

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 purpurea*), Labrador tea (*Ledum 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 (*Lithospermum cansescens*), and creeping juniper (*Juniperus 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 serpentina*), 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 deer mouse (*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 (*Cirseium pitcheri*). Additionally, the breeding range of the Indiana bat (*Myotis sodalists*) 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 fasciated 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 fasciated 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.