



Isle Royale National Park

Windigo Development Concept Plan Environmental Assessment

July 2018



This plan fulfills a park priority for facility asset management and visitor use management at Isle Royale National Park and serves as a component of the park's planning portfolio. This follows the National Park Service's "Planning Portfolio" construct, consisting of a compilation of individual plans, studies, and inventories, which together guide park decision making. The planning portfolio enables the use of targeted planning products (such as this one) to meet a broad range of park planning needs, a change from the previous National Park Service focus on standalone general management plans. The general management plan remains a critical piece of the planning framework and will be revised in a timely manner through the park's planning portfolio.

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Acronyms and Initialisms

CFR	Code of Federal Regulations
DCP	Development Concept Plan
EA	environmental assessment
Isle Royale	Isle Royale National Park
LCM	landing craft mechanized
NEPA	National Environmental Policy Act
NPS	National Park Service
USACE	US Army Corps of Engineers
USC	United States Code
USFWS	US Fish and Wildlife Service

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CHAPTER 1: PURPOSE AND NEED

1.1 INTRODUCTION

The National Park Service (NPS) initiated the Windigo Development Concept Plan (DCP) to implement a program of upgraded and new facilities in Windigo to improve visitor experience at Isle Royale National Park (Isle Royale). This environmental assessment (EA) assesses the potential effects of the proposed facility upgrades, relocations, and replacements.

Isle Royale is located in Keweenaw County, Michigan, in Lake Superior, approximately 60 miles northwest of Houghton, Michigan, and approximately 25 miles east of Grand Portage, Minnesota (see figure 1). Isle Royale was authorized by Congress and approved by President Herbert Hoover on March 3, 1931, and was officially established by President Franklin Roosevelt on April 3, 1940. Isle Royale was established to set aside a remote archipelago and surrounding waters in Lake Superior as a national park for the benefit and enjoyment of the public, and to preserve and protect its wilderness character, cultural and natural resources, scenery, and ecological processes. Additionally, the National Park Service manages Isle Royale to provide opportunities for recreation, education and interpretation, and scientific study. The United Nations designated Isle Royale as an International Biosphere Reserve in November 1980.

This heavily forested archipelago is in a zone of transition between the boreal coniferous forest and northern hardwood forest. Evidence of human use, activity, and habitation can be found throughout Isle Royale and in the surrounding waters. Stone tools, mining pits, shipwrecks, vernacular boats, fishing camps, summer cabins, domestic flowers, and medicinal plants are all part of the cultural resources of the archipelago.

1.2 PURPOSE OF AND NEED FOR ACTION

The underlying purpose of the preferred alternative is to enhance visitor experience by improving facilities (through modification, replacement, or development of new facilities), improving accessibility, improving interpretative exhibits and areas, and creating a sense of welcome at Isle Royale through a unified architectural theme.

The development of the Development Concept Plan is necessary to guide improvement of facilities that have typical deficiencies considering age, usage, and climate, to provide universal access, and to improve the visitors' experience of entering the park. Recent increases in visitation have resulted in stresses to the capacity of the existing visitor facilities. Visitors to Isle Royale have increased by 87 percent in the last 3 years. Although there is a sense of remoteness upon arrival at Windigo, there is not a sense of welcome at a national park.

Specific needs that led to the development of the Development Concept Plan include the following:

- The concessions store (see figures 2 and 3 for location) has structural and utility deficiencies, and does not meet its functional requirements. The foundations of the three individual sections of the building have heaved or settled, and deteriorated, at different rates. This has caused uneven floor and rooflines and has created problems with windows, doors, decking, and plumbing fixtures. All major building components are in need of upgrade or replacement. Electrical and plumbing systems are inadequate and do not meet current codes. The building does not contain a fire suppression system.

- Space within the store is small and compartmentalized; it lacks the flexibility to meet changing needs for space (food and retail space, kitchen space, dining space, space for additional visitors to move around comfortably, deck space, and storage space).
- Space at the visitor center (see figures 2 and 3 for location) is inadequate; the work and display areas are small and not optimally configured for the current number of visitors.
- The slope of paths to the store and visitor center exceeds Architectural Barriers Act Accessibility Standard requirements. The existing trail has an 18 percent grade and does not allow universal access.
- The existing visitor center and store are located on a hill above Washington Harbor and are difficult for the public to see and access.
- The main trail from the dock to the visitor center (see figures 2 and 3 for location) is used to move materials to the visitor center; this creates congestion on the trail. Access for NPS staff between the dock and visitor center is in need of improvement.
- The only access from the docks and the warehouse in the southern portion of Windigo, and between the docks and the generator and water tower in the northeast portion of Windigo, is the shared road and trail along Lake Superior (see figures 2 and 3 for location). Visitors at Windigo use this road and trail. Using the shared road and trail for NPS operations (for example, deliveries of supplies, large equipment, and dumpsters) is not desired because it creates congestion and increases noise of vehicular traffic along a pedestrian route, thus affecting visitor experience.
- The interpretive displays of cultural resources, including historic Ghyllbank mining facilities, need improvement.
- Currently, aesthetics of the area are compromised because vegetation is obscuring views at Windigo, and facilities are a mix of architectural styles.

Vegetation has grown to block views of the shoreline and lake from the visitor center, and is close to existing structures, presenting a fall and fire hazard.

- Enhanced visibility of the visitor facilities with a unifying architectural theme is needed to create a sense of arrival at Isle Royale, because they should know immediately that they are welcomed at a national park.
- The septic system serving the visitor area is aging and may need replacement in the future. The Development Concept Plan includes a potential replacement location.

Improvements are required to address the aforementioned needs through replacement or improvement of existing facilities, relocation of transportation pathways and improvement of access, addition of interpretative materials to improve visitor experience, and unification of architectural styles.

1.3 RELATED PLANNING EFFORTS

The General Management Plan established park management zones; approximately 99 percent of Isle Royale is designated wilderness, but Windigo is designated as a developed zone with convenient and accessible facilities (NPS 1998). Visitor and administrative facilities are provided in Windigo, including visitor centers, educational program areas, park personal residences, and maintenance areas. Primary ferry landings, large docks, marinas, and paved paths are found in Windigo. Resources have been modified to meet visitor and operational needs. The National Park Service manages the visitors and facilities in this zone to protect resources and to keep visitors safe.

Other recent related planning efforts include specific management of wilderness and backcountry areas, consideration of introduction of wolves to Isle Royale, and a comprehensive cultural resource management plan.

The *Final Wilderness and Backcountry Management Plan and Environmental Impact Statement* (NPS 2011) outlines steps for preserving Isle Royale's wilderness character, natural resources, and cultural resources while providing for the use and enjoyment of Isle Royale's wilderness and backcountry by current and future generations. The plan is being updated via a Wilderness Stewardship Plan Supplemental EIS to address current issues, including the treatment of historic structures in wilderness, and a nature trail from Windigo extending into wilderness (referred to as the Windigo Day Trail). The portion of the trail within wilderness would be developed under the wilderness program, and is being addressed for impacts under the Supplemental EIS. The Wilderness Stewardship Plan provides guidelines for managing the wilderness areas of Isle Royale, which encompass all areas outside of the developed zone. The plan is relevant to the development of the Development Concept Plan because some of the improvements proposed to Windigo would occur in near wilderness. Wilderness on the western side of Isle Royale is predominantly accessed through Windigo.

The *Draft Environmental Impact Statement to Address the Presence of Wolves* (NPS 2016a) and *Final Environmental Impact Statement to Address the Presence of Wolves* (NPS 2018c) was prepared to determine whether and how to bring wolves to Isle Royale to function as the apex predator in the near term within a changing and dynamic island ecosystem. The National Park Service identified Windigo as a potential fly-in site for reintroduction of wolves if human traffic could be reduced temporarily. The Final Environmental Impact Statement addressed comments on the Draft, and indicated that although the likely period of wolf re-introduction would be late fall to late winter; it is possible that other times would be advantageous (NPS 2018c). The preferred alternative is immediate limited introduction. The Record of Decision was signed June 7, 2018, and selected the preferred alternative, with potential reintroduction of 20 to 30 wolves.

The Cultural Resource Management Plan for Isle Royale is in development. Many sites and resources still exist from pre-contact and historic use of the archipelago, including periods of use by American Indians, voyageurs, and fur traders, and use from extensive commercial fishing and mining, Lake Superior shipping, vacationing, and resort development. These cultural resources are categorized as archeological sites, historic structures, cultural objects, cultural landscapes, and ethnographic resources. The Windigo area includes remnants of occupation, including the Ghyllbank mining town, and other cultural resources.

1.4 KEY ISSUES AND CONCERNS

Issues are “problems, concerns, conflicts, obstacles, or benefits that would result” if either the No-Action Alternative or the preferred alternative is implemented (NPS 2015).

Impact topics are resources that could be affected, either beneficially or adversely, by implementing any of the proposed alternatives. Key issues and concerns, and potential impact topics were derived from discussions with NPS engineers, scientists, architects, planners, and managers through internal scoping. The key issues and concerns are linked to impact topics to be analyzed or dismissed, as appropriate. Key issues and concerns include the following:

- Constructing new facilities and modifying existing facilities could temporarily increase soil erosion, allow non-native species to establish, and affect water quality.
- Constructing new facilities closer to the dock area could result in higher levels of noise and potentially create safety concerns from the adjacent service road.
- Extending the service road inland from the proposed new and modified facilities would reduce noise and dust, and improve safety, but could affect additional vegetation and wildlife, and potentially affect threatened and endangered species.

- Constructing new facilities, and replacing or modifying existing facilities, could potentially affect cultural resources (historic and archeological resources).
- Constructing new facilities, and replacing or modifying existing facilities, could temporarily affect air quality, affecting visitor experience of remoteness and wilderness.

1.4.1 Impact Topics Retained for Detailed Analysis

Key issues and concerns that warrant detailed analysis were initially identified by NPS staff during the internal scoping process; input from resource agencies contributed to the evaluation of impact topics. Impact topics were identified based on federal laws, regulations, and executive orders; the National Park Service's *Management Policies* (2006); and knowledge of resources that are limited or could be easily affected. Visitor experience is the only impact topic (or resource) retained for detailed analysis in this environmental assessment. Elements of other resources eliminated from detailed analysis (such as vegetation, discussed in section 1.5.2) include elements pertaining to visitor experience that will be addressed in detail.

Visitor Experience. Isle Royale hosts between 15,000 and 20,000 visitors per year. Rock Harbor and Windigo are the main entry points to Isle Royale. The 400-acre Windigo area includes visitor facilities (a visitor center, concessioner-operated store, rustic cabins, laundry, showers, and boat dock and fueling dispenser), Washington Creek Campground, NPS and concessioner housing, and maintenance facilities. Visitor experience can be affected by the facilities, activities, aesthetics, operations, and many other factors. While the NPS preferred alternative will have long-term beneficial impacts on the visitor experience, construction of the proposed improvements may adversely impact the visitor experience and use of Windigo. Consequently, this impact topic was retained for detailed analysis.

1.4.2 Impact Topics Dismissed from Further Analysis

The following topics have been dismissed from further analysis of impacts from the Development Concept Plan based on the rationale provided for each.

Floodplains. Isle Royale has no delineated floodplain boundaries. In general, the short, low-gradient streams on the islands pose few flooding concerns. No new facilities are proposed along streams. Consequently, the topic of floodplains was dismissed from further review in this environmental assessment.

Wetlands. The closest National Wetlands Inventory-mapped wetlands are approximately 100 to 300 feet east of the proposed improvements (United States Fish and Wildlife Service [USFWS] 2017). The park has reviewed the project areas and there are no identifiable ponding or other known wetland areas in the proposed project locations. Prior to construction, the park would review areas to be disturbed and confirm that wetlands would not be impacted. The National Park Service would follow the procedures outlined in its *Procedural Manual 77-1: Wetland Protection* (NPS 2016). These procedures include protecting wetlands from indirect impacts such as sedimentation and runoff from construction sites.

Cultural Resources (Archeological, Structural, Landscapes, Ethnography, and Museum Collections). The Windigo Copper Mining Company constructed the Ghyllbank mining town, consisting of approximately 15 structures, in 1890 to support mining operations on Isle Royale. The Ghyllbank mining town was in the area that became Windigo. In 1902, the land at Ghyllbank was sold to the Washington Club and developed as a hunting and fishing club. Many of the original mining village buildings were demolished, and no buildings from the Washington Club era remain. A 2016 Phase I survey of surface and subsurface remains at the Ghyllbank Townsite determined that the Ghyllbank Townsite is not eligible for listing

on the National Register of Historic Places (Michigan Technological University 2017). On July 24, 2017, the Michigan State Historic Preservation Office concurred with the National Park Service's determination that no historic properties would be affected within the area of potential effect of the proposed improvements for the new concession store and associated trails in Windigo (see Appendix A for Michigan State Historic Preservation Office correspondence). The NPS will conduct archaeological surveys for other Development Concept Plan project areas proposed for disturbance, and if present, coordinate further with the Michigan State Historic Preservation Office and avoid affecting historic archaeological resources. Based on the Michigan State Historic Preservation Office's determination of no historic properties affected for the store and associated trails, and NPS policies and procedures for reviewing areas proposed for future disturbance addressing unplanned discoveries of cultural resources, and avoiding impacts of historic archaeological resources, the topic of cultural resources was dismissed from further independent review in this environmental assessment. However, exposure to and learning about cultural resources are part of the visitor experience, and are briefly addressed in chapter 3 as they apply to that impact topic.

Several bands of Lake Superior Chippewa have rights guaranteed by various treaties in the geographic area in which Isle Royale is located. A tribal consultation meeting for Isle Royale was held with the Grand Portage Band on November 16, 2017, at the Grand Portage Reservation Tribal Council headquarters in Grand Portage, Minnesota. The National Park Service updated the group on planning for future development at Windigo, and no specific comments on the Concept Development Plan were offered. Consultation with the Grand Portage Band and other agencies is further discussed in chapter 4.

Soils and Vegetation. Soils in Windigo are derived from sandy and gravelly glacial till.¹ These sandy and gravelly soils have high runoff of precipitation and are difficult to construct on because of steep slopes and large stones. These soils are moderately erodible and moderately susceptible to soil slumping. In accordance with the National Park Service's *Management Policies* (2006), best management practices would be used for all phases of construction activity, including preconstruction, actual construction, and post-construction. Construction sites would be limited to the smallest feasible area. Ground disturbance and site management would be carefully controlled to prevent undue damage to vegetation, soils, and to minimize air, water, soil, and noise pollution. Protective fencing and barricades would be provided for safety and to preserve natural and cultural resources. Effective storm water management measures specific to the site would be implemented and appropriate erosion and sedimentation control measures would be in place at all times.

Vegetation would be cleared only as necessary to construct the proposed facilities and roads, to meet structure safety requirements, and to improve the viewshed near the dock, concessions store, and visitor center. A variety of trees, bushes, and grasses would be removed along narrow corridors and small areas proposed for new facilities. The park indicates that there is no known unique vegetation based on previous clearing for construction.

Effects on soils and vegetation would be temporary and limited to areas near construction. Approximately 4.3 acres would be disturbed by construction for proposed facilities. Windigo contains approximately 428 acres of land; this disturbance would constitute roughly 1 percent of the total land. Given that the disturbance would occur over time, in different areas, the vegetation that would be disturbed is not unique, and soil

¹ Glacial till is unsorted material deposited directly by glacial ice.

erosion and runoff during construction must be controlled, the topic of soils and vegetation was dismissed from further review in this environmental assessment. However, under the topic of visitor experience, vegetation effects on structure safety and watershed management are carried forward for further analysis under the topic of visitor experience.

Water Quality or Quantity. No streams are near the proposed improvements; however, because of the proximity of Lake Superior, storm water management measures, as described previously for soils and vegetation, would be implemented to protect water quality. Improvement of utilities would involve potential replacement of existing septic systems at their current location, and if additional capacity is needed, it would be developed in a previously disturbed area near the Bone Yard (a storage facility in the northeast portion of Windigo), which would further protect water quality.

Implementation of required erosion and sediment controls would minimize effects on water quality. Effects on water quality such as sedimentation would be short-term (during construction); with controls in place to capture sedimentation to minimize its potential from being carried into water bodies such as streams and Washington Harbor, and to reduce erosion. There would be no impacts on drinking water at Windigo. Minimal water would be required for concrete during construction. Consequently, the topic of water quality or quantity was dismissed from further review in this environmental assessment.

Species of Special Concern (Threatened and Endangered Species). The Endangered Species Act of 1973 requires the evaluation of effects on endangered, threatened, or protected species and critical habitats (16 United States Code [USC] 1531 et seq.). NPS policy requires examination of the effects on federal candidate species as well as threatened, endangered, candidate, rare, declining, and sensitive species that are listed by a state. The US Fish and Wildlife Service identifies two federally listed species, the

Canada lynx (*Lynx canadensis*) and rufa red knot (*Calidris canutus rufa*), as occurring in Keweenaw County, but neither of these species are identified by the National Park Service as occurring on Isle Royale (NPS 2016, 2018). Two federally listed or candidate species have previously been identified as occurring on Isle Royale: the gray wolf (*Canis lupus*) and the northern long-eared bat (*Myotis septentrionalis*).

Isle Royale is designated critical habitat for the gray wolf (USFWS 2015), but the population on Isle Royale does not contribute to the federal recovery goals (NPS 2016). In February 2016, only two wolves were documented on Isle Royale (NPS 2016). The National Park Service, in consideration of the rising moose population and decreased wolf population, proposed to reintroduce wolves to Isle Royale and addressed potential environmental impacts of their proposal in an Environmental Impact Statement (see section 1.4 for further information). A Record of Decision was signed on June 7, 2018, allowing project implementation to begin, with potentially 20 to 30 wolves introduced to Isle Royale. The preferred alternative will not have impacts on wolves because there are roughly 132,000 acres of designated wilderness on Isle Royale, wolves are rarely seen in the administrative or occupied areas, and wolves would likely avoid the Windigo area, especially when construction is happening. Consequently, no adverse impacts would occur to gray wolves.

The northern long-eared bat roosts in trees and forests; occasionally inhabits houses and other human structures; hibernates in rock crevices, caves, and mines; and can be found swarming in wooded areas in autumn (USFWS 2015c). Mine shafts at Isle Royale are not of the type and nature to support bat hibernacula; therefore, bat populations are believed to migrate off the island in winter (NPS 2016).

Section 4(d) of the Endangered Species Act contains the US Fish and Wildlife Service's final rule for the northern long-eared bat effective February 16, 2016 (USFWS 2016).

Northern long-eared bats are likely to be present in the area, but conducting work later in the summer (after July 31) and searching for roost trees within the project study area would help determine presence or absence, and would help evaluate mitigation options should presence be confirmed. Tree cutting for Development Concept Plan activities is planned to occur. The National Park Service will comply with restrictions of the rule. Given implementation of the tree cutting restrictions, there would be no adverse impacts to northern long-eared bats.

Both bald and golden eagles, protected under the Bald and Golden Eagle Protection Act of 1940 and the Migratory Bird Treaty Act of 1918, have been observed on Isle Royale. A visual reconnaissance of the area affected by the proposed improvements would be completed prior to construction to confirm that no active bald or golden eagle nests are within the affected area. If a nest is found, no activity would take place from February 1 through July 15, and eagles or their nests would not be disturbed (USFWS 2007).

Several species listed under the Endangered Species Act of the State of Michigan occur at Isle Royale. However, most of the sites that would be affected by the proposed improvements have been previously disturbed. There would be some minor areas of disturbance for extending the maintenance road and constructing the proposed trails and facilities. Some areas proposed for Development Concept Plan activities have not been surveyed for rare plants but the park plans to review those areas and conserve or move the plant.

Introduction of Non-native Species.

Implementation of the Development Concept Plan could, without appropriate mitigation, contribute to the spread of invasive exotic plants near the proposed improvements. Serious concerns exist regarding non-native species at Isle Royale. However, NPS staff at Isle Royale is actively inventorying, mapping, monitoring, and treating these invasive exotic species annually. The Great Lakes Invasive Plant Management Plan would be followed.

Disturbance of vegetation in proposed construction areas would be held to a minimum or would take place in previously disturbed areas. Mitigation would reduce impacts to the minimum necessary to accomplish objectives and would include careful site selection, salvaging topsoil and plant materials, and rehabilitation of disturbed areas. Wherever facilities would be removed, the disturbed areas would be rehabilitated and revegetated with native species. Only native plants and seed sources near the disturbed site would be used in rehabilitation and revegetation efforts.

Consequently, the topic of introduction of non-native species was dismissed from further review in this environmental assessment.

Wilderness Characteristics. Windigo is adjacent to wilderness, which comprises most of Isle Royale. Wilderness is cherished for its tranquility, and the opportunity for visitors to experience land and vegetation in a natural state. Noise and light pollution can degrade a visitor's experience in wilderness. The light environment would not change much during construction and subsequent operation of the proposed improvements. Construction noise would be localized within several hundred feet of the construction site, but indirect impacts of construction noise at a lower level would extend into nearby wilderness areas on an intermittent basis over the short-term (a few weeks to several months) over the length of program construction. Based on the minimal impacts, the topic of wilderness characteristics was dismissed from further review in this environmental assessment. The Windigo Day Trail extension from the existing Windigo Nature Trail in the southern portion of Windigo would extend into wilderness. The impacts of the trail in the wilderness area are being addressed in the Wilderness Stewardship Plan Supplemental EIS.

American Indian Trust Resources. The United States Department of the Interior requires its bureaus to explicitly consider effects of its actions on American Indian

Trust resources in environmental documents. The National Park Service's environmental assessments and environmental impact statements must include either an analysis of impacts on American Indian sacred sites or a specific dismissal of the issue from detailed analysis (Environmental Compliance Memorandum 97-2: Departmental Responsibilities for Indian Trust Resources and Indian Sacred Sites on Federal Lands, Part 1). Furthermore, Executive Order 13007, Indian Sacred Sites, provides that, to the extent practicable, permitted by applicable law, and not clearly inconsistent with essential agency functions, agencies are required to accommodate access to and ceremonial use of American Indian sacred sites by American Indian religious practitioners and avoid adversely affecting the physical integrity of sites (NPS 2015). The federal American Indian Trust responsibility is a legally enforceable obligation on the part of the United States to protect tribal lands, assets, resources, and treaty rights, and it represents a duty to carry out the directives of federal laws with respect to American Indian tribes. No known American Indian Trust resources are located in Windigo, and the lands composing Isle Royale are not held in trust by the Secretary of the Interior for the benefit of American Indians due to their status as American Indians. Therefore, the topic of American Indian Trust resources was dismissed from further review in this environmental assessment.

Environmental Justice. The United States Department of the Interior requires its bureaus to specifically discuss and evaluate the effects of its actions on minority and low-income populations and communities, as well as the equity of the distribution of the benefits and risk of the decision.

None of the proposed improvements presented in this environmental assessment would result in disproportionately high and adverse environmental effects on minority or low-income communities. No air or water pollution effects would affect human health, and there would be no change in land use in the surrounding area that would affect minority or low-income communities. Therefore, the topic of environmental justice was dismissed from further review in this environmental assessment



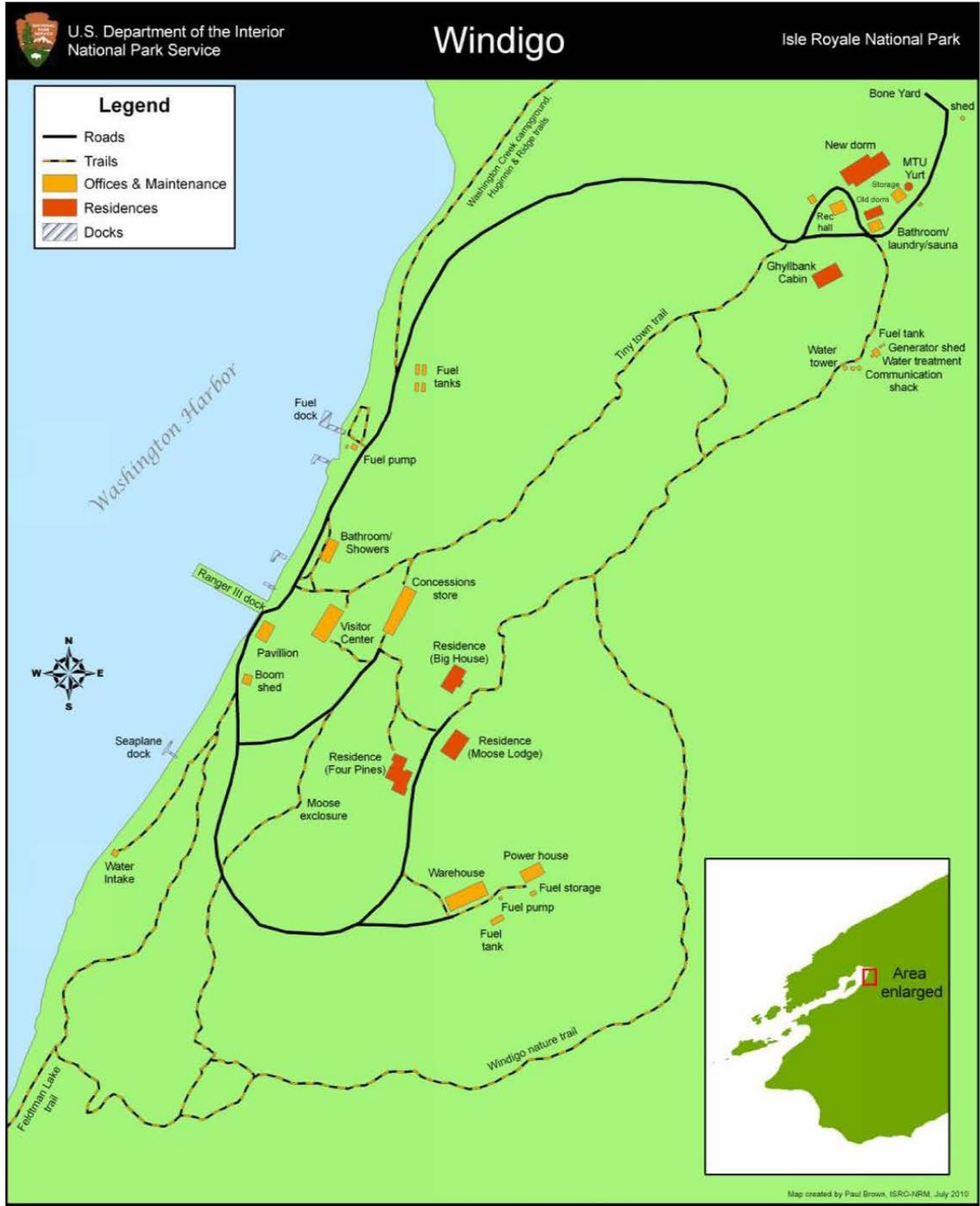
ISLE ROYALE NATIONAL PARK
AND SURROUNDING REGION

FIGURE 1

WINDIGO DEVELOPMENT CONCEPT PLAN

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FIGURE 1 – ISLE ROYALE NATIONAL PARK AND SURROUNDING REGION



NOT TO SCALE



This Map is for Information only
It is not intended for navigation,
See NOAA nautical charts and
USGS topographic maps

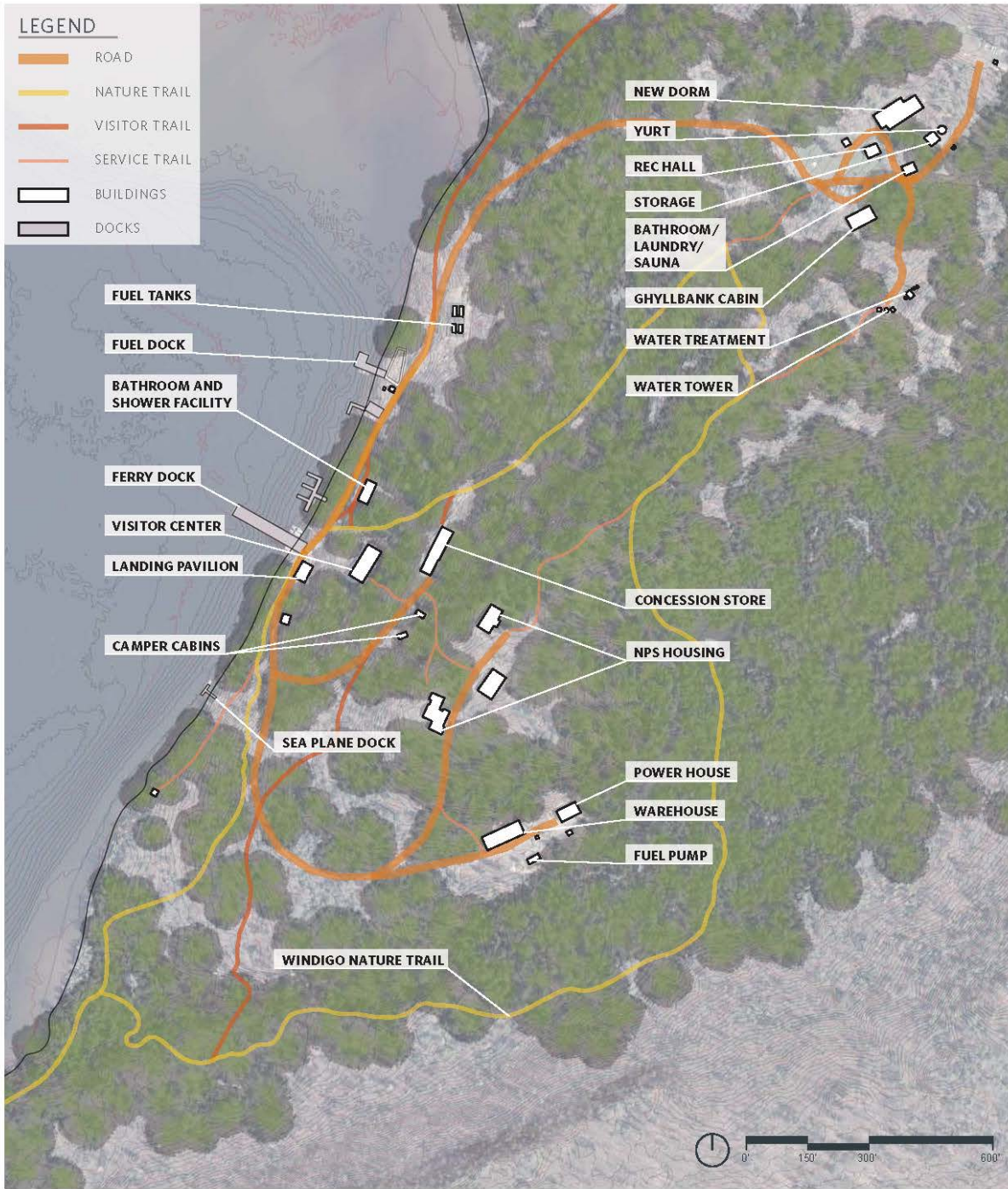
WINDIGO AREA MAP SHOWING KEY ROADS, TRAILS, AND STRUCTURES

FIGURE 2

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WINDIGO DEVELOPMENT CONCEPT PLAN

FIGURE 2 – WINDIGO AREA MAP SHOWING KEY ROADS, TRAILS, AND STRUCTURES



EXISTING FACILITIES

FIGURE 3

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WINDIGO DEVELOPMENT CONCEPT PLAN

FIGURE 3 – EXISTING FACILITIES

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CHAPTER 2: ALTERNATIVES

2.1 INTRODUCTION

This chapter describes the alternatives developed to address the purpose of and need for the proposed action. In addition, this chapter addresses required mitigation measures to be incorporated into DCP projects.

2.2 DEVELOPMENT OF ALTERNATIVES

The National Park Service developed a list of needed improvements and conducted an internal scoping meeting in November 2017 with engineers, scientists, architects, planners, and managers. Several locations and combinations of projects, as well as the size of the projects, were defined and reviewed as a group, and narrowed to one that best met the purpose of and need for the proposed action. The proposed DCP improvements are shown in figure 4 as a concept rendering (chapter 2 figures can be found at the end the chapter). The figure identifies key facilities in Windigo, including new facilities (the concession store, camper cabins, camper condo, comfort station, and shower facility) and facilities proposed for modification (the visitor center and existing comfort station).

2.2.1 No-Action Alternative

Under the no-action alternative, which represents the status quo, the National Park Service would continue to use and maintain the existing facilities and pathways. The concession store would continue to operate in poor physical condition and with physical constraints that limit the ability to meet visitor requirements. The visitor center would continue to operate with limited space for interpretive programs and administrative activities. Deliveries from the dock to the warehouse in the southern portion of Windigo, and from the docks to the generator and water tower in the northeast

portion of Windigo would continue to use the trail along Lake Superior, which is also used by visitors. Access to the visitor center and store would continue to be provided by the existing, steep trail (approximately 18 percent slope). Isle Royale would continue to operate with the existing interpretive program. The number of camper cabins would remain the same and would not meet the need for the growing number of visitors. The Windigo facilities would continue to lack a unifying architectural theme. Vegetation would continue to block views of the shoreline from the visitor center and existing concession store deck. Figure 5 shows the existing configuration of facilities and paths that would remain if no action were taken.

2.2.2 Proposed Action and Preferred Alternative

The preferred alternative is to implement the Development Concept Plan, which includes several individual projects. The projects in the Development Concept Plan include new structures, improvements to existing structures, new trails, new roads, and new interpretive areas and exhibits, and would likely be constructed in phases as funding becomes available. Facilities will be planned, designed, and constructed to minimize facility physical, energy, and water footprints, in addition to replacing existing facilities with more efficient versions.

Figure 6 shows improvements that would be implemented under the preferred alternative. Existing features include current buildings such as the concession store and visitor center, roads, trails, utilities, and docks.

Proposed features include new roads and trails, the new concession store, new cabins and new concessioner housing, a relocated rustic cabin, visitor center expansion, new wagon pavilion, and new interpretive areas and exhibits. After the construction of the new store is finished and the store operational, the existing store would be

demolished (shown in figure 7), and the site and utility connections would be reused for a future camper condo and comfort station/bathhouse for the rental cabins and condo. If necessary, a new septic field would be constructed in a previously disturbed area to service the visitor area.

Typical heavy civil construction equipment would be used to construct the facilities, roads, and trails. This includes, but is not limited to, front-end loaders, excavators, dump trucks, graders, skid-loaders, fork lifts, and cranes. Needed equipment not already present on Isle Royale would be transported by NPS landing craft mechanized (LCM) dock or tug and barge. Gas-powered hand tools such as chainsaws and concrete mixers would be used for construction activities, as would electric and manual tools. To construct facilities, the heavy equipment would grade a site; trees could be removed either via equipment or hand tools. The equipment would need room to maneuver; in addition to disturbance of a facility footprint, disturbance would likely occur within a 20-foot-wide buffer. A few feet of topography would likely be excavated to allow foundation construction. The disturbance buffer would be approximately 10 feet from the edge of a trail or road, where feasible, and require up to a few feet of excavation for use as fill material in other locations to make a relatively smooth surface that primarily follows the topography. Several feet of excavation would be needed for constructing the new concession store into the hillside.

All structures would have a stone foundation and wooden sub floors. Wood lap siding would be used in a similar style to existing structures, and would be painted according to a brown palette approved for use by the National Park Service, and blend in with current structures. The roofs would consist of asphaltic shingles. The roads and trails would be surfaced with crushed rock, with slightly coarser rock used for the roads. The rock would likely be approximately 4 to 5 inches deep on the trails and 8 to 10 inches deep on the roads. The extension of the nature trail could involve use of timber,

rocks, and other material based on the varied terrain.

Under the preferred alternative, the following new facilities would be constructed, or existing facilities modified or demolished, or have planning reviews conducted.

New Windigo Concession Store. A new concession store consisting of a snack bar, kitchen, storage, store, and exterior deck would be constructed near the lakefront north of the existing comfort station. The new store would be constructed to support the recent increase in visitor usage, and to allow the concessioner to expand the services offered. The interior area of the store would be approximately 2,160 square feet, including an interior snack bar of 600 square feet, a 360-square-foot kitchen, 360 square feet of store storage, and 850 square feet of store area. An approximately 500-square-foot deck would also be constructed. After the new store is constructed and operational, the existing store would be demolished, but its utility connection would be retained and the site repurposed for a camper condo and new comfort station, described below.

Disposition of Existing Concession Store. The existing store would be demolished after completion of the new concession store and new concessioner housing. The existing concession store would remain in use until the proposed store would be completed and operational, and then it would be demolished. The utility connections would be retained.

New Concessionaire Housing. Up to three, one-bedroom units (each approximately 800 square feet, approximately 20 feet by 40 feet in size) would be constructed to house four concessioner staff during seasonal operations. The units would be constructed in the northeast portion of Windigo.

Disposition of Existing Concession Housing. The two one-bedroom apartments attached to the existing store would be demolished after completion of the new concession store and new concessioner

housing. The attached housing would remain in use until funding is available to construct the new housing. After the new housing is operational, the former housing would be demolished. The utility connections would be retained, and the area would be reused for construction of a new comfort station and camper condo.

Universally Accessible Trail to Visitor Center and New Concession Store. A new gravel trail with earthen shoulders, approximately 5 to 6 feet wide and 1,200 to 1,400 feet long, would be developed along a new alignment to meet Architectural Barriers Act Accessibility Standard requirements of 5 percent maximum running slope and 1.5 percent maximum cross slope to circulate visitors from the Windigo dock area and pavilion to the visitor center, comfort station and shower facility, new store, and new and existing camper cabins.

Windigo Day Trail. An extension from the existing Windigo Nature Trail is proposed to extend into Wilderness. The extension is approximately 1.25 miles within Windigo. The surfacing of the nature trail would vary based on the slope and terrain the trail passes through, typical of other nature trails on Isle Royale.

Visitor Center Deck Improvements. The existing visitor center deck would be expanded (approximately 1,000 square feet, approximately 25 feet by 40 feet in size) and covered to provide visitors with shelter and to provide a larger area for interpretive programs. The expanded deck would be consistent in appearance with the proposed unified architectural theme.

Additional Camper Cabins. The two existing camper cabins (upgradient of the visitor center) would be supplemented by additional camper cabins (up to four new cabins). Each new camper cabin would be approximately 540 square feet, approximately 18 feet by 30 feet in size.

Additional Camper Condo. A camper condo is considered to be an option if only two new camper cabins would be constructed. The

camper condo would be approximately 1,200 square feet, approximately 30 feet by 40 feet in size, with an approximately 200 square foot deck, approximately 10 feet by 20 feet in size.

New Comfort Station and Shower Facility (for camper cabins and camper condo). A comfort station and shower facility would be constructed to serve the camper cabin and camper condo area. The current wastewater system can support the planned infrastructure, given the planned repairs to the system. The facility would be approximately 900 square feet, approximately 30 feet by 30 feet in size, and sited in the location of the existing store after it is demolished.

Comfort Station Pergola Addition. A pergola (approximately 250 square feet, approximately 25 feet by 25 feet) would be attached to the existing comfort station along the dock area to provide shade, orientation for the visitors arriving at the docks, and wayfinding information such as maps and exhibits.

Maintenance Road between Water Tower and Warehouse. A maintenance road, approximately 2,100 feet long and 8 feet wide, would be constructed from the NPS housing area (upgradient of the camper cabins) to the maintenance area in the northeast portion of Windigo, and from there to the water tower. The road would be a utility-type double-track path (two paths with a grass strip between them) capable of use by a tractor or large forklift for one-way traffic at a time.

Fire Suppression Enhancements. Existing fire suppression capabilities in Windigo facilities would be reviewed and improved as feasible.

Landing Craft Mechanized Dock Relocation. The existing LCM dock would be reviewed for supporting large equipment and delivery operations in Windigo.

Seaplane Dock Improvements. The seaplane dock would be reviewed for improvements, including Architectural Barriers Act Accessibility Standard access and

limited mobility access for emergency operations.

Visitor Center Expansion. The visitor center would be expanded approximately 1,000 square feet (approximately 25 feet by 40 feet in size) to the south to expand office space and include restrooms for staff use. The expansion would be consistent with the proposed unified architectural theme. Fire suppression systems would be installed for areas exhibiting and storing accessioned museum objects.

Visitor Center Service Access. A crushed rock access path (approximately 250 feet long and 8 feet wide) would be developed from the south for the National Park Service's use from the existing road to the concession store.

Interpretive Wayside, Media, and Facilities. Signage on historical activities in the Windigo area would be added at wayside areas along existing trails and new trails. New interpretation materials for Windigo would be developed, likely with posts supporting displays.

Vegetation Management for Shoreline and Views. Vegetation management would occur to improve the viewshed from existing and new facilities, and along existing and new trails. Vegetation management would also be performed to reduce fire and safety hazards.

Utility and Infrastructure Improvements to Support Facilities. Utilities would be extended to new and modified facilities. Current facilities can be serviced with existing capacity. Future facilities will be more efficient and if necessary supplemental solar will be evaluated for implementation as appropriate.

Septic System Improvements. Over time, there may be a need to replace the existing septic field. The current system can be rebuilt at its current location, and if additional capacity is needed, it would be developed in a previously disturbed area near the Bone Yard (a storage facility in the northeast portion of Windigo; see figure 2).

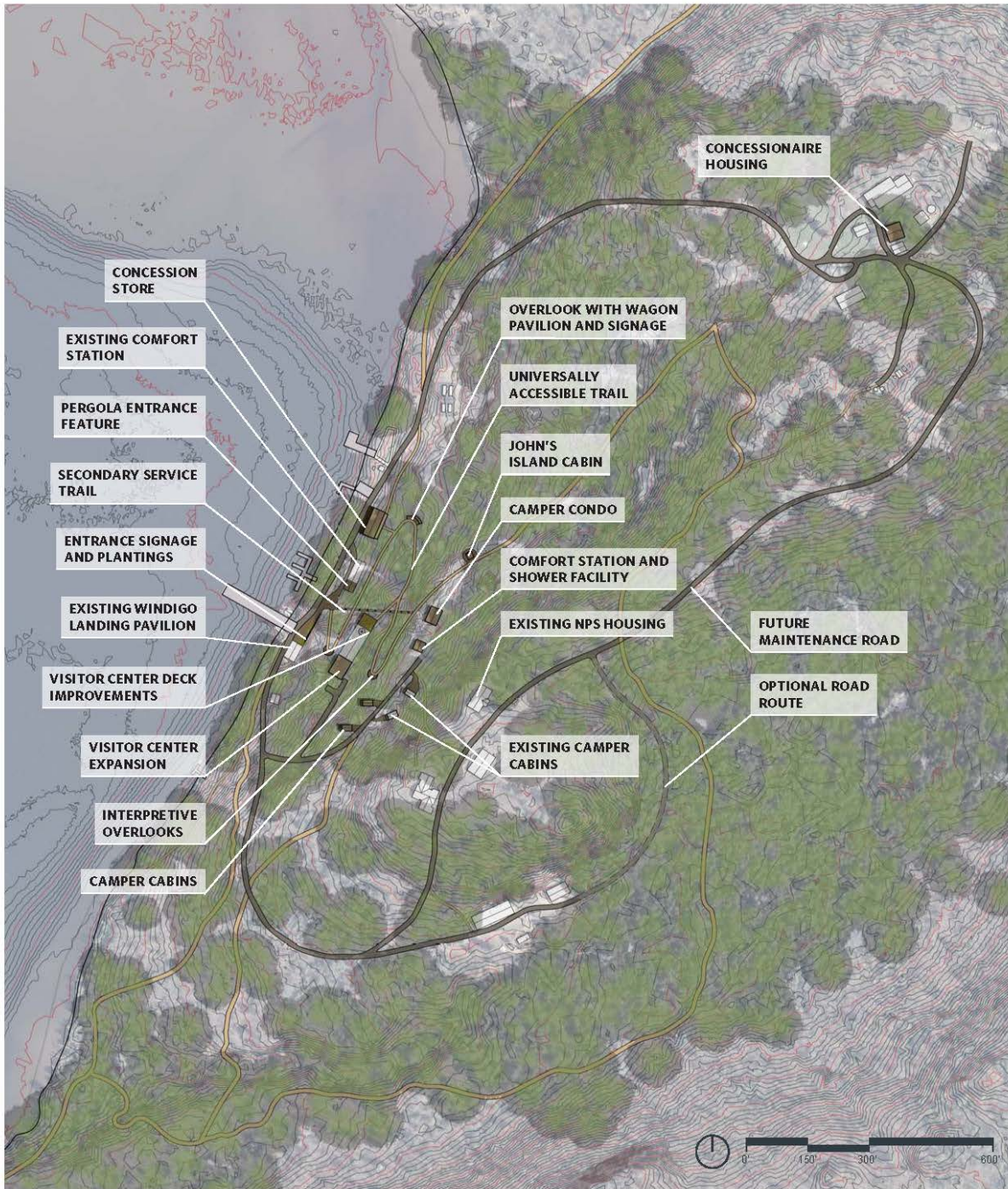
Power System Improvements. Electrical demand for future design will be offset by future solar capacity. Appendix C is an energy load analysis conducted for Windigo.

Wagon Pavilion. An open-air pavilion on gravel with a covered shelter (approximately 180 square feet, approximately 10 feet by 18 feet in size) would be developed to store the 1890s-era wagon (buckboard wagon with undercarriage and wheels) currently stored in the Windigo maintenance yard. The style of the pavilion would be similar to the existing landing dock pavilion, with post and beam construction, and roof with asphalt shingles.

Rustic Cabin. As part of Wilderness Stewardship Plan activities, a cabin from Johns Island in the Isle Royale archipelago is proposed to be relocated in the camper cabin area upgradient of the visitor center for reuse as an interpretive site. The interpretive use of the rustic cabin is a component of the Development Concept Plan. The cabin is approximately 16 feet by 16 feet in size.

2.3 RESOURCE PROTECTION MEASURES

With implementation of the preferred alternative, required mitigation measures would be identified to protect resources that could be disturbed by construction in the immediate vicinity. Best management practices are standard practices implemented to minimize adverse impacts. Appendix B includes those identified and other mitigation measures and best management practices that would be incorporated into the construction documents for the preferred alternative.



FACILITIES INCLUDED IN DEVELOPMENT CONCEPT PLAN

FIGURE 4

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WINDIGO DEVELOPMENT CONCEPT PLAN

FIGURE 4 – FACILITIES INCLUDED IN DEVELOPMENT CONCEPT PLAN

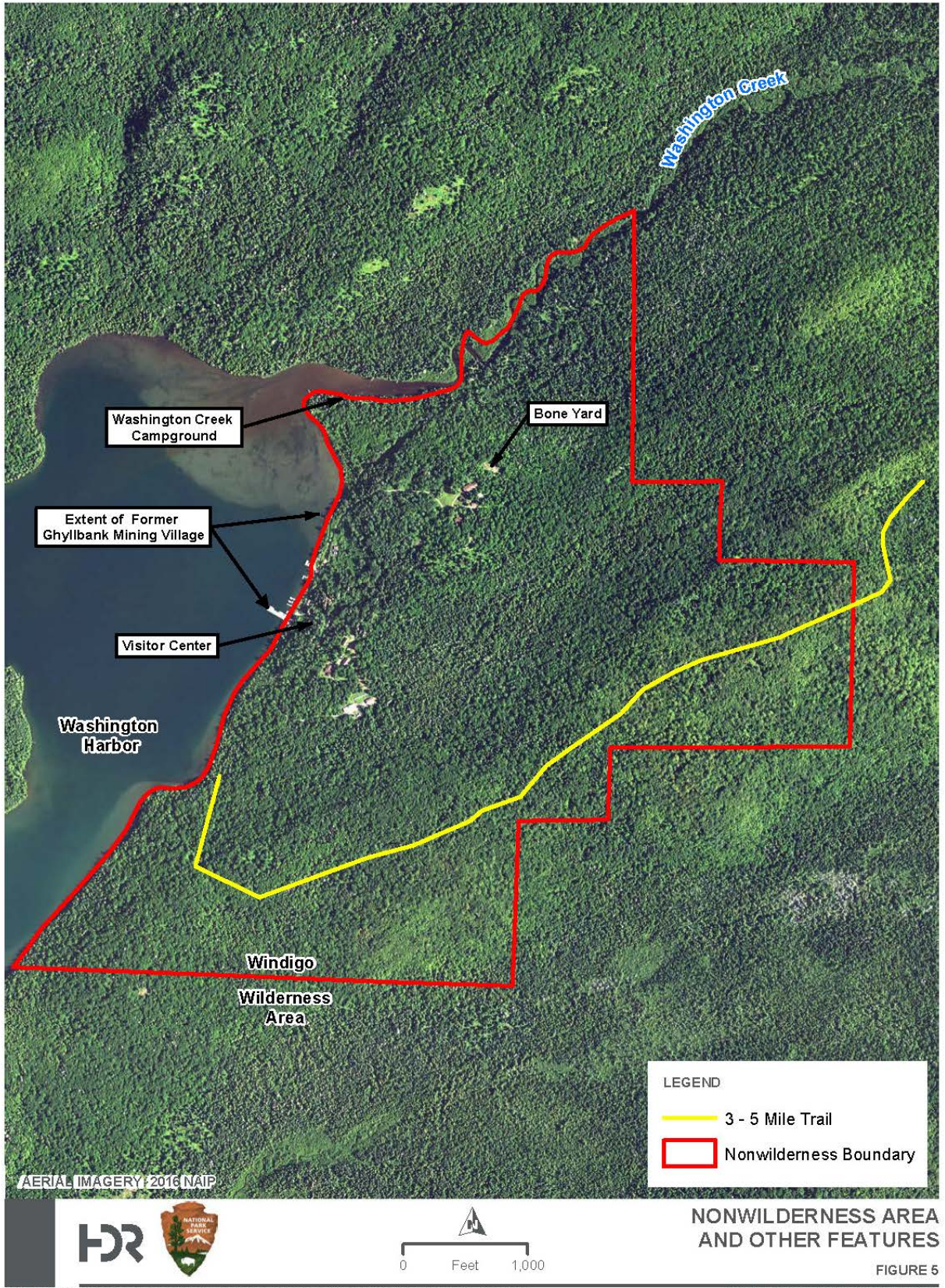


FIGURE 5 – NONWILDERNESS AREA AND OTHER FEATURES



PROPOSED ACTION

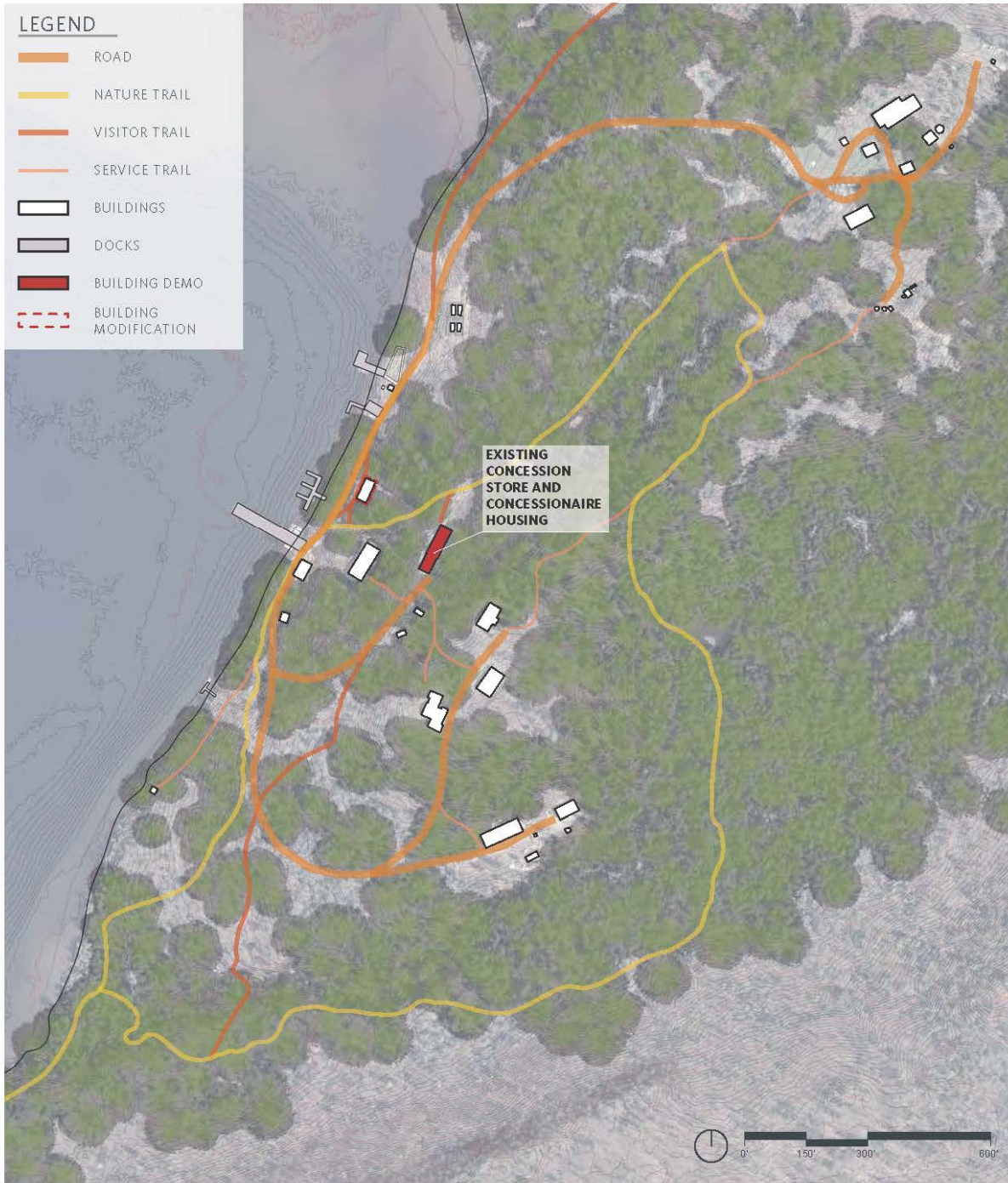
FIGURE 6

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WINDIGO DEVELOPMENT CONCEPT PLAN

FIGURE 6 – PROPOSED ACTION

PURPOSE AND NEED



PROPOSED ACTION DEMOLITION

FIGURE 7

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WINDIGO DEVELOPMENT CONCEPT PLAN

FIGURE 7 – PROPOSED ACTION DEMOLITION

CHAPTER 3: AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 INTRODUCTION

This chapter describes the affected environment and environmental consequences associated with the no-action alternative and preferred alternative. The intent is to provide an analytical basis for comparing the alternatives and the impacts that would result from implementing these alternatives. First, the methodology for conducting the analysis is explained. Then, the affected environment related to visitor experience is described. Finally, the results of the evaluation of environmental consequences on visitor experience are presented, and applicable best management practices and mitigation measures are presented. Visitor experience is the only impact topic (or resource) retained for detailed analysis in this chapter. Elements of other resources eliminated from detailed analysis (such as vegetation, discussed in section 1.5.2), but pertaining to visitor experience, will be addressed as well.

In accordance with the Council on Environmental Quality's Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR 1500–1508), the environmental consequences analysis considers direct impacts and their duration, intensity, type, and context; indirect impacts; cumulative impacts; and measures to mitigate impacts. Potential cumulative impacts are addressed at the end of the chapter. Areas that would be disturbed by the preferred alternative are shown in figure 8 (found at the end the chapter).

3.2 METHODOLOGY

3.2.1 Conducting the General Evaluation

The analysis of potential impacts on visitor experience includes a description of the affected environment and an evaluation of the impacts of implementing either the no-action alternative or the preferred alternative. The impacts are analyzed as if all proposed projects would occur at once to address all potential impacts; however, projects would be constructed in successive phases as funding allows. In reality, the construction impacts are proposed to occur over time. Implementation of projects would be optimized by priority and available funding.

The methods used to assess potential impacts are based on a review of pertinent literature and NPS studies; information provided by on-site experts and other agencies; professional judgment; and NPS staff knowledge and insight.

3.2.2 Evaluating Visitor Experience

As discussed in section 1.5.1, visitor experience is based on the visitors' perception of a variety of resources. Sub-resources of visitor experience include viewshed (the natural environment as well as the architectural elements of the buildings and other structures), vegetation management, operations, safety, recreation opportunities, and interpretative elements. These sub-resources will be discussed holistically in section 3.3 and section 3.4, combined as warranted, and not presented in individual subsections.

3.2.3 Assessing Cumulative Impacts

Activities that could occur under the no-action alternative or the preferred alternative include implementation of the in-process Wilderness Stewardship Plan, Cultural Resources Management Plan, wolf reintroduction, and construction of a 3- to 5-mile-long day trail in wilderness near Windigo.

Cumulative impacts were assessed by considering the impacts of the alternatives in addition to impacts associated with other past, present, and reasonably foreseeable future actions in and near Windigo. To support this analysis, information was gathered on ongoing and future NPS actions. Because some of the projects are in an early planning phase, the evaluation of cumulative impacts is qualitative. Previous and ongoing projects (as well as reasonably foreseeable future projects, such as wilderness trail improvement) were identified, and their potential impacts considered with the new project impacts to review the incremental impact of the preferred alternative on visitor experience.

3.3 AFFECTED ENVIRONMENT

Isle Royale is officially open to visitors from April 16 to October 31 each year. The majority of visitors to the park visit between June and September, with July and August having the greatest turnout. From 1979 to 2017, the average number of visitors to Isle Royale in July was 6,395 and in August was 7,070, with the average number of annual visitors amounting to 19,658 (NPS 2017a).

A visitor survey was conducted in 2017 to measure visitor experience and gather visitor opinions on the overall quality of the facilities, visitor services, and recreational opportunities at Isle Royale. The category indicator of “Assistance from Park Employees” received the highest reviews;

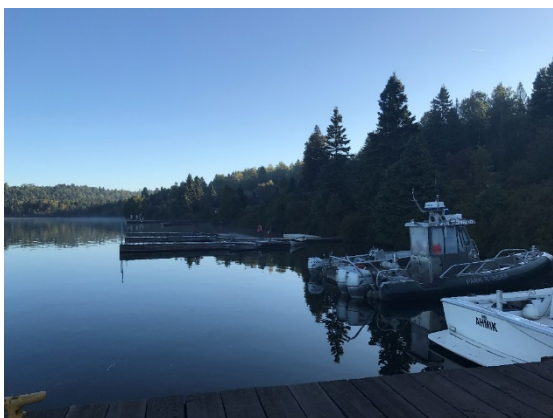
with 84 percent of respondents giving it the best score possible (NPS 2017b). The restrooms at Isle Royale received the lowest score by the visitor respondents, with only 35 percent classifying restrooms as very good and 24 percent scoring the restrooms as average (2017b). The commercial services and pathways (walkways, trails, and roads) at Isle Royale received average scores, 47 percent and 55 percent, respectively (2017b). Overall, 72 percent of respondents gave the facilities, services, and recreational opportunities a score of very good. In comparison to the 2017 overall score, the baseline score (Fiscal Year 2007 to 2016) of the overall quality of facilities, services, and recreational services based on visitor opinions and responses to the survey each year is 68 percent (2017b). Although most respondents commented that the facilities, services, and opportunities were good or very good, there is room for improvement.

Isle Royale retains much of its wilderness character; approximately 80 percent of the viewshed seen by visitors as they arrive at Isle Royale is wilderness. Prominent features observed by visitors approaching Windigo include shoreline vegetation, the docks, and the visitor center. Although arriving visitors view a small sample of what Isle Royale has to offer in terms of scenery and wilderness mystique, there is currently little sense of welcome at a national park (see photograph 1). Visitors arriving are not visually informed that they are approaching a unique location. The isolation of Isle Royale and the resulting hardship associated with transporting building materials and constructing projects led to the development of utilitarian buildings with an amalgamation of architectural styles. The dated and dissimilar structures cause Windigo to stand out from the surrounding scenery rather than appearing to be a natural, complementary extension to the surrounding environment.



PHOTOGRAPH 1 – VISITOR’S VIEW OF WINDIGO AREA FROM THE FERRY DOCK

Visitors can arrive at Windigo via three modes of transportation: a public ferry, a seaplane, or a private boat. Photograph 2 shows the private boat dock.



PHOTOGRAPH 2 – VIEW OF OTHER DOCKS ADJACENT TO THE FERRY DOCK

When visitors arrive at the ferry dock, they face a path with an approximately 18 percent grade slope that leads from the dock to the visitor center. The current path does not meet Architectural Barriers Act Accessibility Standard requirements and can be an arduous walk for elderly visitors or visitors with disabilities. Currently, NPS staff at Isle Royale uses a motorized golf cart to assist visitors who are unable to traverse the steep grades of the trail, and transports them between the dock and the visitor center (see photograph 3). The area adjacent to the ferry dock includes other docks, the pavilion, and bathroom and shower facilities (see figure 2).



PHOTOGRAPH 3 – OUTSIDE VIEW OF VISITOR CENTER SHOWING STEEP TERRAIN AND SMALL DECK

Five additional docks near the ferry dock are used for seaplanes and private boats and are used for fuel deliveries and other maintenance activities. Two other developed areas are northeast and southeast of the dock compound that consist of NPS residences and maintenance support facilities. These developed areas are linked through roads and trails. Several trailheads begin at Windigo, and the Windigo Nature Trail runs along the perimeter of the area.

Visitors may observe that the concession store is showing some structural deficiencies because of its age and exposure to the harsh climate, and has inadequate space, and that the visitor center lacks space for evening programs. Views from the store and from the visitor center to the outside landscape are obstructed by overgrown vegetation (see photographs 4 and 5).



PHOTOGRAPH 4 – VIEW OF CONCESSION STORE

PURPOSE AND NEED



PHOTOGRAPH 5 – OBSCURED VIEW OF WASHINGTON HARBOR FROM STORE DECK

The vegetation in Windigo and around the buildings, structures, and paths is overgrown and in need of trimming; the dying or dead vegetation needs to be removed. The dense foliage obstructs the view of the shorelines from the visitor center and the existing concession store deck, and creates fire hazards (from vegetation near structures) and safety hazards (from branches overhanging trails and structures) (see photographs 6 and 7).



PHOTOGRAPH 6 – OVERGROWN VEGETATION ON TRAIL



PHOTOGRAPH 7 – OVERGROWN VEGETATION ADJACENT TO COMFORT STATION

The current infrastructure of Windigo results in park maintenance operations and visitors often sharing the same space. Because of the isolated nature of Isle Royale, boats are the primary source of transportation for supplies, people, and waste between the island and the mainland. The dock used for passengers and supplies is near the LCM dock used for the transport of waste and large equipment deliveries. Deliveries and commotion associated with the LCM dock creates noise that can be bothersome to the visitors and can diminish their experience of the serenity of the surrounding environment. Currently, the only access between the LCM dock, warehouse, generator, and water tower is the combination road and trail along Lake Superior. The road and trail is used for deliveries from the dock to the warehouse and adjacent facilities, and is also used by all visitors to Windigo. The concentration of traffic along this road and trail, composed of both visitors and maintenance staff, creates a safety hazard and detracts from the overall visitor experience (see photograph 8). The existing septic field serves the visitor area; other septic fields exist for employee housing areas.



PHOTOGRAPH 8 – MULTIPURPOSE ROAD AND TRAIL USED BY MAINTENANCE STAFF AND PARK VISITORS

Recreation opportunities at Windigo include activities based on wilderness experiences (hiking, backpacking, and camping), overnight experiences within Windigo (camper cabins and the Washington Creek Campground), and day trips (visitor center, concession store, boating, kayaking, canoeing, and fishing). Windigo serves as an entry point for wilderness-based recreation. Windigo contains remnants of the Ghyllbank mining settlement, a component of the Windigo mining operation. Visitors can access several hiking trails, including the Greenstone Ridge Trail, the Minong Ridge Trail, the Feldtmann Lake Trail, and the east and west Huginn Cove Trail (NPS 2017c). Windigo provides educational opportunities and interpretative elements on the history, biology, and culture of Isle Royale. Nature walks and dockside talks are available. Evening programs on a variety of natural and cultural history topics are offered regularly. The visitor center contains exhibits and educational publications.

While preserving the wilderness character of Isle Royale is a primary objective for the National Park Service, noise and light pollution generated by human activities around Windigo may compromise the natural sounds and tranquility of the area. Noises in and around Windigo can include, but are not limited to, the sounds of motorboats, generators, aircraft overflights, motorized maintenance equipment, and the activity around the visitor center and concession

store (NPS 2011a). Night lighting from Windigo can be seen within wilderness. During the busy season (July and August), the visitor center and concession store are open from 8 a.m. to 6 p.m. Outside of the busy season, the facilities have a reduced schedule that varies.

The National Park Service enforces quiet hours from 10 p.m. to 6 a.m. eastern standard time across Isle Royale. These measures are adopted in an effort to curtail the disturbance to the bordering landscape and ease the transition from the human-made space to the unhindered environment that is relatively free of human influence.

Beyond the boundary of Windigo, Isle Royale comprises 132,018 acres of designated wilderness (NPS 2016a). The adjacent wilderness areas to Windigo are primarily accessed through Windigo. The wilderness areas provide visitors with the opportunity to experience the natural quality of wilderness and ecosystems largely free of the impacts of modern civilization.

3.4 ENVIRONMENTAL CONSEQUENCES

Visitor experience and the sub-resources discussed in section 3.2.2 were evaluated for potential impacts of the no-action alternative and the preferred alternative. The impact discussion addresses direct impacts (in terms of duration, intensity, type, and context) and indirect impacts, as well as any mitigation measures and best management practices for the preferred alternative related to visitor experience. A complete list of mitigation measures and best management practices for the preferred alternative is included in Appendix B. Potential cumulative impacts are identified in section 3.4.3.

3.4.1 No-Action Alternative

Under the no-action alternative, the existing conditions at Windigo would continue to have adverse impacts on visitor experience. The impacts would occur during their visit (short-term) as well as when later recalling their visit (long-term). Visitors would have

little or no sense that they are welcomed at a national park, and would see varying architectural styles of facilities. In addition, vegetation near the visitor center, concession store, and other facilities would continue to obscure views of Washington Harbor. This vegetation would continue to present potential fire hazards, and vegetation overhanging various facilities would continue to be a safety hazard.

The concession store would continue to operate in poor condition and the visitor center and store would continue to operate with inadequate space to serve visitor needs, both of which would directly affect visitor experience by not meeting visitor needs and expectations. NPS staff would continue to operate golf carts to transport visitors who are unable to climb from the dock area up a steep slope to the visitor center and concession store. In addition, NPS vehicles and hikers would continue to share the same path on maintenance roads and trails, which could have adverse impacts on visitor experience and safety.

Interpretive programs and displays of park features (cultural and biological resources) would continue to partially meet visitor needs and the National Park Service's purpose to provide opportunities for recreation, education and interpretation, and scientific study. Over the long term, continued deterioration of existing facilities, such as the concession store, and limited space of other facilities would continue to affect visitor experience and could lead to declines in visitor numbers, because potential visitors would seek recreation opportunities in other areas of Isle Royale or other regional parks. Direct impacts on visitor experience and the ability of the National Park Service to fulfill its mission at Isle Royale would be adverse, as well as short and long term (occurring both during and subsequent to an individual's visit, respectively).

If visitors are unaware of the value of cultural and biological resources on Isle Royale, these resources could be diminished by visitors trampling areas off trails. Additionally,

knowledge of local history could be lost over time.

Noise levels in Windigo would continue to be affected by current noise generators such as aircraft, motorized boats, and maintenance and construction equipment. Direct impacts on noise levels in the Windigo area would continue to occur and be long-term and adverse. Indirect impacts on noise in surrounding wilderness areas would likely be barely noticeable.

The no-action alternative would not change current night sky impacts in Windigo.

In summary, the no-action alternative would result in adverse impacts on visitor experience from inadequate facilities to meet visitor needs and support recreational opportunities. There would be continued safety hazards on shared paths and from vegetation in close proximity to facilities, and inefficiencies in park operations due to inadequate maintenance roads. There also would be limitations on viewsheds from overgrown vegetation, and limited ability to provide interpretive displays and programs to fulfill the National Park Service's mission to educate the public on cultural and biological resources.

3.4.2 Preferred Alternative

Under the preferred alternative, the National Park Service would construct facilities according to the Development Concept Plan, as discussed in chapter 2. Construction of facilities would occur over time as funds become available. The length of construction projects could vary from a few weeks (for overlooks and interpretive displays) to several months (for the concession store). Funding for constructing the proposed improvements may come from a combination of private sources and NPS sources. Construction equipment and material deliveries, as well as construction waste, would be transported on the LCM dock or contractor boats and would not limit space available for visitors and supplies on ferries. Construction of individual projects would block access to the area under construction

for varying periods (weeks to months). Demolition of the existing concession store would block access to a small area for a few weeks. Existing facilities (such as the visitor center) would be used to the extent practicable during construction, with some access restriction. Proposed new facilities would be constructed with a work and staging area blocked off from public access. Approximately 2.8 acres would be disturbed by construction for proposed facilities (see figure 8), excepting the Windigo Day Trail component in Windigo; development of the trail corridor in Windigo would affect approximately 1.5 additional acres. Direct impacts on visitor experience during construction would be temporary and adverse.

Construction of facilities would temporarily generate dust (that is, particulate matter) near each proposed project within Windigo, resulting in a short-term adverse direct impact on visitor experience. Generation of particulate matter would be mostly from building materials and demolition. Soil disturbance would generally result in little particulate matter because of regular rainfall.¹ Construction impacts on air quality would be localized to the construction site, and would be barely noticeable to visitors. Tree clearing activities, planned to occur between October 1 and March 31 to avoid impacts on migratory birds and northern long-eared bats, would not be seen by most visitors because most visits to Isle Royale occur between May and September.

The adverse impact of noise on visitor experience from construction would vary according to the scale of the proposed project and the type of equipment used. The direct impact of the noise would be localized within several hundred feet of the construction site, but indirect impacts of

construction noise at a lower level would extend into nearby wilderness areas on an intermittent basis.

Building construction (such as a new concession store, new camper cabins, and modifications to the visitor center) would typically result in more adverse noise impacts in Windigo than trail construction or placement of interpretive displays. Because of the phasing of projects, the adverse noise impacts would be short-term (a few weeks to several months) and intermittent over the length of program construction.

If construction occurs during the visitor season, repairs or construction of a new septic system and new septic field is not expected to impact visitors beyond the sights and sounds of construction. The National Park Service will provide waste management functions through pumping of tanks, portables, or other methods if necessary.

Viewsheds from several visitor vantage points would be improved under the preferred alternative by creating a unified architectural theme, replacing and improving existing buildings, and providing better access. As visitors approach Windigo, a greater sense of welcome at a national park would be created through the aforementioned planned improvements. All of the DCP improvements would share a unifying architectural theme, and the proposed comfort station pergola addition would provide orientation and wayfinding. A deck at the new concession store would provide a view of Washington Harbor. Vegetation management would improve the viewshed by clearing excessive vegetation obscuring views from existing and new facilities, and along existing trails.

Extending the maintenance road from the NPS housing area that is southeast of the visitor center to NPS housing and maintenance areas that are northeast of the visitor center would allow NPS staff to reroute much of the current NPS vehicle traffic from a pathway that serves as a trail and maintenance road, to the extended maintenance road. Constructing the universally accessible trail to the visitor

¹ Rainfall at Mott Island, the closest location of rainfall observations, averages nearly 3 inches of rainfall from May through September, approximately 2 inches in October and 4 inches in November. Observations at Mott Island ended in 2016 (Western Regional Climate Center 2018).

center and new concession store would provide a trail meeting Architectural Barriers Act Accessibility Standard requirements from the dock to the visitor center and concession store. Maintenance vehicles and visitors would share an existing road for approximately 100 feet. Maintenance vehicles would continue on the road, while visitors would follow an existing trail to the comfort station and then the universally accessible trail. It is anticipated that more visitors would be able to walk from the dock to the visitor center and that the use of golf carts to transport visitors would be reduced. These improvements would enhance safety and improve access to park features for visitors by reducing the proximity or potential for contact between visitors and vehicles.

The proposed vegetation management would improve safety by reducing the fire hazard around existing buildings and by removing vegetation that overhangs structures and presents a safety hazard.

Recreation opportunities would be supported by the DCP projects. The new concession store would be more accessible to visitors and would support the recent increase in visitor use by providing more space for operations. Store space would be larger than the current space to improve operations for maneuverability of customers and supply storage. The new universally accessible trail to the visitor center and new concession store would meet Architectural Barriers Act Accessibility Standard requirements to move visitors from the Windigo dock area and pavilion to the visitor center, new comfort station and shower facility, new concession store, and new and existing camper cabins. Up to four additional camper cabins would provide additional opportunities for overnight stays, and the proposed comfort station near the camper cabins would eliminate the need for nighttime trips from the cabins to the existing comfort station near the dock.

One of the elements of the Development Concept Plan would be to expand space for

the interpretive program to include information on historic mining to the northeast of Windigo and on the settlement of Ghyllbank (in the area now encompassed by Windigo) that supported mining operations. Additional signage and improvements at the visitor center would enhance interpretive programs, giving visitors a better understanding of cultural resources in the area. An open-air pavilion display of a historic wagon used by the Wendigo Copper Company and relocation of a historic cabin to the camper cabin area would also enhance the interpretive program. Planned expansion of interpretive displays and more space for programs would result in a beneficial impact on visitor experience. Fire suppression systems would be installed for areas exhibiting and storing accessioned museum objects.

Impacts on night skies at Isle Royale during and post construction would be negligible, and barely noticeable to the public. Visitor center and concession store hours of operation and lighting would not be changed. No major sources of lighting would be added under the preferred alternative.

To minimize safety hazards during construction of the proposed facilities, construction workers would be responsible for following recommended safety procedures. An active construction site would be off limits to park visitors; temporary barriers would be used to prevent visitor access into the site, and signs would be installed along haul routes and access points to warn visitors of construction activities. Construction materials would be located within a secure area. Properly implemented safety procedures and security measures would ensure minimal risk to, and impacts on, construction workers, NPS staff, and Isle Royale visitors.

To minimize the impact of noise on visitor experience, the National Park Service would notify visitors to Isle Royale of planned construction and approximate periods. The construction contractor would maintain muffler systems on equipment to minimize

noise generation, and equipment would be operated only as necessary. Construction would be limited to daylight hours.

The planned facilities would be constructed in accordance with accessibility standards as outlined in Director's Order 42, Accessibility for Visitors with Disabilities in National Park Service Programs and Services, and with the Americans with Disabilities Act, Architectural Barriers Act Accessibility Standard requirements, and Uniform Federal Accessibility Standards, as applicable.

In summary, constructing the DCP facilities would result in adverse impacts on visitor experience during construction through small areas blocked from public access and temporary noise and air quality impacts. Post construction, beneficial impacts on visitor experience at Windigo, and overall to Isle Royale, would result from improvements to viewsheds, vegetation management, park operations, safety, recreational opportunities, and interpretation of natural and cultural resources.

3.5 CUMULATIVE IMPACTS

Cumulative impacts are addressed for both the no-action alternative and preferred alternative. For both alternatives, ongoing relevant planning actions identified in section 1.3 are considered for incremental impacts and the potential for cumulative impacts. Two completed projects in Windigo listed in the Development Concept Plan that and are considered in the cumulative impact analysis include:

Helicopter Pad. A helicopter pad was constructed in the northeast portion of Windigo and involved tree removal and, as part of mitigation, development of a bat house. The cleared area for the grass pad is approximately 2,500 square feet, approximately 50 feet by 50 feet in size.

Windigo Landing (Dock) Pavilion. This project included the demolition of the former visitor center and construction of the open air pavilion (approximately 1,500 square feet, approximately 50 feet by 30 feet in size)

located along the lakefront dock area downgradient of the existing visitor center.

3.5.1 No-Action Alternative

Under the no-action alternative, adverse impacts on visitor experience would continue to increase if existing conditions continue at Windigo. Access and visitor experience would continue to be locally affected at Windigo by:

- Its deficiencies and inadequate space at the concession store
- Inadequate space at the visitor center
- Steep slopes from the dock to the store and visitor center
- Use of a shared pathway for visitors and NPS vehicular traffic
- Potential safety hazards and limited viewsheds from growing vegetation
- Limited interpretive displays and programs that constrain the National Park Service's ability to complete its mission to educate the public about Isle Royale resources

Under the no-action alternative, visitor experience and satisfaction with Isle Royale infrastructure would decrease over time. On a regional scale, it is possible that fewer people would visit Windigo from Grand Portage (the shortest ferry route to Isle Royale). Although less likely because of the longer ferry route, some visitors could choose to enter Isle Royale at Rock Harbor instead of Windigo, placing more stress on facilities at Rock Harbor (see figure 1).

To evaluate the cumulative impacts, the National Park Service considered the incremental impacts of the no-action alternative as well as the impacts of the recently completed projects in Windigo, past disturbances, and implementation of reasonably foreseeable actions such as wolf reintroduction, wilderness management (including a new wilderness trail near Windigo), and cultural resources management. The incremental impact of the no-action alternative would result in a less beneficial visitor experience compared to the

preferred alternative. Although the other planned activities would benefit visitor experience, the visitor experience and satisfaction with Isle Royale infrastructure would decrease over time because it would not be improved as part of other planned actions.

3.5.2 Preferred Alternative

Most of Isle Royale is undeveloped wilderness and has not been substantially disturbed. Under the preferred alternative, most of the DCP improvements would be constructed in previously disturbed areas; the exceptions would be constructing the service road to the visitor center, constructing camper cabins, and extending the maintenance road.

However, the maintenance road would consist of a two-track path for a tractor or forklift and would have little adverse impact on the landscape.

Two projects, the helicopter pad and the Windigo landing (dock) pavilion were recently completed. Construction of both of these projects disturbed a limited footprint (50 feet by 50 feet, and 50 feet by 30 feet, respectively). Mitigation for tree-clearing to construct the helicopter pad included construction of a bat house.

The Development Concept Plan includes conducting studies for consideration of two potential future projects—relocating the LCM dock to a location as appropriate to limit or reduce the noise associated with Windigo operations along the lakefront, and seaplane dock improvements to improve access to Windigo. To date, a feasible location to relocate the LCM dock has not been identified, but if a suitable location is found and the project moves forward, additional environmental studies and permitting, such as potential coastal zone management impacts and Lake Superior impacts, would need to be addressed. A Section 404 of the Clean Water Act permit may be required. Depending on the scope of work, permit requirements may apply to the seaplane dock improvements.

The National Park Service is considering an optional road extension, approximately 800 feet in length, from the warehouse to the planned maintenance road. If constructed, approximately 0.5 acre of ground would be temporarily disturbed for the road.

The Wilderness and Backcountry Management Plan and Environmental Impact Statement identified the possibility of constructing a trail from the Nature Trail in the southern Windigo to connect to the Greenstone Ridge Trail in the wilderness area. The potential trail would provide more opportunities for day activities near Windigo. The trail would be approximately 1.25 miles in Windigo, and approximately 0.25 miles in wilderness. The ongoing Wilderness Stewardship Plan Supplemental EIS will address the development of the trail within the wilderness area. .

The Cultural Resources Management Plan seeks to develop a long-term comprehensive strategy for managing cultural resources throughout Isle Royale, including those in Windigo. The plan would be adaptable to account for planned activities in Windigo. Consequently, there would be no conflict in the goals and objectives of the plan with the activities of the Development Concept Plan.

The Final Environmental Impact Statement to Address the Presence of Wolves on Isle Royale concluded that reestablishment of wolves would not considerably detract from the wider array of possible visitor experiences at Isle Royale. Wolves would be released in remote locations away from Windigo and Rock Harbor. However, the Environmental Impact Statement stated that Windigo could potentially be an entry point for transporting wolves by plane if human traffic could be temporarily reduced. For example, if wolves would be transported into Windigo by plane, other modes of transportation into Windigo could be curtailed until the wolves are moved from the plane through Windigo to a release point in the adjoining wilderness. Temporary closures of certain portions of the island for wolf management may be needed, but these

closures would have only a temporary local impact on visitor experience (NPS 2018c) and would not directly affect Windigo. Given that reintroduction of wolves is planned and could occur through Windigo, given that wolves could traverse through the Windigo area, and given that predator-prey relationships within a natural environment area component of visitor experience, the wolf reintroduction plan is relevant for consideration in this analysis.

Projects would be completed in phases over time as funding allows; this would limit the extent of impacts at any given time. In summary, construction of facilities identified in the plan would not substantially contribute

to cumulative impacts on Windigo, Isle Royale, or the region.

To evaluate the cumulative impacts, the National Park Service considered the incremental impacts of the preferred alternative as well as the impacts of the recently completed projects in Windigo, past disturbances, and implementation of reasonably foreseeable actions such as wolf reintroduction, wilderness management, and cultural resources management. The incremental impact of the preferred alternative would result in a more beneficial visitor experience compared to the no-action alternative. No adverse cumulative impacts are anticipated to occur.

PURPOSE AND NEED



AREA OF DISTURBANCE FOR PROPOSED ACTION

FIGURE 8

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WINDIGO DEVELOPMENT CONCEPT PLAN

FIGURE 8 – AREA OF DISTURBANCE FOR PROPOSED ACTION

CHAPTER 4: CONSULTATION AND COORDINATION

The Development Concept Plan is being developed with input from internal scoping, and with input from relevant tribes and resource agencies.

Internal scoping was conducted by an interdisciplinary team from the National Park Service. The team members discussed different concepts and alternatives for the Development Concept Plan, environmental resources potentially affected, and past, present, and reasonably foreseeable future projects that may have cumulative impacts.

On July 24, 2017, the Michigan State Historic Preservation Office concurred with the determination of the National Park Service that no historic properties would be affected within the area of potential effect of the proposed improvements for the new concession store and associated trails in Windigo (see appendix A for agency correspondence). The NPS will conduct archaeological surveys for other Development Concept Plan project areas proposed for disturbance, and if present, coordinate further with the Michigan State Historic Preservation Office and avoid impacting historic archaeological resources.

The shorelines of Lake Superior (a freshwater lake) are subject to the Coastal Zone Management Act. Under the act, each state implements its own coastal management program. Under Michigan's Coastal Management Program, the coastal boundary extends 1,000 feet landward from the ordinary high water mark of Lake Superior (defined as 601 feet above sea level). All lands owned, leased, held in trust, or otherwise legally subject to the sole discretion of federal agencies in their use are excluded specifically from the state Coastal Management Program boundary by the Coastal Zone Management Act. Federally owned lands are excluded from the boundary, and coordination with Michigan Department of Natural Resources determined that a consistency determination

and consultation with the state is not required.

The National Park Service is considering the potential of bringing in a rustic cabin from Johns Island. It is likely that the cabin would be disassembled and then reassembled in Windigo near other cabins. The National Park Service is coordinating with the Michigan State Historic Preservation Office on the relocation. The cabin is eligible for listing on the National Register of Historic Places and could possibly retain its integrity when relocated and reassembled, as well as its historic context (these types of structures were sometimes disassembled and reassembled). The relocation is proposed to occur as part of the Wilderness Stewardship Plan, with the future use of the cabin for interpretation as part of the Development Concept Plan.

Several bands of Lake Superior Chippewa have rights guaranteed by various treaties in the geographic area in which Isle Royale is located. A tribal consultation meeting with the Grand Portage Band was held on November 16, 2017, at the Grand Portage Reservation Tribal Council headquarters in Grand Portage, Minnesota. NPS staff at Isle Royale updated the group on planning for future development at Windigo, noting that development of a Development Concept Plan and environmental assessment is in progress. Isle Royale will be consulting with other tribes concerning the proposed projects.

This environmental assessment will be available for public review and comment during a 30-day period following publication of the environmental assessment. Comments and other input will be summarized in the resulting decision document.

Coordination with the resource agencies and tribes will continue, as needed, prior to and during construction of DCP projects.

The preparers of and contributors to this Environmental Assessment included staff from Isle Royale, the National Park Service

Midwest Region, National Park Service Denver Service Center, and HDR.

TABLE 1 – LIST OF PREPARERS AND CONTRIBUTORS

Name	Title	Agency/Company
Preparers		
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Scott Blackburn	Regional Environmental Coordinator	NPS Midwest Region

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APPENDIXES

Appendix A – Agency Correspondence

Appendix B – Resource Protection Measures

Appendix C – Isle Royale PV / Battery Systems – Operation and Controls Narrative

APPENDIXES

APPENDIX A: AGENCY CORRESPONDENCE



RICK SNYDER
GOVERNOR

STATE OF MICHIGAN
MICHIGAN STATE HOUSING DEVELOPMENT AUTHORITY
STATE HISTORIC PRESERVATION OFFICE

EARL J. POLESKI
EXECUTIVE DIRECTOR

July 24, 2017

SETH DEPASQUAL
SUPERINTENDENT
ISLE ROYALE NATIONAL PARK
800 EAST LAKESHORE DRIVE
HOUGHTON MI 49931-1895

RE: ER97-70 New Windigo Store and Pedestrian Trails: Isle Royale National Park, Sec. 29, T64N, R37W,
Isle Royale, Keweenaw County (NPS)

Dear Mr. SePasqual:

Under the authority of Section 106 of the National Historic Preservation Act of 1966, as amended, we have reviewed the above-cited undertaking at the location noted above. Thank you for submitting *Final Report and Recommendations following Archaeological Investigations at the Ghyllbank Townsite (20IR0224) of Windigo Ranger Station, Isle Royale National Park, Keweenaw County, Michigan* (Scarlett & Chynoweth May 3, 2017). We provided our comments via email and look forward to receiving the revised final report.

It is our opinion that no significant archaeological materials will be impacted by this undertaking. Although no eligible materials are present in the APE, the overall eligibility of 20IR224 remains unassessed as other portions of the townsite have yet to be fully investigated. Therefore, based on the information provided for our review, the State Historic Preservation Officer (SHPO) concurs with the determination of NPS that no historic properties are affected within the area of potential effects of this undertaking.

This letter evidences the NPS's compliance with 36 CFR § 800.4 "Identification of historic properties," and the fulfillment of the NPS's responsibility to notify the SHPO, as a consulting party in the Section 106 process, under 36 CFR § 800.4(d)(1) "No historic properties affected." **If the scope of work changes in any way, or if artifacts or bones are discovered, please notify this office immediately.**

We remind you that federal agency officials or their delegated authorities are required to involve the public in a manner that reflects the nature and complexity of the undertaking and its effects on historic properties per 36 CFR § 800.2(d). The National Historic Preservation Act also requires that federal agencies consult with any Indian tribe and/or Tribal Historic Preservation Officer (THPO) that attach religious and cultural significance to historic properties that may be affected by the agency's undertakings per 36 CFR § 800.2(c)(2)(ii).

The State Historic Preservation Office is not the office of record for this undertaking. You are therefore asked to maintain a copy of this letter with your environmental review record for this undertaking.

If you have any questions, please contact Brian Grennell, Cultural Resource Management Specialist, at 517-335-2721 or by email at GrennellB@michigan.gov. **Please reference our project number in all communication with this office regarding this undertaking.** Thank you for this opportunity to review and comment, and for your cooperation.

Sincerely,

Brian G. Grennell
Cultural Resource Management Specialist

for Brian D. Conway
State Historic Preservation Officer

SAT:BGG



State Historic Preservation Office
735 EAST MICHIGAN AVENUE • PO BOX 30044 • LANSING, MICHIGAN 48909
www.michigan.gov/shpo • 517-373-1630 • FAX 517-335-0348 • TTY 800-382-4568

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APPENDIX B: RESOURCE PROTECTION MEASURES

Resource Category and Action	Responsible Party
Wetlands	—
<p>Wetlands would be avoided to the extent practicable.</p> <p>If any wetlands could not be avoided, the National Park Service would follow the procedures outlined in its Procedural Manual 77-1: Wetland Protection. Any wetland impacts would be minimized to the extent practicable. Any remaining temporary or long-term wetland impacts would be offset through wetland compensation.</p> <p>When compliance with Director’s Order 77-1 Wetland Protection, and Section 404 Clean Water Act is required, the National Park Service would coordinate with the appropriate United States Army Corps of Engineers (USACE) office, Michigan Department of Environmental Quality (Michigan DEQ), and the National Park Service Water Resources Division early on to ensure that Project alternatives and wetland compensation proposals satisfy both processes. Any required Section 404 permit would be obtained through a joint state and federal permit process that has been established between Michigan DEQ and USACE.</p>	National Park Service and Construction Contractor
Cultural Resources	—
NPS policies and procedures for protecting and preserving cultural resources, including guidance addressing unplanned discoveries of cultural resources, would be followed.	National Park Service and Construction Contractor
Soils and Vegetation	—
In accordance with 2006 NPS Management Policies, best management practices would be used for all phases of construction activity, including preconstruction, actual construction, and post-construction.	National Park Service and Construction Contractor
<p>Construction sites would be limited to the smallest feasible area.</p> <p>Ground disturbance and site management would be carefully controlled to prevent undue damage to vegetation, soils, and archeological resources, and to minimize air, water, soil, and noise pollution.</p> <p>Protective fencing and barricades would be provided for safety and to preserve natural and cultural resources.</p> <p>Effective stormwater management measures specific to the site would be implemented, and appropriate erosion and sedimentation control measures would be in place at all times.</p> <p>Vegetation would be cleared only as necessary to construct the proposed facilities and roads, to meet structure safety requirements, and to improve the viewshed in the vicinity of the dock, concessions store, and visitor center.</p>	National Park Service and Construction Contractor
Water Quality or Quantity	—
<p>Implementation of required erosion and sediment controls would minimize impacts on water quality.</p> <p>Controls would be put in place to prevent sedimentation from being carried into the nearby unnamed intermittent stream, and to reduce erosion.</p>	Construction Contractor

Appendixes

Resource Category and Action	Responsible Party
Species of Special Concern	—
<p>Tree cutting to avoid impacts on protected species is planned to occur between October 1 and March 31, to meet Migratory Bird Treaty Act and Endangered Species Act tree-cutting restrictions.</p> <p>A visual reconnaissance of the area affected by the proposed improvements would be completed prior to construction to confirm that no active bald or golden eagle nests are within the affected area. If a bald or golden eagle nest is found, no activity would take place from February through July 15, and eagles or their nests would not be disturbed.</p>	Construction Contractor
Introduction of Non-native Species	—
<p>The Great Lakes Invasive Plant Management Plan would be followed.</p>	National Park Service and Construction Contractor
<p>Disturbance of vegetation in proposed construction areas would be held to a minimum or would take place in previously disturbed areas.</p> <p>Mitigation would reduce impacts to the minimum necessary to accomplish objectives and would include careful site selection, salvaging topsoil and plant materials, and rehabilitation of disturbed areas.</p> <p>Wherever facilities would be removed, the disturbed areas would be rehabilitated and revegetated with native species.</p> <p>Only native species and seed sources near the disturbed site would be used in rehabilitation and revegetation efforts.</p>	National Park Service and Construction Contractor
Visitor Experience and Aesthetic Resources	—
<p>In order to minimize safety hazards during construction of the proposed facilities, construction workers would be responsible for following recommended safety procedures. An active construction site would be off limits to park visitors; temporary barriers would be used to prevent visitor access into the site, and signs would be installed along haul routes and access points to warn visitors of construction activities. Construction materials would be located within a secure area.</p>	Construction Contractor
<p>Construction equipment and material deliveries, as well as construction waste, would be transported on the landing craft mechanized dock or contractor boats and would not limit space available for visitors on ferries (currently the Voyager II and Seahunter III), and supplies for the visitor center and concession store.</p>	Construction Contractor
<p>To minimize the impact of noise on visitor experience, National Park Service would notify Isle Royale visitors of planned construction and approximate timeframes. The construction contractor would minimize noise generated by construction equipment by maintaining muffler systems on equipment. Equipment would be operated only as necessary. Construction would be limited to daylight hours.</p>	National Park Service and Construction Contractor
<p>The planned facilities would be constructed in accordance with accessibility standards as outlined in Director's Order 42, Accessibility for Visitors with Disabilities in National Park Service Programs and Services, and with Americans with Disabilities Act, Architectural Barriers Act Accessibility Standard, and Uniform Federal Accessibility Standards, as applicable.</p>	National Park Service and Construction Contractor

APPENDIX C: ISLE ROYALE PV / BATTERY SYSTEMS – OPERATION AND CONTROLS NARRATIVE

Both of the Isle Royale microgrid sites (Rock Harbor and Windigo) have the same major components: Solar PV array and PV Inverter, Battery Bank and Battery Inverter, three Diesel Generators which can run in parallel, a Site Controller Computer running controls software, and the Electrical Loads being served by the system, such as the various buildings and other equipment at the site (Site Load). The overall goal of the systems is to take maximum advantage of the Solar PV, and to allow the Solar PV to produce as many kilowatt-hours (kWh) of electricity as possible based on the available sunlight, so that the number of kWh produced by the Diesel Generators is as low as possible.

Due to space and economic constraints, the size of the Solar PV and Battery Banks at each site is such that the Solar PV will not produce all of the kWh used at the site – some level of Diesel Generator usage is required to provide the rest of the Site Loads. The Site Controller Computer is in continuous communication with the PV and Battery Inverters, the Generator Controllers, and Meters measuring Site Load, PV Generation, and Battery Inverter power. The Site Controller Computer is also keeping track of the State of Charge of the Battery Bank, knows the time of day, and knows the size and capabilities of the Generators and PV and Battery Inverters. Based on all of this information, it sends commands to the Generator Controllers to turn Generators on and off as needed, and sends power level commands to control the Battery and PV Inverter output.

Because there are no controllable Site Loads at either site (that is, not controllable by the Site Controller Computer), the Site Controller computer must make decisions that result in a balance between the generation sources on the grid at any given time (PV, Diesel Generators, and Battery Inverter if it is discharging) and the Site Load. The Site Controller determines if it is necessary to run Diesel Generators – if at a given time the level of sunlight and the Battery State of Charge are such that the Site Load can be served by a combination of the available PV Generation and the Battery Inverter, then no generators are run. If some combination of high Site Load, low sunlight level, and/or low Battery State of Charge exists, the Site Controller will run generators to serve the Site Load and charge the Battery Bank if this is needed. When choosing which Diesel Generators to run, the Site Controller aims for a Generator loading of 80% of Generator nameplate rating for the best Generator efficiency, to the extent that this is possible based on the size of the available Generators.

In rare circumstances, there may be PV Generation higher than Site Load at a time when the Battery Bank is already full, and even with all Diesel Generators off there may be too much generation on the microgrid. At these times the Site Controller computer will “curtail” the PV Inverter output, that is, command the PV Inverter to operate at a power level lower than would be possible given the available sunlight. This is not a desirable condition as it “wastes” some available Solar PV power, thus the Site Controller uses Battery Charging setpoints which vary by time of day, so that the Battery Bank is not entirely full as the solar day begins. One of the control goals is to always have some room in the Battery Bank during the day so that the Batteries can store excess solar PV Generation if it is available.

The size of the various components in the systems at each site is summarized in the Table below. Site Load can vary quite a bit at each site, so the Site Loads listed below are not absolute maximum values, but what has been observed on a typical day during the main part of the operating season.

Site	Rock Harbor	Windigo
PV Array Size, kWdc	118.8	46.2
PV Inverter Size, kWac	100.0	100.0
Battery Bank Size, nominal kWh	653	288
Battery Inverter Size, kWac	100.0	100.0
Generator Sizes, kWac Nameplate	60, 150, 275	36, 36, 60
Maximum Site Load, typical day, kWac	130	45
Average Site Load, typical day, kWac	60	20
PV Array Size, kWdc	118.8	46.2

Below is a more detailed description of the Princeton Power Systems Generator Control Process (GCP) software, which the software running on the Site Controller Computer at both sites.

Princeton Power Systems Generator Control Process (GCP) – Operational Narrative

The GCP software determines which generator or combination of generators (including no generators) is needed at a given time by monitoring Site Load, PV Generation, Battery Voltage, and Battery State of Charge continuously.

The value of (Site Load) – (PV Generation) is a key value because it represents the amount of power that must come either from the batteries through the Battery Inverter, or from Diesel Generator(s).

If the Battery Inverter can handle the current power requirements as expressed by (Site Load) – (PV Generation), in general no generators will be running, unless a Battery Charging cycle is active (the batteries are being charged). When the Battery Voltage or Battery State of Charge reaches a low set point, a Battery Charging cycle is initiated in the software. The Battery Charging cycle will remain in effect until the Battery Voltage and/or Battery State of Charge reach their high set point.

The GCP software turns one or more generators on in response to a number of conditions:

1. Low battery voltage set point reached (450Vdc typical)
2. High load set point reached for the battery inverter (80kW of battery inverter load on 100kW inverter typ.)
3. If battery inverter is not operating, the GCP will turn generators on/off as needed to cover site load

The GCP turns generators off in response to a number of conditions:

1. High battery voltage set point reached (540Vdc typ.)
2. Low load set point reached for the battery inverter (70kW battery inverter load on 100kW inverter typ.)
3. If battery inverter is not operating, the GCP will turn generators on/off as needed to cover site load

The GCP determines which generator or combination of generators is needed at a given time by calculating values for Minimum Required Generation and Maximum Required Generation. It will look for a generator combination that falls within the power range between the Minimum and Maximum Required Generation values. When doing this, the GCP seeks to load generators at 80% of their rated nameplate values.

The basic equations used to calculate Minimum and Maximum Required Generation are:

Minimum Required Generation = (Site Load) – (PV Generation) – (Battery Discharge Capacity)

Maximum Required Generation = (Site Load) – (PV Generation) + (Battery Charging Capacity)

When Battery Charging cycle is active, Battery Charging Capacity = (Inverter Rated Charging Capacity) and Battery Discharge Capacity = 0.

When Battery Charging cycle is not active, Battery Charging Capacity = 0 and Battery Discharge Capacity = 70kW typ.

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