Pierce Stocking Scenic Drive), Dune Climb parking area improvements, and MDOT M-22 shoulder improvements. Each of these projects would likely result in short-term and long-term, minor adverse impacts to vegetation and wildlife. The no-action alternative would contribute nothing to these impacts.

Conclusions. There would be no impacts to vegetation and wildlife from this alternative. Cumulative impacts would be anticipated to be short-term and long-term, minor and adverse. There would be no *impairment* of vegetation and wildlife from implementation of the no-action alternative (see specific definition of impairment in section 2.6.3 “Impairment of National Park Resources”).

Alternative A
Under Alternative A, a non-motorized trail would be constructed in the M-22/M-109 rights-of-way to the extent possible, only deviating where necessary due to physical or environmental constraints. Much of the highway rights-of-way have been previously impacted by construction activities. Even in some of the rights-of-way that extend 100 feet from centerline, there are some areas within the rights-of-way where vegetation is firmly established, and some areas where mature forest exists.

By placing the trail within the disturbed rights-of-way, to the extent possible, impacts to vegetation and wildlife will be minimized. Placement outside rights-of-way would be required in Segments 1, 5, and 9. In Segment 1, switchbacks would be necessary on the escarpment north of the restored Scussel pit where most of this area has been previously disturbed. In Segment 5, the trail would leave M-109 north of the Dune Climb and follow the old narrow gauge railroad grade to Glen Haven. Vegetation that has been established over the years on the grade would be removed. In Segment 9, north of the Bufka farm, due to physical limitations, the trail would be placed below the road, in an area of mature hardwoods. Minimal tree removal is expected due to the wide spacing of the existing mature trees in this area.

Since virtually all trail locations out of the highway rights-of-way are on previously disturbed areas, or areas with widely-spaced trees, impacts to vegetation in the short-term and long-term, are likely to be minor and adverse. Impacts to wildlife due to sensory-based disturbance are expected to be minor and adverse both during construction and in the long-term. Since most of the trail would be near the traveled road surface, bicycle and other non-motorized uses would add little disturbance to that already caused by motor vehicle traffic.

Cumulative effects. Past, present, and anticipated future projects that contribute to impacts on vegetation and wildlife include improvements to the road ends on Lake Michigan at county roads 669 and 651, Glen Haven Village improvements, Lake Michigan overlooks improvements (Pierce Stocking Scenic Drive), Dune Climb parking area improvements, and MDOT M-22 shoulder improvements. Each of these projects would likely result in short-term and long-term, minor adverse impacts to vegetation and wildlife. Alternative A would contribute short-term and long-term, minor adverse impacts. The impacts of the other actions described above, would result in short-term and long-term, minor adverse cumulative impacts to vegetation and wildlife. Alternative A's contribution to these cumulative impacts would be moderate.

Conclusions. Alternative A would likely have short-term and long-term minor adverse impacts on vegetation and wildlife of the Lakeshore. Cumulative impacts would be anticipated to be short-term and long-term, minor and adverse.

There would be no *impairment* of vegetation and wildlife from implementation of alternative A (see specific definition of impairment in section 2.6.3 "Impairment of National Park Resources").

Alternative B: the Preferred Alternative

or recreation resources, and to promote a broader variety of experiences for the Trailway user. Placement outside rights-of-way would be required in Segments 1, 4, 5, 7, 8, and 9. North of Wilco Road the trail turns away from the M-22 right-of-way and through mature hardwood forest. Mature trees would be removed in this area to construct the trail. In Segment 4, the trail would leave M-109 on an old, vegetated logging road and would connect with Greenan Road to the north. The spacing of mature hardwoods on the logging road would minimize the number of trees that would be removed. Placing the trail along Greenan Road would require some tree removal. In Segment 5, the trail would leave M-109 at the Dune Climb, parallel the Duneside Accessible Trail, and then connect with the old narrow gauge railroad grade to Glen Haven. Much of the route along the Duneside Accessible Trail is open field, requiring little vegetation removal. Some mature trees would be removed to the north, before the connection with the railroad grade. Vegetation that has been established over the years on the grade would be removed. Some mature trees would have to be removed along the two-track road from Glen Haven to D.H. Day Campground and along the two-track road along Alligator Hill to accommodate the trail. In Segment 7, the trail would use the existing Bay View lower trail north of southern most Thoreson Road/M-22 intersection. Some mature tree removal would be

required along this trail to meet design standards. In Segment 8, the trail would be located behind the North Unity School to provide an interesting perspective of the school and Narada Lake where mature trees in this area would be removed to accommodate the trail. In Segment 9, north of the Bufka farm, due to physical limitations, the trail would be placed below the road, in an area of mature hardwoods. Minimal tree removal is expected due to the wide spacing of the existing mature trees in this area.

Since virtually all trail locations out of the highway rights-of-way are on previously disturbed areas, or areas with widely-spaced trees, impacts to vegetation are likely, in the short-term to be moderate adverse and in the long-term, to be minor and adverse. Impacts to wildlife due to sensory-based disturbance are expected to be minor and adverse both during construction and in the long-term. Since most of the trail would be near the traveled road surface, bicycle and other non-motorized uses would add little disturbance to that already caused by motor vehicle traffic.

Cumulative effects. Past, present, and anticipated future projects that contribute to impacts on vegetation and wildlife include improvements to the road ends on Lake Michigan at county roads 669 and 651, Glen Haven Village improvements, Lake Michigan overlooks improvements (Pierce Stocking Scenic Drive), Dune Climb parking area improvements, and MDOT M-22 shoulder improvements. Each of these projects would likely result in short-term and long-term, minor adverse impacts to vegetation and wildlife. Alternative B would contribute short-term, moderate adverse impacts and long-term, minor adverse impacts. The impacts of the other actions described above, would result in short-term and long-term, minor adverse cumulative impacts to vegetation and wildlife. Alternative B's contribution to these cumulative impacts would be moderate.

Conclusions. Alternative B would likely have short-term moderate adverse and long-term minor adverse impacts on vegetation and wildlife of the Lakeshore. Cumulative impacts would be anticipated to be short-term and long-term, minor adverse impacts. There would be no *impairment* of vegetation and wildlife from implementation of alternative A (see specific definition of impairment in section 2.6.3 "Impairment of National Park Resources").

MICHIGAN STATE-LISTED SPECIES

Michigan state-listed species that could be impacted by the action alternatives and are addressed in this section, include plant (e.g. fascicled broom-rape and ginseng) and wildlife (e.g. common loon, prairie warbler, bald eagle, and least bittern) species. As such, the impacts associated with visitor use and infrastructure development described above for vegetation and wildlife would also apply to these state-listed species.

National Park Service policy dictates that, to the greatest extent possible, parks will inventory, monitor, and manage state and locally listed species in a manner similar to the treatment of federally listed species. In addition, the parks are to inventory other native species that are of special management concern to parks (such as rare, declining, sensitive, or unique species and their habitats) and manage them to maintain their natural distribution and abundance.

The National Park Service determines all management actions for the protection and perpetuation of federally, state, or locally listed species through the park management planning process, and includes consultation with lead federal and state agencies, as appropriate.

Impact thresholds for Michigan state-listed plant and wildlife species are defined as follows:

Negligible: Impacts to Michigan state-listed plant and wildlife species would not be observable or measurable and would be well within the range of natural variability.

Minor: Impacts to species or their habitat would be detectable, but still within the range of natural variability both spatially and temporally. No interference with feeding, reproduction or other activities affecting population viability would result from the impacts. Sufficient functional habitat would remain to support viable populations.

Moderate: Impacts on activities necessary for survival, and on species habitats, can be expected on an occasional basis, but are not anticipated to threaten potential or continued existence of the species in the park. Changes to population characteristics could be outside the natural range of variability spatially or temporally but would not be anticipated to result in loss of population viability.

Major: Impacts to Michigan state-listed plant and wildlife species or their habitats would be detectable, outside of the natural range of variability both spatially and temporally, and would be anticipated to result in loss of viability at the population level.

No-Action Alternative
Under the no-action alternative, no new non-motorized trail would be constructed on or near the M-22/M-109 rights-of way. Bicyclists and other users would continue to use the travel surface or shoulder of the state highways. There would be no impacts to Michigan state-listed species from this activity since the highways are already being used by motor vehicles.

Cumulative effects. Past, present, and anticipated future projects that contribute to impacts on Michigan State-listed species include improvements to the road ends on Lake Michigan at county roads 669 and 651, Glen Haven Village improvements, Lake Michigan overlooks improvements (Pierce Stocking Scenic Drive), Dune Climb parking area improvements, and MDOT M-22 shoulder improvements. Each of these projects could result in short-term and long-term, minor adverse impacts to Michigan state-listed species. The no-action alternative would contribute nothing to these impacts.

Conclusions. There would be no impacts to Michigan state-listed species from this alternative. Cumulative impacts would be anticipated to be short-term and long-term, minor and adverse. There would be no *impairment* of vegetation and wildlife from implementation of the no-action alternative (see specific definition of impairment in section 2.6.3 “Impairment of National Park Resources”).

Alternative A
Under Alternative A, a non-motorized trail would be constructed in the M-22/M-109 rights-of-way to the extent possible, only deviating where necessary due to physical or environmental constraints. Placement outside rights-of-way would be required in Segments 1 and 5. In Segment 1, switch-backs would be necessary on the escarpment north of the restored Scussel pit. Most of this area has been previously disturbed and provides no habitat for Michigan state-listed species. In Segment 5, the trail would leave M-109 north of the Dune Climb and follow the old narrow gauge railroad grade to Glen Haven. This area is adjacent the Mill Pond and is known habitat for a state-listed species. The trail is expected to have negligible impact to this

species. There is suitable habitat for fascicled broom-rape and prairie warbler in the Glen Haven-D.H. Day campground area, but the trail development and use is expected to have a negligible impact on these species. In Segment 8, the trail parallels the M-22 bridge (by boardwalk) at Narada Lake, known habitat for the common loon and the bald eagle. Since the trail would be immediately adjacent the highway bridge at this location, trail construction is expected to have short-term, moderate and adverse impacts on these species, but in the long-term, negligible adverse impacts would occur. Construction activities would be planned so as to not impact common loon nesting activity.

Cumulative effects. Past, present, and anticipated future projects that contribute to impacts on Michigan State-listed species include improvements to the road ends on Lake Michigan at county roads 669 and 651, Glen Haven Village improvements, Lake Michigan overlooks improvements (Stocking Scenic Drive), Dune Climb parking area improvements, and MDOT M-22 shoulder improvements. Each of these projects could result in short-term and long-term, minor adverse impacts to Michigan state-listed species. Alternative A would contribute short-term, moderate adverse and long-term, negligible adverse impacts. The impacts of the other actions described above, would result in short-term and long-term, minor adverse cumulative impacts to Michigan state-listed species. Alternative A's contribution to these cumulative impacts would be moderate.

Conclusions. Alternative A would likely have short-term, moderate adverse and long-term minor adverse impacts on Michigan state-listed species (common loon and bald eagle) of the Lakeshore. Cumulative impacts would be anticipated to be short-term and long-term, minor and adverse. There would be no *impairment* of vegetation and wildlife from implementation of the alternative A (see specific definition of impairment in section 2.6.3 "Impairment of National Park Resources").

Alternative B: the Preferred Alternative

Under Alternative B, a non-motorized trail would be constructed in the M-22/M-109 rights-of-way, in many areas, but deviating from the highway corridor where possible to avoid physical or environmental constraints, provide access to natural, cultural, or recreation resources, and to promote a broader variety of experiences for the Trailway user. Placement outside rights-of-way would be required in Segments 1, 4, 5, 7, 8, and 9. In Segment 1, north of Wilco Road the trail meanders through mature hardwood forest, a cool, moist environment that is suitable habitat for sensitive species. In Segment 4, the trail would leave M-109 on an old, vegetated logging road and would connect with Greenan Road to the north. Construction in this general vicinity could impact ginseng habitat. In Segment 5, the trail would leave M-109 at the Dune Climb, parallel the Duneside Accessible Trail, and then connect with the old narrow gauge railroad grade to Glen Haven. There is suitable habitat for fascicled broom-rape and prairie warbler in the Glen Haven-D.H. Day campground area, but the trail development and use is expected to have a negligible impact on these species. In Segment 7, the Trailway follows the Bayview Trail, which is already impacted. In Segment 8, the trail parallels the M-22 bridge (by boardwalk) at Narada Lake, known habitat for the common loon and the bald eagle. Since the trail would be immediately adjacent the highway bridge at this location, trail construction is expected to have moderate and adverse impacts on these species, but in the long-term, negligible adverse impacts would occur. Construction activities would be planned so as to not impact common loon nesting activity. In Segment 9, north of the Bufka farm, due to physical limitations, the trail would be placed below the road, in an area of mature hardwoods, suitable habitat for ginseng.

Cumulative effects. Past, present, and anticipated future projects that contribute to impacts on Michigan State-listed species include improvements to the road ends on Lake Michigan at county roads 669 and 651, Glen Haven Village improvements, Lake Michigan overlooks improvements (Pierce Stocking Scenic Drive), Dune Climb parking area improvements, and MDOT

M-22 shoulder improvements. Each of these projects could result in short-term and long-term, minor adverse impacts to Michigan state-listed species. Alternative B would contribute short-term, moderate adverse and long-term, negligible adverse impacts. The impacts of the other actions described above, would result in short-term and long-term, minor adverse cumulative impacts to Michigan state-listed species. Alternative B's contribution to these cumulative impacts would be moderate.

Conclusions. Alternative B would likely have short-term, moderate adverse and long-term minor adverse impacts on Michigan state-listed species of the Lakeshore. Cumulative impacts would be anticipated to be short-term and long-term, minor and adverse. There would be no *impairment* of vegetation and wildlife from implementation of the alternative B (see specific definition of impairment in section 2.6.3 "Impairment of National Park Resources").

SOILS

Analysis of soils revealed two primary potential impact sources: soil impacts from visitor use, and soil impacts due to infrastructure development. Visitor uses that impact soils include hiking or bicycling in non-designated areas. Hiking and bicycling off-trail destabilizes the substrate in sandier areas and packs the soil down in areas with higher clay content. These actions can lead to ***soil erosion*** and ***soil compaction*****.** Soil erosion would be low to the sandy soils and high porosity. Trail development activities frequently result in ***soil disturbance*** during the construction phase. Clearing of vegetation would disturb the soils around the plants. Removal of topsoil would be a soil disturbance.

The thresholds to determine the intensity of impacts to soils are defined as follows:

Negligible: The impact is barely detectable and/or would result in no measurable or perceptible changes to soils.

Minor: The impact is slight, but detectable, and/or would result in small but measurable changes in soils; the effects would be localized.

Moderate: The impact is readily apparent and/or would result in easily detectable changes to soils; the effects would be localized.

Major: The impact is severely adverse or exceptionally beneficial and/or would result in appreciable changes to soils; the effects would be regionally important.

No Action Alternative
Under the no-action alternative, no new non-motorized trail would be constructed on or near the M-22/M-109 rights-of way. Bicyclists and other users would continue to use the travel surface or shoulder of the state highways. There would be no impact on soils.

Cumulative effects. Past, present, and anticipated future projects that contribute to impacts on soils include improvements to the road ends on Lake Michigan at county roads 669 and 651, Glen Haven Village improvements, Lake Michigan overlooks improvements (Pierce Stocking Scenic Drive), Dune Climb parking area improvements, and MDOT M-22 shoulder

improvements. Each of these projects would likely result in short-term and long-term, minor adverse impacts to soils, since most of the soils in these areas have been previously disturbed. The no-action alternative would contribute nothing to these impacts.

Conclusions. There would be no impacts to soils from this alternative. Cumulative impacts would be anticipated to be short-term and long-term, minor and adverse. There would be no *impairment* of soils from implementation of the no-action alternative (see specific definition of impairment in section 2.6.3 “Impairment of National Park Resources”).

Alternative A

Under Alternative A, a non-motorized trail would be constructed in the M-22/M-109 rights-of-way to the extent possible, only deviating where necessary due to physical or environmental constraints. Much of the highway right-of-way has been previously impacted by construction activities. Some of the right-of-way extends 100 feet from centerline and there are some areas within the right-of-way where soils have not been disturbed, at least not for many years. By placing the trail within the disturbed right-of-way, to the extent possible, impacts to undisturbed soils would be minimized. Placement outside rights-of-way would be required in Segments 1, 5, and 9. In Segment 1, switch-backs would be necessary on the escarpment north of the restored Scussel pit. Most of this area has been previously disturbed. In Segment 5, the trail would leave M-109 north of the Dune Climb and follow the old narrow gauge railroad grade to Glen Haven. Soils on the grade were disturbed when the grade was constructed, so impacts would be minimal. In Segment 9, north of the Bufka farm, due to physical limitations, the trail would be placed below the road, in an area of mature hardwoods. Soils would be disturbed in these areas, since in most cases the trail would not follow old two-track roads, where soils have already been disturbed.

Since virtually all trail locations out of the highway rights-of-way are on previously disturbed soils, impacts to soils, in the short-term and long-term, are likely to be minor and adverse. Impacts would occur from soil disturbance and erosion. Erosion would be minimized by best management practices such as silt fences, drainage control structures, and vegetating disturbed soils immediate after construction.

Cumulative effects. Past, present, and anticipated future projects that contribute to impacts on soils include improvements to the road ends on Lake Michigan at county roads 669 and 651, Glen Haven Village improvements, Lake Michigan overlooks improvements (Pierce Stocking Scenic Drive), Dune Climb parking area improvements, and MDOT M-22 shoulder improvements. Each of these projects would likely result in short-term and long-term, minor adverse impacts to soils, since most of the soils in these areas have been previously disturbed. Alternative A would contribute short-term and long-term, minor adverse impacts. The impacts of the other actions described above, in combination with the impacts of alternative A, would result in short-term and long-term, minor adverse cumulative impacts to soils. Alternative A’s contribution to these cumulative impacts would be minor.

Conclusions. Alternative A would have short-term and long-term, minor adverse impacts to soils. Cumulative impacts would be anticipated to be short-term and long-term, minor and adverse. There would be no *impairment* of soils from implementation of the alternative A (see specific definition of impairment in section 2.6.3 “Impairment of National Park Resources”).

Alternative B: the Preferred Alternative
Under Alternative B, a non-motorized trail would be constructed in the M-22/M-109 rights-of-way, in many areas, but deviating from the highway corridor where possible to avoid physical or environmental constraints, provide access to natural, cultural, or recreation resources, and to promote a broader variety of experiences for the Trailway user.

Placement outside rights-of-way would be required in Segments 1, 4, 5, 7, 8, and 9. In Segment 1, south and north of Wilco Road the trail uses a power line right-of-way. Since soils were disturbed during construction of the right-of-way, impacts to soils would be minimal in this location. Further north the trail traverses mature hardwood forest. Some Trailway locations would use two-tracks, while others would impact areas with little soil disturbance. In Segment 4, the trail would leave M-109 on an old, vegetated logging road and would connect with Greenan Road. Since soils were disturbed during construction of the logging road, little impact would occur. Placing the trail along Greenan Road would require some soil disturbance. In Segment 5, the trail would leave M-109 at the Dune Climb; parallel the Duneside Accessible Trail, then would connect with the old narrow gauge railroad grade to Glen Haven. Much of the route along the Duneside Accessible Trail is open field, requiring some soil disturbance. Indications are that this area has been previously disturbed. Further north, before the connection with the railroad grade, the route traverses forested wetland areas with hydric soils. Boardwalks may be needed in some of these areas, as soil disturbance is not possible. The route would follow areas of disturbed soils along the narrow gauge railroad grade, two-tracks in and around Glen Haven Village, and the two-track adjacent the Alligator Hill escarpment. Some native soils may be impacted in the forest adjacent Pine Haven Road. In Segment 7, the trail would use the existing Bay View Trail lower trail north of the southernmost Thoreson Road/M-22 intersection. Soils along this trail have already been disturbed. In Segment 8, the trail would be located behind the North Unity School to provide an interesting perspective of the school and Narada Lake. Undisturbed soils in this area may be impacted, unless an old two-track can be found that is suitable for a trail location. In Segment 9, north of the Bufka farm, due to physical limitations, the trail would be placed below the road, in an area of mature hardwoods. Soils would be disturbed in these areas, since in most cases the trail would not follow old two-track roads, where soils have already been disturbed.

Due to the concept of this alternative, the Trailway alignment leaves the M-22/M-109 right-of-way in part of six of the nine segments. In most cases, however, they are deviations from the highway use routes where the soils have previously been disturbed. Since many of the trail locations out of the highway rights-of-way are on areas of previously disturbed soils, impacts to soils is likely, in the short-term to be moderate adverse and in the long-term, minor and adverse.

Cumulative effects. Past, present, and anticipated future projects that contribute to impacts on soils include improvements to the road ends on Lake Michigan at county roads 669 and 651, Glen Haven Village improvements, Lake Michigan overlooks improvements (Pierce Stocking Scenic Drive), Dune Climb parking area improvements, and MDOT M-22 shoulder improvements. Each of these projects would likely result in short-term and long-term, minor adverse impacts to soils, since most of the soils in these areas have been previously disturbed. Alternative B would contribute short-term, moderate and long-term, minor adverse impacts. The impacts of the other actions described above, would result in short-term, moderate adverse and long-term, minor adverse cumulative impacts to soils. Alternative B's contribution to these cumulative impacts would be moderate.

Conclusions. Alternative B would have short-term, moderate adverse and long-term, minor adverse impacts to soils. Cumulative impacts would be anticipated to be short-term and long-term, minor and adverse. There would be no *impairment* of soils from implementation of the alternative A (see specific definition of impairment in section 2.6.3 “Impairment of National Park Resources”).

Soil Characteristics and Proposed Trailway Segments

Map Unit	Soil Association	Soil Composition / Permeability	Gradient (Slope)	Erodability (from K-factor)	Occurrence by Trail Segment
Ah	Adrian-Houghton Mucks	Organics / Very poorly drained	**Lowland**	Low	**5,6,8**
AuA	Au Gres - Kalkaska sands	Two sands / Somewhat poorly drained	0-4%	Low - Moderate	**6,8,9**
DkD	Deer Park sand	Sandy / Excessively drained	6-18%	Low	**2,5,6,9**
DkF	Deer Park sand	Sandy / Excessively drained	**18-45%**	Low	**2,9**
DrB	Deer Park - Roscommon sands	Two sands / Excessively drained	0-6%	Low	**5,6**
Du	Dune Land	Active sand dunes	6-60%	**High**	**5**
EaB	East Lake loamy sand	Sandy loam / Somewhat excessively drained	0-6%	Low	**1,4,5,**
EdB	Eastport sand	Sand / Somewhat excessively drained	0-6%	Low	**2,4,5,6**
Em	Edwards muck	Muck - marl beds complex / V. Poorly drained	**Lowland**	Low	**9**
EnA	Emmet-Leelanau complex	Two loamy / Well drained	0-2%	Moderate	**7**
EnB	Emmet-Leelanau complex	Two loamy / Well drained	2-6%	Moderate	**2,7**
EnC	Emmet-Leelanau complex	Two loamy / Well drained	6-12%	Moderate	**7**
EnD	Emmet-Leelanau complex	Two loamy / Well drained	12-18%	Moderate	**7**
EnE	Emmet-Leelanau complex	Two loamy / Well drained	**18-25%**	Moderate	**7**
EsE	Emmet-Omena sandy loams	Two sandy loams / Moderately well drained	**18-25%**	Moderate	**9**
KaB	Kalkaska sand	Sand / Somewhat excessively drained	0-6%	Low	**1,2,**
KaC	Kalkaska sand	Sand / Somewhat excessively drained	6-12%	Low	**1,3,6,7**
KaD	Kalkaska sand	Sand / Somewhat excessively drained	12-18%	Low	**1,2,3,5,7**
KaE	Kalkaska sand	Sand / Somewhat excessively drained	**18-25%**	Low	**7**
KaF	Kalkaska sand	Sand / Somewhat excessively drained	**25-45%**	Low	**2,3,7**
KeB	Kalkaska-East Lake loamy sands	Two sandy loams / Somewhat excessively drained	0-6%	Low	**1,3,6,7,8,9**
LIB	Leelanau-East Lake loamy sands	Two sandy loams / Moderate to excessively drained	0-6%	Low - Moderate	**3,4,7**
LIC	Leelanau-East Lake loamy sands	Two sandy loams / Moderate to excessively drained	6-12%	Low - Moderate	**2,4,7**
LID	Leelanau-East Lake loamy sands	Two sandy loams / Moderate to excessively drained	12-18%	Low - Moderate	**1,3,4,7**
LIE	Leelanau-East Lake loamy sands	Two sandy loams / Moderate to excessively drained	**18-25%**	Low - Moderate	**1,4,7**
LIF	Leelanau-East Lake loamy sands	Two sandy loams / Moderate to excessively drained	**25-45%**	Low - Moderate	**1,4**
Lm	Lupton-Markey mucks	Organics / Very poorly drained	**Lowland**	Low	**6,8,9**
MdB	Mancelona sandy loam	Sandy / Excessively drained	0-6%	Moderate	**1,**
MdC	Mancelona sandy loam	Sandy / Excessively drained	6-12%	Moderate	**1,9**
MIB	Mancelona -East Lake loamy sands	Sand / Somewhat excessively drained	0-6%	Low - Moderate	**1,5,7**
MIC	Mancelona -East Lake loamy sands	Sand / Somewhat excessively drained	6-12%	Low - Moderate	**4,**
MIE	Mancelona -East Lake loamy sands	Sand / Somewhat excessively drained	**18-25%**	Low - Moderate	**1**
MrB	Mancelona-Richter gravelly sandy loams	Two Gravelly sandy loams / Poorly drained	0-6%	Moderate - Low-L	**8,9**
NsC	Nester silt loam	Clayey / Moderately well drained	6-12%	**High**	**1**
Rm	Roscommon sand - Markey muck	Two soils Sandy Muck complex / Poor to mod. drained	**Lowland**	Low	**5**
TmA	Tonkey-Mususcong-Iosco sandy loams	Three soils loamey clayey / Poor to v. poorly drained	0-2%	**Moderate - High**	**7**
WkC	Wallace-Kalkaska sands	Two sand / Somewhat excessively drained	2-12%	Low	**5,8,9**
WIC	Wind Eroded Land	Conditions to variable for interpretations to be made	Varies	**High**	**5,7,8**

SOCIOECONOMICS

The influence area for economic and social considerations associated with the Lakeshore encompasses Benzie, Leelanau and Grand Traverse Counties. Benzie and Leelanau are directly affected as portions of the Lakeshore are located within their boundaries, whereas Grand Traverse is indirectly affected due to its role as a regional trade and service center and a center of seasonal migration and tourism for the entire region. The region is largely rural, though along with neighboring Kalkaska County, the three counties comprise the Traverse City "micropolitan" statistical area. Traverse City, the largest community in the region (2006 pop. 14,407), is located about 25 miles east of the Lakeshore. The communities of Empire, Glen Arbor, Leland, Beulah and others are located in nearby areas surrounding the Lakeshore. Timber, maritime commerce, agriculture, light manufacturing were important in the region's economic development with tourism and outdoor recreation emerging as economic drivers more recently.

Population

All three counties have experienced long-term population growth, characterized by relatively rapid growth in the 1970s, tempered by state and national economic slowdowns in the early/mid 1980s, with growth resuming thereafter. The pace of population growth has moderated in recent years. The three counties had a combined total of 124,716 residents in 2006, more than two-thirds of which lived in Grand Traverse County. Benzie County's population of 17,652 accounted for 14% of the total with Leelanau County having 18% of the total.

Economic Overview

Strong economic growth accompanied the region's population growth. Total full and part-time employment in Benzie County was 8,611 in 2005, compared to 5,539 in 1995; a gain of 3,072 jobs or 55%. Employment gains in Grand Traverse County during the 10 years totaled 10,302 jobs, or 19%, and raising total employment to 65,301 jobs in 2005. Leelanau County saw an increase of 2,350 jobs, or 30%, between 1995 and 2005. Recent economic growth and development has brought about differences in the economic structures of the individual counties. Employment data for 2005 highlight those differences. Benzie County's economy tends to be more industrial, that of Grand Traverse more trade and services oriented, and that of Leelanau more dependent on agriculture, government and services. Unemployment rates are generally below the statewide averages in Leelanau and Grand Traverse counties, while those in Benzie County tend to be higher.

Demographics

Residents of the region tend to be older than the general population statewide, with median ages ranging from 37.7 years in Grand Traverse County, to 40.8 years in Benzie County, to 42.6 years in Leelanau County. Leelanau and Benzie counties have relatively higher proportions of residents 55 years and older, many of whom are retired or semi-retired.

Land Use and Ownership

The predominant land uses in the study area include agriculture, forested areas, natural areas supporting wildlife, rural residential, residential, commercial and industrial lands. The latter are concentrated in and near Traverse City, other communities in the area, and along the major highway corridors through the region. Land use adjacent to the Lakeshore is a combination of private forested and farm lands and rural residential development, the latter including clustered developments around private inland lakes.

Trailway sections with the highest potential to conflict with existing land use includes those sections crossing private land, running adjacent to private land (in the right-of-way), and sections running through existing communities and residential and commercial neighborhoods. The Village of Empire, the community of Glen Arbor, and a few isolated rural residential areas near the Dune Climb and Little Traverse Lake have been identified as potential conflict areas.

The thresholds to determine the intensity of impacts on socioeconomics are defined as follows:

Negligible: Effects on adjacent landowners, neighbors, businesses, agencies, community infrastructure, social conditions, etc. would be non-existent, barely detectable, or detectable only through indirect means and with no discernible impact on local social or economic conditions.

Minor: Effects on adjacent landowners, neighbors, businesses, agencies, community infrastructure, social conditions, etc. would be small but detectable, geographically localized, affect few people, comparable in scale to typical year-to-year or seasonal variations, and not expected to substantively alter established social or economic structures over the long-term.

Moderate: Effects on adjacent landowners, neighbors, businesses, agencies, community infrastructure, social conditions, etc. would be readily apparent or observable across a wider geographic area, affect many people, and could have noticeable effects on the established economic or social structure and conditions over the long-term.

Major: Effects on adjacent landowners, neighbors, businesses, agencies, community infrastructure, social conditions, etc., would be readily detectable or observable, affect a large segment of the population, extend across much of a community or region, and have a substantial influence on the established social or economic conditions.

No Action Alternative

Under the no-action alternative, no new non-motorized trail would be constructed on or near the M-22/M-109 rights-of way. Bicyclists and other users would continue to use the travel surface or shoulder of the state highways. There would be no impacts on socioeconomics.

Cumulative effects. Past, present, and anticipated future projects that contribute to impacts on socioeconomics include improvements to the road ends on Lake Michigan at county roads 669 and 651, Glen Haven Village improvements, Lake Michigan overlooks improvements (Pierce Stocking Scenic Drive), Dune Climb parking area improvements, and MDOT M-22 shoulder improvements. Most of these projects would likely result in short-term and long-term, negligible beneficial impacts to socioeconomics, since they are generally upgrades to existing developments. Only planned developments at Glen Haven Village may have long-term, minor beneficial impacts due to a possible increase in visitation or length of stay. The no-action alternative would contribute nothing to these impacts.

Conclusions. There would be no impacts to socioeconomics from this alternative. Cumulative impacts would be anticipated to be short-term and long-term, negligible and beneficial.

Alternative A
Under Alternative A, a non-motorized trail would be constructed in the M-22/M-109 rights-of-way to the extent possible, only deviating where necessary due to physical or environmental constraints. Placement outside rights-of-way would be required in Segments 1 and 5. Development of the Trailway would have negligible impacts on the population of the area in both the short-term and long-term. There may be increases in the number of visitors who come to the area to use the Trailway and they may stay longer. There may be more retail, lodging, and tourism-type spending, which could result in more seasonal jobs. Community services may be affected due to more visitors to the area. Little increase in vehicular traffic is expected. In fact, there may be slightly fewer motor vehicles on the roads due to increased bicycle traffic. Adjacent land use would be affected, especially in areas where driveways are concentrated (along lakes and in communities), where vehicle and Trailway conflicts could occur. Overall, implementation of this alternative would, in the short-term and long-term, be negligible to minor, adverse and beneficial.

Cumulative effects. Past, present, and anticipated future projects that contribute to impacts on socioeconomics include improvements to the road ends on Lake Michigan at county roads 669 and 651, Glen Haven Village improvements, Lake Michigan overlooks improvements (Stocking Scenic Drive), Dune Climb parking area improvements, and MDOT M-22 shoulder improvements. Most of these projects would likely result in short-term and long-term, negligible beneficial impacts to socioeconomics, since they are generally upgrades to existing developments. Only planned developments at Glen Haven Village may have long-term, minor beneficial impacts due to a possible increase in visitation or length of stay, and resultant tourism-associated economic gains for the area. The impacts of the other actions described above, would result in short-term and long-term, minor adverse and beneficial cumulative impacts to socioeconomics. Alternative A's contribution to these cumulative impacts would be minor.

Conclusions. Alternative A would have short-term and long-term, negligible to minor, adverse and beneficial impacts to socioeconomics. Cumulative impacts would be anticipated to be short-term and long-term, negligible and beneficial.

Alternative B: the Preferred Alternative
Under Alternative B, a non-motorized trail would be constructed in the M-22/M-109 rights-of-way, in many areas, but deviating from the highway corridor where possible to avoid physical or environmental constraints, provide access to natural, cultural, or recreation resources, and to promote a broader variety of experiences for the Trailway user. Development of the Trailway would have negligible impacts on the population of the area in both the short-term and long-term. There may be increases in the number of visitors who come to the area to use the Trailway and they may stay longer. There may be more retail, lodging, and tourism-type spending, which could result in more seasonal jobs. Community services may be affected due to more visitors to the area. Little increase in vehicular traffic is expected. In fact, there may be slightly fewer motor vehicles on the roads due to increased bicycle traffic. Adjacent land use would be minimally affected, especially since areas where driveways are concentrated (along lakes and in communities) are circumvented, where possible where vehicle and Trailway conflicts could occur. Overall, implementation of this alternative would, in the short-term and long-term, be negligible, adverse and beneficial.

Cumulative effects. Past, present, and anticipated future projects that contribute to impacts on socioeconomics include improvements to the road ends on Lake Michigan at county roads 669 and 651, Glen Haven Village improvements, Lake Michigan overlooks improvements (Pierce Stocking Scenic Drive), Dune Climb parking area improvements, and MDOT M-22

shoulder improvements. Most of these projects would likely result in short-term and long-term, negligible beneficial impacts to socioeconomics, since they are generally upgrades to existing developments. Only planned developments at Glen Haven Village may have long-term, minor beneficial impacts due to a possible increase in visitation or length of stay, and resultant tourism-associated economic gains for the area. The impacts of the other actions described above, would result in short-term and long-term, negligible adverse and beneficial cumulative impacts to socioeconomics. Alternative B's contribution to these cumulative impacts would be negligible.

Conclusions. Alternative B would have short-term and long-term, negligible, adverse and beneficial impacts to socioeconomics. Cumulative impacts would be anticipated to be short-term and long-term, negligible and beneficial.

CULTURAL RESOURCES

Potential impacts on cultural resources (defined as archeological resources, ethnographic resources, prehistoric structures, and historic properties), either listed on or eligible for inclusion on the National Register of Historic Places, were identified and evaluated in accordance with the Advisory Council on Historic Preservation's regulations implementing Section 106 of the National Historic Preservation Act (36 CFR 800, *Protection of Historic and Cultural Properties):* by (1) determining the area of potential effect; (2) identifying cultural resources present in the area of potential effect that are National Register listed or eligible for such listing; (3) applying the criteria of adverse effect to affected resources; and (4) considering ways to avoid, minimize, or mitigate adverse effects.

Under the Advisory Council's regulations a formal determination of *adverse effect* or *no adverse effect* must be made for affected National Register listed or eligible cultural resources. An *adverse effect* occurs whenever an action alters, directly or indirectly, any of the characteristics of a cultural resource that qualify it for inclusion on the National Register, i.e., diminishing the integrity of its location (the extent to which a resource retains its historic appearance), design, setting, materials, workmanship, feeling, or association. Adverse effects also include reasonably foreseeable effects caused by the alternatives that would occur later in time, be farther removed in distance or be cumulative (36 CFR 800.5 (a)(1)). A determination of *no adverse effect* means there is an effect, whether negative or beneficial, but the effect would not meet the criteria of an adverse effect (36 CFR 800.5(b)). Thus, the criteria used in this plan for characterizing the severity or intensity of impacts to National Register listed or eligible historic properties are the Section 106 determinations of effect: *adverse effect* or *no adverse effect.*

No Action Alternative

Under the no-action alternative, no new non-motorized trail would be constructed on or near the M-22/M-109 rights-of way. Bicyclists and other users would continue to use the travel surface or shoulder of the state highways. There would be no impacts on cultural resources.

Cumulative effects. Past, present, and anticipated future projects that contribute to impacts on cultural resources include Glen Haven Village improvements and MDOT M-22 shoulder improvements. These projects would have no adverse effect in the short-term and long-term. The no-action alternative would contribute nothing to these impacts.

Conclusions. There would be no impacts to cultural resources from this alternative. Cumulative impacts would be anticipated to be short-term and long-term, with no adverse effect. There would be no *impairment* of cultural resources from implementation of the no-action alternative (see specific definition of impairment in section 2.6.3 “Impairment of National Park Resources”).

Alternative A

Under Alternative A, a non-motorized trail would be constructed in the M-22/M-109 rights-of-way to the extent possible, only deviating where necessary due to physical or environmental constraints. Placement outside rights-of-way would be required in Segments 1, 5, 7. In segment 1, the Trailway would remain near M-22 through the Tweddle-Treat cultural landscape, passing in front of the Pelky Barn and the Tweddle School. In Segment 5 the route would use the old narrow-gauge railroad grade to Glen Haven Village, pass through the village, and then on to D.H. Day Campground. It would pass through Port Oneida Rural Historic District, generally adjacent to M-22, except in Segment 7 when following the Bay View Trail behind the Charles Olsen farm. In Segments 8 and 9, it would pass in front of the Shalda Log Cabin and the Bufka/Kropp/Eitzen cultural landscape, adjacent to M-22. Trail width and surface would be sensitive to cultural resources. Crushed limestone, rather than asphalt, would be considered in cultural landscapes. The following guidelines were taken into consideration in the placement and construction of the Trailway so as to limit adverse effects on cultural resources:

- Routes along or in road rights-of-way would have no impacts.
- Routes along tree lines at the edge of open fields would not have an adverse impact.
- Routes along hedgerows, fence lines, wind breaks, would similarly not have an adverse impact.
- Routes along utility corridors would similarly not have adverse impacts.
- Routes along old railroad grades would similarly not have an adverse impact.
- Routes through the middle of fields would potentially have impacts.
- Routes through the middle of farmsteads would potentially have impacts.

Cumulative effects. Past, present, and anticipated future projects that contribute to impacts on cultural resources include Glen Haven Village improvements and MDOT M-22 shoulder improvements. These projects would have no adverse effect in the short-term and long-term. The impacts of the other actions described above, would result in short-term and long-term, no adverse effect to cultural resources. Alternative A’s contribution to these cumulative impacts would be negligible, which would result in a no adverse effect.

Conclusions. Alternative A would have short-term and long-term, no adverse effects on cultural resources. Cumulative impacts would be anticipated to be short-term and long-term, with no adverse effect. There would be no *impairment* of cultural resources from implementation of the Alternative A (see specific definition of impairment in section 2.6.3 “Impairment of National Park Resources”).

Alternative B: the Preferred Alternative

Under Alternative B, a non-motorized trail would be constructed in the M-22/M-109 rights-of-way, in many areas, but deviating from the highway corridor where possible to avoid physical or environmental constraints, provide access to natural, cultural,

or recreation resources, and to promote a broader variety of experiences for the Trailway user. Placement outside rights-of-way would be required in Segments 1, 5, 7, 8, and 9.

In Segment 1, the west side of Norconk Road and the north side of Stormer would be used to establish a 10' crushed limestone pathway. The pathway would pass near the Tweddle Farm and Tweddle School. Consideration of the Tweddle-Treat cultural landscape would be made through use of trail material.

In Segment 5 the trail would extend from Harwood Drive to the Glen Haven Historic District along the former narrow gauge railroad grade as a 10' wide crushed limestone path. An existing two-track road would be used to connect the railroad grade route with M-209 in Glen Haven. An M-209 crossing would be developed near the Dean and Rude houses and in the vicinity of the Blacksmith Shop.

In Segment 7 the Trailway enters the Port Oneida Historic District. The Trailway diverts from M-22 north on Thoreson Road to access the lower section of the Bay View Hiking Trail and would be a 10' crushed limestone path. The Trailway crosses Thoreson Road, links up again with the Bay View Trail behind the Charles Olsen Farm and provides access to the Olsen farm, Kelderhouse farm and cemetery, and other properties in the Port Oneida Rural Historic District.

In Segment 8 it would then pass through Port Oneida Rural Historic District, generally adjacent to M-22 until it swings behind the North Unity School. In Segment 9, it would pass in front of the Shalda Log Cabin along M-22 and then follow the tree line of the Bufka Farm to hook up with an old wagon road the goes behind the Bufka/Kropp/Eitzen cultural landscape. Trail width and surface would be sensitive to cultural resources. Crushed limestone, rather than asphalt, would be considered in cultural landscapes. The following guidelines were taken into consideration in the placement and construction of the Trailway so as to limit adverse effects on cultural resources:

- Routes along or in road rights-of-way would have no impacts.
- Routes along tree lines at the edge of open fields would not have an adverse impact.
- Routes along hedgerows, fence lines, wind breaks, would similarly not have an adverse impact.
- Routes along utility corridors would similarly not have adverse impacts.
- Routes along old grades would similarly not have an adverse impact.
- Routes through the middle of fields would potentially have impacts.
- Routes through the middle of farmsteads would potentially have impacts.

Cumulative effects. Past, present, and anticipated future projects that contribute to impacts on cultural resources include Glen Haven Village improvements and MDOT M-22 shoulder improvements. These projects would have no adverse effect in the short-term and long-term. The impacts of the other actions described above, would result in short-term and long-term, no adverse effect to cultural resources. Alternative B's contribution to these cumulative impacts would be negligible, which would result in a no adverse effect.

Conclusions. Alternative B would have short-term and long-term, no adverse effects on cultural resources. Cumulative impacts would be anticipated to be short-term and long-term, with no adverse effect. There would be no *impairment* of cultural

resources from implementation of the alternative A (see specific definition of impairment in section 2.6.3 “Impairment of National Park Resources”).

VISITOR USE

Visitor Opportunities
Development of the Trailway would provide visitors with opportunities to experience the Lakeshore in a way not currently available. Construction of the Trailway would provide visitors with a non-motorized linear trail system that is interconnected with historical, cultural, recreational, and environmental points of interest throughout the Lakeshore and surrounding communities; a Trailway that promotes health, environmental, social, and economic benefits and provides a safe alternative for walking, biking, running, and cross-country skiing; and is universally accessible wherever possible. Scenic views would be offered in ways not available from motor vehicles.

Visitor Use
Visitor use at the Lakeshore has been relatively steady over time, though with some positive correlation to overall economic conditions in the broader Great Lakes region and to local population growth. Thus, visitor use at the Lakeshore in the future will be primarily a function of population growth and continuing rural residential development in the vicinity of Empire, Beulah, Glen Arbor and Cedar, realizing increases in the region’s seasonal population and long-term growth across the Great Lakes.

Changes in park visitation due to construction of Trailway are difficult to predict. The Trailway could cause some local residents to visit the Lakeshore more frequently than they normally would. The Trailway could become a destination for some; for others it may extend their stay. The Trailway may also change visitor use patterns for activities not related to the Trailway.

The thresholds to determine the intensity of impacts on visitor opportunities and use are as follows:

Negligible: The changes in visitor opportunities and use are barely detectable to individual visitors.

Minor: The changes in visitor opportunities and use are small but detectable to individual visitors.

Moderate: The changes in visitor opportunities and use are of medium intensity and are readily apparent to individual visitors.

Major: The changes in visitor opportunities and use are severely adverse or exceptionally beneficial and are conspicuous to individual visitors.

No Action Alternative
Under the no-action alternative, no new non-motorized trail would be constructed on or near the M-22/M-109 rights-of way. Bicyclists and other users would continue to use the travel surface or shoulder of the state highways. There would be no impacts on visitor opportunities and use.

Cumulative effects. Past, present, and anticipated future projects that contribute to impacts on visitor opportunities and use include improvements to the road ends on Lake Michigan at county roads 669 and 651, Glen Haven Village improvements, Lake Michigan overlooks improvements (Pierce Stocking Scenic Drive), Dune Climb parking area improvements, and MDOT M-22 shoulder improvements. These projects would likely result in short-term and long-term, minor beneficial impacts to visitor opportunities and use, since they are generally upgrades to existing developments. The no-action alternative would contribute nothing to these impacts.

Conclusions. There would be no impacts to visitor opportunities and use from this alternative. Cumulative impacts would be anticipated to be short-term and long-term, minor and beneficial.

Alternative A

Under Alternative A, a non-motorized trail would be constructed in the M-22/M-109 rights-of-way to the extent possible, only deviating where necessary due to physical or environmental constraints. This alternative would provide visitors with a non-motorized linear Trailway system that is interconnected with historical, cultural, recreational, and environmental points of interest throughout the Lakeshore and surrounding communities; a Trailway that promotes health, environmental, social, and economic benefits and provides a safe alternative for walking, biking, running, and cross-country skiing; and is universally accessible wherever possible. Impacts on visitor opportunities are likely to be, in the short-term and long-term, moderate and beneficial. Recent research suggests that overall visitor use in the Lakeshore may increase about 60,000 visitors due to development of the Trailway, a short-term and long-term, moderate beneficial impact.

Cumulative effects. Past, present, and anticipated future projects that contribute to impacts on visitor opportunities and use include improvements to the road ends on Lake Michigan at county roads 669 and 651, Glen Haven Village improvements, Lake Michigan overlooks improvements (Pierce Stocking Scenic Drive), Dune Climb parking area improvements, and MDOT M-22 shoulder improvements. These projects would likely result in short-term and long-term, minor beneficial impacts to visitor opportunities and use, since they are generally upgrades to existing developments. The impacts of the other actions described above, would result in short-term and long-term, and moderate beneficial impacts to visitor opportunities and use. Alternative A's contribution to these cumulative impacts would be moderate.

Conclusions. Alternative A would have short-term and long-term, moderate beneficial impacts on visitor opportunities and use. Cumulative impacts would be anticipated to be short-term and long-term, minor and beneficial.

Alternative B: the Preferred Alternative

Under Alternative B, a non-motorized trail would be constructed in the M-22/M-109 rights-of-way, in many areas, but deviating from the highway corridor where possible to avoid physical or environmental constraints, provide access to natural, cultural, or recreation resources, and to promote a broader variety of experiences for the Trailway user. This alternative would provide visitors with a non-motorized linear Trailway system that is interconnected with historical, cultural, recreational, and environmental points of interest throughout the Lakeshore and surrounding communities; a Trailway that promotes health, environmental, social, and economic benefits and provides a safe alternative for walking, biking, running, and cross-country skiing; and is universally accessible wherever possible. Impacts on visitor opportunities are likely to be, in the short-term and long-term, moderate and beneficial. Recent research suggests that overall visitor use in the Lakeshore may increase about 60,000 visitors due to development of the Trailway, a short-term and long-term, moderate beneficial impact.

Cumulative effects. Past, present, and anticipated future projects that contribute to impacts on visitor opportunities and use include improvements to the road ends on Lake Michigan at county roads 669 and 651, Glen Haven Village improvements, Lake Michigan overlooks improvements (Pierce Stocking Scenic Drive), Dune Climb parking area improvements, and MDOT M-22 shoulder improvements. These projects would likely result in short-term and long-term, minor beneficial impacts to visitor opportunities and use, since they are generally upgrades to existing developments. The impacts of the other actions described above, would result in short-term and long-term, and moderate beneficial impacts to visitor opportunities and use. Alternative B's contribution to these cumulative impacts would be moderate.

Conclusions. Alternative B would have short-term and long-term, moderate beneficial impacts on visitor opportunities and use. Cumulative impacts would be anticipated to be short-term and long-term, minor and beneficial.

OPERATIONS AND MAINTENANCE

The thresholds to determine the intensity of impacts on operations and maintenance are as follows:

Negligible: Effects on entities' operations would be at or below the level of detection.

Minor: Effects on entities' operations would be small but detectable. The change would be noticeable to staff, but probably not to the public.

Moderate: Effects on entities' operations would be readily apparent to staff and possibly to the public.

Major: Effects on entities' operations would be substantial, widespread, and apparent to staff and the public.

No Action Alternative

Under the no-action alternative, no new non-motorized trail would be constructed on or near the M-22/M-109 rights-of way. Bicyclists and other users would continue to use the travel surface or shoulder of the state highways. There would be no impact on operations and maintenance of any entity involved with operation and maintenance, including the Lakeshore, MDOT, or a Trailway Management Team.

Cumulative effects. Past, present, and anticipated future projects that contribute to impacts on entity operations and maintenance include improvements to the road ends on Lake Michigan at county roads 669 and 651, Glen Haven Village improvements, Lake Michigan overlooks improvements (Pierce Stocking Scenic Drive), Dune Climb parking area improvements, and MDOT M-22 shoulder improvements. These projects would likely result in short-term and long-term, minor adverse impacts to operations and maintenance. The no-action alternative would contribute nothing to these impacts.

Conclusions. There would be no impacts to operations and maintenance from this alternative. Cumulative impacts would be anticipated to be short-term and long-term, minor and adverse.

Alternative A
Under Alternative A, a non-motorized trail would be constructed in the M-22/M-109 rights-of-way to the extent possible, only deviating where necessary due to physical or environmental constraints. When completed, the Trailway would include roughly 27 miles of trail, with asphalt and crushed limestone surfaces, bridges, boardwalks, trail and road striping, signage, interpretive waysides, retention walls, landscaping, and many other associated components. These all have to be monitored and maintained. At this time, it is uncertain who will be responsible for trail operations and maintenance. It is likely, however, that short-term and long-term impacts to entities from operations and maintenance would be major and adverse.

Cumulative effects. Past, present, and anticipated future projects that contribute to impacts on visitor opportunities and use include improvements to the road ends on Lake Michigan at county roads 669 and 651, Glen Haven Village improvements, Lake Michigan overlooks improvements (Pierce Stocking Scenic Drive), Dune Climb parking area improvements, and MDOT M-22 shoulder improvements. These projects would likely result in short-term and long-term, minor adverse impacts to NPS, MDOT, and the Trailway Management Team operations and maintenance. The impacts of the other actions described above, would result in short-term and long-term, major impacts to operations and maintenance. Alternative A's contribution to these cumulative impacts would be major.

Conclusions. Alternative A would have short-term and long-term, major adverse impacts on operations and maintenance. Cumulative impacts would be anticipated to be short-term and long-term, minor and adverse.

Alternative B: the Preferred Alternative
Under Alternative B, a non-motorized trail would be constructed in the M-22/M-109 rights-of-way, in many areas, but deviating from the highway corridor where possible to avoid physical or environmental constraints, provide access to natural, cultural, or recreation resources, and to promote a broader variety of experiences for the Trailway user. When completed, the Trailway would include roughly 27 miles of trail, with asphalt and crushed limestone surfaces, bridges, boardwalks, trail and road striping, signage, interpretive waysides, retention walls, landscaping, and many other associated components. These all have to be monitored and maintained. At this time, it is uncertain who will be responsible for trail operations and maintenance. It is likely, however, that short-term and long-term impacts to entities from operations and maintenance would be major and adverse.

Cumulative effects. Past, present, and anticipated future projects that contribute to impacts on visitor opportunities and use include improvements to the road ends on Lake Michigan at county roads 669 and 651, Glen Haven Village improvements, Lake Michigan overlooks improvements (Pierce Stocking Scenic Drive), Dune Climb parking area improvements, and MDOT M-22 shoulder improvements. These projects would likely result in short-term and long-term, minor adverse impacts to NPS, MDOT, and Trailway Management Team operations and maintenance. The impacts of the other actions described above, would result in short-term and long-term, major impacts to operations and maintenance. Alternative B's contribution to these cumulative impacts would be major.

Conclusions. Alternative B would have short-term and long-term, major adverse impacts on operations and maintenance. Cumulative impacts would be anticipated to be short-term and long-term, minor and adverse.

C H A P T E R 3 – Public Involvement

3.1 LEELANAU SCENIC HERITAGE ROUTE COMMITTEE

In the summer of 1999, a committee was developed to investigate the possibility of designating M-22 as a Scenic Corridor and as such, eligible for the Michigan Department of Transportation (MDOT) State Heritage Route Program funds (National Scenic Byways) and Transportation Enhancement Act-21 (TEA-21) funds for projects. As part of this effort, the Leelanau Heritage Route nominating team developed the following mission statement:

> ***"To promote measures which protect and enhance the scenic, historical and recreational characteristics of Michigan Highway 22 as it traverses the rural countryside and unique villages of Leelanau County."***

The nominating team also worked to compose and gather a list of concerned citizens from all parts of the County that would represent the opinions, views and concerns of the citizenry of Leelanau County. Community involvement encompassed many aspects including county, township and village government representation, local conservation groups, and private citizens. The Leelanau Conservancy helped secure initial planning and inventory funding to produce the ***Leelanau Scenic Heritage Route Management Plan***.

The M-22 Nominating Team, now the Leelanau Scenic Heritage Route Committee, is still composed of representatives from each Village and Township along the Heritage Route Corridor which has expanded to include M-22, M-109, and M-204. Committee members include the Michigan Department of Transportation, Leelanau County Planning Commission, Leelanau County Road Commission, Leelanau Conservancy, Traverse Area Recreational and Transportation Trails, Inc. (TART), chambers of commerce, and citizens. The Committee is managed and coordinated by the Northwest Michigan Council of Governments. In 2006, the Committee completed the required five year management plan update which included the Trailway as a priority project.

Over the years, there has been much interest in developing an off-road non-motorized trailway parallel to the Leelanau Scenic Heritage Route on M-22 and M-109 in the Sleeping Bear Dunes National Lakeshore. A non-motorized trailway along the corridor would enable bicyclists and pedestrians to enjoy the scenic beauty of Leelanau County while at the same time increasing safety, and connecting the Lakeshore features and local communities.

3.2 ENGAGING THE PUBLIC AND STAKEHOLDERS

In 2006, the Leelanau Scenic Heritage Route Committee created a Trailway Work Group to develop a multi-use, non-motorized trailway along the M-22 and M-109 corridor in the Lakeshore in Leelanau County. The Work Group includes members from the Lakeshore, the Michigan Department of Transportation, townships and village, the Friends of Sleeping Bear Dunes, TART Trails Inc., and interested citizens.

By working through the Leelanau Scenic Heritage Route Committee and the Trailway Work Group, this project has provided many opportunities for public involvement. Below is the listing of the meetings and activities where the public has provided input and review.

Leelanau Scenic Heritage Route Committee Meetings:

2005
September 26
October 24
November 28

2006
January 30
February 27
March 27
April 24
May 22
June 26
August 4-5: Port Oneida Days at Sleeping Bear Dunes National Lakeshore
September 25
October 30
November 27

2007
January 29
February 26
March 26
April 21
May 21
June 25
August 10-11: Port Oneida Days at Sleeping Bear Dunes National Lakeshore
September 24
October 29
November 26

2008
January 28
February 25
March 31
April 28
May 19
June 23
October 27

Trailway Work Group Meetings:

October 25, 2005
January 23, 2006
February 21, 2006
March 20, 2006
July 18, 2006
September 13, 2006
October 18, 2006
March 22, 2007
May 11, 2007
May 31, 2007
June 24, 2007
February 25, 2008
July 28, 2008
November 17, 2008
December 9, 2008

Introductory Presentations to Local Governments:

Leelanau Scenic Heritage Route Committee staff with the support of the National Park Service, Rivers and Trails Program presented the proposed Trailway Project to the following governments in early 2006:

Empire Township
Village of Empire
Glen Arbor Township
Cleveland Township

The Trailway flyer handout/map (please refer to the following page) was distributed at these meetings. At the time, Centerville Township was not contacted because the trail did not go to that far in the first stages of planning. The Township has been included and contacted to present and discuss the draft environmental assessment and plan.

Leelanau Scenic Heritage Route Trailway Project

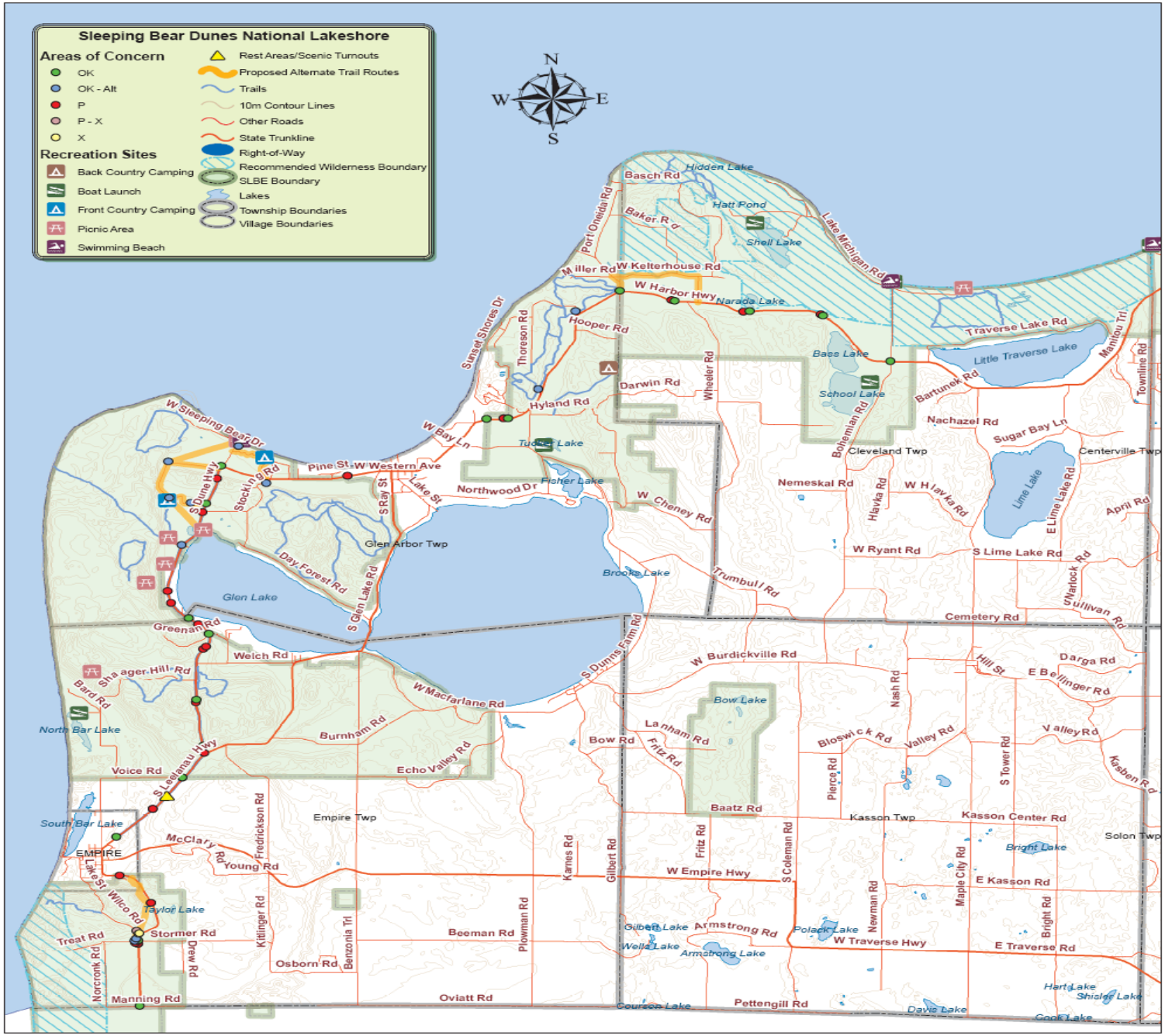
Who: The Leelanau Scenic Heritage Route Committee's Trailway Work Group is continuing the development of a multi-use, non-motorized trailway along the M-22 and M-109 corridor in Leelanau County. The Work Group includes members from the Leelanau Scenic Heritage Route Committee (Sleeping Bear Dunes National Lakeshore, the Michigan Department of Transportation, and local governments); Friends of Sleeping Bear Dunes, TART Trails Inc., cyclist clubs, recreation groups, and citizens.

What: The proposed 25 mile non-motorized Trailway would parallel M-22 and M-109 and connect national lakeshore park visitor sites and facilities, including campgrounds and other points of interest. The trailway would be separated from the roadway where possible and would provide a safe, alternative transportation opportunity for park visitors. It would also connect the Park to the adjacent communities of Empire and Glen Arbor, which will be working with the Trailway Work Group to consider the Trailway route through their communities.

When: The Work Group's consultant has completed Phase One: Environmental Assessment and Pre-Engineering that includes recommendations for the preferred Trailway route, trail width, and surfacing and cost estimates. The primary concerns that have been studied include the impact of the Trailway on the park's natural and cultural resources, providing a quality recreational experience for park visitors, and the Trailway development and maintenance costs.

The Leelanau Scenic Heritage Route Trailway Work Group is dedicated to the planning and creation of a public non-motorized trail from County Road 651 to Manning Road in Leelanau County, most of which goes through the Sleeping Bear Dunes National Lakeshore. To fulfill this purpose, the work group will:

- Plan, promote, and secure funding for the project.
- Collaborate with local, state, and federal partners.
- Provide a safe and accessible trail for walking, running, biking, cross-country skiing and nature study for all ages and abilities.
- Promote the Trailway project to enhance the local economy by serving as a destination for outdoor recreational activities by residents and visitors alike.


Sleeping Bear Dunes National Lakeshore
Areas of Concern
OK
OK - Alt
P
P - X
X
Recreation Sites
Back Country Camping
Boat Launch
Front Country Camping
Picnic Area
Swimming Beach
Rest Areas/Scenic Turnouts
Proposed Alternate Trail Routes
Trails
10m Contour Lines
Other Roads
State Trunkline
Right-of-Way
Recommended Wilderness Boundary
SLBE Boundary
Lakes
Township Boundaries
Village Boundaries
N
W
E
S
Basch Rd
Hidden Lake
Hatt Pond
Shell Lake
Port Oneida Rd
Baker R d
Lake Michigan Rd
Miller Rd
W Kelterhouse Rd
W Harbor Hwy
Narada Lake
Hooper Rd
Sunset Shores Dr
Thoreson Rd
Traverse Lake Rd
Manitou Trl
Bass Lake
Little Traverse Lake
Townline Rd
Darwin Rd
Wheeler Rd
School Lake
Bartunek Rd
Hyland Rd
W Bay Ln
Bohemian Rd
Nachazel Rd
Sugar Bay Ln
Centerville Twp
Cleveland Twp
W Sleeping Bear Dr
Tucker Lake
Pine St
W Western Ave
Stocking Rd
S Dune Hwy
S Ray St
Lake St
Northwood Dr
Fisher Lake
Nemeskal Rd
Havka Rd
W H lavka Rd
W Cheney Rd
Lime Lake
E Lime Lake Rd
April Rd
Glen Arbor Twp
Day Forest Rd
S Glen Lake Rd
Brooks Lake
W Ryant Rd
S Lime Lake Rd
Trumbull Rd
Warlock Rd
Sullivan Rd
Glen Lake
Greenan Rd
Cemetery Rd
Weich Rd
S Dunns Farm Rd
W Burdickville Rd
Hill St
Darga Rd
E Bellinger Rd
Shaeager Hill Rd
Bard Rd
W Macfarlane Rd
Bow Lake
Nash Rd
North Bar Lake
Burnham Rd
Lanham Rd
Bow Rd
Fritz Rd
Bloswick Rd
Valley Rd
S Leelanau Hwy
Echo Valley Rd
Pierce Rd
S Tower Rd
Kasben Rd
Voice Rd
Baatz Rd
Kasson Twp
Kasson Center Rd
Solon Twp
South Bar Lake
Empire Twp
Fredrickson Rd
McClary Rd
Young Rd
Kames Rd
Gilbert Rd
Fritz Rd
S Coleman Rd
Bright Lake
EMPIRE
Lake St
Wilco Rd
W Empire Hwy
Maple City Rd
E Kasson Rd
Taylor Lake
Kittinger Rd
Newman Rd
Bright Rd
Treat Rd
Stormer Rd
Beeman Rd
Plowman Rd
Gilbert Lake
Armstrong Rd
Polack Lake
W Traverse Hwy
E Traverse Rd
Norcronk Rd
Drew Rd
Osborn Rd
Benzonia Trl
Wells Lake
Armstrong Lake
Hart Lake
Shisler Lake
Manning Rd
Oviatt Rd
Pettengill Rd
Davis Lake
Cook Lake

A series of meetings were held with each local municipalities during July 2008 to present the Leelanau Scenic Heritage Route Trailway Plan and Environmental Assessment. A public review session was held on October 16, 2008 at the Glen Arbor Township Hall during the 30 day public review period. At the open house, comments were taken from twenty members of the public and incorporated into the Plan. Also during the 30 day review period the Plan was posted on the Sleeping Bear Dunes National Lakeshore and Northwest Michigan Council of Governments websites. Copies were distributed to each of the local governments and libraries.

Based on the public comments received, under the preferred alternative, changes were made to Trailway routes in segments 1, 2 and 9 and are reflected in this document.

Trailway Plan and Environmental Assessment Presentations

July 9, 2008	Cleveland Township
July 9, 2008	Empire Township
July 10, 2008	Centerville Township
July 16, 2008	Glen Arbor Township
July 23, 2008	Village of Empire

Trailway Plan and Environmental Assessment Public Review

Posted for 30 days – October 1 to October 31, 2008
Public Review Session at the Glen Arbor Township Hall – October 16, 2008

CHAPTER 4 – Trail Cross Section Development

4.1 TYPICAL CORRIDOR CROSS-SECTIONS

Typical corridor cross-sections were developed as a basis for studying proposed cross-sections within each alternative. Several different proposed cross-sections exist throughout the alternatives; moreover, the development of the cross-sections has aided in the planning and evaluation of different types of bicycle facilities. Several types of bicycle facilities exist that include ***shared roadway*** (no bikeway designation), ***signed shared roadway***, ***bike lane or bicycle lane***, and ***shared use paths***.

Typical cross-sections are an important step towards developing construction documents, plans, and details. Typical cross-sections have also been used for cost estimating. While not all of the following bicycle facilities may be found along the proposed trailway, it is important to understand the differences between them.

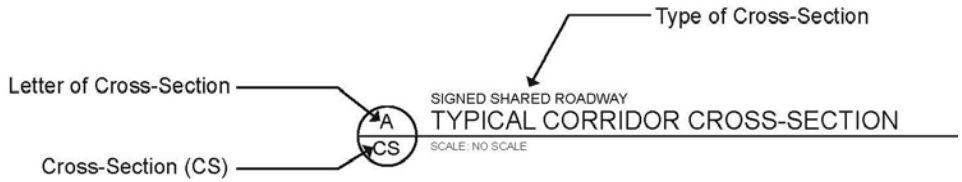
Shared Roadway (no bikeway designation). Shared bikeways refer to bike use on a community's existing street system without bikeway designation (AASHTO 1999). A minimum 4-foot paved shoulder with a 4" stripe is recommended.

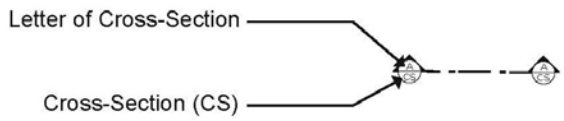
Signed Shared Roadway. Signed shared roadways are designated by bike route signs, and serve either to provide continuity to other bicycle facilities or to designate preferred routes (AASHTO 1999).

Bike Lane or Bicycle Lane. Bike lanes or bicycle lanes provide the safest alternative for shared roadway facilities. Bike lanes are most often used along streets in corridors where there is significant bicycle demand (AASHTO 1999).

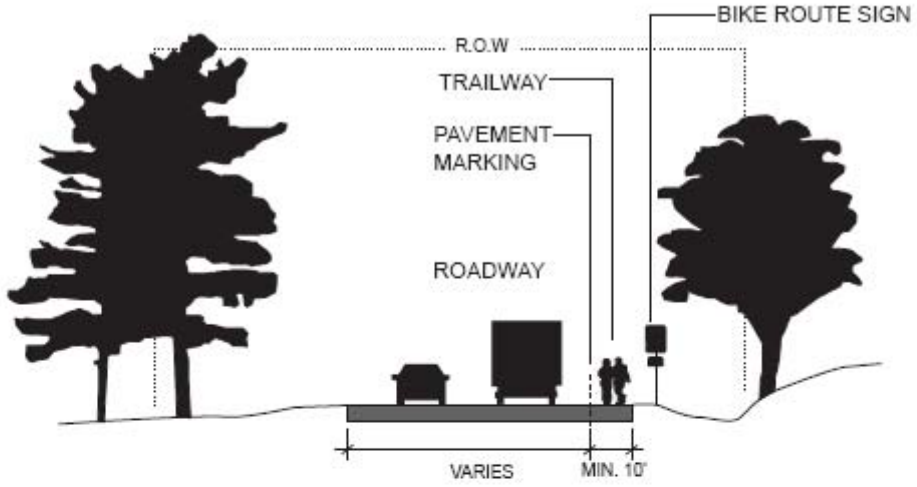
Shared Use Paths. This master plan refers to shared use paths as a trailway. Shared use paths are separated from the roadway by a buffer of at least 5 to 10 feet and serve multiple uses including pedestrians, joggers, dog walkers, people pushing baby carriages, persons in wheelchairs, skate boarders, and in-line skaters. Shared use paths offer opportunities not provided by the road system. They can provide a recreational opportunity or, in some instances, can serve as direct commute routes (AASHTO). A minimum 10-12 foot width path is recommended.

The following ***typical corridor cross-sections*** can be located on the "*Proposed Trailway Alternatives"* mapping using the cross-section or section letters, title and symbol.





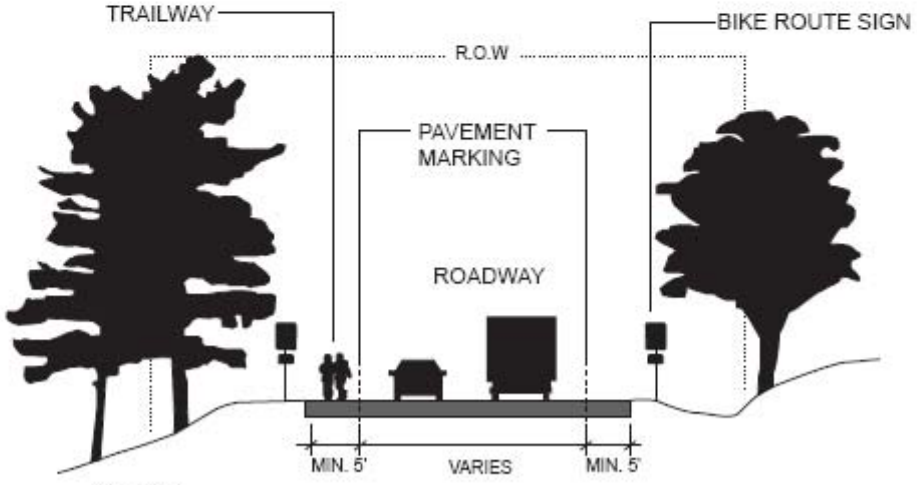
Typical Corridor Cross-Sections



A CS — SIGNED SHARED ROADWAY
TYPICAL CORRIDOR CROSS-SECTION
SCALE: NO SCALE

TYPICAL CORRIDOR CROSS-SECTIONS
LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN

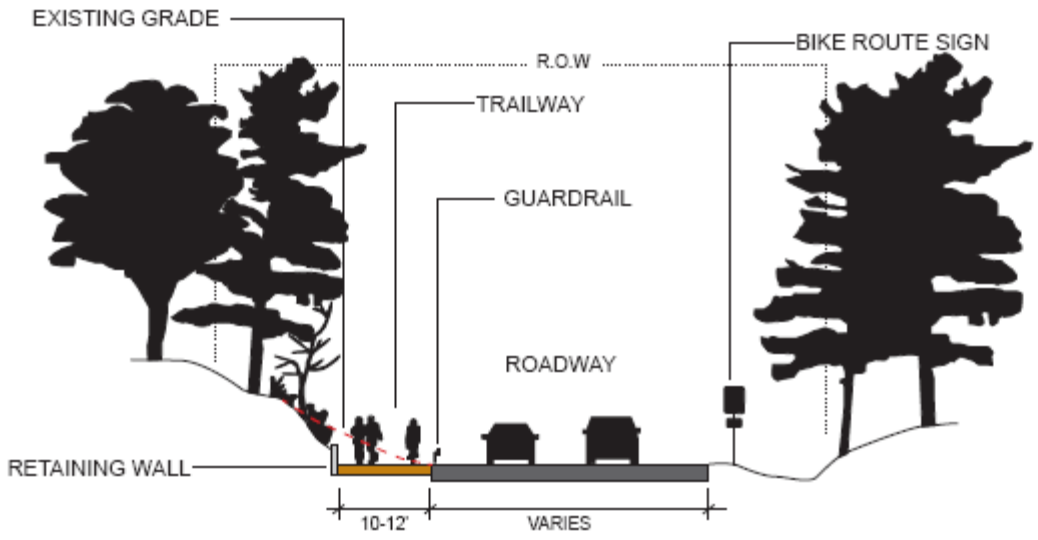
SIGNED SHARED ROADWAY:
CROSS-SECTION A
CROSS-SECTION A REFERS TO A DESIGNATED SIGNED SHARED ROADWAY THAT IS DELINEATED BY A STRIPED PAVEMENT MARKING (BIKE LANE) OR TEXTURED STRIP. A MINIMUM 8 TO10 FOOT WIDTH IS RECOMMENDED.



B CS — BIKE LANE
TYPICAL CORRIDOR CROSS-SECTION
SCALE: NO SCALE

BIKE LANE: CROSS-SECTION B
CROSS-SECTION B REFERS TO A DESIGNATED BIKE LANE THAT IS DELINEATED BY A STRIPED PAVEMENT MARKING (BIKE LANE) OR TEXTURED STRIP (REFER TO AASHTO AND MUTCD FOR APPROPRIATE PAVEMENT MARKINGS, SIGNAGE, AND ROAD CROSSING SPECIFICATIONS. A MINIMUM 5 FOOT WIDTH IS RECOMMENDED.

Gosling Czubak engineering sciences, inc.



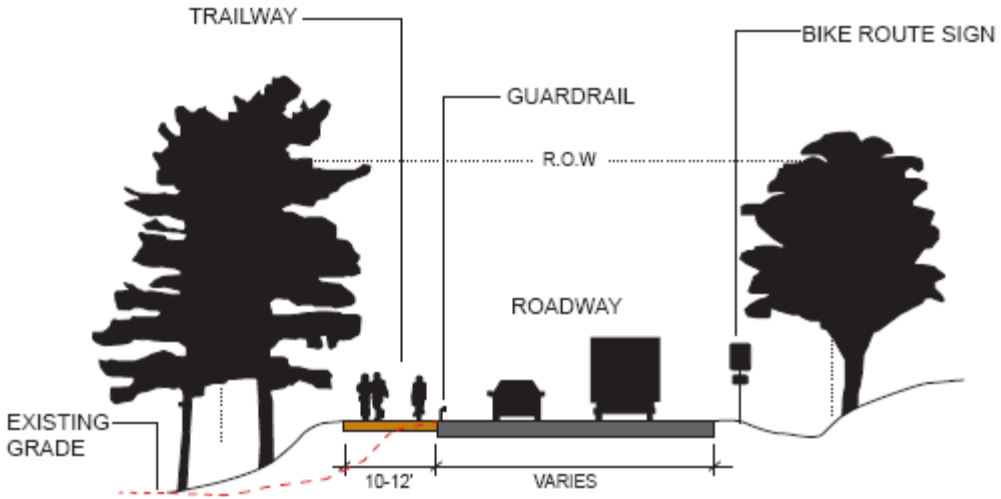
SIGNED SHARED ROADWAY WITH GUARDRAIL & RETAINING WALL
C CS TYPICAL CORRIDOR CROSS-SECTION
SCALE: NO SCALE

TYPICAL CORRIDOR CROSS-SECTIONS
LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN

SIGNED SHARED ROADWAY WITH GUARDRAIL & RETAINING WALL: CROSS-SECTION C

CROSS-SECTION C REFERS TO A (MODIFIED) SHARED ROADWAY THAT IS SEPARATED BY GUARDRAIL. THE SEPARATED TRAILWAY PROVIDES A CROSS-SECTIONAL DESIGN THAT CAN BE USED WHERE LIMITED RIGHT-OF-WAY IS AVAILABLE. A 10 TO 12 FOOT WIDE TRAILWAY IS RECOMMENDED.

RETAINING WALLS MAY HAVE TO BE USED WHEN THE SIDESLOPE EXCEEDS 25% (3:1) OR THE ANGLE OF REPOSE.

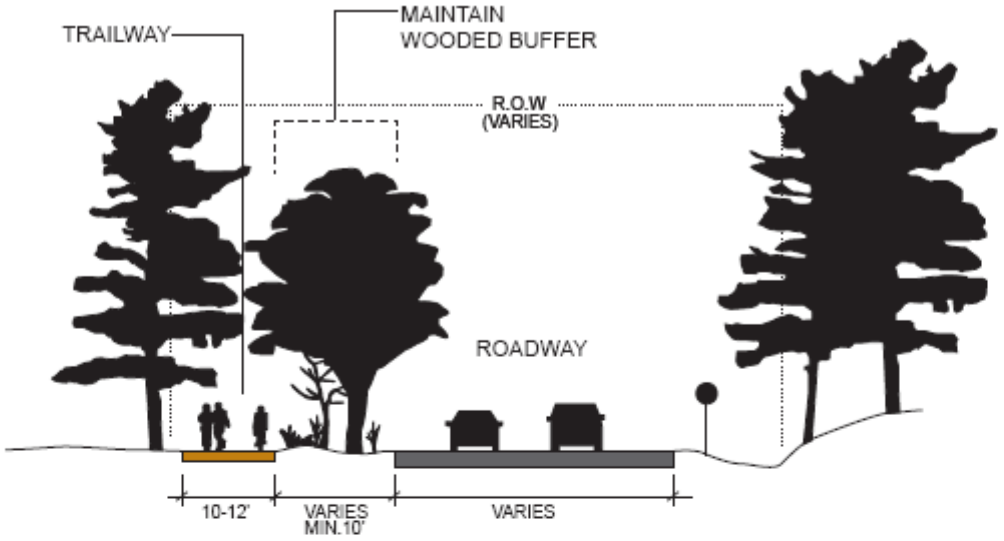


SIGNED SHARED ROADWAY WITH GUARDRAIL
D CS TYPICAL CORRIDOR CROSS-SECTION
SCALE: NO SCALE

SIGNED SHARED ROADWAY WITH GUARDRAIL: CROSS-SECTION D

CROSS-SECTION D REFERS TO A (MODIFIED) SHARED ROADWAY THAT IS SEPARATED BY GUARDRAIL. THE SEPARATED TRAILWAY PROVIDES A CROSS-SECTIONAL DESIGN THAT CAN BE USED WHERE LIMITED RIGHT-OF-WAY IS AVAILABLE. A 10 TO 12 FOOT WIDE TRAILWAY IS RECOMMENDED.

Gosling Czubak engineering sciences, inc.



SEPARATED SHARED USE TRAILWAY

E / CS TYPICAL CORRIDOR CROSS-SECTION

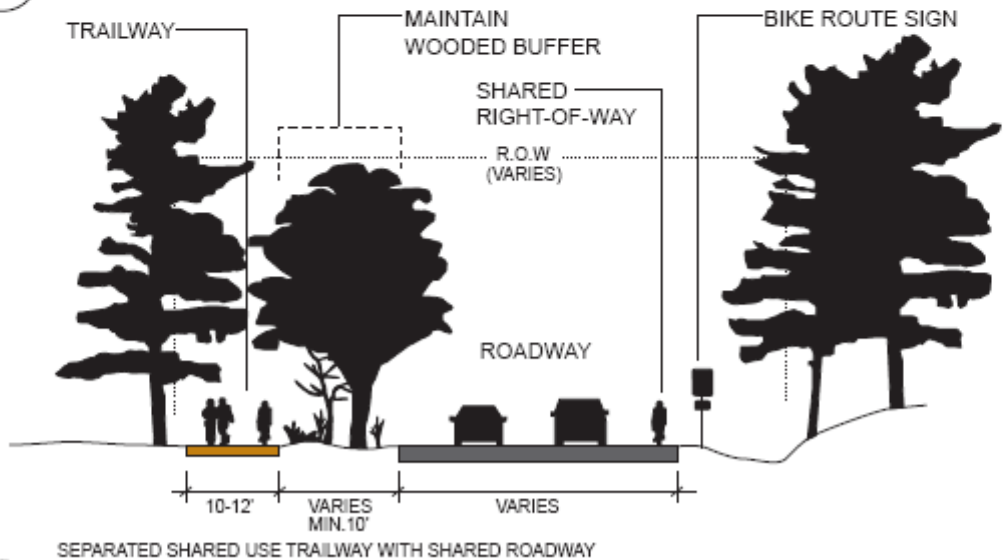
SCALE: NO SCALE

TYPICAL CORRIDOR CROSS-SECTIONS

LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN

SEPARATED SHARED USE TRAILWAY: CROSS-SECTION E

CROSS-SECTION E REFERS TO A SEPARATED TRAILWAY WITHIN THE RIGHT-OF-WAY. THE TRAILWAY IS SEPARATE FROM MOTOR VEHICLE TRAFFIC BY AN OPEN SPACE OR BUFFER EITHER WITHIN THE ROAD RIGHT-OF-WAY OR AN INDEPENDENT RIGHT-OF-WAY, AND FOR NON-MOTORIZED USES. A 10 TO 12 FOOT WIDE TRAILWAY IS RECOMMENDED.



SEPARATED SHARED USE TRAILWAY WITH SHARED ROADWAY

F / CS TYPICAL CORRIDOR CROSS-SECTION

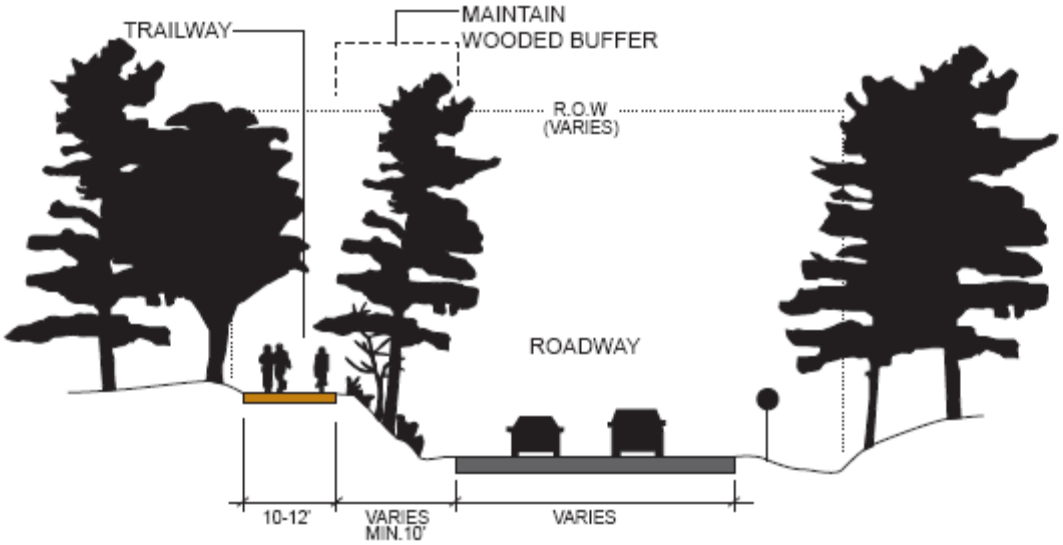
SCALE: NO SCALE

SEPARATED SHARED USE TRAILWAY WITH SHARED ROADWAY: CROSS-SECTION F

CROSS-SECTION F REFERS TO A SEPARATED TRAILWAY IN THE RIGHT-OF-WAY. THE TRAILWAY IS SEPARATE FROM MOTOR TRAFFIC BY AN OPEN SPACE OR BARRIER EITHER WITHIN THE ROAD RIGHT-OF-WAY OR AN INDEPENDENT RIGHT-OF-WAY, AND FOR NON-MOTORIZED USES. A 10 TO 12 FOOT WIDE TRAILWAY IS RECOMMENDED.

THE SHARED ROADWAY IS RECOMMENDED FOR BICYCLISTS ONLY AND MAY NOT ALWAYS BE DESIGNATED BY SIGNS OR PERMANENT MARKINGS AS A BICYCLE ROUTE. THE SHARED ROADWAY PROVIDES AN ALTERNATIVE ROUTE FOR MORE ADVANCED BICYCLISTS.

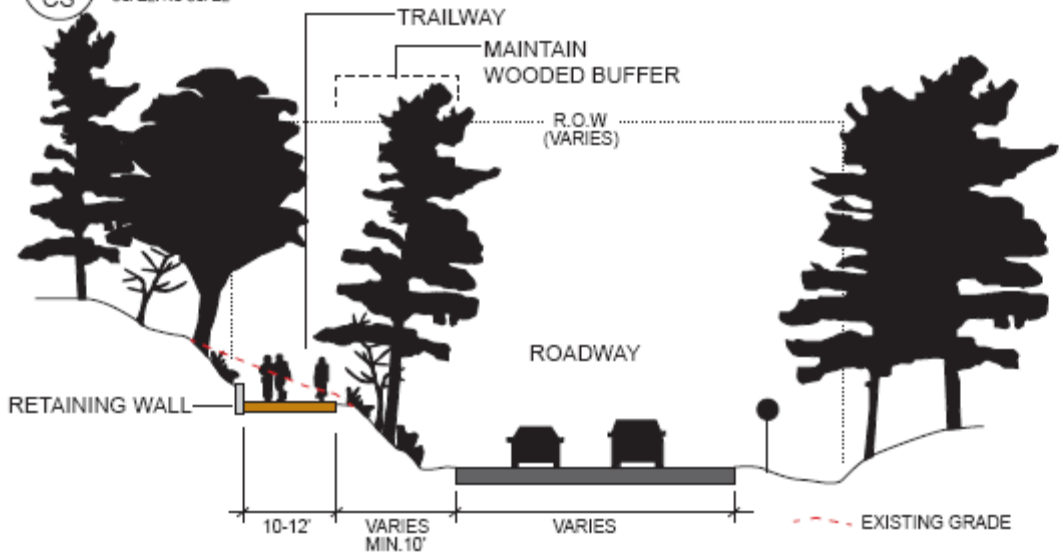
Gosling Czubak engineering sciences, inc.



SEPARATED SHARED USE TRAILWAY WITH SIDESLOPE

G CS TYPICAL CORRIDOR CROSS-SECTION

SCALE: NO SCALE



SEPARATED SHARED USE TRAILWAY WITH SIDESLOPE AND RETAINING WALL

H CS TYPICAL CORRIDOR CROSS-SECTION

SCALE: NO SCALE

TYPICAL CORRIDOR CROSS-SECTIONS

LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN

SEPARATED SHARED USE TRAILWAY WITH SIDESLOPE: CROSS-SECTION G

CROSS-SECTION G REFERS TO A SEPARATED TRAILWAY IN THE RIGHT-OF-WAY. THE TRAILWAY IS SEPARATE FROM MOTOR TRAFFIC BY AN OPEN SPACE OR BARRIER EITHER WITHIN THE ROAD RIGHT-OF-WAY OR AN INDEPENDENT RIGHT-OF-WAY, AND FOR NON-MOTORIZED USES. A 10 TO 12 FOOT WIDE TRAILWAY IS RECOMMENDED.

MAINTAINING A WOODED BUFFER BETWEEN THE ROADWAY AND TRAIL WILL PROTECT HERITAGE ROUTE VIEWSHEDS AND LIMIT POTENTIAL IMPACT TO SLEEPING BEAR NATIONAL LAKESHORE (LAKESHORE) VISITOR EXPERIENCE AND CULTURAL AND HISTORIC LANDSCAPES.

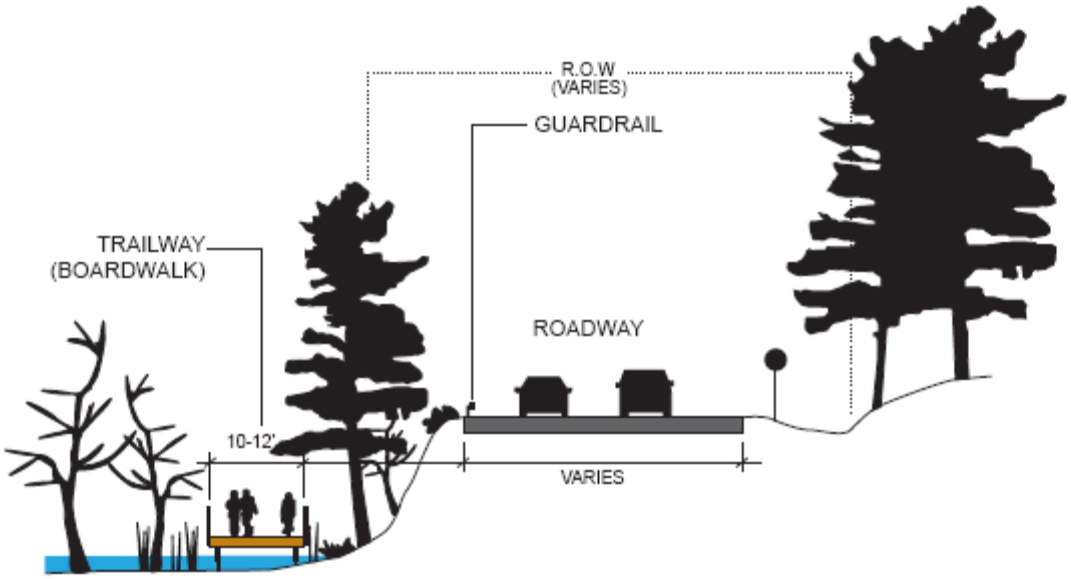
SEPARATED SHARED USE TRAILWAY WITH SIDESLOPE & RETAINING WALL: CROSS-SECTION H

CROSS-SECTION H REFERS TO A SEPARATED TRAILWAY IN THE RIGHT-OF-WAY. THE TRAILWAY IS SEPARATE FROM MOTOR TRAFFIC BY AN OPEN SPACE OR BARRIER EITHER WITHIN THE ROAD RIGHT-OF-WAY OR AN INDEPENDENT RIGHT-OF-WAY, AND FOR NON-MOTORIZED USES. A 10 TO 12 FOOT WIDE TRAILWAY IS RECOMMENDED.

MAINTAINING A WOODED BUFFER BETWEEN THE ROADWAY AND TRAIL WILL PROTECT HERITAGE ROUTE VIEWSHEDS AND LIMIT POTENTIAL IMPACT TO SLEEPING BEAR NATIONAL LAKESHORE (LAKESHORE) VISITOR EXPERIENCE AND CULTURAL AND HISTORIC LANDSCAPES.

RETAINING WALLS MAY HAVE TO BE USED WHEN THE SIDESLOPE EXCEEDS 25% (3:1) OR THE ANGLE OF REPOSE.

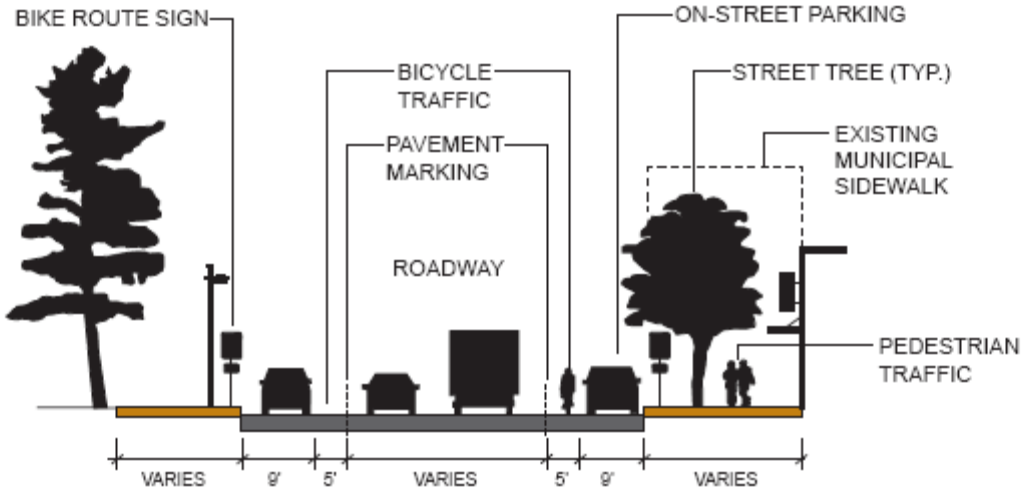
Gosling Czubak engineering sciences, inc.



HELICAL PIER SUPPORTED BOARDWALK

I / CS TYPICAL CORRIDOR CROSS-SECTION

SCALE: NO SCALE



BIKE LANE IN A VILLAGE

J / CS TYPICAL CORRIDOR CROSS-SECTION

SCALE: NO SCALE

TYPICAL TRAILWAY CROSS-SECTIONS

LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN

HELICAL PIER SUPPORTED BOARDWALK: CROSS-SECTION I

CROSS-SECTION I REFERS TO A SEPARATED TRAILWAY IN THE RIGHT-OF-WAY. THE TRAILWAY IS SEPARATE FROM MOTOR TRAFFIC BY AN OPEN SPACE OR BARRIER EITHER WITHIN THE ROAD RIGHT-OF-WAY OR AN INDEPENDENT RIGHT-OF-WAY, AND FOR NON-MOTORIZED USES.

HELICAL PIER SUPPORTED BOARDWALK WILL BE USED FOR TRAIL SECTIONS THAT SPAN WET AREAS (WETLANDS, CREEKS) INCLUDING NARADA LAKE. INCLUDING BOARDWALK AS AN OPTION WILL ALLOW THE TRAILWAY TO LEAVE THE RIGHT-OF-WAY IN CASES WHERE NARROW ROAD SHOULDER, GUARDRAIL LIMITATIONS, AND SAFETY ARE A CONCERN.

A 10 TO 12 FOOT WIDE TRAILWAY IS RECOMMENDED.

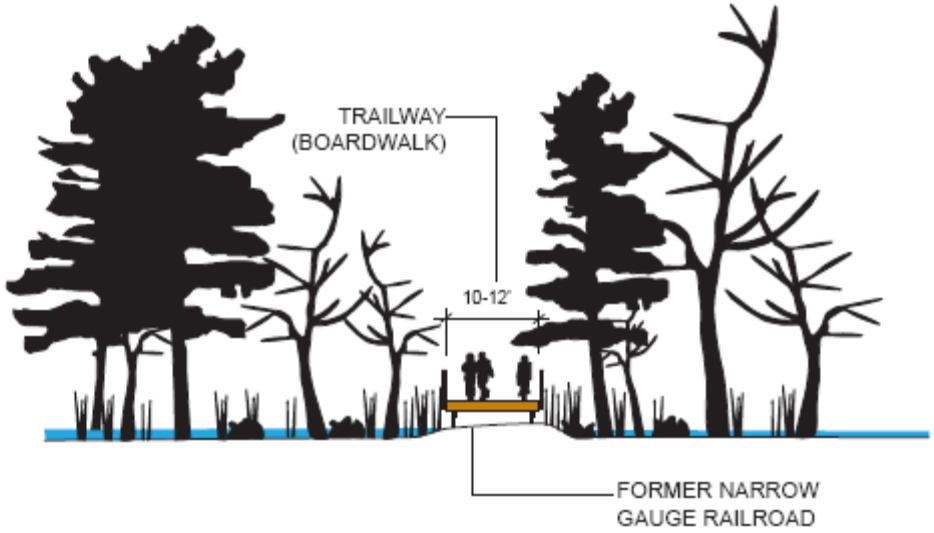
BIKE LANE IN A VILLAGE: CROSS-SECTION J

CROSS-SECTION J REFERS TO A DESIGNATED BIKE LANE THAT IS DELINEATED BY A STRIPED PAVEMENT MARKING OR TEXTURED STRIP.

AS TRAILWAY USERS MOVE INTO VILLAGES (GLEN ARBOR, EMPIRE) DIFFERENT TRAIL USER GROUPS (I.E. BICYCLISTS, WALKERS, RUNNERS, ROLLERBLADING) WILL BE ENCOURAGED TO USE DIFFERENT ROUTING IN ORDER TO ENSURE SAFETY.

5 FEET IS THE MINIMUM RECOMMENDED WIDTH FOR BIKE LANES.

Gosling Czubak engineering sciences, inc.



BOARDWALK IN FORMER NARROW GAUGE RAILROAD

K CS TYPICAL CORRIDOR CROSS-SECTION

SCALE: NO SCALE

TYPICAL TRAILWAY CROSS-SECTIONS

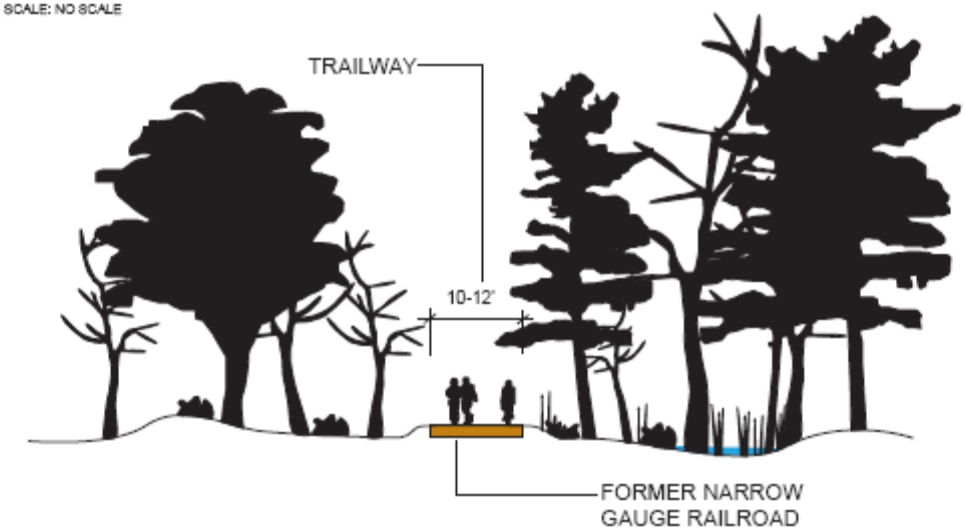
LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN

BOARDWALK IN FORMER NARROW GAUGE RAILROAD: CROSS-SECTION K

CROSS-SECTION K REFERS TO SHARED USE TRAILWAY THAT LEAVES THE ROAD RIGHT-OF-WAY AND FOLLOWS THE FORMER NARROW GAUGE RAILROAD.

IT WILL NEED TO BE DETERMINED WHICH AREAS ARE MORE SENSITIVE, ARE MORE LIMITING WITH REGARD TO MESIC CONDITIONS, IN ORDER TO DETERMINE THE AREAS THAT WILL RECEIVE BOARDWALK (REFER TO PROPOSED TRAILWAY ALTERNATIVES MAPPING).

A 10 TO 12 FOOT WIDE TRAILWAY IS RECOMMENDED.



SHARED USE TRAILWAY IN FORMER NARROW GAUGE RAILROAD

L CS TYPICAL CORRIDOR CROSS-SECTION

SCALE: NO SCALE

SHARED USE TRAILWAY IN FORMER NARROW GAUGE RAILROAD: CROSS-SECTION L

CROSS-SECTION L REFERS TO TRAILWAY THAT LEAVES THE ROAD RIGHT-OF-WAY AND FOLLOWS THE FORMER NARROW GAUGE RAILROAD. THE TRAILWAY WILL UTILIZE THE EXISTING ELEVATED NARROW GAUGE RAILROAD.

A 10 TO 12 FOOT WIDE TRAILWAY IS RECOMMENDED.

GoslingCzubak engineering sciences, inc.

4.2 TYPICAL TRAILWAY CONSTRUCTION SECTIONS

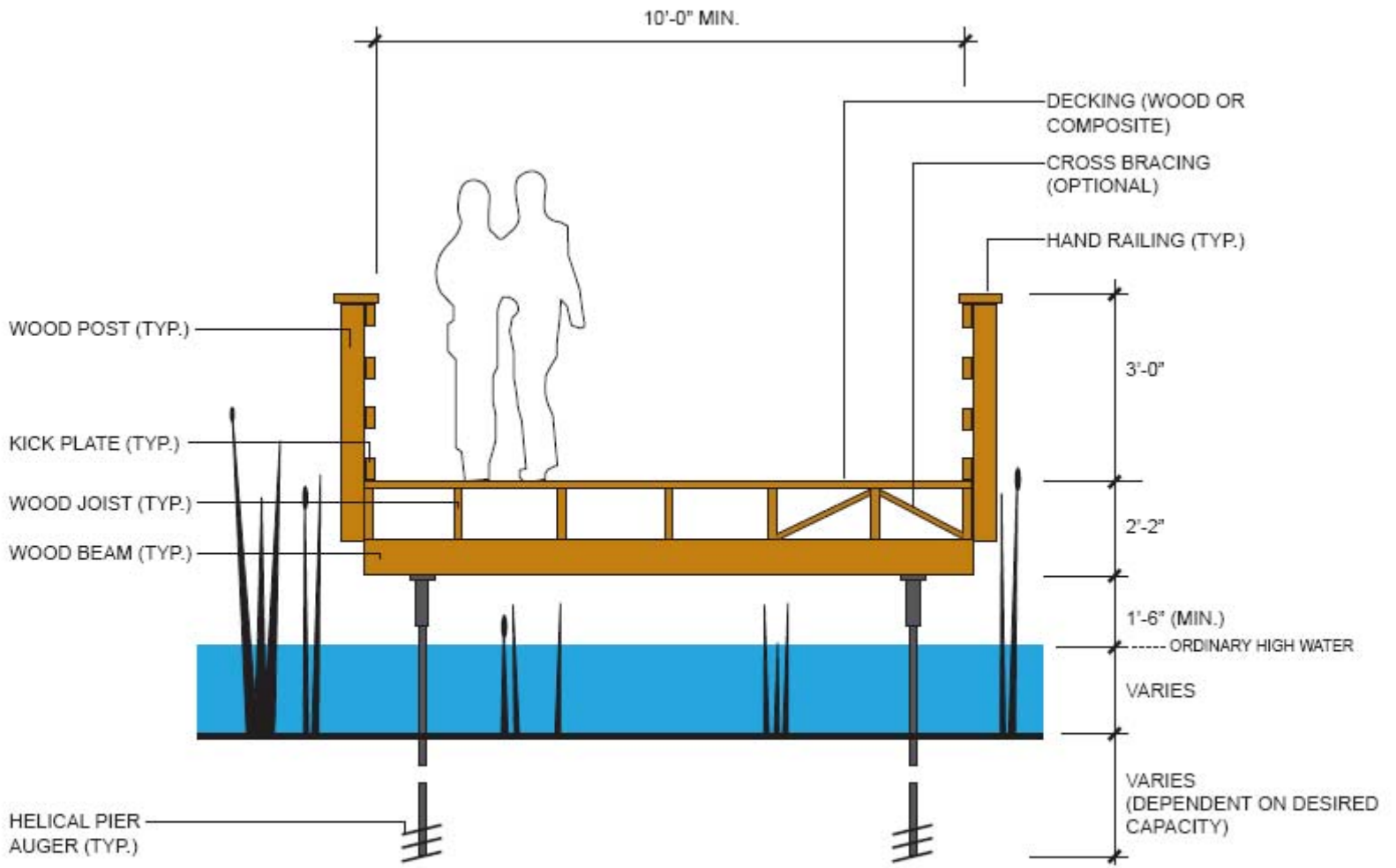
Typical trailway construction sections were also developed as a basis for studying proposed cross-sections within each alternative. Typical construction sections are an important step towards identifying trail surfaces, developing construction documents, plans, and details. Typical construction sections have also been used for cost estimating.

Typical trailway surfaces for shared use pathways include ***asphalt***, ***crushed limestone***, ***boardwalk***, and ***existing gravel roads***. The most common and often preferred trail surface is asphalt; however, crushed limestone paths offer an alternative that provides a trail surface that is more economically feasible in the short-term, is more environmentally friendly with regard to permeability, and does provides barrier-free accessibility. The downfall of crushed limestone is the high-cost of operation and maintenance in the long-term. Boardwalk trailway is the most expensive and is used to span streams, creeks, and wetlands.

A typical trailway construction section of a road crossing is also shown below. The construction section includes sign types, traffic bollards, location, and approximate mounting heights. Refer to AASHTO and Manual on Uniform Traffic Control Devices (MUTCD) standards for the most current trailway facility standards.

The following ***typical trailway construction sections*** can be located on the "*Proposed Trailway Alternatives"* Mapping using the title and map symbols shown above in section 4.1.

Typical Trailway Construction Sections



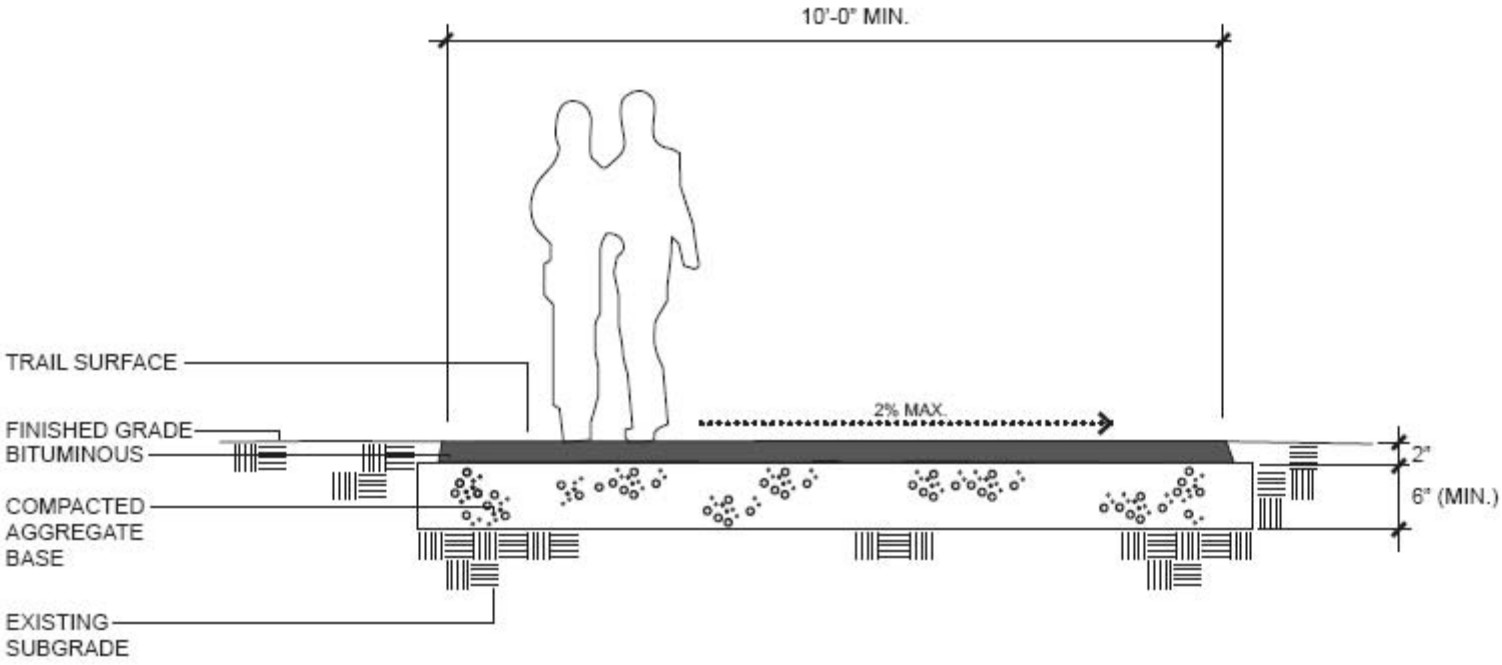
A1
S

HELICAL PIER SUPPORTED BOARDWALK

TYPICAL TRAILWAY CONSTRUCTION SECTION

SCALE: NO SCALE

GoslingCzubak engineering sciences, inc.



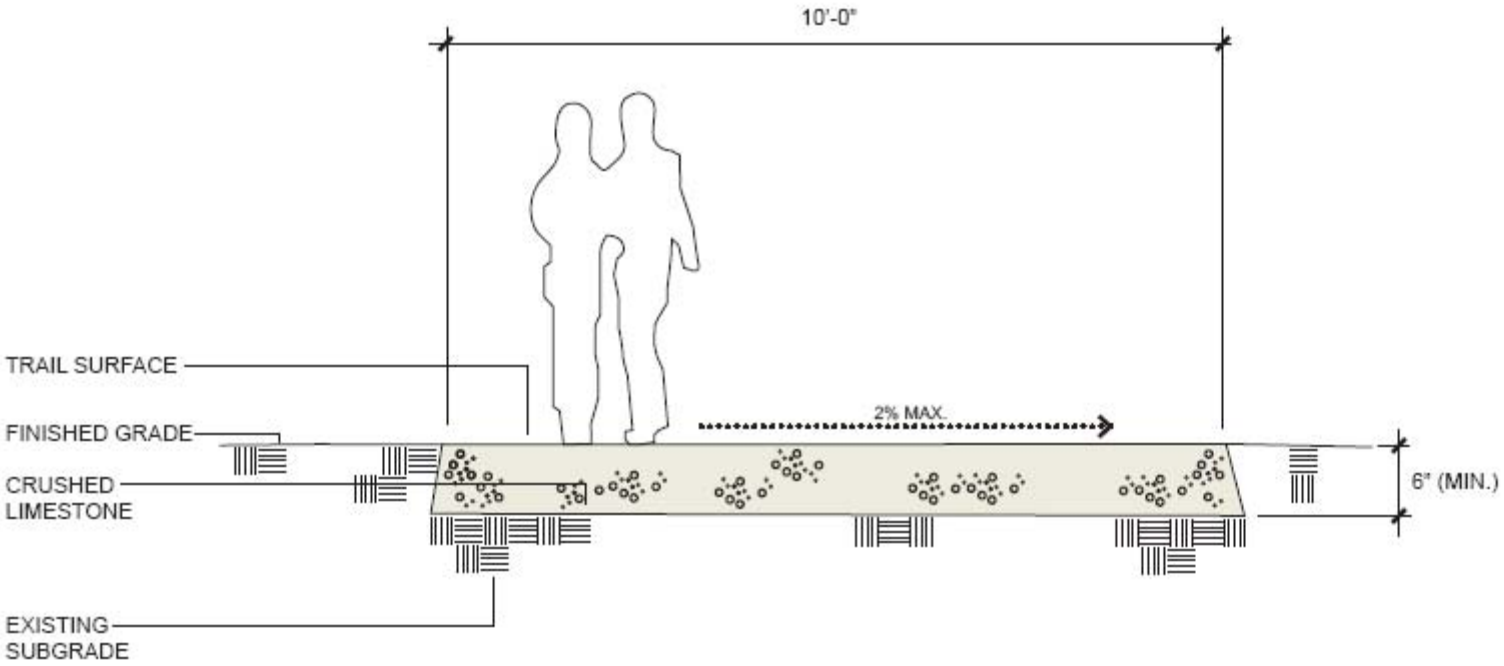
B1
S

ASPHALT TRAILWAY

TYPICAL TRAILWAY CONSTRUCTION SECTION

SCALE: NO SCALE

Gosling Czubak engineering sciences, inc.

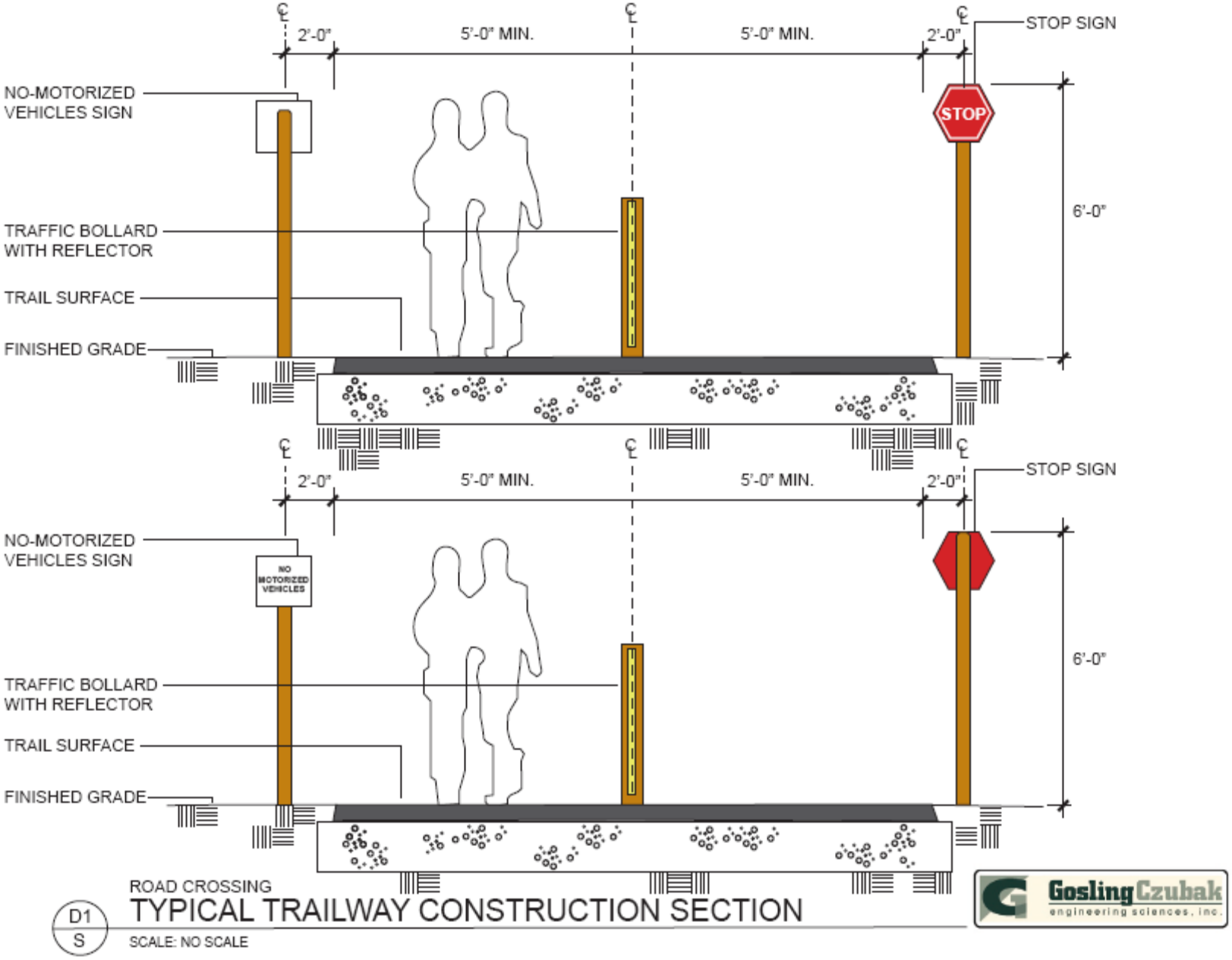


CRUSHED LIMESTONE

C1
S

TYPICAL TRAILWAY CONSTRUCTION SECTION

SCALE: NO SCALE



ROAD CROSSING

TYPICAL TRAILWAY CONSTRUCTION SECTION

D1
S

SCALE: NO SCALE

GoslingCzubak engineering sciences, inc.

CHAPTER 5 – Cost Projections

Leelanau Scenic Heritage Route Trailway Plan

5.1 COST ANALYSIS OVERVIEW

The following cost analysis was done based on typical cost projections gathered from similar trail system master plans in various parts of the country, and actual bid tabulations for projects in northwest Michigan. Detailed Cost projections were compiled for each of the 9 trail segments developed for the Trailway - ***Preferred Alternative B*** (Please see appendix)

Unit pricing was developed for this plan by considering cost projections ranges from the following sources: *Asheville, North Carolina, Greenway (2005),* *Indiana Ped. & Pedal* (2004), Seattle, *Washington Bicycle Master Plan* (2007). The unit pricing from these sources provided a baseline for comparison to estimate 2007-2008 pricing for services, materials, and labor for the Trailway. Where unit costs were utilized for comparison from the sources above, a *Consumer Price Index* conversion was used to account for inflation and calculate an equivalent value for 2007-2008.

The baseline unit costs from selected master plans were then compared to bid tabulations available from: the *South Boardman Lake Trail project, Traverse City, Michigan.* (2005); Charlevoix County (Charlevoix to Petoskey) non-motorized Trail (MDOT 2002); Three Mile Road Bicycle path (Grand Traverse County Road Commission 2005); and the Kalkaska Area Recreational Trail (KART 2007) data from recent regional projects. Finally, unit costs for major trail elements were converted to a ***per mile cost*** (MI) and per linear foot for boardwalk (LF) for ease of comparison. The following chart is a breakdown of the values generated for the major trail elements used in the detailed costs analysis

Site Preparation	Unit	Cost / Unit
Clear and Grub; Topsoil (Remove and Stockpile)	MI	$4,000
Unclassified Embankment; Sub grade excavation	MI	$3,600
Trail Cross section		
Asphalt paving (2") (220#/sy)(6" - 22A)(Trail grading)	MI	$158,400
Asphalt paving (2") (220#/sy)(3"- 22A + Ex. Gravel)	MI	$100,300
Limestone paving (4")(Base amend)(Trail grading)	MI	$116,200
Limestone paving (4")(Existing substrate/gravel)	MI	$87,100
Engineered soil paving (existing path)	MI	$53,000
On-Road Bikelane (4" white waterborne - two sides)	MI	$7,500
Existing Gravel Road	MI	TBD
Wood boardwalk - auger supported (10' width)	LF	$360
Trail Restoration		
Seeding / Vegetation (restoration)	MI	$950

5.2 ASSUMPTIONS

The cost projections developed for the Trailway Master Plan are preliminary in nature and designed to give a comparative assessment of relative Trailway segment costs. The detailed unit cost projections also serve as checklists for tracking detail needed during final design development of a Trailway segment. The following assumptions were made in the development of the cost projections.

- *All segments would occur on either the National Park Service (NPS) property, Michigan Department of Transportation, or Leelanau County right-of-ways..*
- *No costs for land acquisition or Trailway easements over private, utility or public land was included.*
- *Trailway routes chosen are conceptual for the purposes of calculations and may vary significantly in final design.*
- *Trailway materials chosen are conceptual for the purposes of calculations and may vary significantly in final design.*
- *Trailway lengths indicated may vary significantly in final design development.*
- *Detailed design elements such as retaining walls, guardrails, culverts, advanced warning signals are <u>not</u> quantified in the estimate but identified as probable details to be included in final design.*
- *A 20% contingency was utilized to account for details and modifications to the proposed segment.*
- *Asphalt paving is estimated with a 2" thickness throughout the cost analysis.*
- *Design and construction engineering services, surveying, permitting, and contractor mobilization/bonds and insurance are estimated on a per segment basis.*
- *Cost projections must be adjusted for inflation as they are utilized for grant development, funding and planning in the future.*

5.3 COST PROJECTION SUMMARY

The cost projections summarized on the following table were developed to provide a comparative breakdown of each segment represented in the ***Trailway Preferred Alternative B.*** Relative lengths, materials and overall projected costs are provided. The modifications to Alternative B, Segments 1, 2 and 9 do not significantly impact the overall cost projections for the Alternative.

TRAILWAY SEGMENTS - Alternative B

COST PROJECTION SUMMARY

Leelanau Scenic Heritage Route Trailway

Phase I - Planning Project - February 2008

	Total Trail Lengths (in miles)	Trail Surface Materials						Recommendations	
Segment	Length (miles)	Asphalt (mi)	Limestone (mi)	Boardwalk (mi)	On-road Bike Lanes (mi)	Ex. Gravel Road (mi)	Cost Projection	Phase / Year	Funding Sources
1	2.15	1.22	0.93				**$490,869**	$0	$0
2	2.66	1.96			0.7		**$500,674**	$0	$0
3	1.49	1.49					**$443,414**	$0	$0
4	2.21	2.21					**$684,075**	$0	$0
5	3.96	3.71	0.25				**$897,799**	$0	$0
6	2.42	1.27		0.51	0.64		**$2,345,690**	$0	$0
7	2.32	0.32	2				**$395,447**	$0	$0
8	4.26	3.07		0.13	1.06		**$1,070,015**	$0	$0
9	4.76	0.38	1.27		2.43	0.57	**$477,776**	$0	$0
Totals	**26.23**	**15.63**	**4.45**	**0.64**	**4.83**	**0.57**	**$7,305,761**	**$0**	**$0**

= Alternative Route

TRAIL SEGMENT 1 - Alt B

COST PROJECTION

Leelanau Scenic Heritage Route Trailway
Phase I - Planning Project - February 2008

Total Trail Section Length:	**11,352 Ft.**		**2.15 MI.**			
Description: In M-22 R.O.W. west side from Manning Rd. to Stormer Rd. (limestone); In M-22 R.O.W west side from Stormer Rd. to Empire Village limits (paved)						
Item	***Estimated Quantity***	***Units***	***Unit Price in Year 2007***	***Estimated Cost***	***Notes***	***Subtotal***
R.O.W. / DESIGN ENGINEERING						
ROW Land and Purchase (Survey, Legal, Admin. etc.)	NA/	LS			None	
Surveying (5%)	0.05	LS	$16,494	$16,494	50% wooded; hilly	
Permit Processing; Engineering Design (12%)	0.12	LS	$39,586	$39,586	SESC; MDOT pemits	
Subtotal:						**$56,080**
TRAIL CONSTRUCTION COSTS						
General Construction Costs						
Bonds and Insurance (typ. 1-2%)	0.01	LS	$5,349	$5,349		
Mobilization (3-5K)	1	LS	$4,000	$4,000		
Site Preparation						
Clear and Grub; Topsoil (Remove and Stockpile)	1.61	MI	$4,000	$6,440	yes	
Unclassified Embankment; Subgrade excavation	2.15	MI	$3,600	$7,740	yes	
Traffic control	1	LS	$3,000	$3,000	yes	
Trail Cross section						
Asphalt paving (2") (220#/sy)(6" - 22A)(Trail grading)	1.22	MI	$158,400	$193,248	1.22 Mi. @ 10'	
Asphalt paving (2") (220#/sy)(3"- 22A + Ex. Gravel)		MI	$100,300	$0		
Limestone paving (4")(Base amend)(Trail grading)	0.93	MI	$116,200	$108,066	.93 Mi. @ 10'	
Limestone paving (4")(Existing substrate/gravel)		MI	$87,100	$0		
Engineered soil paving (existing path)		MI	$53,000	$0		
On-Road Bikelane (4" white waterborne - two sides)		MI	$7,500	$0	5' width both sides	
Existing Gravel Road		MI	TBD	$0	Amendment	
Wood boardwalk - auger supported (10' width)		MI	$360	$0		
Trail Restoration						
Seeding / Vegetation (restoration)	2.15	MI	$950	$2,043	yes	
Trees (restoration)		EA	$450	$0	?	
Subtotal:						**$329,885**
STRUCTURES / SPECIAL FEATURES / SAFETY / DRAINAGE						
Guard Rail Railings		LS		$0	possible	
Culverts; Rip-rap; Erosion Control (Silt fencing)		LS		$0	possible	
Crossing Advanced Warning (lights, signs, striping)		LS		$0	M-22 @ Quer. Alb.	
Pavement markings		LS		$0	3 crosswalks	
Perminant signage		LS		$0	Mile markers; Interpretive	
Bridge (10' width); Bridge Abutment/Wing walls		LS		$0		
Retaining Walls (Wood, modular conc.)		LS		$0	yes , ?	
Subtotal:						**$0**
CONSTRUCTION ENGINEERING						
Material Testing; Construction Management (6%)	0.06	LS	$19,793	$19,793		
Grant management / assistance (1%)	0.01	LS	$3,299	$3,299		
Subtotal:						**$23,092**
SUBTOTAL ENGINEERING AND CONSTUCTION:				$409,058		**$409,058**
PROJECT CONTINGENCY (20%):	0.2			$81,812		
TOTAL PROJECT COST PROJECTION				**$490,869**		

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TRAIL SEGMENT 2 - Alt B

COST PROJECTION

Leelanau Scenic Heritage Route Trailway
Phase I - Planning Project - February 2008

Total Trail Section Length:	**14,045 Ft.**		**2.66 MI.**			
Description: In Quecas alba bike lane to M-22 (paved connector);New neighborhood bike lanes to M-22 (paved connector); Lacore bike lanes to Fisher St.; In LaCore ROW (east or west side) bike path to N. Bar Lake Rd.; Voice Rd. bike path (north side) to M-22.						
Item	***Estimated Quantity***	***Units***	***Unit Price in Year 2007***	***Estimated Cost***	***Notes***	***Subtotal***
R.O.W. / DESIGN ENGINEERING						
ROW Land and Purchase (Survey, Legal, Admin. etc.)	NA/	LS			None	
Surveying (2%)	0.02	LS	$6,896	$6,896	Ex. R.O.W / platted Roads in Village	
Permit Processing; Engineering Design (12%)	0.12	LS	$41,378	$41,378	SESC; MDOT pemits	
Subtotal:						**$48,274**
TRAIL CONSTRUCTION COSTS						
General Construction Costs						
Bonds and Insurance (typ. 1-2%)	0.01	LS	$5,345	$5,345		
Mobilization (3-5K)	1	LS	$4,000	$4,000		
Site Preparation						
Clear and Grub; Topsoil (Remove and Stockpile)	1.96	MI	$4,000	$7,840	yes	
Unclassified Embankment; Subgrade excavation	1.96	MI	$3,600	$7,056	Along voice Rd.; M-22 and Voice Road	
Traffic control	1	LS	$3,000	$3,000	yes	
Trail Cross section						
Asphalt paving (2") (220#/sy)(6" - 22A)(Trail grading)	1.96	MI	$158,400	$310,464	Includes two added paved connections at Quecas Alba and New neigborhood	
Asphalt paving (2") (220#/sy)(3"- 22A + Ex. Gravel)		MI	$100,300	$0		
Limestone paving (4")(Base amend)(Trail grading)		MI	$116,200	$0		
Limestone paving (4")(Existing substrate/gravel)		MI	$87,100	$0		
Engineered soil paving (existing path)		MI	$53,000	$0		
On-Road Bikelane (4" white waterborne - two sides)	0.7	MI	$7,500	$5,250	5' width both sides	
Existing Gravel Road		MI	TBD	$0	Amendment	
Trail Restoration						
Seeding / Vegetation (restoration)	1.96	MI	$950	$1,862	yes	
Trees (restoration)		EA	$450	$0	?	
Subtotal:						**$344,817**
STRUCTURES / SPECIAL FEATURES / SAFETY / DRAINAGE						
Guard Rail Railings		LS		$0	Possible at M-22 and Voice Road	
Culverts; Rip-rap; Erosion Control (Silt fencing)		LS		$0	Possible at M-22 and Voice Road	
Crossing Advanced Warning (lights, signs, striping)		LS		$0	M-72 @ New Neighborhood; M-22 @ Salsbury Rd.; LaCore at N. Bar Lake Rd.	
Pavement markings		LS		$0	3 crosswalks	
Perminant signage		LS		$0	Mile markers; Interpretive	
Subtotal:						**$0**
CONSTRUCTION ENGINEERING						
Material Testing; Construction Management (6%)	0.06	LS	$20,689	$20,689		
Grant management / assistance (1%)	0.01	LS	$3,448	$3,448		
Subtotal:						**$24,137**
SUBTOTAL ENGINEERING AND CONSTUCTION:				$417,229		**$417,229**
PROJECT CONTINGENCY (20%):	0.2			$83,446		
TOTAL PROJECT COST PROJECTION				**$500,674**		

TRAIL SEGMENT 3 - Alt B

COST PROJECTION

Leelanau Scenic Heritage Route Trailway
Phase I - Planning Project - February 2008

Total Trail Section Length:	**7,867 Ft.**		**1.49 Mi.**			
Description: In M-22 R.O.W. (west side) from Voice Rd. to Stormer Rd. (paved) to intersection of M-109; In M-109 R.O.W (west side) to Pierce Stocking Drive (paved)						
Item	***Estimated Quantity***	***Units***	***Unit Price in Year 2007***	***Estimated Cost***	***Notes***	***Subtotal***
R.O.W. / DESIGN ENGINEERING						
ROW Land and Purchase (Survey, Legal, Admin. etc.)	NA/	LS			None	
Surveying (5%)	0.05	LS	$14,900	$14,900	100% wooded; hilly	
Permit Processing; Engineering Design (12%)	0.12	LS	$35,759	$35,759	SESC; MDOT pemits	
Subtotal:						**$50,659**
TRAIL CONSTRUCTION COSTS						
General Construction Costs						
Bonds and Insurance (typ. 1-2%)	0.01	LS	$4,738	$4,738		
Mobilization (3-5K)	1	LS	$4,000	$4,000		
Site Preparation						
Clear and Grub; Topsoil (Remove and Stockpile)	1.49	MI	$4,000	$5,960	yes, construct on shelf abve road	
Unclassified Embankment; Subgrade excavation	1.49	MI	$3,600	$5,364	yes, construct on shelf abve road	
Traffic control	1	LS	$3,000	$3,000	Intersection of M-22, M-109	
Trail Cross section						
Asphalt paving (2") (220#/sy)(6" - 22A)(Trail grading)	1.49	MI	$158,400	$236,016	1.49 Mi. @ 10'	
Asphalt paving (2") (220#/sy)(3"- 22A + Ex. Gravel)		MI	$100,300	$0		
Limestone paving (4")(Base amend)(Trail grading)		MI	$116,200	$0		
Limestone paving (4")(Existing substrate/gravel)		MI	$87,100	$0		
Trail Restoration						
Seeding / Vegetation (restoration)	1.49	MI	$950	$1,416	yes, wooded understory	
Trees (restoration)	150	EA	$250	$37,500	yes, wooded understory	
Subtotal:						**$297,994**
STRUCTURES / SPECIAL FEATURES / SAFETY / DRAINAGE						
Guard Rail Railings		LS		$0	possible	
Culverts; Rip-rap; Erosion Control (Silt fencing)		LS		$0	possible	
Crossing Advanced Warning (lights, signs, striping)		LS		$0	Safety concerns clear vision at M-109 and Pierce Stocking Drive	
Pavement markings		LS		$0		
Perminant signage		LS		$0	Mile markers; Interpretive	
Retaining Walls (Wood, modular conc.)		LS		$0	Possible north of Voice Rd. and north of M-22/M-109 intersection	
Subtotal:						**$0**
CONSTRUCTION ENGINEERING						
Material Testing; Construction Management (6%)	0.06	LS	$17,880	$17,880		
Grant management / assistance (1%)	0.01	LS	$2,980	$2,980		
Subtotal:						**$20,860**
SUBTOTAL ENGINEERING AND CONSTUCTION:				$369,512		**$369,512**
PROJECT CONTINGENCY (20%):	0.2			$73,902		
TOTAL PROJECT COST PROJECTION				**$443,414**		

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TRAIL SEGMENT 4 - Alt B

COST PROJECTION

Leelanau Scenic Heritage Route Trailway

Phase I - Planning Project - February 2008

Total Trail Section Length:		**11,669 Ft.**		**2.21 MI.**		
Description: In M-109 R.O.W. (west side) from Pierce Stocking to .2 mi. north of W. Welch Rd.; Old logging road (west side) to Greenan Rd. (.2 Mi paved); Greenan Rd. (east or west side) to M-109 (.4 Mi. paved); In M-22 R.O.W west side from Stormer Rd to Empire Village limits (paved)						
Item	***Estimated Quantity***	***Units***	***Unit Price in Year 2007***	***Estimated Cost***	***Notes***	***Subtotal***
R.O.W. / DESIGN ENGINEERING						
ROW Land and Purchase (Survey, Legal, Admin. etc.)	NA/	LS			None	
Surveying (5%)	0.05	LS	$22,986	$22,986	50% wooded; hilly	
Permit Processing; Engineering Design (12%)	0.12	LS	$55,167	$55,167	SESC; MDOT pemits	
Subtotal:						**$78,154**
TRAIL CONSTRUCTION COSTS						
General Construction Costs						
Bonds and Insurance (typ. 1-2%)	0.01	LS	$5,268	$5,268		
Mobilization (3-5K)	1	LS	$4,000	$4,000		
Site Preparation						
Clear and Grub; Topsoil (Remove and Stockpile)	2.21	MI	$4,000	$8,840		
Unclassified Embankment; Subgrade excavation	2.21	MI	$3,600	$7,956	yes	
Traffic control	1	LS	$3,000	$3,000	yes	
Trail Cross section						
Asphalt paving (2") (220#/sy)(6" - 22A)(Trail grading)	2.01	MI	$158,400	$318,384		
Asphalt paving (2") (220#/sy)(3"- 22A + Ex. Gravel)	0.6	MI	$100,300	$60,180	Ex. Greenan Rd. (gravel) (.4 mi); Old logging road bed (.2 mi)	
Limestone paving (4")(Base amend)(Trail grading)		MI	$116,200	$0		
Limestone paving (4")(Existing substrate/gravel)		MI	$87,100	$0		
Engineered soil paving (existing path)		MI	$53,000	$0		
Existing Gravel Road		MI	TBD	$0	Possible as early phase on Greenan Rd.	
Trail Restoration						
Seeding / Vegetation (restoration)	2.21	MI	$950	$2,100	yes, wooded understroy	
Trees (restoration)	200	EA	$250	$50,000	yes, wooded understory	
Subtotal:						**$459,728**
STRUCTURES / SPECIAL FEATURES / SAFETY / DRAINAGE						
Guard Rail Railings		LS		$0	possible	
Culverts; Rip-rap; Erosion Control (Silt fencing)		LS		$0	possible	
Crossing Advanced Warning (lights, signs, striping)		LS		$0		
Pavement markings		LS		$0		
Perminant signage		LS		$0	Mile markers; Interpretive	
Retaining Walls (Wood, modular conc.)		LS		$0	Possible north of Greenan Rd.	
Subtotal:						**$0**
CONSTRUCTION ENGINEERING						
Material Testing; Construction Management (6%)	0.06	LS	$27,584	$27,584		
Grant management / assistance (1%)	0.01	LS	$4,597	$4,597		
Subtotal:						**$32,181**
SUBTOTAL ENGINEERING AND CONSTUCTION:				$570,062		**$570,062**
PROJECT CONTINGENCY (20%):	0.2			$114,012		
TOTAL PROJECT COST PROJECTION				**$684,075**		

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TRAIL SEGMENT 5 - Alt B

COST PROJECTION

Leelanau Scenic Heritage Route Trailway
Phase I - Planning Project - February 2008

Total Trail Section Length: **20,909 Ft.** **3.96 MI.**

Description: In M-22 R.O.W. west side Hunter Rd. following a parallel trail along the duneside trail; continue on narrow gauge RR bed to former group camp ground at Harwood Dr. to Dune Valley Rd. then to Glen Haven Village (1.86 mi paved); Glen Haven Village (sub-area paved and/or limestone); to D.H. Day campground utilize existing two-track (paved); to Pine Haven Rd. utilized existing gravel road ROW (paved to crossing at M-22 and Stocking Rd.; continue on s. side Stocking Rd. ROW to existing NPS forest tow-tracks along base of escarpment (Alligator Hill) to S. Forest Haven Dr (paved); N. side of S. forest Haven Dr. in ROW to M-22; (2.44 mi. paved)

Item	*Estimated Quantity*	*Units*	*Unit Price in Year 2007*	*Estimated Cost*	*Notes*	*Subtotal*	*Subtotal*
R.O.W. / DESIGN ENGINEERING							
ROW Land and Purchase (Survey, Legal, Admin. etc	NA/	LS			None		
Surveying (3%)	0.03	LS	$18,627	$18,627	50% wooded; existing RR bed (fair to deteriorating)		
Permit Processing; Engineering Design (8%)	0.12	LS	$74,506	$74,506	SESC; MDOT, MDEQ pemits		
Subtotal:						**$93,133**	**$0**
TRAIL CONSTRUCTION COSTS							
General Construction Costs							
Bonds and Insurance (typ. 1-2%)	0.015	LS	$9,102	$9,102			
Mobilization (3-5K)	1	LS	$5,000	$5,000			
Site Preparation							
Clear and Grub; Topsoil (Remove and Stockpile)	3.96	MI	$4,000	$15,840	50% wooded; existing RR bed and two tracks		
Unclassified Embankment; Subgrade excavation	2.5	MI	$3,600	$9,000	limited		
Traffic control	1	LS	$3,000	$3,000	yes		
Trail Cross section							
Asphalt paving (2") (220#/sy)(6" - 22A)(Trail grading	2.78	MI	$158,400	$440,352			
Asphalt paving (2") (220#/sy)(3"- 22A + Ex. Gravel)	0.93	MI	$100,300	$93,279	Existing two tracks; Haven Rd. ROW		
Limestone paving (4")(Base amend)(Trail grading)	0.25	MI	$116,200	$29,050	alternative route extened barrier free pathway (.67 mi.)		
Existing Gravel Road	0.32	MI	TBD	$0	Early phase could use Haven Rd.		
Wood boardwalk - auger supported (10' width)		LF	$360	$0	Boardwalk from Hunter Rd. at dune climb to narrow gauge railbed (.61 Mi.)		
Trail Restoration							
Seeding / Vegetation (restoration)	3.96	MI	$950	$3,762	Yes, wooded wetland edge restoration		
Trees (restoration)	50	EA	$250	$12,500	yes, wooded understory		
Subtotal:						**$620,885**	**$0**
STRUCTURES / SPECIAL FEATURES / SAFETY / DRAINAGE							
Culverts; Rip-rap; Erosion Control (Silt fencing)		LS		$0	yes		
Crossing Advanced Warning (lights, signs, striping)		LS		$0	Hunter Rd. at dune climb; M-22 and Stocking Rd.; Glen Haven Village (at least one)		
Pavement markings		LS		$0	3+ Crosswalks		
Perminant signage		LS		$0	Mile markers; Interpretive		
Subtotal:						**$0**	**$0**
CONSTRUCTION ENGINEERING							
Material Testing; Construction Management (5%)	0.05	LS	$31,044	$31,044			
Grant management / assistance	0.005	LS	$3,104	$3,104			
Subtotal:						**$34,149**	**$0**
SUBTOTAL ENGINEERING AND CONSTUCTION:				$748,166		**$748,166**	**$0**
PROJECT CONTINGENCY (20%):	0.2			$149,633			
TOTAL PROJECT COST PROJECTION				**$897,799**			

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TRAIL SEGMENT 6 - Alt B

COST PROJECTION
Leelanau Scenic Heritage Route Trailway
Phase I - Planning Project - February 2008

Total Trail Section Length: **12,778 Ft.** **2.42 MI.**

Description: In ROW to M-22 on-road bike lanes from S. Forest Haven Rd. to Village of Glen Arbor; Bike lanes thru Village via S. Ray St., State St. and Oak St. back to M-22 east of town; in M-22 ROW south side following utility corridor from Oak St. to W. Crystal View Rd. (paved with short section of boardwalk (140 l.f.) near Marathon Station); Along and in W. Crystal View Rd. ROW on (south side) from M-22 to Westman Rd. (paved and boardwalk (2000 l.f.); Along Westman Rd. (west side) from W. Crystal Veiw Rd. to M-22 (paved with boardwalk segments)

Item	*Estimated Quantity*	*Units*	*Unit Price in Year 2007*	*Estimated Cost*	*Notes*	*Subtotal*	*Subtotal*
R.O.W. / DESIGN ENGINEERING							
ROW Land and Purchase (Survey, Legal, Admin. etc	NA/	LS			None		
Surveying (5%)	0.05	LS	$76,657	$76,657	60% wooded wetlands		
Permit Processing; Engineering Design (15%)	0.15	LS	$229,970	$229,970	SESC; MDOT, MDEQ pemits		
Subtotal:						**$306,626**	**$0**
TRAIL CONSTRUCTION COSTS							
General Construction Costs							
Bonds and Insurance (3%)	0.02	LS	$23,983	$23,983			
Mobilization	1	LS	$10,000	$10,000			
Site Preparation							
Clear and Grub; Topsoil (Remove and Stockpile)	2.42	MI	$4,000	$9,680	yes, wooded wetlands		
Unclassified Embankment; Subgrade excavation	1	MI	$3,600	$3,600	limited		
Traffic control	1	LS	$6,000	$6,000	yes		
Trail Cross section							
Asphalt paving (2") (220#/sy)(6" - 22A)(Trail grading	1.27	MI	$158,400	$201,168			
Asphalt paving (2") (220#/sy)(3"- 22A + Ex. Gravel)		MI	$100,300	$0			
On-Road Bikelane (4" white waterborne - two sides)	0.64	MI	$7,500	$4,800	' width both sides M-22 and in Village of Glen Abor		
Wood boardwalk - auger supported (10' width)	2700	LF	$360	$972,000	Boardwalk along W.Harbor Highway (500 l.f) and W. Crystal View Rd. - s. side (2200 l.f)		
Trail Restoration							
Seeding / Vegetation (restoration)	2	MI	$950	$1,900	yes, wooded wetland edge restoration		
Trees (restoration)		EA	$450	$0	possilbe		
Subtotal:						**$1,233,131**	**$0**
STRUCTURES / SPECIAL FEATURES / SAFETY / DRAINAGE							
Culverts; Rip-rap; Erosion Control (Silt fencing)		LS		$0	yes		
Crossing Advanced Warning (lights, signs, striping)		LS		$0	Major safety crossings in Village		
Pavement markings		LS		$0	Multiple crosswalks		
Perminant signage		LS		$0	Mile markers; Interpretive		
Bridge (10' width); Bridge Abutment/Wing walls	1	LS		$300,000	Yes, south side at Crystal River (150+ ft. span)		
Retaining Walls (Wood, modular conc.)		LS		$0	yes , ?		
Subtotal:						**$300,000**	**$0**
CONSTRUCTION ENGINEERING							
Material Testing; Construction Management (7%)	0.07	LS	$107,319	$107,319			
Grant management / assistance	0.005	LS	$7,666	$7,666			
Subtotal:						**$114,985**	**$0**
SUBTOTAL ENGINEERING AND CONSTUCTION:				$1,954,742		**$1,954,742**	**$0**
PROJECT CONTINGENCY (20%):	0.2			$390,948			
TOTAL PROJECT COST PROJECTION				**$2,345,690**			

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TRAIL SEGMENT 7 - Alt B

COST PROJECTION

Leelanau Scenic Heritage Route Trailway
Phase I - Planning Project - February 2008

Total Trail Section Length:	**12,250 Ft.**		**2.32 MI.**				
Description: In M-22 ROW on west side from Westman Rd.to S. Thoreson Rd. (paved); On existing Bayview Trail alignment from S. Thoreson Rd. To N. Thoreson Road cross and contiue on Bayview Trail past Oleson Farm (amended limestone path); additional new spur to connect to Port Oneida Rd. (500 l.f.); cross at Port Onieda Road link to M-22 (paved)							
Item	*Estimated Quantity*	*Units*	*Unit Price in Year 2007*	*Estimated Cost*	*Notes*	*Subtotal*	*Subtotal*
R.O.W. / DESIGN ENGINEERING							
ROW Land and Purchase (Survey, Legal, Admin. etc	NA/	LS			None		
Surveying (5%)	0.05	LS	$13,451	$13,451	70% wooded uplands		
Permit Processing; Engineering Design (12%)	0.12	LS	$32,281	$32,281	SESC; MDOT, MDEQ pemits		
Subtotal:						**$45,732**	**$0**
TRAIL CONSTRUCTION COSTS							
General Construction Costs							
Bonds and Insurance (typ. 1-2%)	0.01	LS	$2,624	$2,624			
Mobilization (3-5K)	1	LS	$4,000	$4,000			
Site Preparation							
Clear and Grub; Topsoil (Remove and Stockpile)	1	MI	$4,000	$4,000	yes, wooded wetlands		
Unclassified Embankment; Subgrade excavation	1	MI	$3,600	$3,600	limited		
Traffic control	1	LS	$3,000	$3,000	yes		
Trail Cross section							
Asphalt paving (2") (220#/sy)(6" - 22A)(Trail grading	0.32	MI	$158,400	$50,688	Link to existing trail head on Thoreson Rd. and Alternate route (2.08 Mi) not included		
Asphalt paving (2") (220#/sy)(3"- 22A + Ex. Gravel)		MI	$100,300	$0			
Limestone paving (4")(Base amend)(Trail grading)		MI	$116,200	$0	Additional spur to connect to Port Oneida Rd. (500 l.f.)		
Limestone paving (4")(Existing substrate/gravel)	2	MI	$87,100	$174,200			
Engineered soil paving (existing path)		MI	$53,000	$0			
On-Road Bikelane (4" white waterborne - two sides)		MI	$7,500	$0			
Trail Restoration							
Seeding / Vegetation (restoration)	2	MI	$950	$1,900	Yes, wooded sideslope restoration		
Trees (restoration)	100	EA	$250	$25,000	yes, wooded understory		
Subtotal:						**$269,012**	**$0**
STRUCTURES / SPECIAL FEATURES / SAFETY / DRAINAGE							
Culverts; Rip-rap; Erosion Control (Silt fencing)		LS		$0	yes		
Crossing Advanced Warning (lights, signs, striping)		LS		$0	Westman Rd; Thoreson Rd. (twice)		
Pavement markings		LS		$0	3 crosswalks		
Perminant signage		LS		$0	Mile markers; Interpretive		
Retaining Walls (Wood, modular conc.)		LS		$0	Yes, possible near Westman Rd.		
Subtotal:						**$0**	**$0**
CONSTRUCTION ENGINEERING							
Material Testing; Construction Management (5%)	0.05	LS	$13,451	$13,451			
Grant management / assistance	0.005	LS	$1,345	$1,345			
Subtotal:						**$14,796**	**$0**
SUBTOTAL ENGINEERING AND CONSTUCTION:				$329,540		**$329,540**	**$0**
PROJECT CONTINGENCY (20%):	0.2			$65,908			
TOTAL PROJECT COST PROJECTION				**$395,447**			

Gosling Czubak engineering sciences, inc.

TRAIL SEGMENT 8 - Alt B

COST PROJECTION

Leelanau Scenic Heritage Route Trailway

Phase I - Planning Project - February 2008

Total Trail Section Length:	**16,738 Ft.**		**3.17 MI.**				
Description: In M-22 ROW on north side from Port Onieda Rd. to just west of North Unity School (paved); Out of ROW west of North Unity School on north side of buildings to Narada Lake boardwalk; in M-22 ROW from Narada Lake boardwalk (north side) to Bohemian Rd. (paved)							
Item	*Estimated Quantity*	*Units*	*Unit Price in Year 2007*	*Estimated Cost*	*Notes*	*Subtotal*	*Subtotal*
R.O.W. / DESIGN ENGINEERING							
ROW Land and Purchase (Survey, Legal, Admin. etc	NA/	LS			None		
Surveying (5%)	0.05	LS	$35,810	$35,810	50% wooded wetlands		
Permit Processing; Engineering Design (12%)	0.12	LS	$85,945	$85,945	SESC; MDOT, MDEQ pemits		
Subtotal:						**$121,755**	**$0**
TRAIL CONSTRUCTION COSTS							
General Construction Costs							
Bonds and Insurance (typ. 1-2%)	0.015	LS	$4,190	$4,190			
Mobilization (3-5K)	1	LS	$4,000	$4,000			
Site Preparation							
Clear and Grub; Topsoil (Remove and Stockpile)	2	MI	$4,000	$8,000	yes, wooded wetlands		
Unclassified Embankment; Subgrade excavation	0.5	MI	$3,600	$1,800	limited		
Traffic control	1	LS	$4,000	$4,000	yes		
Trail Cross section							
Asphalt paving (2") (220#/sy)(6" - 22A)(Trail grading	3.07	MI	$158,400	$486,288	Does not include alternative route along S. Basch Rd. (gravel) - (1.68 mi.) or Good Harbor Beach trailhead link on Bohemian Rd. (1.21 mi.)		
Asphalt paving (2") (220#/sy)(3"- 22A + Ex. Gravel)		MI	$100,300	$0			
On-Road Bikelane (4" white waterborne - two sides)		MI	$7,500	$0			
Wood boardwalk - auger supported (10' width)	528	LF	$360	$190,080	embankment near North Unity School at Narada Lake - (north side)		
Trail Restoration							
Seeding / Vegetation (restoration)	3	MI	$950	$2,850	yes, wooded and wetland edge restoration		
Trees (restoration)	60	EA	$250	$15,000	yes, wooded understory		
Subtotal:						**$716,208**	**$0**
STRUCTURES / SPECIAL FEATURES / SAFETY / DRAINAGE							
Culverts; Rip-rap; Erosion Control (Silt fencing)		LS		$0	yes		
Crossing Advanced Warning (lights, signs, striping)		LS		$0	Port Onieda Rd.; S. Basch Rd.		
Pavement markings		LS		$0	2 crosswalks		
Perminant signage		LS		$0	Mile markers; Interpretive		
Subtotal:						**$0**	**$0**
CONSTRUCTION ENGINEERING							
Material Testing; Construction Management (7%)	0.07	LS	$50,135	$50,135			
Grant management / assistance	0.005	LS	$3,581	$3,581			
Subtotal:						**$53,716**	**$0**
SUBTOTAL ENGINEERING AND CONSTUCTION:				$891,679		**$891,679**	**$0**
PROJECT CONTINGENCY (20%):	0.2			$178,336			
TOTAL PROJECT COST PROJECTION				**$1,070,015**			

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TRAIL SEGMENT 9 - Alt B

COST PROJECTION

Leelanau Scenic Heritage Route Trailway
Phase I - Planning Project - February 2008

Total Trail Section Length: **25,133 Ft.** **4.76 MI.**

Description: In M-22 ROW on north side from Bohemian Rd. to Little Traverse Lake Rd.(paved); Out of ROW west of Bufka Farm on north side of buildings to Townline Rd. (limestone) and possible boardwalk sections.

Item	*Estimated Quantity*	*Units*	*Unit Price in Year 2007*	*Estimated Cost*	*Notes*	*Subtotal*	*Subtotal*
R.O.W. / DESIGN ENGINEERING							
ROW Land and Purchase (Survey, Legal, Admin. etc	NA/	LS			None		
Surveying (5%)	0.05	LS	$13,179	$13,179	50% wooded wetlands		
Permit Processing; Engineering Design (12%)	0.12	LS	$31,629	$31,629	SESC; MDOT, MDEQ pemits		
Subtotal:						**$44,807**	**$0**
TRAIL CONSTRUCTION COSTS							
General Construction Costs							
Bonds and Insurance (typ. 1-2%)	0.01	LS	$3,956	$3,956			
Mobilization (3-5K)	1	LS	$4,000	$4,000			
Site Preparation							
Clear and Grub; Topsoil (Remove and Stockpile)	2	MI	$4,000	$8,000	yes, wooded wetlands		
Unclassified Embankment; Subgrade excavation	0.5	MI	$3,600	$1,800	limited		
Traffic control	1	LS	$4,000	$4,000	yes		
Trail Cross section							
Asphalt paving (2") (220#/sy)(6" - 22A)(Trail grading	0.38	MI	$158,400	$60,192	Traverse Lake Rd. (ex. paved rd.) - (2.76 mi.) or Good Harbor Beach trailhead link on Townline Rd. (.46 mi.)		
Asphalt paving (2") (220#/sy)(3"- 22A + Ex. Gravel)		MI	$100,300	$0			
Limestone paving (4")(Base amend)(Trail grading)	1.27	MI	$116,200	$147,574	Additional spur to connect to Port Oneida Rd. (500 l.f.)		
On-Road Bikelane (4" white waterborne - two sides)	2.43	MI	$7,500	$18,225	Little Traverse Lake Road		
Wood boardwalk - auger supported (10' width)		LF	$360	$0	Possible with wetlands near Bartunek Rd. and near Townline Rd. west of the Bufka Farm		
60	0.57	MI	$0	$0	Good Harbor Beach Road - to be paved by NPS		
Trail Restoration							
Seeding / Vegetation (restoration)	3.5	MI	$950	$3,325	yes, wooded and wetland edge restoration		
Trees (restoration)	50	EA	$250	$12,500	yes, wooded understory		
Subtotal:						**$263,572**	**$0**
STRUCTURES / SPECIAL FEATURES / SAFETY / DRAINAGE							
Culverts; Rip-rap; Erosion Control (Silt fencing)		LS		$0	yes		
Crossing Advanced Warning (lights, signs, striping)		LS		$0	Port Onieda Rd.; S. Basch Rd.		
Pavement markings		LS		$0	2 crosswalks		
Perminant signage		LS		$0	Mile markers; Interpretive		
Bridge (10' width); Bridge Abutment/Wing walls	1	LS		$70,000	es, creek location w. of Bartunek Rd. (30 Ft. span)		
Retaining Walls (Wood, modular conc.)		LS		$0	yes, possible		
Subtotal:						**$0**	**$0**
CONSTRUCTION ENGINEERING							
Material Testing; Construction Management (7%)	0.07	LS	$18,450	$18,450			
Grant management / assistance	0.005	LS	$1,318	$1,318			
Subtotal:						**$19,768**	**$0**
SUBTOTAL ENGINEERING AND CONSTUCTION:				$398,147		**$328,147**	**$0**
PROJECT CONTINGENCY (20%):	0.2			$79,629			
TOTAL PROJECT COST PROJECTION				**$477,776**			

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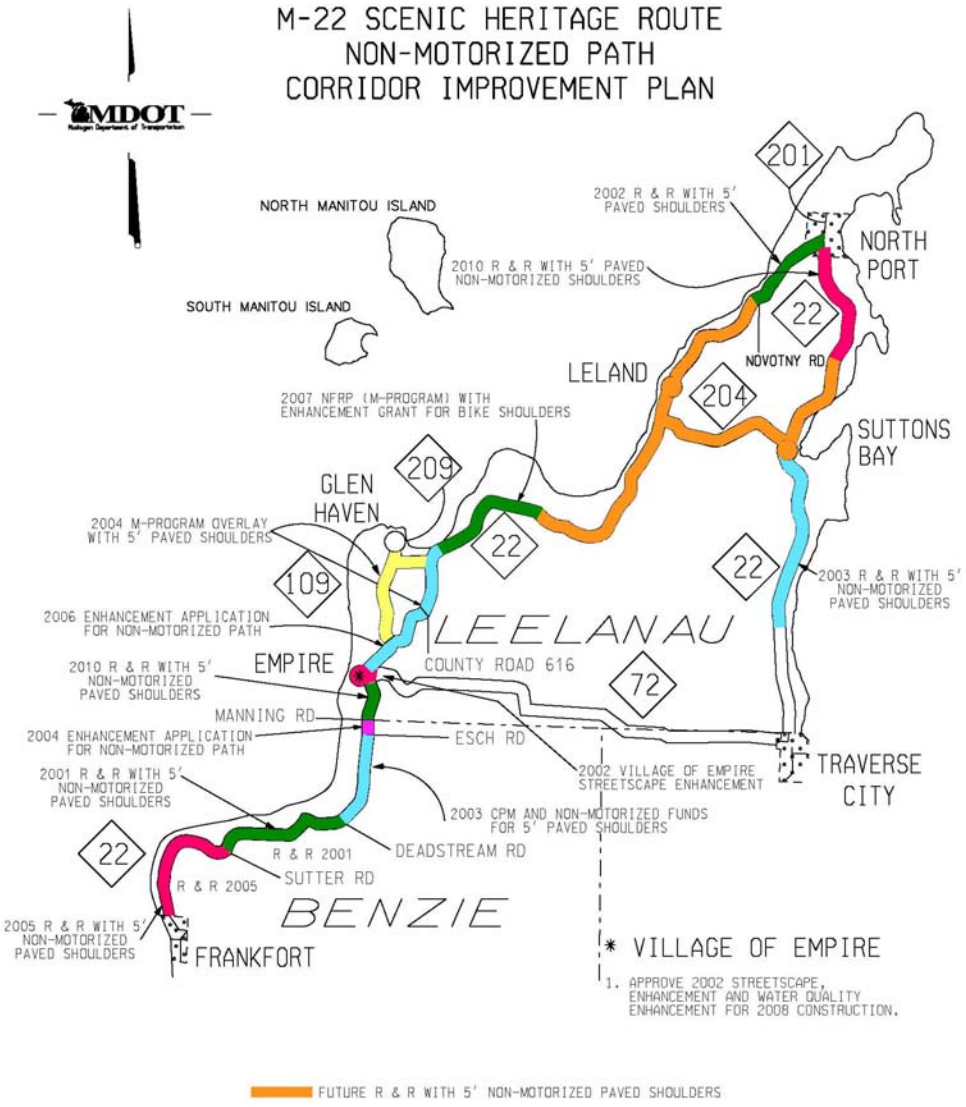
APPENDIX

Leelanau Scenic Heritage Route Trailway Plan

MAPS
TRAIL PLANNING AND DESIGN GUIDELINES
PRELIMINARY IMPACT TOPICS
MATRICES
OPTIONS MAPS

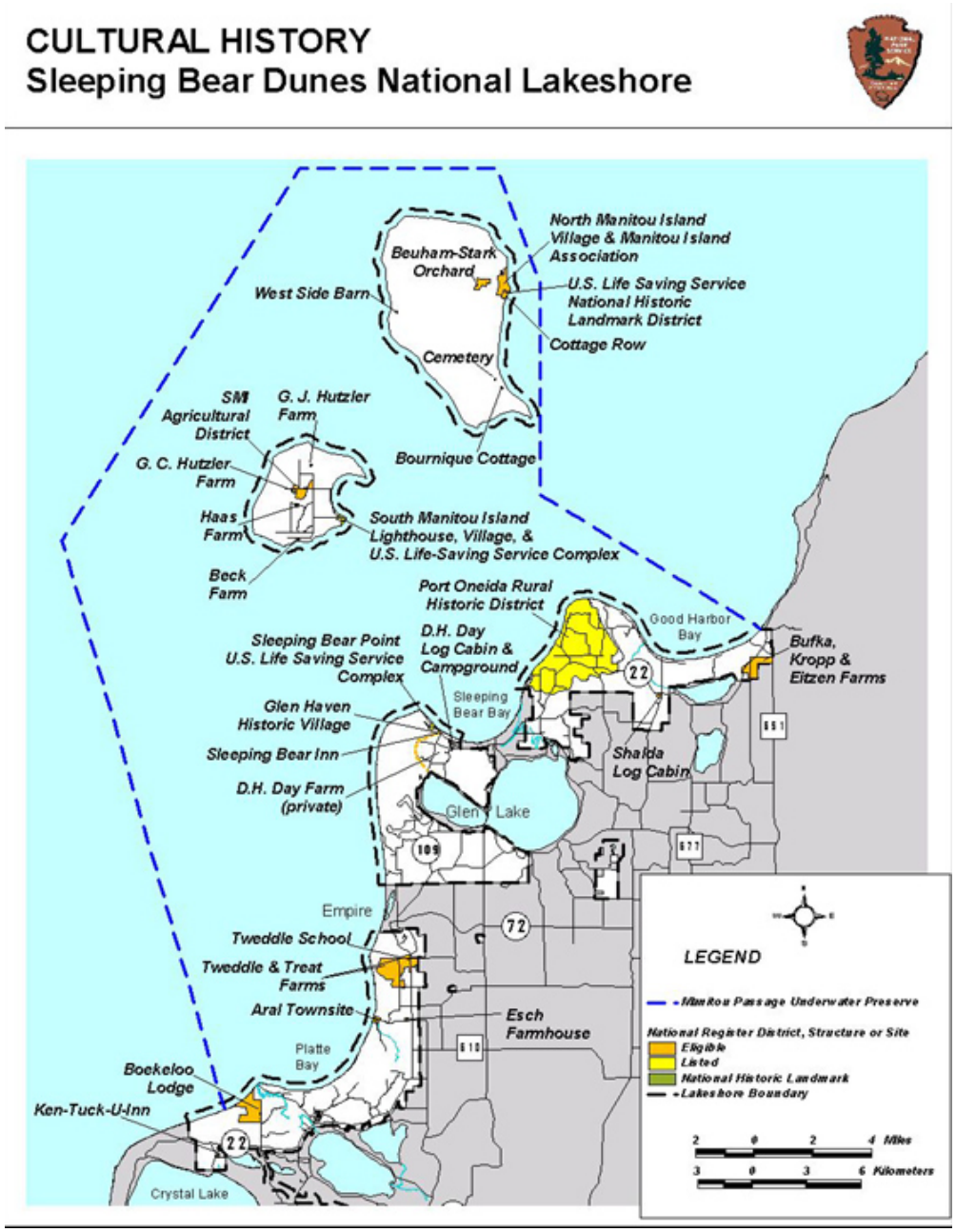
APPENDIX A


M-22 SCENIC HERITAGE ROUTE
NON-MOTORIZED PATH
CORRIDOR IMPROVEMENT PLAN
MDOT
NORTH MANITOU ISLAND
SOUTH MANITOU ISLAND
2002 R & R WITH 5' PAVED SHOULDERS
2010 R & R WITH 5' PAVED NON-MOTORIZED SHOULDERS
NORTH PORT
NOVOTNY RD
LELAND
2007 NFRP (M-PROGRAM) WITH ENHANCEMENT GRANT FOR BIKE SHOULDERS
SUTTONS BAY
GLEN HAVEN
2004 M-PROGRAM OVERLAY WITH 5' PAVED SHOULDERS
2003 R & R WITH 5' NON-MOTORIZED PAVED SHOULDERS
2006 ENHANCEMENT APPLICATION FOR NON-MOTORIZED PATH
LEELANAU
EMPIRE
COUNTY ROAD 616
2010 R & R WITH 5' NON-MOTORIZED PAVED SHOULDERS
MANNING RD
2004 ENHANCEMENT APPLICATION FOR NON-MOTORIZED PATH
ESCH RD
2001 R & R WITH 5' NON-MOTORIZED PAVED SHOULDERS
2002 VILLAGE OF EMPIRE STREETSCAPE ENHANCEMENT
TRAVERSE CITY
2003 CPM AND NON-MOTORIZED FUNDS FOR 5' PAVED SHOULDERS
R & R 2001
DEADSTREAM RD
R & R 2005
SUTTER RD
BENZIE
2005 R & R WITH 5' NON-MOTORIZED PAVED SHOULDERS
FRANKFORT
* VILLAGE OF EMPIRE
1. APPROVE 2002 STREETSCAPE, ENHANCEMENT AND WATER QUALITY ENHANCEMENT FOR 2008 CONSTRUCTION.
FUTURE R & R WITH 5' NON-MOTORIZED PAVED SHOULDERS

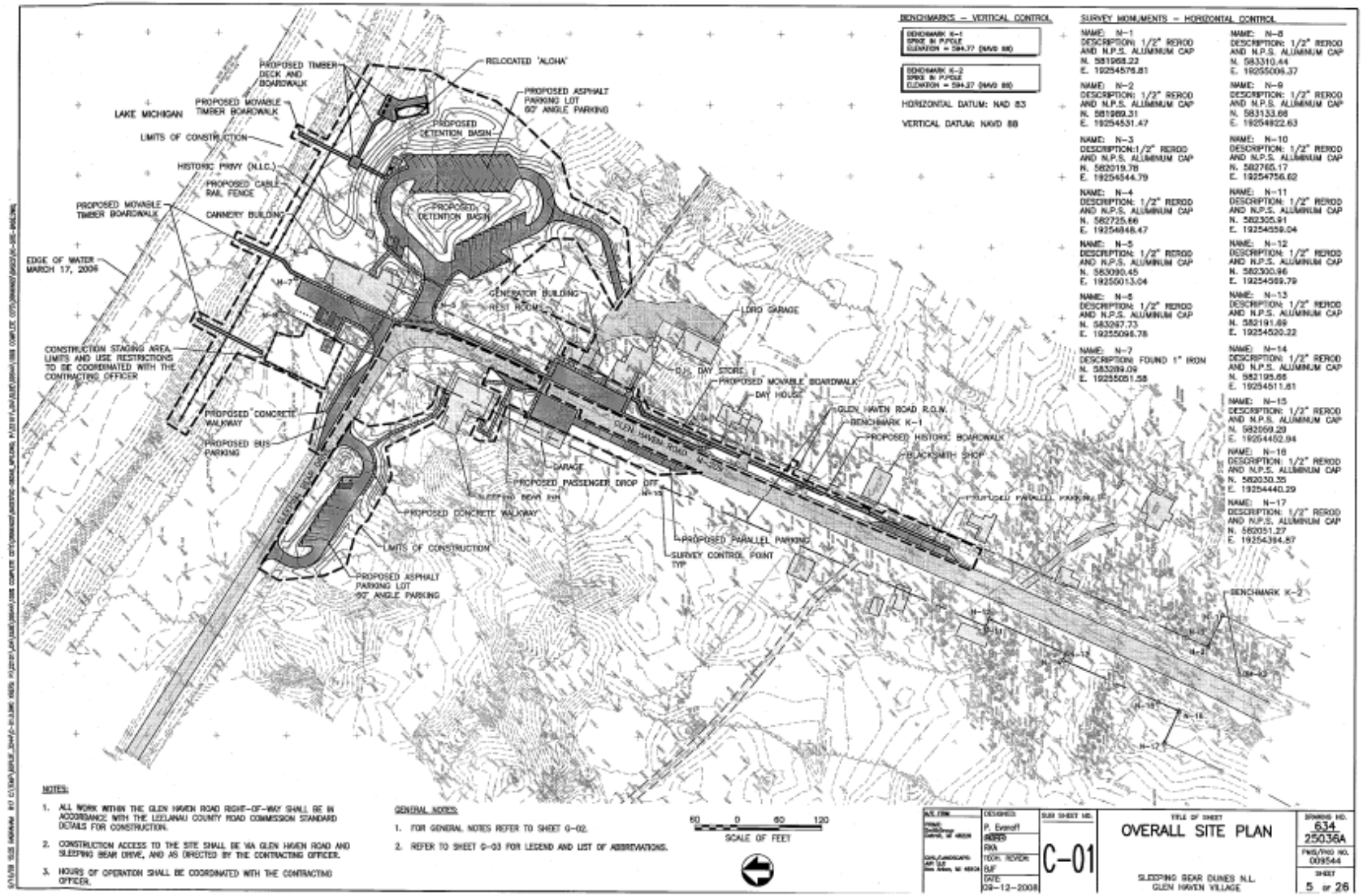
APPENDIX B


Port Oneida
Rural Historic District
Sleeping Bear Dunes National Lakeshore
NATIONAL PARK SERVICE
N
LEGEND
NPS-Owned Farm
Privately Leased, NPS-Owned Farm
NPS Barn; Private House
Privately-Owned Farm
Other Points of Interest
Hiking Trail
Lookout
Wetlands
Rising Sun Shipwreck (Submerged)
Pyramid Point (Dunes)
Mary Miller Farmstead (Remains)
Pyramid Pt. Trailhead
Schnor Farm
Nicholas Basch Farm
Baker Farm
Basch Rd.
Weaver Farm
Baker Rd.
Carsten Burfiend Farm
George Olsen Farm
Shell Lk.
Port Oneida Rd.
Barratt Pig Barn
Schmidt Farm
Historic Site of Pt. Oneida Dock
Martin Basch Farm
Werner Family Cemetary
Eckhert Farm
Ole Olsen Farm
Miller Rd.
Kelderhouse Rd.
Miller Barn
John Burfiend Farm
Beaver Pond
Kelderhouse Farm
Brunson Barn
Pt. Oneida School
Kelderhouse Cemetary
Narada Lk.
Bay View Trailhead
Chas & Hattie Olsen Farm
Goffar Farm
Dechow Farm
Peter Burfiend Farm
Lawr Farm
Former Church Site
Sugar Shack
Werner Farm
North Unity School
Wheeler Rd.
Thoreson Farm
Thoreson Rd.
Sunset Trail
22
KM
1
2
Miles
1
2/04

APPENDIX C


CULTURAL HISTORY
Sleeping Bear Dunes National Lakeshore
North Manitou Island Village & Manitou Island Association
Beuham-Stark Orchard
U.S. Life Saving Service National Historic Landmark District
West Side Barn
Cottage Row
Cemetery
SMI Agricultural District
G. J. Hutzler Farm
G. C. Hutzler Farm
Bournique Cottage
Haas Farm
South Manitou Island Lighthouse, Village, & U.S. Life-Saving Service Complex
Beck Farm
Port Oneida Rural Historic District
Good Harbor Bay
Bufka, Kropp & Eitzen Farms
Sleeping Bear Point U.S. Life Saving Service Complex
D.H. Day Log Cabin & Campground
Sleeping Bear Bay
Glen Haven Historic Village
Sleeping Bear Inn
Shalda Log Cabin
D.H. Day Farm (private)
Glen Lake
Empire
Tweddle School
Tweddle & Treat Farms
Aral Townsite
Esch Farmhouse
Platte Bay
Boekeloo Lodge
Ken-Tuck-U-Inn
Crystal Lake
LEGEND
Manitou Passage Underwater Preserve
National Register District, Structure or Site
Eligible
Listed
National Historic Landmark
Lakeshore Boundary
2 0 2 4 Miles
3 0 3 6 Kilometers

APPENDIX D


BENCHMARKS – VERTICAL CONTROL
BENCHMARK K-1
SPIKE IN P.P.O.E.
ELEVATION = 594.77 (NAVD 88)
BENCHMARK K-2
SPIKE IN P.P.O.E.
ELEVATION = 594.27 (NAVD 88)
HORIZONTAL DATUM: NAD 83
VERTICAL DATUM: NAVD 88
SURVEY MONUMENTS – HORIZONTAL CONTROL
NAME: N-1
DESCRIPTION: 1/2" REROD AND N.P.S. ALUMINUM CAP
N. 581958.22
E. 19254576.81
NAME: N-2
DESCRIPTION: 1/2" REROD AND N.P.S. ALUMINUM CAP
N. 581989.31
E. 19254531.47
NAME: N-3
DESCRIPTION:1/2" REROD AND N.P.S. ALUMINUM CAP
N. 582019.78
E. 19254544.79
NAME: N-4
DESCRIPTION: 1/2" REROD AND N.P.S. ALUMINUM CAP
N. 582725.66
E. 19254848.47
NAME: N-5
DESCRIPTION: 1/2" REROD AND N.P.S. ALUMINUM CAP
N. 583090.45
E. 19255013.04
NAME: N-6
DESCRIPTION: 1/2" REROD AND N.P.S. ALUMINUM CAP
N. 583267.73
E. 19255098.78
NAME: N-7
DESCRIPTION: FOUND 1" IRON
N. 583289.09
E. 19255051.58
NAME: N-8
DESCRIPTION: 1/2" REROD AND N.P.S. ALUMINUM CAP
N. 583310.44
E. 19255006.37
NAME: N-9
DESCRIPTION: 1/2" REROD AND N.P.S. ALUMINUM CAP
N. 583133.66
E. 19254922.63
NAME: N-10
DESCRIPTION: 1/2" REROD AND N.P.S. ALUMINUM CAP
N. 582765.17
E. 19254756.62
NAME: N-11
DESCRIPTION: 1/2" REROD AND N.P.S. ALUMINUM CAP
N. 582325.91
E. 19254559.04
NAME: N-12
DESCRIPTION: 1/2" REROD AND N.P.S. ALUMINUM CAP
N. 582300.96
E. 19254589.79
NAME: N-13
DESCRIPTION: 1/2" REROD AND N.P.S. ALUMINUM CAP
N. 582191.69
E. 19254520.22
NAME: N-14
DESCRIPTION: 1/2" REROD AND N.P.S. ALUMINUM CAP
N. 582195.66
E. 19254511.61
NAME: N-15
DESCRIPTION: 1/2" REROD AND N.P.S. ALUMINUM CAP
N. 582059.29
E. 19254452.94
NAME: N-16
DESCRIPTION: 1/2" REROD AND N.P.S. ALUMINUM CAP
N. 582030.35
E. 19254440.29
NAME: N-17
DESCRIPTION: 1/2" REROD AND N.P.S. ALUMINUM CAP
N. 582051.27
E. 19254394.87
LAKE MICHIGAN
PROPOSED TIMBER DECK AND BOARDWALK
PROPOSED MOVABLE TIMBER BOARDWALK
LIMITS OF CONSTRUCTION
HISTORIC PRIVY (N.L.G.)
PROPOSED CABLE RAIL FENCE
CANNERY BUILDING
PROPOSED MOVABLE TIMBER BOARDWALK
EDGE OF WATER MARCH 17, 2008
CONSTRUCTION STAGING AREA LIMITS AND USE RESTRICTIONS TO BE COORDINATED WITH THE CONTRACTING OFFICER
PROPOSED CONCRETE WALKWAY
PROPOSED BUS PARKING
RELOCATED 'ALOHA'
PROPOSED ASPHALT PARKING LOT 60° ANGLE PARKING
PROPOSED DETENTION BASIN
PROPOSED DETENTION BASIN
GENERATOR BUILDING REST ROOMS
LORD GARAGE
BUS DAY STORE
PROPOSED MOVABLE BOARDWALK
DAY HOUSE
GLEN HAVEN ROAD R.O.W.
BENCHMARK K-1
PROPOSED HISTORIC BOARDWALK
BLACKSMITH SHOP
GLEN HAVEN ROAD
SLEEPING BEAR DUNES N.L.
GARAGE
PROPOSED PASSENGER DROP OFF
SLEEPING BEAR DR.
PROPOSED CONCRETE WALKWAY
LIMITS OF CONSTRUCTION
PROPOSED ASPHALT PARKING LOT 90° ANGLE PARKING
PROPOSED PARALLEL PARKING
SURVEY CONTROL POINT TYP
PROPOSED PARALLEL PARKING
BENCHMARK K-2
NOTES:
1. ALL WORK WITHIN THE GLEN HAVEN ROAD RIGHT-OF-WAY SHALL BE IN ACCORDANCE WITH THE LEELANAU COUNTY ROAD COMMISSION STANDARD DETAILS FOR CONSTRUCTION.
2. CONSTRUCTION ACCESS TO THE SITE SHALL BE VIA GLEN HAVEN ROAD AND SLEEPING BEAR DRIVE, AND AS DIRECTED BY THE CONTRACTING OFFICER.
3. HOURS OF OPERATION SHALL BE COORDINATED WITH THE CONTRACTING OFFICER.
GENERAL NOTES:
1. FOR GENERAL NOTES REFER TO SHEET G-02.
2. REFER TO SHEET G-03 FOR LEGEND AND LIST OF ABBREVIATIONS.
60 0 60 120
SCALE OF FEET
DESIGNED: P. Evanoff
DRAWN: ABES
CHECKED: RKA
TECH. REVIEW: BJF
DATE: 09-12-2008
SUB SHEET NO. C-01
TITLE OF SHEET
OVERALL SITE PLAN
SLEEPING BEAR DUNES N.L.
GLEN HAVEN VILLAGE
DRAWING NO. 634 25036A
PWIS/PKG NO. 009544
SHEET 5 OF 26

APPENDIX E: Trail Planning and Design Guidelines

Grade (Slope)

Grade (slope) is defined as the slope parallel to the direction of travel and is calculated by dividing the vertical change in elevation by the horizontal distance covered. For example, a trail that gains 2 m in elevation over 40 m of horizontal distance has a grade of 5 percent. Some guidelines use the term "slope" to refer to grade. However, the term "grade" will be used in this plan to avoid confusion with cross-slope.

Average grade is defined as the average of many contiguous running grades. Running grade is usually measured over the maximum distance afforded by sight lines when grades are continuous. However, more detailed grade information can be obtained if measurement distances do not exceed 100 ft. Running grade is also measured on shorter trail segments between changes on grade.

Maximum grade is defined as a limited section of trail that exceeds the typical running grade. Maximum grade values can differ significantly from the running grade values. For example, a trail that gains 50 ft. in elevation gradually over 1 mile has the same running grade as a trail that is flat for 0.75 miles and then climbs 50 ft. over the last 0.25 mile; however, the two trails make very different strength and endurance demands of users.

Federal Guidelines for Maximum Allowable Running Grade

Source	Path Type	Single Level	Multiple Levels		
			Easier	Moderate	Difficult
		%	%	%	%
USDA FS Trails Mgt. Handbook (USDA FS, 1985)	H		n/a	n/a	n/a
Guide for the Dev. of Bicycle Facilities (AASHTO, 1997, Draft)	S	5			
Guide for the Dev. of Bicycle Facilities (AASHTO, 1991)	B	5			
USDA FS Trails Mgt. Handbook (USDA FS, 1985)	E		n/a	n/a	n/a
USDA FS Trails Mgt. Handbook (USDA FS, 1985)	X		7.5	12	17
USDA FS Trails Mgt. Handbook (USDA FS, 1985)	SM		8	n/a	15
USDA FS Trails Mgt. Handbook (USDA FS, 1985)	ATV		15	25	35

AR = Accessible Route ORAR = Outdoor Recreation Access Route RT = Recreational Trail

H = Hiking Trail S = Shared-Use Path B = Bicycle Path

MB = Mountain Biking Trail E = Equestrian Trail X = Cross-Country Ski Trail

SM = Snow Machine Trail ATV = All-Terrain Vehicle Trail

OHV = Off-Highway Vehicle Trail M = Motorcycle Trail

** Source: U.S. Department of Transportation – Federal Highway Administration, website: (www.fhwa.dot.gov)*

Cross Slope
For trail design is hilly areas along with gradient, it is also important to consider it cross-slope.

Cross-slope is defined as the slope measured perpendicular to the direction of travel. Cross-slope must be measured at specific points. The average cross-slope is the average of cross-slopes measured at regular intervals along the trail.

Running cross-slope is defined as the average cross-slope of a contiguous section of trail. The running cross-slope can be determined by taking periodic measurements throughout a section of trail and then averaging the values.

Maximum cross-slope is defined as a limited section of the trail that exceeds the typical running cross-slope of the path.

Rate of change of cross-slope is defined as the change in cross-slope over a given distance. Typically rate of change of cross-slope is measured over 2 ft intervals, which is the approximate length of a single walking pace and the wheelbase of a wheelchair. Rate of change of cross-slope can be measured by placing a level 2 ft before and after a maximum cross-slope. It is important to note that rapidly changing cross-slopes can cause one wheel of a wheelchair or one leg of a walker to lose contact with the ground and also can cause walking pedestrians to stumble or fall.

Because some trail users and people in wheelchairs, may have difficulty negotiating extreme cross-slopes even for short distances, the following recommended parameters for the trail design should be considered:

- Maximum cross-slope of 5 percent for a distance of 3.050 m (10 ft) average trail difficulty
- Maximum cross-slope of 5 percent for 3.660 m (12 ft). for easier recreational trails

* Source: Axelson, Chesney, and Longmuir (1995)

AASHTO Green Book's specifications for cross-slopes based on surface type. According to the *AASHTO Green Book*, a 1.5 percent cross-slope provides effective drainage in most weather conditions for surfaces with the highest pavement standards. Intermediate and low surface types, such as gravel, may require larger cross-slopes to enable adequate drainage (AASHTO, 1995, 1999).

Cross-Slope Ranges by Surface Type (AASHTO, 1995)

Surface Type	Cross-Slope Range
High(highest pavement standard)	1.5-2.0%
Intermediate(slightly below high)	1.5-3.0%
Low(loose surface; earth, gravel, etc.)	2.0-6.0%

Some studies indicate that adults with and without disabilities are unable to distinguish between 2 and 3 percent cross-slopes (Axelson, Chesney, and Longmuir, 1995).

Maintaining minimal cross-slope values can significantly increase the cost and environmental modifications required to build trails on steep terrain per the following chart:

Federal Guidelines for Maximum Allowable Running Cross-Slope:

Source	Path Type	Single Level	Multiple Levels		
			Easier	Moderate	Difficult
		%	%	%	%
USDA FS Trails Mgt. Handbook (USDA FS, 1985)	H		n/a	n/a	n/a
Guide for the Dev. of Bicycle Facilities (AASHTO, 1997, Draft)	S	2			
Guide for the Dev. of Bicycle Facilities (AASHTO, 1991)	B	2			
USDA FS Trails Mgt. Handbook (USDA FS, 1985)	E		n/a	n/a	n/a
USDA FS Trails Mgt. Handbook (USDA FS, 1985)	X		n/a	n/a	n/a
USDA FS Trails Mgt. Handbook (USDA FS, 1985)	SM		15	30	40
USDA FS Trails Mgt. Handbook (USDA FS, 1985)	ATV		20	30	40

AR = Accessible Route ORAR = Outdoor Recreation Access Route RT = Recreational Trail

H = Hiking Trail S = Shared-Use Path B = Bicycle Path

MB = Mountain Biking Trail E = Equestrian Trail X = Cross-Country Ski Trail

SM = Snow Machine Trail ATV = All-Terrain Vehicle Trail

OHV = Off-Highway Vehicle Trail M = Motorcycle Trail

** Source: U.S. Department of Transportation – Federal Highway Administration, website: (www.fhwa.dot.gov)*

APPENDIX F: Preliminary Impact Topics

DERIVATION OF IMPACT TOPICS

Impact topics were used to focus the evaluation of the potential environmental consequences of the alternatives. The impact topics that were selected were identified based on guidance from the National Park Service, input from the LSHRC, public concerns, and resource information specific to the Lakeshore and outlying project area. Described below is a brief foundation for the selection of each impact topic, as well as rationale for dismissing specific topics from further consideration.

IMPACT TOPICS SELECTED FOR ANALYSIS

The impact topics that were selected and retained had several concerns that warranted discussion. These impact topics were retained because they were identified either through the development of the project scope, or development of a planning program, or the alternative identified was anticipated to have an impact on at least one of the impact topics and the resources within the project area.

Impact topics that were considered when evaluating the Trailway routing options are represented in ***Preliminary Matrices*** developed to help measure and compare potential impact to the environment and feasibility, and ***Trailway Option Maps 1.1 through 1.9b***, found in the Appendices. The Tables and Maps measure the opportunities and challenges of possible alternatives in relation to environmental consequences. A series of 9 Impact Topics were originally selected for analysis for *Impact to the Environment while* 5 Impact Topics were selected for analysis for *Impact to Feasibility*. Each topic was described in terms of impact ranging from negligible to major, and provided a standardized basis of comparison between options.

The retained impact topics discussed in detail in section 2.4 and 2.5 - ***"Affected Environment and Environmental Consequences,"*** only include those topics that posed a potential impact and may differ from the impact topics that were identified initially. The preliminary impact topics include the following:

Topography was retained due to the extensive relief of the Sleeping Bear Dunes National Lakeshore (Lakeshore). For universal accessibility as well as constructability of trail routes, topography is a key component for the feasibility assessment. In addition, many recreational features and park assets that visitors are encouraged to experience are related to the topographic land forms.

Wetlands was retained as an impact topic because of concerns with hydrology, local and state policies regulating wetlands, permitting, flora and fauna, and potential effects from the alternatives considered. Wetlands do exist within the project area, and some alternatives cross areas of wetlands.

Streams & Creeks was retained as an impact topic because the action alternatives would require crossings at some locations. Several streams and creeks (including the Crystal River) exist throughout the project area, and it was determined

the action alternatives would require a stream or creek crossing including boardwalk or bridge; furthermore, the same alternatives come within 100' of a stream or creek with the possibility of sediment entering nearby surface waters.

Wildlife was retained despite no threatened and endangered species' habitats were found within the vicinity of the proposed alternatives and effects on habitat would be below detectable levels of disturbance. Working together with NPS staff, "Proposed Trailway Routing" maps were overlaid with existing T&E Wildlife habitats in order to arrive at the conclusion that no T&E habitats would be affected. However, the criteria were included due to proposed Trailway activity in close proximity to wetland, woodland and stream, creek, wooded upland, and successive prairie habitat of species regularly occurring in the Lakeshore.

Vegetation was retained as an impact topic even after evaluation determined the impact to be short-term and negligible to minor primarily due to use of previously disturbed areas and existing right-of-way for proposed Trailway segments.

Soils were retained due to the importance of existing soil type and the relationship to trail constructability and susceptibility during and after construction. Soil surveys were gathered from the Michigan Resource Inventory System (MIRIS) database and the United States Department of Agriculture - (USDA) - Natural Resources Conservation Service for Leelanau County. Soil associations were considered for soil type (hydric, silty, sandy), permeability, gradient (slope) and erosion factors.

Land Use was retained as an impact topic due to the proposed alternatives potential introduction of increased human activity in proximity to other land uses, and the physical encroachment and/or potential easements needed to cross private and public land, utility and road right-of-way. The land use impact topic considers only non-SHPO and GMP related land uses (refer below to Cultural Landscapes and Historic Resources or Lakeshore Visitor Experience).

Cultural Landscapes and Historic Resources was retained because of existing designated historical buildings and cultural landscapes that have the potential to be affected by the alternatives considered. The cultural landscapes and historic resources impact topic deals specifically with state and federally designated sites.

Viewsheds was retained due to the importance of overlooks and natural landforms within the project area and the potential detriment to the scenic and rural character that potentially could be introduced if the proposed alternatives were implemented.

Lakeshore Visitor Experience was retained as a feasibility impact topic because the proposed alternatives have the potential to affect visitor experience in the park in terms of its proximity and relationship to cultural landscapes, wilderness and nature zones and roadway corridor and other scenic viewsheds. Although, a large percentage of the proposed Trailway would occur in the road right-of-way, Lakeshore visitor experience, both by the Trailway user and other lakeshore visitors could be affected.

Safety was retained as a feasibility impact topic due the importance of protecting the health and safety (including accessibility) of park visitors and Trailway users. Accessibility is also considered in the impact topic topography. The proposed alternatives have the potential to be affected by health and safety.

Cost was retained as a feasibility impact topic in order to compare the cost between differing cross-sections and to not exceed the current standards expected for the surface needed in comparison with the least expensive cross-section. Cost has the potential to affect which alternative is most feasible.

Operation and Maintenance was retained as a feasibility topic because it is expected the Trailway has the potential to affect park operations and management, MDOT, and local jurisdictions. For this topic, no numeric score was identified, but operations and maintenance is analyzed in the "Environmental Consequences" chapter.

IMPACT TOPICS ELIMINATED

Recreational Experience was eliminated because no adverse effects were identified that would negatively impact the recreational experience of a Trailway user along the proposed Action Alternatives. Recreational experience was defined *as the user experience along the proposed Trailway not including the Lakeshore GMP management zones (Wilderness, Recreational, Cultural / Historical)* (refer to the preliminary impact topics in Chapter 1).

Although the potential for adverse affects exists, site specific placement, design detailing and BMP's would be utilized in all cases to mitigate any potential negative impact to other recreational activities that may be in the vicinity; moreover, the advent of the Trailway would provide better access for more users in terms of barrier-free gradient and surfaces, and connect various recreational opportunities more readily.

APPENDIX G: Measuring the Impact to the Environment and Feasibility - Matrices

Table 1 – Segment 1 Impact to the Environment										
	Topography	Wetlands	Streams & Creeks	Soils	Wildlife	Vegetation	Land Use	Cultural Resource	Viewsheds	TOTAL IMPACT TO THE ENVIRO.
SEGMENT 1										
Option 1.1	**0-1** M-22 R.O.W.; Existing; Minor long. slope	**0**	**0**	**1-3**	**0**	**1** Trillium in R.O.W.	**1** Private Farmstead on Manning Rd.	**1-3**	**3** Moderate Impact to rural viewshed Tweddle / Treat Farm	**7-12** (varies)
Option 1.2	**2** Proposed; Switch backs needed	**0**	**0**	**3** modified, surface mined	**0**	**0** Nap weed introduced	**0**	**0**	**0**	**5**
Option 1.3	**1** Proposed; Grading needed in Utility R.O.W.	**0**	**0**	**1**	**0**	**0**	**1,** Existing Utility Easement	**3** Historic Farm	**3** Moderate to major impact to rural viewshed Tweddle / Treat Farm	**9**
Option 1.4	**2** Proposed; Moderate side slopes	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**4**
Option 1.5	**2** Proposed; Switch backs needed	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**4**
Option 1.6	**3** Proposed; Tight ravine; wet/organic soils	**0**	**0**	**2**	**0**	**0**	**0** Close to SLBE Park Entrance sign	**0** Logging route	**0**	**5**
Segment 1: Stormer Rd.(County Line) to Barracks Rd.(SLBE & Village of Empire Boundary - South)										

Table 2 – Segment 1 Impact to Feasibility							
	Recreational Experience	SLBE Visitor Experience	Safety	Cost	Operation & Maintenance	TOTAL IMPACT TO FEASIBILITY	TOTAL COMBINED IMPACT
SEGMENT 1							
Option 1.1	**0**	**2** Moderate Impact to Visitor Experience Tweddle-Treat Farm;	**3** Road crossing; Gradient; Sideslope in R.O.W.; Guardrail	**2-3**	Evaluation with assistance from SLBE Staff	**7-8** (varies)	**14-20** (varies)
Option 1.2	**0**	**0**	**1** Gradient	**2** Asphalt or Limestone	Evaluation with assistance from SLBE Staff	**3**	**8**
Option 1.3	**0**	**3** Major Impact to Visitor Experience Tweddle-Treat Farm;	**1** Road crossing	**2** Limestone	Evaluation with assistance from SLBE Staff	**6**	**15**
Option 1.4	**0**	**1**	**0**	**2** Asphalt or Limestone	Evaluation with assistance from SLBE Staff	**3**	**7**
Option 1.5	**0**	**0**	**1** Gradient	**3** Asphalt or Limestone	Evaluation with assistance from SLBE Staff	**4**	**8**
Option 1.6	**0**	**1**	**1** Gradient	**3** Asphalt or Limestone	Evaluation with assistance from SLBE Staff	**5**	**10**
Segment 1: Stormer Rd.(County Line) to Barracks Rd.(SLBE & Village of Empire Boundary - South)							

Table 3 – Segment 2 Impact to the Environment										
	Topography	Wetlands	Streams & Creeks	Soils	Wildlife	Vegetation	Land Use	Cultural Resource	Viewsheds	TOTAL IMPACT TO THE ENVIRO.
SEGMENT 2										
Option 2.1	**0-1** M-22 R.O.W.; Proposed; Minor long. slope	**1**	**1**	**1-3**	**0**	**0**	**2** Private land use; Village of Empire	**0**	**0**	**5-8** (varies)
Option 2.2	**2** Proposed; Berm along north end of New Neighborhood	**0**	**0**	**0** modified	**0**	**0**	**3** Private land use/New Neighborhood	**0**	**0**	**5**
Option 2.3	**0**	**0**	**0**	**0** modified	**0**	**0**	**0**	**0**	**0**	**0**
Option 2.4	**0**	**0**	**0**	**0** modified	**0**	**0**	**2** Private housing development	**0**	**0**	**2**
Option 2.5	**0**	**0**	**0**	**0** modified	**0**	**0**	**2** Private housing development	**0**	**0**	**2**
Option 2.6	**0**	**0**	**0**	**0** modified	**0**	**0**	**3** Commercial business /trail easement needed	**0**	**0**	**3**
Option 2.7	**1** Existing; Minor long. slopes on Voice Rd. Scenic Beauty Rd./Gravel	**0**	**0**	**0** modified	**0**	**0**	**3** Commercial business /trail easement required	**0**	**0**	**4**
Segment 2: Barracks Rd.(SLBE & Village of Empire Boundary - South) to Voice Rd.(SLBE & Village of Empire Boundary - North)										

Table 4 – Segment 2 Impact to Feasibility							
	Recreational Experience	SLBE Visitor Experience	Safety	Cost	Operation & Maintenance	TOTAL IMPACT TO FEASIBILITY	TOTAL COMBINED IMPACT
SEGMENT 2							
Option 2.1	**0** Connection to Beach Park and Downtown	**NA/** outside of Park	**3** Road crossing, gradient, Trail access	**2-3**	Evaluation with assistance from SLBE Staff	**5-6** (varies)	**10-14** (varies)
Option 2.2	**0**	**NA/** outside of Park	**1** Road crossing	**1** Use ex.road; limited trail for access to M-22 (need trail easement)	Evaluation with assistance from SLBE Staff	**2**	**7**
Option 2.3	**0** Connection to Beach Park and Downtown	**NA/** outside of Park	**1** Road crossing	**2** New Bituminous in R.O.W	Evaluation with assistance from SLBE Staff	**3**	**3**
Option 2.4	**0**	**NA/** outside of Park	**1** Road crossing	**2** Use ex.road or new existing new bitumnous	Evaluation with assistance from SLBE Staff	**3**	**5**
Option 2.5	**0**	**NA/** outside of Park	**1** Road crossing	**2** Use ex.road or new existing new bitumnous	Evaluation with assistance from SLBE Staff	**3**	**5**
Option 2.6	**0**	**NA/** outside of Park	**1** Road crossing	**2** New Bituminous out of R.O.W (need trail easement)	Evaluation with assistance from SLBE Staff	**3**	**6**
Option 2.7	**0** Connection to Village Recreation Park	**1**	**1-2** Gradient; shoulder option	**2** stiped bike lane or separated paved trail on La Core	Evaluation with assistance from SLBE Staff	**4-5**	**8-9**

Table 5 – Segment 3 Impact to the Environment

	Topography	Wetlands	Streams & Creeks	Soils	Wildlife	Vegetation	Land Use	Cultural Resource	Viewsheds	TOTAL IMPACT TO THE ENVIRO.
SEGMENT 3										
Option 3.1	**0-2** M-109 R.O.W.; Minor long. Slope; Existing Moderate Sideslopes	**0**	**0**	**1-3**	**0**	**0**	**0**	**0**	**0**	**1-5** (varies)
Segment 3: Voice Rd.(SLBE & Village of Empire Boundary – North) to Pierce Stocking Dr.										

Table 6 – Segment 3 Impact to Feasibility

	Recreational Experience	SLBE Visitor Experience	Safety	Cost	Operation & Maintenance	TOTAL IMPACT TO FEASIBILITY	TOTAL COMBINED IMPACT
SEGMENT 3							
Option 3.1	**0** Provides connection to Pierce Stocking Dr. & Windy Moraine Trail	**0** Provides connection to Pierce Stocking Dr. & Windy Moraine Trail	**2** gradient, Trail access	**2** New Bituminous in R.O.W	Evaluation with assistance from SLBE Staff	**4**	**5-9** (varies)
Segment 3: Voice Rd.(SLBE & Village of Empire Boundary – North) to Pierce Stocking Dr.							

Table 7 – Segment 4 Impact to the Environment										
	Topography	Wetlands	Streams & Creeks	Soils	Wildlife	Vegetation	Land Use	Cultural Resource	Viewsheds	TOTAL IMPACT TO THE ENVIRO.
SEGMENT 4										
Option 4.1	**0-2** M-109 R.O.W.; Existing; Minor long. Slope; Moderate Sideslopes	**0**	**0**	**1-3**	**0**	**0**	**2** Private land use; fences; shrubbery	**0**	**1** Minor impact to Sleeping Bear Dune Climb Viewshed from M-22 and R.O.W.	**4-8** (varies)
Option 4.2	**1** Proposed; Minor long. slopes	**0**	**0**	**2**	**0**	**0**	**1** SLBE Scenic Dr. Entrance/ Pierce Stocking Dr	**0**	**0**	**4**
Option 4.3	**3** Proposed; Switch backs needed	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**6**
Option 4.4	**3** Proposed; Switch backs needed	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**6**
Option 4.5	**0**	**0**	**0**	**3**	**0**	**0**	**0** Utilize Greenan Rd.; Close to vehicular traffic	**0**	**0**	**3**
Segment 4: Pierce Stocking Dr. to Hunter Rd.(Sleeping Bear Dune Climb Visitor Entrance)										

Table 8 – Segment 4 Impact to Feasibility							
	Recreational Experience	SLBE Visitor Experience	Safety	Cost	Operation & Maintenance	TOTAL IMPACT TO FEASIBILITY	TOTAL COMBINED IMPACT
SEGMENT 4							
Option 4.1	**0** Provides connection to Pierce Stocking Dr.; Sleeping Bear Dune Climb; picnick areas; & Windy Moraine Trail hiking	**1** Provides connection to Pierce Stocking Dr.; Sleeping Bear Dune Climb; picnick areas; & Windy Moraine Trail hiking	**2** Multiple private driveway crossings; Road crossing, gradient	**2-3**	Evaluation with assistance from SLBE Staff	**5-6** (varies)	**9-14** (varies)
Option 4.2	**0** Provides connection to Pierce Stocking Dr.; picnick areas; & Windy Moraine Trail hiking	**0** Provides connection to Pierce Stocking Dr.; & Windy Moraine Trail hiking	**0**	**3** Asphalt; Clear and grubbing if separate trail	Evaluation with assistance from SLBE Staff	**3**	**7**
Option 4.3	**0** Nature experience	**0** Nature experience	**1** Gradient	**3** Asphalt; Clear and grubbing if separate trail	Evaluation with assistance from SLBE Staff	**4**	**10**
Option 4.4	**0** Nature experience	**0** Nature experience	**1** Gradient	**3** Asphalt; Clear and grubbing if separate trail	Evaluation with assistance from SLBE Staff	**4**	**10**
Option 4.5	**0** Nature experience	**0** Nature experience	**0**	**2** New Asphalt; or Paved pathway on the edge of Greenan Rd.; or close to vehicular traffic	Evaluation with assistance from SLBE Staff	**2**	**5**
Segment 4: Pierce Stocking Dr. to Hunter Rd.(Sleeping Bear Dune Climb Visitor Entrance)							

Table 9 – Segment 5 Impact to the Environment										
	Topography	Wetlands	Streams & Creeks	Soils	Wildlife	Vegetation	Land Use	Cultural Resource	Viewsheds	TOTAL IMPACT TO THE ENVIRO.
SEGMENT 5										
Option 5.1	**0-2** M-109 R.O.W.; Existing; Moderate long slope	**3** Boardwalk needed	**0**	**1-3**	**0**	**0**	**2** Private land use; Glen Arbor	**0**	**0**	**6-10** (varies)
Option 5.2	**0**	**0**	**0**	**0** modified	**0**	**0**	**1** SLBE Dune Climb Entrance/ Pierce Stocking Dr	**0**	**0**	**1**
Option 5.3	**0**	**0**	**0**	**1**	**0**	**2** T&E in vicinity	**0**	**0**	**0**	**3**
Option 5.4	**0**	**3** Boardwalk needed	**0**	**3** Muck soils	**1** Former narrow gauge railine; wetland	**1** Former narrow gauge railine; wetland	**3**	**0**	**1** Minor impact to Sleeping Bear Dune Climb Viewshed from M-22 and R.O.W.	**12**
Option 5.5	**0**	**0**	**0**	**0** Modified; existing road gravel	**0**	**0**	**1** County Road Gravel Improved	**0**	**0**	**1**
Option 5.6	**0**	**0**	**0**	**0** Modified; Former narrow gauge railine	**0**	**0**	**0**	**0**	**0**	**0**
Option 5.7	**2**	**0**	**0**	**0** Modified; existing road gravel	**0**	**0**	**1** County Road Gravel Improved	**0**	**0**	**3**
Option 5.8	**0**	**0**	**0**	**0** Modified; Former narrow gauge railine	**0**	**0**	**0**	**3** Historic telegraph pole line; Glen Haven	**0**	**3**

Table 9 – Segment 5 Impact to the Environment (Continued)										
	Topography	Wetlands	Streams & Creeks	Soils	Wildlife	Vegetation	Land Use	Cultural Resource	Viewsheds	TOTAL IMPACT TO THE ENVIRO.
Option 5.9	0	0	0	0 Modified; Former narrow gauge railine	0	0	0	3 Glen Haven; Cannery Bldg.	0	3
Option 5.10	2 Existing; Moderate long. slope	0	0	0 Modified; Former narrow gauge railine	0	0	0	3 Glen Haven/ Sleeping Bear Inn & Garage	0	5
Option 5.11	1 Existing; Minor long. slope	0	0	0 Modified; existing road gravel	0	0	0	3 Glen Haven/ DH Day Store & Restroom Bldg; DH Day Campground/ Historic Cabin	0	4
Option 5.12	0	0	0	0	0	0	2 Private land use; Glen Arbor	0	0	2
Option 5.13	0	0	0	0 Modified; existing road gravel	0	0	1 SLBE Road Gravel Improved	0	0	1
Option 5.14	0	0	0	0 Modified; existing road gravel	0	0	1 Private land use; County Road Gravel Improved	0	0	1
Option 5.15	1 Proposed; Minor long. slope	0	0	3	0	0	2 Private land use	0	0	6
Segment 5: Hunter Rd.(Sleeping Bear Dune Climb Visitor Entrance) to Sylvan St./S.Forest Haven Dr. NE										

Table 10 – Segment 5 Impact to Feasibility							
	Recreational Experience	SLBE Visitor Experience	Safety	Cost	Operation & Maintenance	TOTAL IMPACT TO FEASIBILITY	TOTAL COMBINED IMPACT
SEGMENT 5							
Option 5.1	**0** Provides connection to D.H. Day Campgrounds; Picnicing; Dune Climb; Glen Haven Historic District; Beach Access; Glen Arbor;	**1** Provides connection to D.H. Day Campgrounds; Picnicing; Dune Climb; Glen Haven Historic District; Beach Access; Glen Arbor;	**3** Multiple private driveway crossings; Multiple road crossing; gradient; Trail access	**2-3** Existing R.O.W./ Boardwalk needed in sections	Evaluation with assistance from SLBE Staff	**6-7** (varies)	**12-17** (varies)
Option 5.2	**0** Provides connection to Dune Climb picnic areas; ADA Interpretive Trail	**1** Provides connection to Dune Climb; ADA Interpretive Trail	**0**	**1** Modify existing limestone; Some clear and grubbing	Evaluation with assistance from SLBE Staff	**2**	**3**
Option 5.3	**0** Provides connection to D.H. Day Group Campground; picnic areas; ADA Interpretive Trail; Dune Ecosystem interpretive	**1** Provides connection to D.H. Day Group Campground; picnic areas; ADA Interpretive Trail; Dune Ecosystem interpretive	**0**	**3** Asphalt; Clear and grubbing if separate trail	Evaluation with assistance from SLBE Staff	**4**	**7**
Option 5.4	**0** Provides connection to Wetland ecosystem experience; D.H. Day Group Campground; picnic areas; Historic Narrow gauge Rail bed	**2** Boardwalk necessary would be highly visible	**1** Remoteness to pubic view	**3** Boardwalk; Some clear and grubbing; some grade modifications	Evaluation with assistance from SLBE Staff	**6**	**18**
Option 5.5	**0** Provides connection to D.H. Day Group Campground; picnic areas	**0**	**0**	**0**	Evaluation with assistance from SLBE Staff	**0**	**1**
Option 5.6	**0** Provides connection to D.H. Day Group Campground; picnic areas; Dune Ecosystem interpretive; Historic Narrow gauge Rail bed	**0**	**1** Remoteness to pubic view	**2** Limestone	Evaluation with assistance from SLBE Staff	**3**	**3**
Option 5.7	**0**	**0**	**3** Road crossings; gradient; trail access	**0**	Evaluation with assistance from SLBE Staff	**3**	**6**
Option 5.8	**0** Provides connection to picnic areas; Dune Ecosystem; Historic Narrow gauge Rail bed; Glen Haven Historic District; Beach Access	**0**	**1** Remoteness to pubic view	**2** Limestone	Evaluation with assistance from SLBE Staff	**3**	**6**

Table 10 – Segment 5 Impact to Feasibility (Continued)

	Recreational Experience	SLBE Visitor Experience	Safety	Cost	Operation & Maintenance	TOTAL IMPACT TO FEASIBILITY	TOTAL COMBINED IMPACT
Option 5.9	**0** Provides connection to picnic areas; Historic Narrow gauge rail bed; Glen Haven Historic District; Beach Access	**3** Glen Haven	**0**	**2** Limestone	Evaluation with assistance from SLBE Staff	**5**	**8**
Option 5.10	**0** Provides connection to picnic areas; Historic Narrow gauge rail bed; Glen Haven Historic District; Beach Access	**3** Glen Haven	**0**	**2** Limestone	Evaluation with assistance from SLBE Staff	**5**	**10**
Option 5.11	**0** Provides connection to Provides connection to D.H. Day Campground; picnic areas; Historic Narrow gauge rail bed; Glen Haven Historic District; Beach Access	**1**	**1** Road crossing	**2** Limestone	Evaluation with assistance from SLBE Staff	**4**	**8**
Option 5.12	**0** Provides connection to picnic areas; Historic Narrow gauge rail bed; Glen Haven Historic	**1** Glen Haven	**0**	**2** Limestone	Evaluation with assistance from SLBE Staff	**3**	**5**
Option 5.13	**0** Provides connection to D.H. Day Campground; Beach Access	**0**	**2** Utilize campground access road	**0**	Evaluation with assistance from SLBE Staff	**2**	**3**
Option 5.14	**0** Provides connection to D.H. Day Campground; Beach Access	**0**	**0**	**2** Limestone	Evaluation with assistance from SLBE Staff	**2**	**3**
Option 5.15	**0** Provides connection to Glacial escarpment; Glen Arbor	**0**	**1** Road crossing	**3** New Asphalt	Evaluation with assistance from SLBE Staff	**4**	**10**
Segment 5: Hunter Rd.(Sleeping Bear Dune Climb Visitor Entrance) to Sylvan St./S.Forest Haven Dr. NE							

Table 11 – Segment 6 Impact to the Environment

	Topography	Wetlands	Streams & Creeks	Soils	Wildlife	Vegetation	Land Use	Cultural Resource	Viewsheds	TOTAL IMPACT TO THE ENVIRO.
SEGMENT 6										
Option 6.1	**0-1** M-22 R.O.W.; Existing; Minor Long. slope	**2**	**0** Existing bridge at Crystal River w/ pedestrian crossings	**1-3**	**0**	**0**	**2** Private land use; commercial land use; Glen Arbor	**0**	**0**	**5-8** (varies)
Option 6.2	**0**	**0**	**0**	**0** modified	**0**	**0**	**2** Private land use; commercial land use; Glen Arbor	**0**	**0**	**2**
Option 6.3	**2**	**2**	**3** Boardwalk needed	**3** Modified; existing two track	**1** Wetland	**1** Wetland	**3** Private land use; trail easement needed	**0**	**0**	**15**
Option 6.4	**0**	**0**	**0**	**0** modified	**0**	**0**	**2** Private & Commercial land use; Glen Arbor	**0**	**0**	**2**
Option 6.5	**2** Proposed; Moderate sideslope	**0**	**0**	**0** Modified; irrigated turf lawn	**0**	**0**	**2** Private land use/ Homestead Resort	**0**	**0**	**4**
Option 6.6	**0** Westman Rd. R.O.W.; Existing	**0**	**0**	**0** Modified	**0**	**0**	**0**	**0**	**0**	**0**
Option 6.7	**0** Hyland Rd. R.O.W.; Existing	**0**	**0**	**0** Modified	**0**	**0**	**0**	**0**	**0**	**0**
Segment 6: Sylvan St./S.Forest Haven Dr. NE to Westman Rd.										

Table 12 – Segment 6 Impact to Feasibility							
	Recreational Experience	SLBE Visitor Experience	Safety	Cost	Operation & Maintenance	TOTAL IMPACT TO FEASIBILITY	TOTAL COMBINED IMPACT
SEGMENT 6							
Option 6.1	**0** Glen Arbor Downtown; Crystal River Access; Lake MI Beach Access; Glen Arbor Park	**0**	**3** Multiple private driveway crossings; Multiple road crossings; Bike Lanes; High traffic; Trail access	**1** Existing R.O.W./ Striped Bike lanes or walking on ex. Sidewalks	Evaluation with assistance from SLBE Staff	**4**	**9-12** (varies)
Option 6.2	**0** Glen Arbor Downtown; Crystal River Access; Lake MI Beach Access; Glen Arbor Park	**0**	**2** Multiple private driveway crossings; Multiple road crossings; Bike Lanes; Lesser traffic; Trail access	**1** Existing R.O.W./ Striped Bike lanes or walking on ex. Sidewalks	Evaluation with assistance from SLBE Staff	**3**	**5**
Option 6.3	**0** Glen Arbor Downtown; Crystal River Access; Lake MI Beach Access; Glen Arbor Park	**0**	**3** Private driveway crossings; Road crossings; Bike Lanes; Lesser traffic; Trail access	**2** Limestone or asphalt	Evaluation with assistance from SLBE Staff	**5**	**20**
Option 6.4	**0** Glen Arbor Downtown; Crystal River Access; Lake MI Beach Access; Glen Arbor Park	**0**	**2** Multiple private driveway crossings; Multiple road crossings; Bike Lanes; Lesser traffic; Trail access	**1** Existing R.O.W./ Striped Bike lanes or walking on ex. Sidewalks	Evaluation with assistance from SLBE Staff	**3**	**5**
Option 6.5	**0** Glen Arbor Downtown; Crystal River Access; Lake MI Beach Access; Glen Arbor Park	**0**	**1** Homestead driveway crossing	**2** New asphalt across lawns	Evaluation with assistance from SLBE Staff	**3**	**7**
Option 6.6	**0** Glen Arbor Downtown; Crystal River Access; Lake MI Beach Access; Glen Arbor Park	**0**	**1** Road crossing	**2** New asphalt across lawns	Evaluation with assistance from SLBE Staff	**3**	**3**
Option 6.7	**0** Glen Arbor Downtown; Crystal River Access; Lake MI Beach Access; Glen Arbor Park	**0**	**1** Road crossing	**2** New asphalt across lawns	Evaluation with assistance from SLBE Staff	**3**	**3**
Segment 6: Sylvan St./S.Forest Haven Dr. NE to Westman Rd.							

Table 13 – Segment 7 Impact to the Environment										
	Topography	Wetlands	Streams & Creeks	Soils	Wildlife	Vegetation	Land Use	Cultural Resource	Viewsheds	TOTAL IMPACT TO THE ENVIRO.
SEGMENT 7										
Option 7.1	**1** M-22 R.O.W.; Existing; Minor long. slope	**0**	**0**	**1-2**	**0**	**0**	**2** Private land use	**3** Port Oneida Rural District; Olsen Farm;	**3** Port Oneida Rural District; Olsen Farm;	**10-11** (varies)
Option 7.2	**2** Thoreson Rd.; Existing; Moderate long. slope	**0**	**0**	**0** modified	**0**	**0**	**0** County Road Gravel Improved	**1** Thoreson Farm;	**0**	**3**
Option 7.3	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**3** Port Oneida Rural District; Olsen Farm;	**3** Port Oneida Rural District; Olsen Farm;	**7**
Segment 7: Westman Rd. to Port Oneida Rd.										

Table 14 – Segment 7 Impact to Feasibility							
	Recreational Experience	SLBE Visitor Experience	Safety	Cost	Operation & Maintenance	TOTAL IMPACT TO FEASIBILITY	TOTAL COMBINED IMPACT
SEGMENT 7							
Option 7.1	**0** Provides access to existing hiking, cross country ski trails and camping	**2** Provides access to Port Oneida Rural Historic District;	**2** Two Road crossings on Thoreson Rd.	**2-3** Existing R.O.W./ New Asphalt	Evaluation with assistance from SLBE Staff	**6-7** (varies)	**16-18** (varies)
Option 7.2	**0** Provides access to existing hiking, cross country ski trails and camping	**1** Provides access to Thorson Farmsted (Port Oneida; Trail on existing road; Introduces potential for more people in the area	**2** Gradient (Thoreson Rd.)	**0** Utilize existing gravel road	Evaluation with assistance from SLBE Staff	**3**	**6**
Option 7.3	**0** Provides access to existing hiking, cross country ski trails and camping	**2** Provides access to Port Oneida Rural Historic District; Olsen Farm; Utilizes existing park trail	**1** Road crossings on Thoreson Rd.	**0** Limestone on existing mown trail	Evaluation with assistance from SLBE Staff	**3**	**10**
Segment 7: Westman Rd. to Port Oneida Rd.							

Table 15 – Segment 8 Impact to the Environment

	Topography	Wetlands	Streams & Creeks	Soils	Wildlife	Vegetation	Land Use	Cultural Resource	Viewsheds	TOTAL IMPACT TO THE ENVIRO.
SEGMENT 8										
Option 8.1	**0-1** M-22 R.O.W.; Existing; Negligible long. slope; Moderate sideslope	**0**	**0**	**1**	**0**	**0**	**2** Private land use;	**3** Shielding Tree; Historic Schoolhouse	**2** Port Oneida Rural District	**8-9** (varies)
Option 8.2	**0**	**0**	**0**	**0** modified	**0**	**0**	**0** County Road Gravel Improved	**3** Port Oneida Rural District	**0**	**3**
Option 8.3	**2** Proposed; Moderate long. slope	**3** Narada Lake; Boardwalk needed	**0**	**3** Muck soil	**1** Wetland; Loon nesting	**1** Wetland	**0**	**0**	**0**	**10**
Option 8.4	**0**	**0**	**0**	**0** modified	**0**	**0**	**2** Private land use; commercial land use; Glen Arbor	**3** Historic Schoolhouse	**0**	**5**

Segment 8: Port Oneida Rd. to Bohemian Rd.

Table 16 – Segment 8 Impact to Feasibility							
	Recreational Experience	SLBE Visitor Experience	Safety	Cost	Operation & Maintenance	TOTAL IMPACT TO FEASIBILITY	TOTAL COMBINED IMPACT
SEGMENT 8							
Option 8.1	**0**	**2** Adds trail to existing R.O.W.; past Cultural sites in Port Oneida	**2** Road crossings at Basch; Trail access tight to ex. guardrail	**2-3** Existing R.O.W./ New Asphalt	Evaluation with assistance from SLBE Staff	**6-7** (varies)	**14-16** (varies)
Option 8.2	**0**	**0** Provides access to Pyramid Point overlook	**1** Trail access on ex. Gravel road	**0** Trail access on ex. Gravel road	Evaluation with assistance from SLBE Staff	**1**	**4**
Option 8.3	**0** Wetland ecosystem interpretation (loon nesting)	**1** Proximity to Cultural site school site	**1** Gradient	**3** New Asphalt; Boardwalk	Evaluation with assistance from SLBE Staff	**5**	**15**
Option 8.4	**0** Boat launch; Beach access Bohemian Rd; Picnicking	**0** Good Harbor Bay Access	**1** Trail access along ex. Paved road - striped bike lane	**0** Trail access along ex. Paved road - striped bike lane	Evaluation with assistance from SLBE Staff	**1**	**6**
Segment 8: Port Oneida Rd. to Bohemian Rd.							

Table 17 – Segment 9 Impact to the Environment

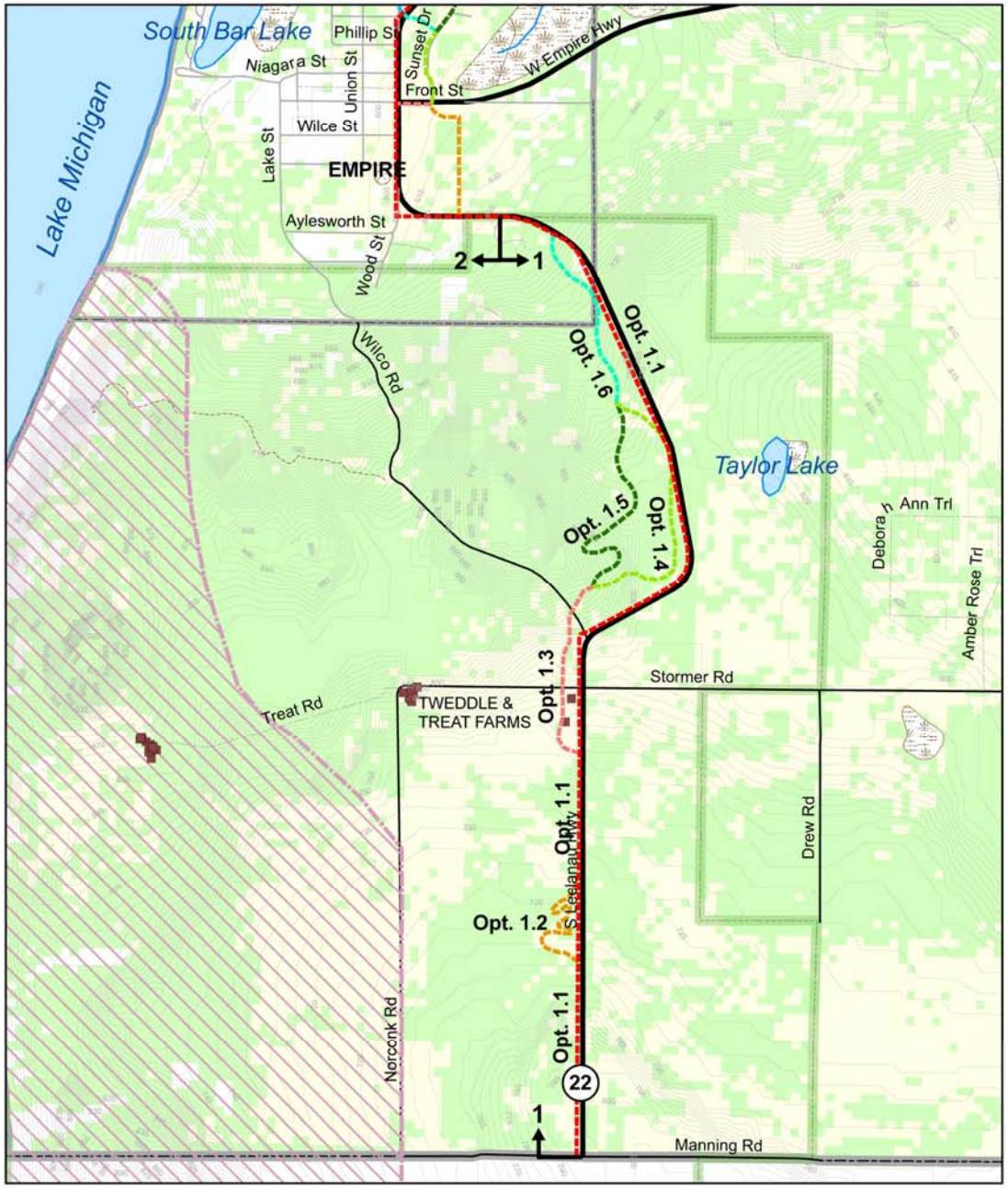
	Topography	Wetlands	Streams & Creeks	Soils	Wildlife	Vegetation	Land Use	Cultural Resource	Viewsheds	TOTAL IMPACT TO THE ENVIRO.
SEGMENT 9										
Option 9.1	**0-1** M-22 R.O.W.; Ex. Minor long. slope; Mod. sideslope	**0**	**1** Stream Name?	**1-3** Muck soils along L.Traverse Lake	**0**	**0**	**2** Private land use	**0**	**2** Bufka Farm rural viewshed	**6-9** (varies)
Option 9.2	**0** Existing; Negligible slope	**0**	**0**	**0** modified	**0**	**0**	**2** Private land use/ Lake Assoc.; Co. Rd Chip Seal	**2** Trail borders recommended Wilderness Boundary	**0**	**4**
Option 9.3	**1** Proposed; Minor long. slope	**3** Limited brdwalk	**0**	**3** Wetland	**1** Wetland	**1** Wetland	**0**	**3** Trail borders recommended Wilderness Boundary	**0**	**12**
Option 9.4	**1** Proposed; Minor long. slope	**0**	**1** Bridge less than 15'	**3** Limited muck soils	**0**	**0**	**0**	**0**	**2** Bufka Farm rural viewshed	**7**
Option 9.5	**2** Proposed; Moderate long. slope	**0**	**0**	**3** Limited muck soil	**0**	**0**	**0**	**0**	**0**	**5**
Option 9.6	**2** Proposed; Moderate long. slope	**0**	**0**	**3** Limited muck soil	**0**	**0**	**0**	**0**	**0**	**5**
Option 9.7	**2** Proposed; Moderate long. slope	**3** Wetland Deliniation needed	**1**	**3** Limited muck soil	**0**	**0**	**0**	**0**	**0**	**9**
Option 9.8	**0**	**0**	**0**	**0** modified	**0**	**0**	**0** County Road Gravel Improved	**0**	**0**	**0**
Option 9.9	**1** Existing; Minor long. slope	**0**	**0**	**0** modified	**0**	**0**	**0** County Road Gravel Improved	**0**	**0**	**0**

Segment 9: Bohemian Rd. to Good Harbor Trail

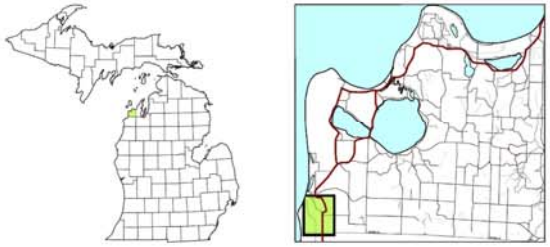
Table 18 – Segment 9 Impact to Feasibility

	Recreational Experience	SLBE Visitor Experience	Safety	Cost	Operation & Maintenance	TOTAL IMPACT TO FEASIBILITY	TOTAL COMBINED IMPACT
SEGMENT 9							
Option 9.1	**0**	**2** Proximity to Bufka Farm; Trail within R.O.W.	**2** Road crossings; Trail access	**2-3** Existing R.O.W./ New Asphalt	Evaluation with assistance from SLBE Staff	**6-7** (varies)	**12-16** (varies)
Option 9.2	**0** Hiking access; Twp Park Access; picnicking; beach access to Little Traverse Lake	**0**	**1** Utilizes existing chip seal road (22')	**0** Utilize existing road no modification	Evaluation with assistance from SLBE Staff	**1**	**5**
Option 9.3	**0** Wilderness ecosystem interpretation	**2** Proximity to proposed Wilderness boundary	**1** Remoteness	**3** New asphalt; small boardwalk section possible	Evaluation with assistance from SLBE Staff	**6**	**18**
Option 9.4	**0**	**2** Proximity to proposed Wilderness boundary and Bufka Farm	**0**	**2** Limestone	Evaluation with assistance from SLBE Staff	**4**	**11**
Option 9.5	**0** Wilderness ecosystem interpretation; Forested dune ecosystem	**3** Goes through proposed Wilderness boundary	**1** Gradient	**2** Limestone	Evaluation with assistance from SLBE Staff	**6**	**11**
Option 9.6	**0**	**3** Goes through proposed Wilderness boundary	**0**	**2** Limestone	Evaluation with assistance from SLBE Staff	**5**	**10**
Option 9.7	**0** Ridge and swale ecosystem interpretation;	**0**	**1** Remoteness; Gradient	**3** Limestone, Clearing and grubbing	Evaluation with assistance from SLBE Staff	**4**	**13**
Option 9.8	**0** Good Harbor Beach Access; Swimming, Picnicking	**0**	**1** Utilizes existing gravel road	**0** Utilize existing road no modification - Good Harbor Rd.	Evaluation with assistance from SLBE Staff	**1**	**1**
Option 9.9	**0**	**0**	**2** Gradient; Trail access	**0** Utilize existing road no modification - Good Harbor Rd.	Evaluation with assistance from SLBE Staff	**2**	**2**
Segment 9: Bohemian Rd. to Good Harbor Trail							

APPENDIX H: Trailway Options Maps



MAP 1.1 - PROPOSED TRAILWAY ROUTING
LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN



SEGMENT 1: OPTIONS 1-6

Opt. 1.1 PROPOSED TRAIL ROUTE OPTIONS

GENERAL LEGEND

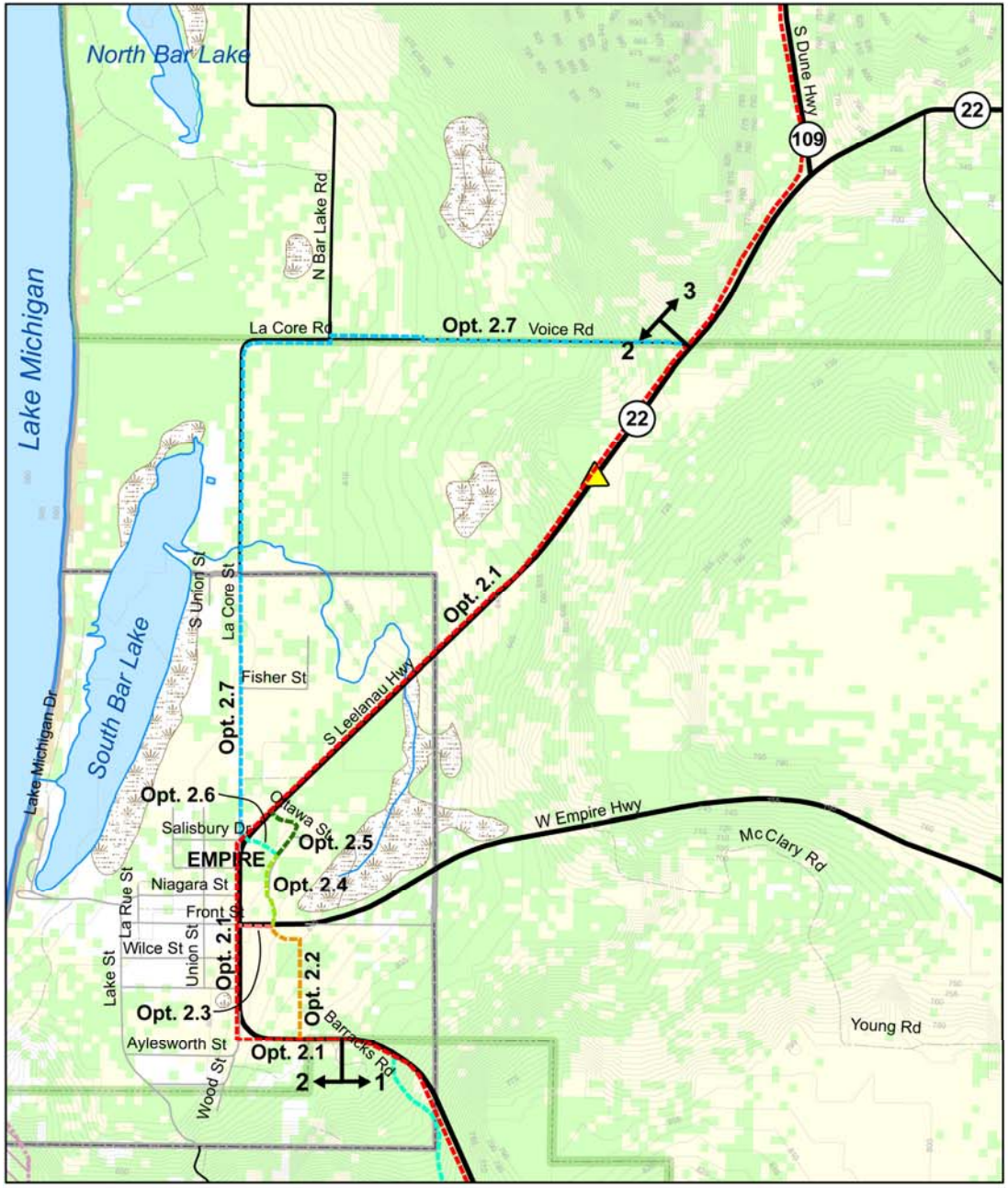
- State Trunkline
- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
- Recommended SLBE Wilderness Boundary
- SLBE Boundary
- Rivers
- Lakes
- Village Boundaries
- Township Boundaries
- Aquatic Bed
- Forested
- Agricultural

0 375 750 1,500 2,250 3,000 Feet

N W E S

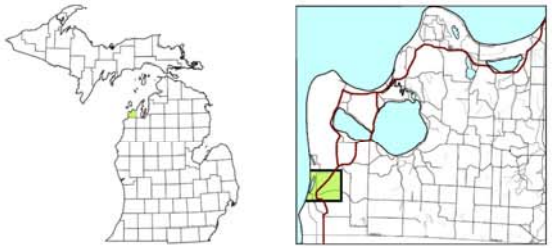
Base GIS Data: Michigan Framework Data
1992 National Land Cover Dataset
1992 National Wetlands Cover Dataset
National Park Service
NAD 1983 UTM ZONE 16N

Gosling Czubak engineering sciences, inc.



MAP 1.2 - PROPOSED TRAILWAY ROUTING

LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN



SEGMENT 2: OPTIONS 1-7

Opt. 2.1 PROPOSED TRAIL ROUTE OPTIONS

GENERAL LEGEND

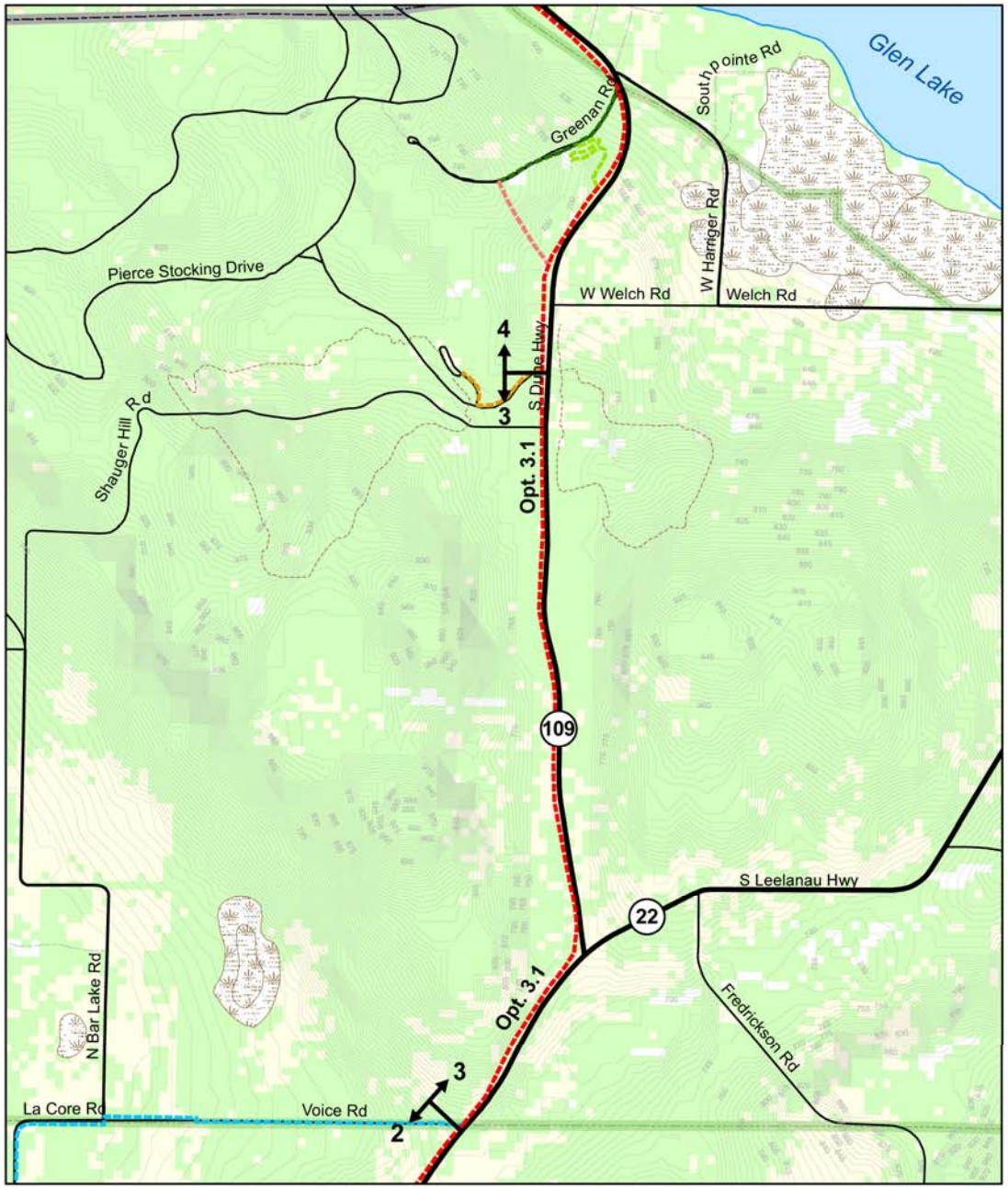
- State Trunkline
- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
- Recommended SLBE Wilderness Boundary
- SLBE Boundary
- Rivers
- Lakes
- Village Boundaries
- Township Boundaries
- Aquatic Bed
- Forested
- Agricultural

0 375 750 1,500 2,250 3,000 Feet

N W E S

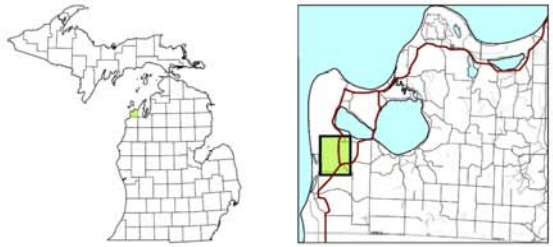
Base GIS Data: Michigan Framework Data
1992 National Land Cover Dataset
1992 National Wetlands Cover Dataset
National Park Service
NAD 1983 UTM ZONE 16N

Gosling Czubak engineering sciences, inc.



MAP 1.3 - PROPOSED TRAILWAY ROUTING

LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN



SEGMENT 3: OPTION 1

Opt. 3.1 PROPOSED TRAIL ROUTE OPTIONS

GENERAL LEGEND

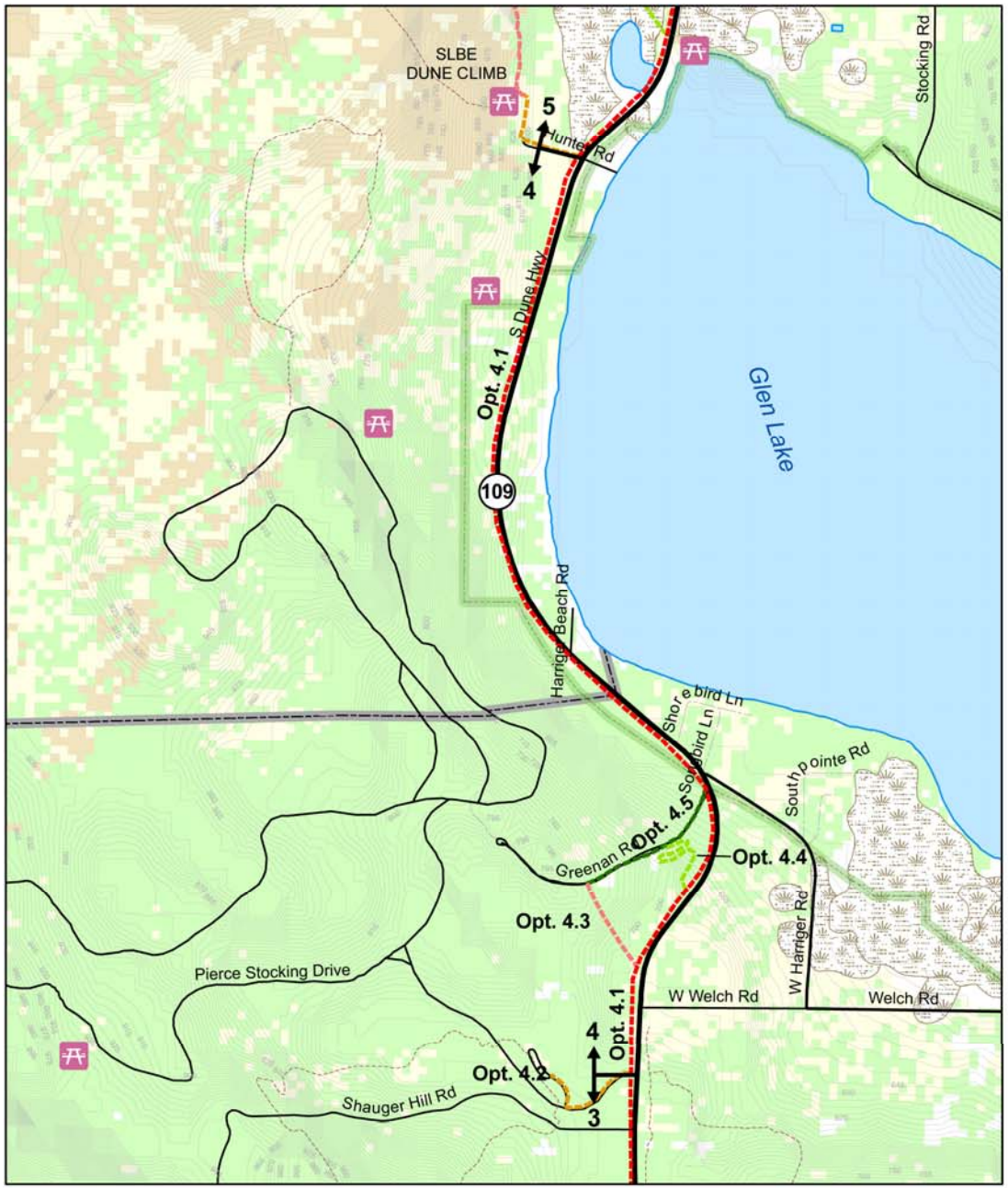
- State Trunkline
- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
- Recommended SLBE Wilderness Boundary
- SLBE Boundary
- Rivers
- Lakes
- Village Boundaries
- Township Boundaries
- Aquatic Bed
- Forested
- Agricultural

0 375 750 1,500 2,250 3,000 Feet

N W E S

Base GIS Data: Michigan Framework Data
1992 National Land Cover Dataset
1992 National Wetlands Cover Dataset
National Park Service
NAD 1983 UTM ZONE 16N

Gosling Czubak engineering sciences, inc.



MAP 1.4 - PROPOSED TRAILWAY ROUTING

LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN

SEGMENT 4: OPTIONS 1-5

Opt. 4.1 PROPOSED TRAIL ROUTE OPTIONS

GENERAL LEGEND

- State Trunkline
- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
- Recommended SLBE Wilderness Boundary
- SLBE Boundary
- Rivers
- Lakes
- Village Boundaries
- Township Boundaries
- Aquatic Bed
- Forested
- Agricultural

0 375 750 1,500 2,250 3,000 Feet

N W E S

Base GIS Data: Michigan Framework Data
1992 National Land Cover Dataset
1992 National Wetlands Cover Dataset
National Park Service
NAD 1983 UTM ZONE 16N

Gosling Czubak engineering sciences, inc.

MAP 1.5 - PROPOSED TRAILWAY ROUTING

LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN

SEGMENT 5: OPTIONS 1-15

Opt. 5.1 PROPOSED TRAIL ROUTE OPTIONS

GENERAL LEGEND

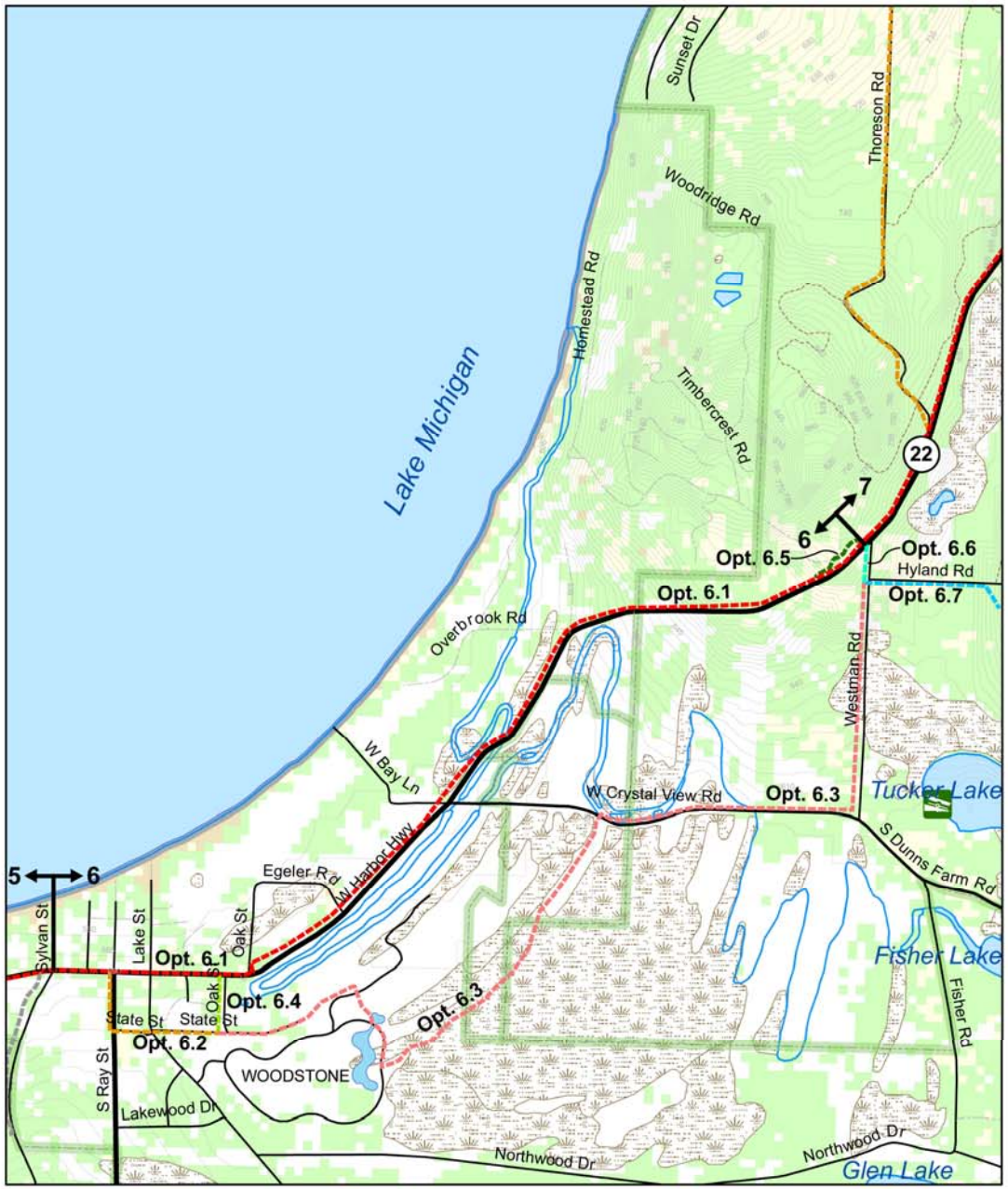
- State Trunkline
- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
- Recommended SLBE Wilderness Boundary
- SLBE Boundary
- Rivers
- Lakes
- Village Boundaries
- Township Boundaries
- Aquatic Bed
- Forested
- Agricultural

Base GIS Data: Michigan Framework Data
1992 National Land Cover Dataset
1992 National Wetlands Cover Dataset
National Park Service
NAD 1983 UTM ZONE 16N

N W E S

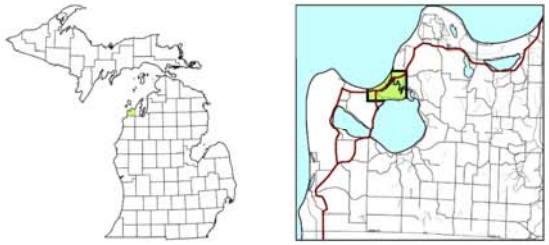
0 375 750 1,500 2,250 3,000 Feet

GoslingCzubak engineering sciences, inc.



MAP 1.6 - PROPOSED TRAILWAY ROUTING

LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN



SEGMENT 6: OPTIONS 1-7

Opt. 6.1 PROPOSED TRAIL ROUTE OPTIONS

GENERAL LEGEND

- State Trunkline
- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
- Recommended SLBE Wilderness Boundary
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- Aquatic Bed
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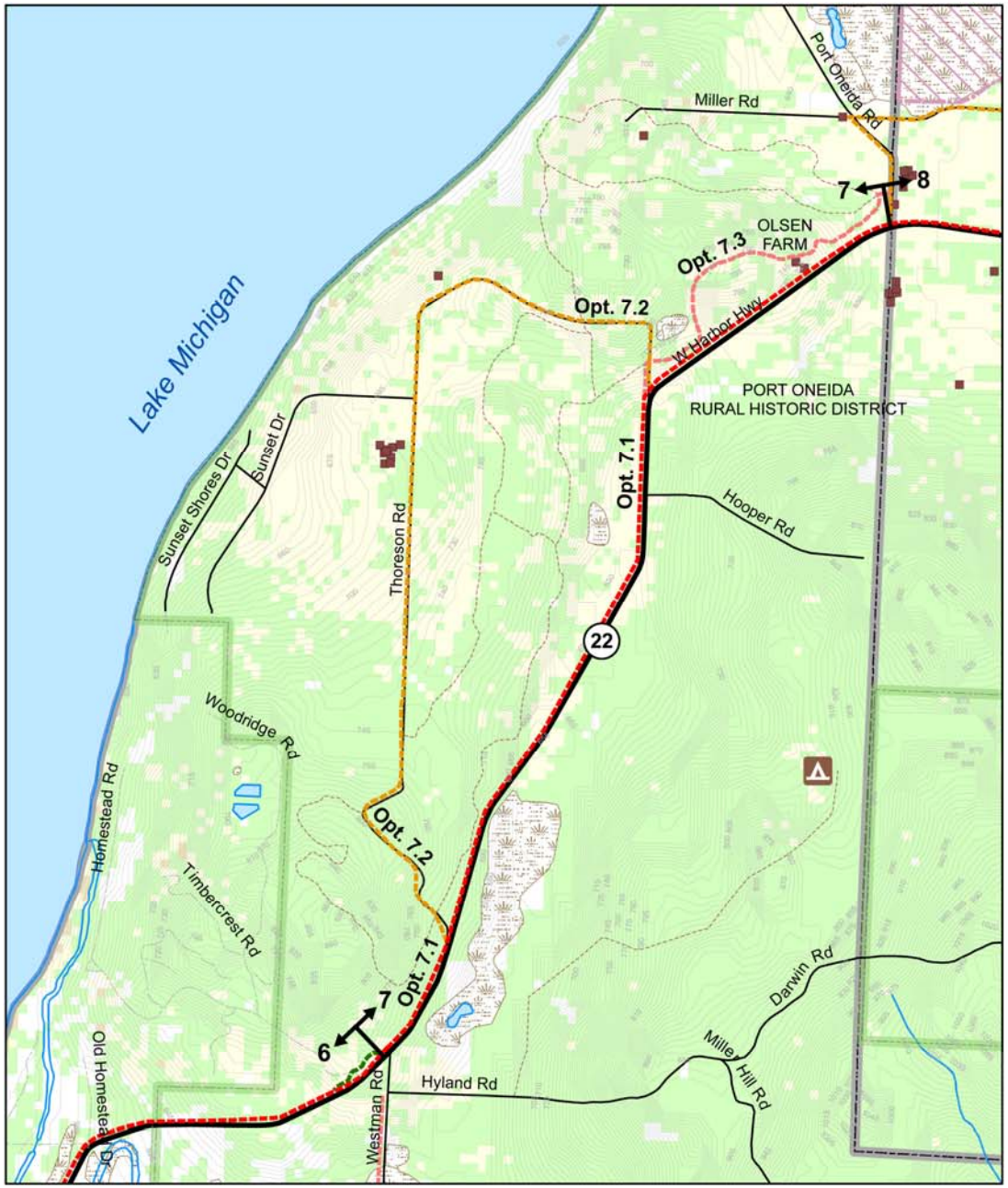
0 375 750 1,500 2,250 3,000 Feet

N W E S

Base GIS Data: Michigan Framework Data
1992 National Land Cover Dataset
1992 National Wetlands Cover Dataset
National Park Service
NAD 1983 UTM ZONE 16N

Gosling Czubak engineering sciences, inc.



MAP 1.7 - PROPOSED TRAILWAY ROUTING

LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN

SEGMENT 7: OPTIONS 1-3

Opt. 7.1 PROPOSED TRAIL ROUTE OPTIONS

GENERAL LEGEND

- State Trunkline
- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
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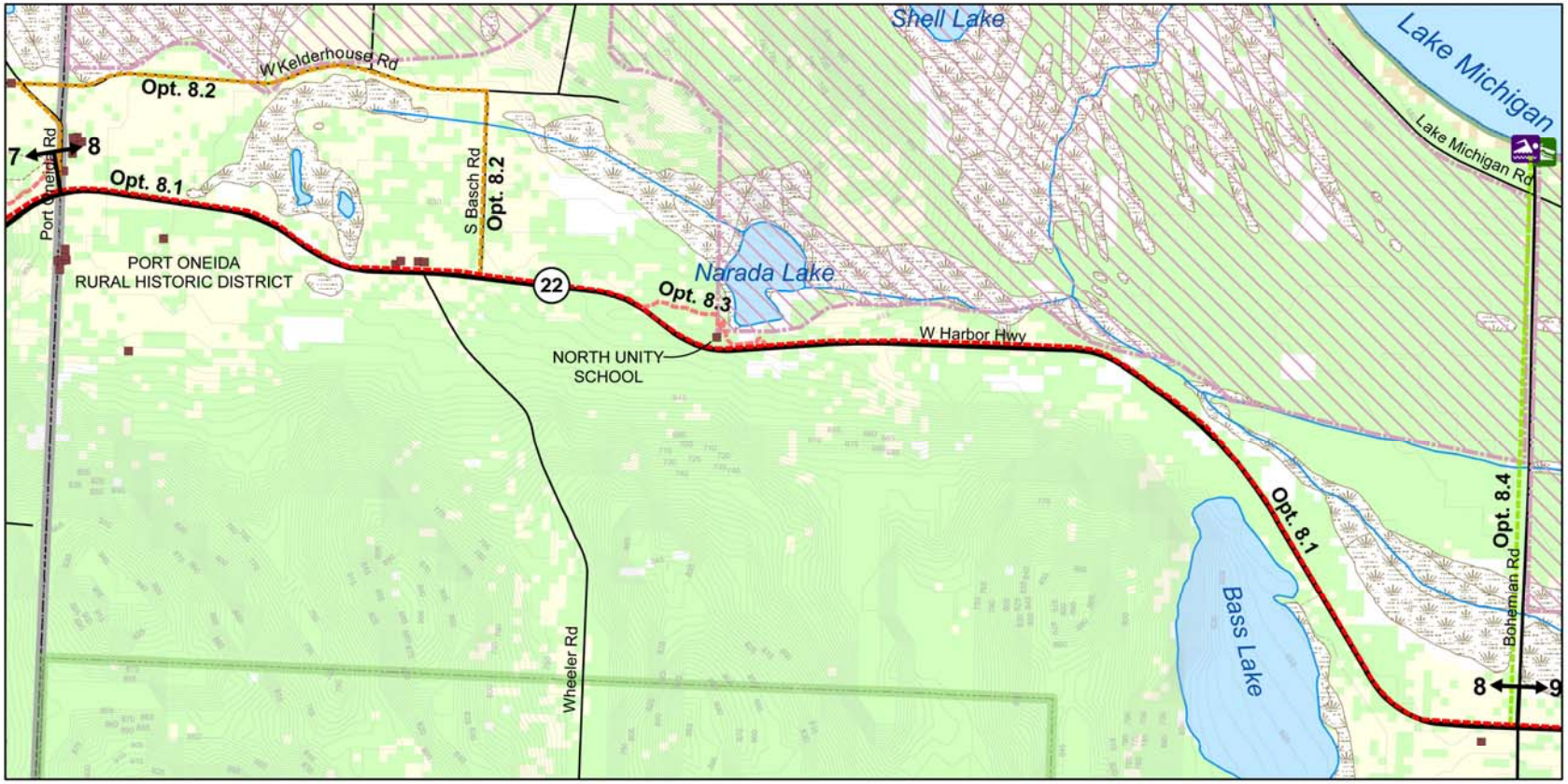
- SLBE Boundary
- Rivers
- Lakes
- Village Boundaries
- Township Boundaries
- Aquatic Bed
- Forested
- Agricultural

0 375 750 1,500 2,250 3,000 Feet

N W E S

Base GIS Data: Michigan Framework Data
1992 National Land Cover Dataset
1992 National Wetlands Cover Dataset
National Park Service
NAD 1983 UTM ZONE 16N

Gosling Czubak engineering sciences, inc.



MAP 1.8 - PROPOSED TRAILWAY ROUTING

LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN

SEGMENT 8: OPTIONS 1-4

Opt. 8.1 PROPOSED TRAIL ROUTE OPTIONS

GENERAL LEGEND

- State Trunkline
- County Primary Roads
- County Local Roads
- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
- Historic Buildings & Structures
- Rest Areas/Scenic Turnouts
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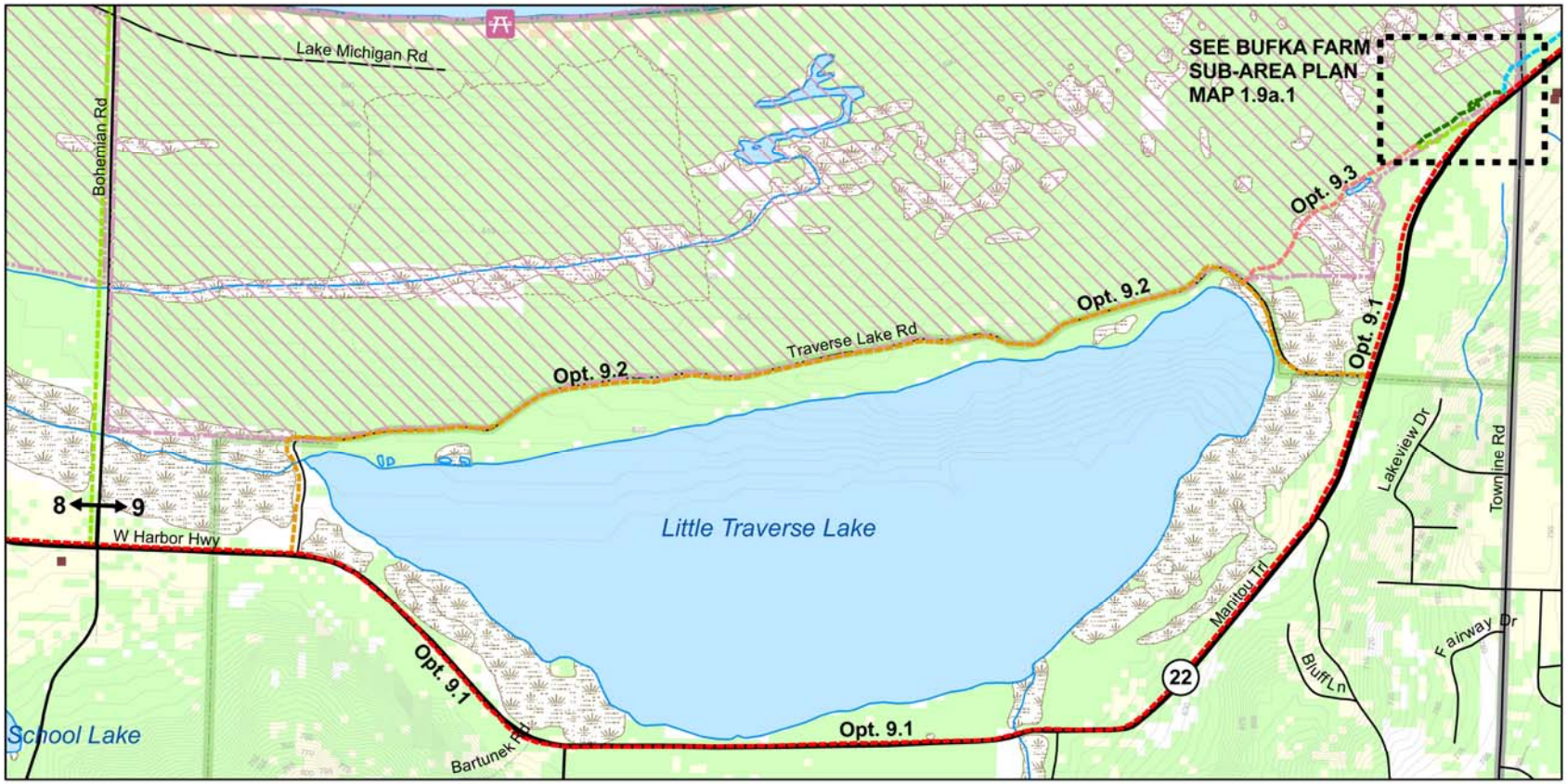
1992 National Land Cover Dataset
1992 National Wetlands Cover Dataset
National Park Service
NAD 1983 UTM ZONE 16N

N W E S

0 375 750 1,500 2,250 3,000 Feet

GoslingCzubak engineering sciences, inc.



MAP 1.9a - PROPOSED TRAILWAY ROUTING

LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN

SEGMENT 9: OPTIONS 1-9

Opt. 9.1 PROPOSED TRAIL ROUTE OPTIONS

GENERAL LEGEND

- State Trunkline
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1992 National Wetlands Cover Dataset
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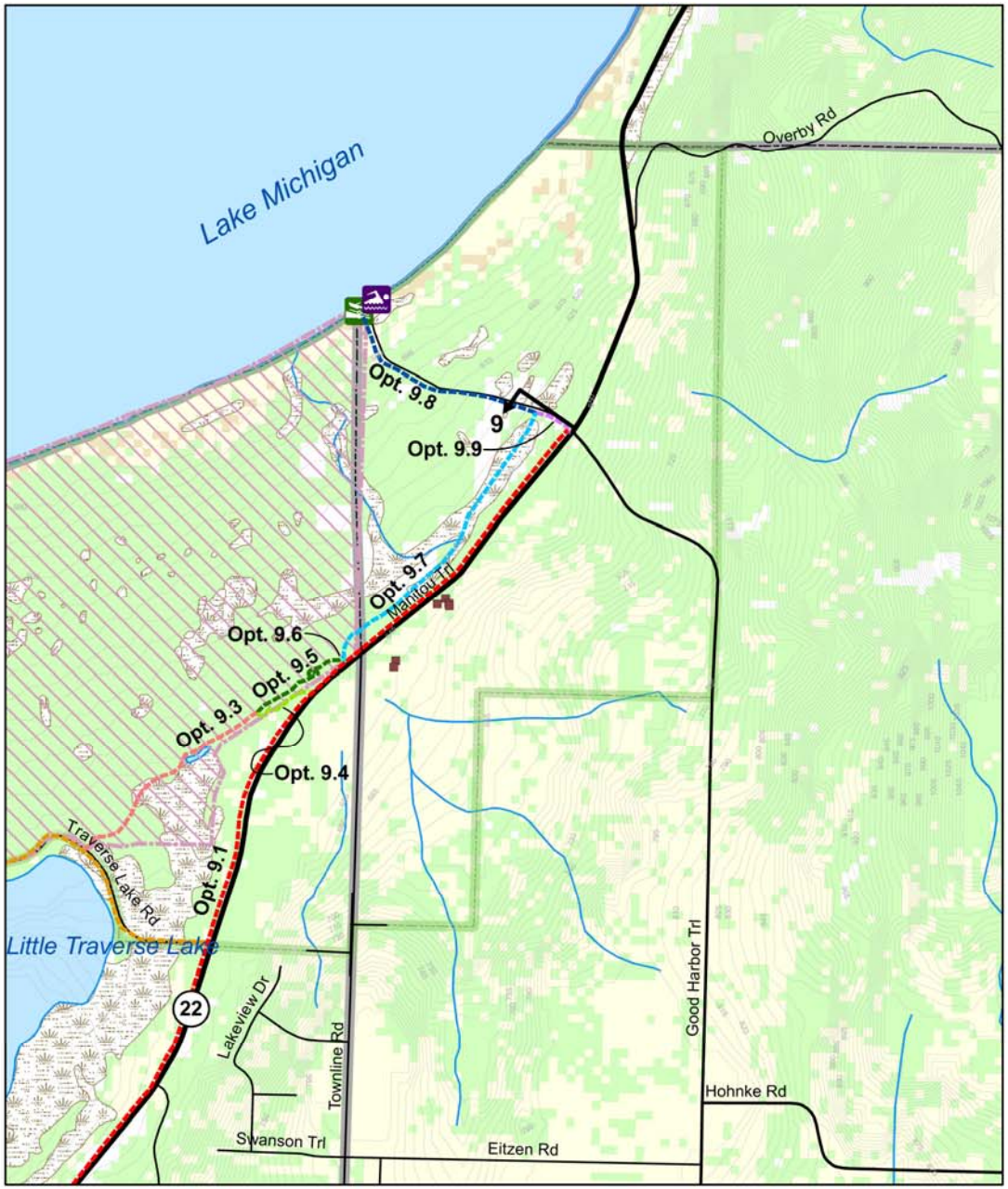
NAD 1983 UTM ZONE 16N

N W E S

0 375 750 1,500 2,250 3,000 Feet

Gosling Czubak engineering sciences, inc.



MAP 1.9b - PROPOSED TRAILWAY ROUTING

LEELANAU SCENIC HERITAGE ROUTE TRAILWAY MASTER PLAN

SEGMENT 9: OPTIONS 1-9

Opt. 9.1 PROPOSED TRAIL ROUTE OPTIONS

GENERAL LEGEND

- State Trunkline
- County Primary Roads
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- Village Roads
- Other Roads
- Existing Hiking & Skiing Trails
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0 375 750 1,500 2,250 3,000 Feet

N W E S

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Gosling Czubak engineering sciences, inc.