Upper Peninsula Power Company

Assessment of the Recreation, Wildlife, Loon, and Aesthetic Resources of the

Au Train Impoundment
Alger County, Michigan

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1.0 Study Overview

1.1 Scope of Studies

In December 2005, the Upper Peninsula Power Company (UPPCO) sold land surrounding Boney Falls, Cataract Basin, and a portion of Bond Falls hydro-electric project. UPPCO has announced plans to transfer ownership of non-project lands at the Au Train, Prickett, Victoria, and the remainder of the Bond Falls projects. Although the lands sold in 2005 were outside the Federal Energy Regulatory Commission (FERC) boundaries for the hydro-electric projects, several state and federal agencies, non-governmental organizations, and members of the public expressed concern regarding potential impacts that development of these lands would have on environmental resources within the FERC project boundaries.

E·PRO Engineering & Environmental Consulting, LLC (E·PRO) was retained by UPPCO to evaluate high priority environmental habitat at each of the six projects. E·PRO retained H. Dominie Consulting of Readfield, Maine to conduct the aesthetic study of the impoundments. Work scopes were prepared and distributed to agencies and the public for review and comment. Scopes were revised to accommodate a large percentage of the comments received. Written explanations were provided in those instances where the scopes were not changed.

E·PRO and H. Dominie Consulting conducted field investigations at each of the six impoundments during May, June, and September 2006. They were assisted by technical staff from King and McGregor Environmental, Gomez and Sullivan Engineers, Riveredge Associates, and Wisconsin Public Service. The results of the field investigations are reported by resource area; recreation, wildlife and aquatic habitat, loons (where applicable), and aesthetics.

1.2 Au Train Impoundment

The Au Train Project (FERC No. 10856) is located in the central part of Michigan's Upper Peninsula in Alger County. The Au Train Dam is located approximately 15.3 river miles upstream from the mouth of the Au Train River. The Au Train impoundment is approximately 1,530-acres in size at the maximum water surface elevation of 780 feet mean sea level.

2.0 Recreation Resources

2.1 Introduction

In response to recent requests from UPPCO, several entities Michigan Department of Natural Resources (MDNR), U.S. Fish and Wildlife Services (FWS), U.S. Forest Service (USFS), Keweenaw Bay Indian Community (KBIC), and the Michigan Hydro Relicensing Coalition (MHRC): hereafter, the "Agencies", working collectively, have provided recommendations regarding environmental resources on several UPPCO projects. Among recommendations submitted on March 13, 2006, the Agencies requested that UPPCO review and report on recreation with regard to existing recreational facilities.

2.1.1 Study Objectives

The objective of this investigation was to review and map existing recreation facilities at the Au Train impoundment. In addition, a desktop analysis to determine recreational boating carrying capacity was conducted.

2.1.2 Methodology

Two tasks were involved in assessing the quantity and types of existing recreation facilities at Au Train impoundment. The first task was to review existing information regarding recreation facilities at the impoundment in order to become familiar with the project. The second task was to perform a site visit at the Au Train impoundment in order to assess the existing recreation facilities. During the site visit, a field crew used a boat to travel around the perimeter of the lake and islands to visually determine areas that are being used for recreation purposes. At each site, the field crew exited the boat to examine the site amenities and assess the amount of use. At each recreation site, a GPS location was recorded, a photograph taken, and the appropriate sections of a standard recreation survey form were completed. While in the field, crews also recorded any areas of erosion and/or steep slopes that were associated with the recreation sites.

In addition, a desk top analysis was developed to determine boating carrying capacity levels. The analysis used accepted existing information and methodologies. Criteria and calculations used in the study focused on the concepts of usable lake area, boating densities based on boat type/activity and setting, and lake use rate.

2.2 Resource Assessment

2.2.1 Existing Recreation Facilities

Existing recreation facilities were categorized as either a formal or informal facility. A formal facility is defined as a recreation facility that is actively managed and provides amenities. An informal facility is an area that is currently being used for some form of recreation activity; however the site has not been prepared for public recreation use and is not actively managed.

There are currently two formal and nine informal recreation facilities located on the Au Train impoundment. The site locations are depicted on Map 2-1.

Site R-1, Forest Lake Campground, is a formal campground and boat launching facility (See Figure 2-1). There is a boat ramp, a parking area for 15 vehicles with trailers and 15 passenger cars, and a courtesy dock available to the public for launching on the lake. There is also a 26-site campground with potable water. Each campsite has a picnic table and fire ring. There are two women's, two men's, and one unisex vault privies available around the campground and day use area.

Figure 2-1: Site R-1 Campsite

Site R-2 is a formal campground and boat launch area that is operated by UPPCO (See Figure 2-2). There is no formal parking area for the boat launch; however, there is enough space to park approximately three vehicles with trailers at the site. The boat launch is an unimproved gravel launch. There are seven campsites spread out along both sides of the boat launch that are accessible by vehicle.

Figure 2-2: Site R-2 UPPCO Camping and Day Use Area

Site R-3 is an informal boat ramp located at the end of a gated road (See Figure 2-3). The site is accessible by boat, as well as the dirt/grass road. There are no amenities at the site. While no erosion was observed, there was compaction evident at the site.

Figure 2-3: Informal Boat Launch Site R-3

Site R-4 is an informal boat launching site that is accessible from the water or an unpaved single lane track (See Figure 2-4). There are no formal amenities. Compaction was noted while at the site. The site does not appear to receive much use.

Figure 2-4: Site R-4 Informal Boat Launch

Site R-5 is an informal campsite located on an island, and therefore is accessible from the water only (See Figure 2-5). There is an unauthorized fire ring at the site. The site does not appear to have received recent use, although there are the remnants of a shelter made out of a tarp on the island. There is erosion at the site.

Figure 2-5: Informal Site R-5

Site R-6 is an informal campsite and bank fishing area (See Figure 2-6). The site is also on an island and accessible from the water only. It appears that the site hasn't been used in a while. There is erosion on the shoreline.

Figure 2-6: Site R-6 Access Point

Site R-7 is an informal campsite area (See Figure 2-7). Individuals have made unauthorized improvements to the site, which include a picnic table and fire ring. The site does not appear to have had recent use. There was erosion evident at the site. There is a make-shift shelter that has been constructed using a variety of available coniferous boughs.

Figure 2-7: Site R-7 Fire Ring

Site R-8 is an informal campsite accessible from the water or from a one-lane unpaved road (See Figure 2-8). The road proceeds beyond the Project boundary and accesses Route 94. There is an unauthorized fire ring on site. There was erosion noted along the shoreline. There is also compaction evident at the site. There is a tree blocking vehicle access to the camping area.

Figure 2-8: Site R-8

Site R-9 is an informal campsite that is accessible from the water or from a gated road (See Figure 2-9). There is a fire ring and dock at the site. Erosion was noted where individuals are accessing the site. There was also compaction noted. It appears that the site receives a considerable amount of use.

Figure 2-9: Site R-9 taken from the dock

Site R-10 is an informal campsite that is accessible from the water (See Figure 2-10). It appears that at one time the site was accessible via a one-lane unpaved road. There is a fire ring and picnic table at the site. There is erosion and compaction evident at the site. The site appears to receive some use during the summer season.

Figure 2-10: Site R-10 Picnic Table

Site R-11 is an informal boat launching area. There is room to park two vehicles with trailers. There is erosion evident at the site.

Figure 2-11: Site R-11 Launch from the water

2.2.2 Additional Recreation Observations

In May, June, and September a total of ten visits (May 17, May 22, June 1, June 12, June 19 – 22, June 25, and September 3) were made to the Au Train impoundment by various E·PRO consultants and contractors for numerous concurrent studies. These visits included weekdays and weekend days but did not typically include early morning observations (i.e. before 8am). During each of these visits, the numbers and types of boats observed was noted. The number of boats observed on these dates ranged from zero to eight. The average number of boats observed was four. The boats were being used almost exclusively for fishing, though one pontoon boat was engaged in general sight-seeing.

2.2.3 Areas not conducive to recreation development

The shoreline of the impoundment was relatively flat and did not contain notable areas of steep banks.

Field crews observed eroded banks in two locations at the northern end of the lake, along the west shore. The locations are depicted on Map 2-1. Section 3.0 of this report, Habitat Assessment, further discusses these areas of erosion.

There were a few additional areas of erosion also observed at all of the recreation sites. Some of the sites exhibited a significant amount of shoreline erosion.

2.3 Boating Carrying Capacity

This study is a literature review/desk-top analysis of boating carrying capacity that closely follows the concepts presented in *The Techniques of Estimating Boating Carrying Capacity: A Literature Review* (Bosley 2005). Seven studies, conducted between 1989 and 2004 were reviewed. Of particular interest was a 2001 Michigan study entitled, *Four Township Recreational Carrying Capacity Study: Pine Lake, Upper Crooked Lake, Gull Lake, Sherman Lake* (Progressive Architecture Engineers 2001). Such studies discuss and analyze several factors including concepts such as, useable lake area, boating density, lake use rate, use characteristics, and boater's perceptions of crowding. In addition, safety, environmental impacts, physical characteristics of the water body (*e.g.*, shoreline configuration and depth), and desired experience are often considered.

Because defining a boating carrying capacity (level of use beyond which impacts exceed levels specified by evaluative standards (Shelby and Herbelein 1986 as cited in Bosley (2005)) for a particular water body includes in part the perceptions of users and/or managers/planners it is a somewhat subjective process. For this reason, the results of this analysis are presented as ranges based on assumptions that are made in the process and will provide a point of departure for further discussion regarding appropriate boating carrying capacities for the Au Train impoundment.

2.3.1 Useable Lake Surface Area

The first step in determining boating carrying capacity is to calculate the useable lake surface area of the waterbody. Usable lake surface area is based on the premise that most safety, navigational, and environmental problems associated with boating activity occur in shallow waters (PAE 2001). Useable lake surface area is calculated by determining the total surface area of an impoundment at full pond and subtracting out the area deemed not acceptable for boating purposes. This excluded area is commonly referred to as a no-wake, water safety, or a shoreline buffer zone. In addition to navigational issues, this buffer zone approach generally factors in shallowness and environmental impacts since these aspects are most commonly associated with shallow water areas (e.g., suspension of bottom sediments, decreased water transparency, impacts to aquatic vegetation, shoreline erosion, destruction of fish spawning areas, and loss of fish and wildlife habitat).

The width of the buffer zone typically ranges from 100 to 200-feet around the perimeter of the lake (Bosley 2005) and any islands. Depending on the jurisdiction (e.g., state law, local ordinances/prohibitions), this zone may be extended further out in areas where shoals make power boating hazardous, or other factors are of concern. Michigan law (Part 801m, Marine Safety, of the Natural Resources and Environmental Protection Act (PA 451 of 1994)) establishes a no wake zone of within 100 feet of the shoreline where the water depth is less than 3 feet, and also away from any dock, raft, buoyed or occupied bathing area, or moored vessel. In comparison Maine has established a "water safety zone" of within 200 feet of any shoreline, whether the shoreline of the mainland or an island. No person may operate a watercraft at a speed greater than headway speed while within the water safety zone (Maine 2005).

The useable lake surface area for the Au Train impoundment assuming a 100 or 200-foot buffer was determined using GIS data (see Map 2-2) and is as follows:

	100-Foot Buffer	**200-Foot Buffer**
Lake Area at Full Pond	1489 acres	1489 acres
Area of Buffer	241 acres	465 acres
Useable Lake Surface Area	**1248 acres**	**1024 acres**

2.3.2 Boating Density

Boating density is a recommended spatial requirement, measured in acres per boat. Boating density standards vary due to a number of factors including: waterbody characteristics, types of watercraft and their associated activities, and perceptions of the waterbody users. For purposes of this report, three watercraft types representing the most likely users of the Au Train impoundment have been designated:

- motorized watercraft greater than 25 HP (e.g., water ski boats and personal watercraft),
- motorized watercraft 25HP or less (e.g., fishing boats), and
- non-motorized watercraft (e.g., canoes/kayaks)

In addition, a fourth category designation representing all uses combined has been included.

Some researchers have presented a range for the density standards for boat type/activity designations. A summary of study findings addressing boating density is presented in Table 2-1 below.

Table 2-1: Boating Density Standards
(Acres per boat)

Data Source	Motorized >25 HP	Motorized ≤ 25 HP	Non-motorized	Combined Use
Progressive AE (2001) 1. Ashton 2. Kusler 3. Jackson 4. Wagner 5. Warbach	 20 20 	 10 	 8 	 5-9, 4-9, 6-11* 40 10 25 30
Warren and Rea (1989)	12	1.3	1.3	
Florida DEP (unknown)	10-20 20-50 (water-ski)	5-10	5-10	
EDAW (2004b) 1. Nat'l Rec and Pk Assoc. 2. Bur Outdoor Recreation 3. AZ Outdoor Rec. Coordination Comm. 4. WI Comprehensive Plan 5. LA Pk & Rec Comm.	 	 	 	 4 9 10-20 20-40 20-40
NY State Comp. Outdoor Rec Plan (2003)	15-20 (waterskiing)	6-8 power boats	1	

* values for three lakes

Boating carrying capacity scenarios for the Au Train impoundment were calculated by dividing the usable lake surface area by an assigned boating density. The acres per boat numbers shown in Table 2-2 were calculated by averaging the literature figures in Table 2-1 for each category. Where the literature presented ranges, the mean of the average of the sum of all the high ends of the ranges and all the low ends of the ranges was used.

The results are presented below assuming a 100 or 200-foot buffer zone width for the Au Train impoundment.

Table 2-2: Boating Carrying Capacity Scenarios
Number of Boats on Au Train Impoundment

By Boat Type/Activity	With 100' Buffer	With 200' Buffer
Motorized > 25 HP (20 acres/boat)	62	51
Motorized ≤ 25 HP (7 acres/boat)	178	146
Non-motorized (4 acres/boat)	312	256
Combined Use (26 acres/boat)[1]	48	39

[1] For the combined use category, the high density acres per boat numbers for the three lakes presented in Ashton (1971) as cited in Bosley (2005) were omitted as these are all heavily used lakes (in southeast Michigan) and as such are not readily comparable to the Au Train impoundment. Similarly the National Recreation and Park Association and the Bureau of Outdoor Recreation numbers were omitted as being unrealistically low when considering safety for higher speed activities such as water skiing and the use of personal watercraft.

2.3.3 Lake Use Rate

Lake use rate is the number of boats on a waterbody at one time. Boats on a waterbody originate from either riparian sources (boats moored or docked along the perimeter of the waterbody) or from public boat launch facilities. Progressive AE (2001) as cited in Bosley (2005) suggest that when empirical data on lake use is not available, a conservative peak use rate of 15% of existing riparian boats is appropriate. For boats launched at a public facility, it is assumed that facilities will be used at virtually 100% of capacity during peak recreation times. The lake use rate during peak use periods is found by summing the number of boats from riparian and public launch sources.

Accordingly, capacity at the Au Train impoundment launch sites is estimated at 33 spaces (Forest Lake Campground - 15 vehicles with trailers and an additional 15 vehicle parking spaces, and the UPPCO campground – 3 vehicles with trailers). Assuming one boat per vehicle/rig space this equates to 33 boats.

To make the analysis germane to any dock proposal, an estimate of the number of docks that would not lead to an exceedance of the boating carrying capacity can be back-calculated using lake use rate (i.e., proportion of total moored boats on the lake at any given time) and public access capacity. The following provide examples of how this is done.

100-foot buffer
For example, if one were to assume a 100-foot buffer zone (1248 useable lake surface acres) and that all boats on the Au Train impoundment were to have motors of 25 HP or less (acceptable boating density of 7 acres/boat), the boating carrying capacity for the impoundment would be 178 boats. During peak periods 33 of those boats would be assumed to originate from the public boat launches. That leaves a capacity of 145 additional boats that could be on the water at any given time originating from riparian sources. Further assuming that only 15% of riparian boats are on the water at any one time, the pool of riparian boats moored on the Au Train

impoundment could be as high as 967 boats. If you assume one boat per dock, this translates to up to 967 docks under this scenario.

200-foot buffer

Using different assumptions based on literature findings would lead to a greater or smaller number of boats/docks. To take another example, if one assumes a 200-foot buffer (i.e., 1024 useable lake acres), and a combined use density of 26 acres/boat; the maximum number of boats on the impoundment at any one time would be 39. During peak periods 33 of those boats would be assumed to originate from the public boat launches. That leaves a capacity of six additional boats that could be on the water at any given time originating from riparian sources. Assuming that only 15% of riparian boats are on the water at any one time, the pool of riparian boats moored on the Au Train impoundment could be as high as 40 boats. If you assume one boat per dock, this translates to up to 40 docks under this scenario.

2.3.4 Conclusions

The approach presented above provides a tool for decision-makers to use in determining the boating carrying capacity for a waterbody. Impoundment configuration, width of buffer zone, types of watercraft and their associated activities, and the expectations related to the waterbody all factor into the determination of a boating carrying capacity for a particular waterbody. For the Au Train impoundment a boating carrying capacity range of as few as 39 (200-foot buffer, combined use), to as many as 312 watercraft (100-foot buffer with only non-motorized watercraft) may be appropriate based on the assumptions made in its determination.

Map 2-1: Recreation Resources

Map 2-2: Recreation Resources

3.0 Wildlife and Aquatic Habitat

3.1 Introduction

In response to recent proposals by UPPCO, several agencies (MDNR, FWS, USFS, KBIC and MHRC: henceforward the "Agencies"), working collectively, provided recommendations regarding environmental resources on several UPPCO projects. In their recommendations, the Agencies identified a number of significant or important habitat types and components (for various life stage usage and support), and various species of interest that should be identified and protected. Based on these recommendations, UPPCO collected location data on these natural resources and developed a series of Natural Resource Inventory Maps. The study area for this effort included lands and waters within the FERC project boundaries of the Bond Falls, Prickett, Victoria, Cataract, Boney Falls, and Au Train impoundments. This report reflects the results of this effort at the Au Train impoundment.

3.1.1 Study Objectives

The main objectives of this study were to 1) gather all readily obtainable, existing information on wildlife and aquatic habitat/species associated with Au Train impoundment and FERC project lands, 2) conduct fieldwork to verify the presence and condition of existing data, 3) map and document (on a broad-scale) new occurrences of habitat and species of interest observed during the fieldwork effort, and 4) use these data to develop natural resource inventory maps/databases for each impoundment.

The primary habitat/habitat components and species of interest considered during this study included:

- Nearshore aquatic habitat (littoral) including emergent aquatic vegetation (EAV), submerged aquatic vegetation (SAV), coarse woody debris, clay, sand, gravel, and cobble;
- Possible nesting platform locations and potential nesting sites;
- Waterfowl nesting (including any existing nesting platforms);
- Sandhill crane nesting;
- Great blue heron nesting;
- Wood turtle nesting;
- Wetland habitats;
- Rare, threatened, and endangered (RTE) plant species;
- Bald eagle nesting;
- Osprey nesting (including any existing nesting platforms);
- Goshawk, red shouldered hawk, and other woodland raptor nesting;
- Gray wolf and gray wolf habitat;
- Trumpeter swan;
- Garlic mustard and other nuisance plants;
- Presence of Canada geese; and
- Shoreline erosion and steep slopes.

In addition to these specific natural resource considerations, other habitat types/components and species occurrences were documented and mapped.

3.1.2 Methodology

Existing Data Gathering and Desktop Analysis
UPPCO gathered all readily obtainable, existing information on wildlife and aquatic habitat/species associated with the subject impoundments and project lands. This information was used to develop a series of preliminary, GIS-based maps. These maps were analyzed and used by field crews for existing data confirmation purposes.

Field Surveys and Helicopter Flights
On May 17, 2006 aerial surveys were conducted using a helicopter to document nesting bald eagles, ospreys, and great blue herons, the presence of potential nesting sites (super canopy trees, large snags) and perch trees, the occurrence of individuals of these species, and to verify existing DNR bald eagle data. Weather conditions included partly overcast skies with multi-mile visibility. These surveys were conducted by two wildlife biologists as follows:

- Flying multiple, low elevation (50-150 feet above tree tops) transects (generally less than 100 feet apart) and circular patterns over FERC project lands and all six impoundments, and hovering over many areas of interest to thoroughly observe and document conditions;
- Recording location information using GPS, taking detailed field notes and digital photographs, and sketching the locations of new nest sites onto a set of GIS-generated field maps.

Observations of habitat and other species of interest (i.e., large, significant wetland complexes, woodland raptors, waterfowl and wading birds) were also noted.

Boat and Ground Surveys
Field surveys at the Au Train impoundment were conducted by a 3-person field crew on June 19, 20, 21, and 22, 2006. In addition, a 2-person field crew conducted electronic call surveys for woodland raptors on June 25, 2006. The three-person crew documented conditions using GIS-based field maps and a GPS unit loaded with the following information:

- Shapefiles of the impoundments and FERC project lands; and
- Comprehensive data dictionaries of habitat component information (e.g., for submerged aquatic vegetation there will be pull-down menus for dominant species composition, percent areal coverage, etc.).

The crew navigated along the entire shoreline and sampled, examined, and documented critical aquatic and terrestrial habitat components, and species occurrences. Equipment used to document habitat features and species included:

- Underwater camera;
- Small dredge for sediment and aquatic plant sampling;
- Binoculars;
- Digital camera;
- Field guides;
- CD player with woodland raptor calls (northern goshawk, broad-winged hawk, Cooper's hawk, red-shouldered hawk, barred owl); and
- Depth finder.

The crew collected bathymetry data along transects extending through SAV beds and unique/critical substrate types (coarse woody debris, cobble/gravel bars, etc.). At Au Train, all raptor calls were conducted in general accordance with the U.S. Forest Service's Woodland Raptor Survey Protocol of the Hiawatha National Forest (Hiawatha National Forest 2004).

3.2 Results

3.2.1 Nearshore Aquatic Habitat

The majority of nearshore aquatic habitat at Au Train generally consisted of silts and fine sands along the immediate shoreline. Other nearshore habitat components included large accumulations of submerged coarse woody debris associated with large rafts of floating woody debris and dead logs, and a number of areas of cobble mixed with fine sands. Figure 3-1 shows a typical area of submerged and floating coarse woody debris and Figure 3-2 depicts a cobble island with nearby associated inundated cobble. Coarse woody debris was most common at the southern end of the impoundment, whereas cobble substrates were most common along the southern portions of the western and eastern shorelines.

Dense beds of SAV were ubiquitous throughout the impoundment to depths of 15 feet. Therefore, it was not possible to map individual beds of SAV. SAV habitat at Au Train was composed of plants from the following genera: Vallisneria, Potamogeton, Ranuculus, Elodea, and native Myriophyllum.

Figure 3-1: Coarse Woody Debris

Figure 3-2: Cobble Island and Submerged Cobble Substrate at Au Train

3.2.2 Bald Eagle, Great Blue Heron, and Osprey Nesting

Field surveys revealed the presence of one active bald eagle nest [redacted] The nest contained a single eaglet and was [redacted]

Figure 3-3: Active Bald Eagle Nest at Au Train

In addition to the active nest, a number of bald eagles were observed in flight (see Point Features 1-4, Map 3-4), a perch tree with an eagle in it was documented (see Point Feature 5, Map 3-4), and several suitable eagle perch trees were documented (see Point Features 5, and 23, Map 3-4). No inactive bald eagle nests were observed.

Three occurrences of great blue heron were recorded. Specifically, two great blue herons were observed foraging and one was observed in-flight (see Point Features 8, 9, and 10, Map 3-3). All three great blue herons were observed along the western shore. No great blue heron rookeries or suitable nesting habitat was documented at Au Train.

One osprey was observed in-flight at Au Train (see Point Feature 35, Map 3-3), and a single, inactive osprey platform was documented (see Point Feature 36, Map 3-3). No natural osprey nests were observed; however, there are a couple of small peninsulas along the eastern shore of the impoundment that may be appropriate for the siting of additional osprey nesting platforms.

3.2.3 Waterfowl, Sandhill Crane, and Trumpeter Swan

Five species of waterfowl were observed at Au Train including hooded merganser, common merganser, wood duck, black duck, and mallard. Specifically, there were three occurrences of hooded merganser (Point Features 24 and 25, Map 3-4, Point Feature 26, Map 3-3), two occurrences of common merganser (Point Features 21 and 22, Map 3-3), one occurrence of black duck, one occurrence of wood duck (Point Feature 43, Map 3-4), and six occurrences of mallard (Point Features 29-34, Map 3-3). Figure 3-4 shows a female common merganser and her brood.

Figure 3-4: Female Common Merganser with Brood

In addition to these waterfowl observations, a spotted sandpiper was observed foraging near an island at the southern end of the impoundment (Point Feature 42, Map 3-4). No natural waterfowl nests were observed, however suitable nesting habitat exists for hooded and common merganser, wood duck (islands at the northern end of the impoundment), and mallard.

A large portion of the southern end of the impoundment appeared to be suitable forage habitat for migrating dabbling ducks (Map 3-4). This area was composed of extensive shallow water zones with coarse woody debris substrate and large SAV beds. In addition, portions of the eastern and western shorelines north of the above-referenced area offer foraging habitat for migrating dabbling ducks and wading birds. These areas contain SAV beds and emergent wetlands and occasional areas of coarse woody debris in shallow water. As with the other impoundments examined during this overall investigation, this habitat is distributed primarily in coves and areas protected from wind and waves, and in narrow littoral zones along the eastern and western shorelines of the impoundment.

A large portion of the impoundment is also suitable staging and foraging habitat for migrating diving ducks since many of the SAV beds, and micro-habitat components including coarse woody debris, occur at depths of greater than 12 inches.

Four occurrences of Sandhill crane were documented at Au Train (Point Features 38-41, Map 3-4). The wetland areas located at the southern end of the Au Train impoundment provide suitable foraging and roosting habitat for Sandhill cranes. During field surveys, biologists observed Sandhill cranes foraging in these wetlands on a daily basis. Twenty-six cranes were observed at one time. Cranes frequently flew in to the islands in the late afternoon and early evening, suggesting they may roost in the wetlands. Both adult and immature birds were observed. All immature birds observed were capable of flight. No evidence of nesting was found at Au Train, although unison calls were heard. In the Upper Peninsula, Sandhill cranes nest most commonly in sphagnum bogs (Tacha et al., 1992), a habitat that is not present at Au Train Basin.

Trumpeter swans nest on a wide variety of freshwater marshes, ponds, lakes, and rivers that vary in size, elevation, hydrology, water chemistry, macrophyte and invertebrate communities, topography, surrounding vegetation, and level of human disturbance (Mitchell, 2004). In general, Trumpeter Swans prefer large, shallow wetlands one to three feet deep with a diverse mix of emergent vegetation and open water (WDNR, 2003). Nesting habitat parameters include room for take off (approx. 100 m); accessible forage; shallow, stable levels of unpolluted, fresh water; emergent vegetation, muskrat or beaver house island or other structure for nest site; and low human disturbance (Mitchell, 1994). Species of submerged aquatic vegetation (SAV) preferred by swans include pondweed (Potamogeton) and water milfoil (Myriophyllum), along with such emergent plants as arrowhead (Sagittaria), bur-reed (Sparganium), bulrush (Scirpus), sedges (Carex), and wild rice (Zizania).

Suitable habitat for Trumpeter Swans was present in the shallow wetlands found at the southern end of the Au Train impoundment. This area contained extensive areas of SAV and emergent wetland vegetation; including some of the food plants preferred by Trumpeter Swans (one species preferred by swans, wild rice, was not present at Au Train).

3.2.4 Wetlands and Significant Upland Habitats

Two vegetated wetland types were observed and mapped at the Au Train impoundment. These were classified in accordance with Cowardin et al. (1979) and consisted of the Palustrine Emergent Persistent (PEM1), and Palustrine Scrub-shrub Broad-leaved Deciduous (PSS1) cover types. Figures 3-5 and 3-6 show the typical wetland habitat found at Au Train. These occurred at the southern end of the impoundment and protected shores and coves along the western and eastern shorelines of the impoundment (see Maps 3-1 and 3-2).

Dominant plant species that were observed within the emergent wetland cover types included reed canary grass, tussock sedge, broad-leaved cattail, burreed, lake sedge, spadderdock, spike rush, soft stemmed bulrush, sensitive fern, boneset, water horehound, swamp milkweed, and blue flag iris. At the time of the field surveys, indicators of wetland hydrology associated with the emergent wetland cover type included saturated soils and some small areas that were inundated by water depths generally less than 12 inches. Plant species that were common to the shrub wetland cover type included the above-listed species as well as tag alder, sandbar willow, sweet

gale, silky dogwood, American elm, and black ash. Indicators of wetland hydrology associated with the shrub wetland cover type included saturated soils and water marks.

Figure 3-5: Typical Emergent Wetland Habitat at Au Train

Figure 3-6: Typical Shrub Wetland at Au Train (at water's edge)

Other than the occurrence of perching trees and cavity trees, lands within the FERC project boundary did not appear to contain unique or significant upland habitat.

3.2.5 Wood Turtles

No wood turtles were observed at Au Train. Several creeks flow into the Au Train impoundment including Joe Creek, Johnson Creek, and Slapneck Creek. All three creeks, as well as the Au Train Falls and river at the outlet, were investigated for suitable wood turtle habitat. In general, the three creeks contained cool flowing water with cobble bottoms and little aquatic vegetation. [redacted] The shoreline of the impoundment proper did not appear to have any suitable wood turtle nesting habitat.

3.2.6 Woodland Raptor Nesting

Surveys for woodland raptors generally followed the Woodland Raptor Survey Protocol of the Hiawatha National Forest (Hiawatha National Forest, 2004). Broadcast calls of five woodland raptors were conducted during daylight hours. Surveys were not conducted during high winds or heavy rains. Raptor calls were taken from the Stokes Field Guide to Bird Songs, Eastern Region CD (1997). Each species' call was played on a portable MP3 player (Western Rivers Predation) three times with 30 seconds of silence after each playing to listen for a response. Calls of five species were played: Northern Goshawk, Red-shouldered Hawk, Cooper's hawk, Broad-winged Hawk, and Barred Owl.

Raptor calls were played from 16 locations on FERC project lands adjacent to the impoundment, and at one location downstream of the impoundment at Au Train Falls. Red-shouldered hawks answered the call playbacks and were observed at three of the 16 locations along the impoundment. Barred Owls responded at a fourth location. No responses by Northern Goshawk, Cooper's hawk, or Broad-winged Hawk were recorded at Au Train. Additional observations included a Broad-winged Hawk near the state campground on the western shoreline and a Cooper's hawk in-flight near Au Train Falls. In general, the forests surrounding the Au Train impoundment appeared to be suitable for nesting woodland raptors.

3.2.7 Presence of Nuisance Species

Reed canary grass and orange hawkweed were the only nuisance plant species observed during field surveys at Au Train. Orange hawkweed was widely distributed in sparse patches in upland areas, and reed canary grass was widespread and common in wetlands along the shorelines of the Au Train impoundment. Garlic mustard has been documented in the vicinity of the impoundment; however, none was observed on lands within the FERC project boundary during this study.

Canada goose was the only nuisance wildlife species documented at Au Train. Canada geese are listed as a nuisance species because the resource agencies have indicated that in large numbers they have the potential to become a nuisance. Specifically, five separate occurrences of Canada geese were documented (Point Features 13 and 17, Map 3-3, and Point Features 12, 14, 15, and 16, Map 3-4). In addition, evidence of extensive use of the Au Train impoundment by Canada geese included tracks, dropping, and stands of heavily grazed reed canary grass. Figure 3-7 shows a small flock of Canada geese at Au Train.

Figure 3-7: Canada Geese at Au Train Emergent Wetland

No other nuisance plant or wildlife species, either terrestrial or aquatic, were documented at Au Train.

3.2.8 Wild Rice Surveys and Possible Restoration Assessment

No wild rice was observed at the Au Train impoundment. The substrates at the northern end of the impoundment that occur in shallow water are not conducive to the growth of wild rice. In general, these substrates are coarse cobble or sand, with little silt, muck or organic matter. At the southern end, pockets of thick organic material can be found among the islands, although there is little flow in these areas. Overall, it is possible that a wild rice restoration effort would not be successful at the Au Train impoundment without an extensive Canada goose exclusion system/program.

3.2.9 Shoreline Erosion and Steep Slopes

At Au Train, erosion features were found at three locations, two in the northwest corner of the impoundment (Map 3-1) and one in the southeast corner (Map 3-4). At the sites found at the northwest corner of the impoundment, the erosion was limited to steep banks composed primarily of sand and unconsolidated material. Although relatively tall and steep, the horizontal length of the eroding banks was relatively short (60 and 40 feet long). At the southeast corner of the impoundment, a small area of mass wasting was observed not far from the earthen dike. This area was about 30 feet long. Figure 3-8 shows one of the northwestern areas of erosion at Au Train.

Figure 3-8: Small Erosion Area at Au Train

3.2.10 Impoundment Fisheries

According to data collected by the Michigan Department of Natural Resources (MDNR), the Au Train impoundment is a warm-water fishery that supports a variety of game and non-game fish species. Piscivore species found at Au Train include northern pike, walleye, and smallmouth bass, and panfish species that occur in the impoundment include rock bass, yellow perch, and pumpkinseed. In addition to these species, other fish species sampled by the MDNR include white sucker, brown bullhead, common shiner, golden shiner, bluntnose minnow, and blackchin shiner. All of the above-mentioned species were observed by the MDNR during the most recent sampling effort conducted in 2004.

3.2.11 Other Wildlife Species Observations

A number of other wildlife species or signs of wildlife species were documented at Au Train. Please note that the intent of this section is to provide anecdotal information on species observed at the time of the survey. This list is not intended to be all inclusive and does not include all species that would be expected to utilize habitats at the Au Train impoundment during various seasons and life stages. The species observed by biologists at the time of the surveys included the following:

Mammals	Birds	Birds Observed by Others
Raccoon	Bluejay	Wood duck
Beaver	American redstart	Blue-winged teal
Muskrat	American crow	Black-bellied plover
Black bear	Northern parula warbler	Semi-palmated plover
Amphibians	Hermit thrush	Killdeer
Green frog	Northern flicker	Spotted sandpiper
Mink frog	Raven	Solitary sandpiper
Reptiles	Brown creeper	Greater yellowlegs
Northern water snake	Belted kingfisher	Lesser yellowlegs
	Common grackle	Least sandpiper
	Winter wren	Baird's sandpiper
	Cedar waxwing	Pectoral Sandpiper
	Downy woodpecker	Buff-breasted sandpiper
	Red-eyed vireo	Wilson's sniper
	Hairy Woodpecker	Caspian tern
	Ovenbird	Trumpeter swan
	Yellow-bellied sapsucker	Northern harrier
	Yellow-rumped warbler	Peregrine falcon
	Common Loon	Semi-palmated Sandpiper
	Chestnut-sided warbler	
	Black and white warbler	
	Common yellowthroat	
	Black-throated green warbler	
	White-throated sparrow	

3.2.12 Gray Wolf Consultation

UPPCO was requested by the agency stakeholders to investigate possible impacts to Gray Wolf habitat and/or populations with regard to any proposed increases to recreational development and uses at the projects. UPPCO requested information from the Michigan Department of Natural Resources (MDNR) in February, 2006. On July 19, 2006 E·PRO Engineering & Environmental Consulting, LLC received an e-mail response from MDNR.

"Mr. Campbell
I have reviewed our data sets on wolf movements in particular around the flowages in question. Wolves are habitat generalists and distributed widely in the Upper Peninsula monitoring data on wolves suggests that the area surrounding the flowages are probably used at least occasionally by wolves, particularly in the western Upper Peninsula where telemetry data and pack surveys have shown wolves using territory within a mile of the shoreline of Bond, Victoria and Prickett flowages."

Brian Roell
Wildlife Biologist
Wolf Coordinator
Michigan Dept. of Natural Resources

(E-mail between Brian Roell, MDNR and William Campbell, E·PRO)

Map 3-1: Habitat Inventory Map

Map 3-2: Habitat Inventory Map

Map 3-3: Species Observations and Habitat Components

Map 3-4: Species Observations and Habitat Components

4.0 Common Loons

4.1 Introduction

In response to recent proposals by UPPCO, several agencies (MDNR, FWS, USFS, KBIC and MHRC: henceforward the "Agencies"), working collectively, have provided recommendations regarding environmental resources on several UPPCO projects. Among recommendations submitted on February 1, 2006 and March 1, 2006, the Agencies requested that UPPCO evaluate and map potential loon nesting habitat on the Au Train impoundment.

In the Agencies' recommendations, potential nesting habitat is defined as "islands with minimal or light evidence of human activity, quiet bays or coves, and shoreline areas with minimal road access". For the purpose of this study, a more encompassing set of known parameters necessary for loon nesting were considered. These include physical habitat, water levels, water quality, foraging habitat, chick rearing habitat and human disturbance. The following discussion of these parameters is based on Evers 2004, and others as cited.

Physical Habitat
In general, loons prefer lakes that are greater than 60 acres with numerous islands and complex shorelines. Nests are created within a few feet of the water's edge and preferred nesting locations include small islands (usually the leeward side), floating bog mat and grassy hummocks. Marsh and mainland sites are of lower preference and are usually selected only when better habitat is not available. Appropriate nesting locations must possess sufficient nesting materials on-site, as loons use only what materials are readily available and will not carry nesting materials to a nest site from other locations.

Water Levels
On average, a change in water level greater than 0.5 vertical feet up, or 1 vertical foot down occurring within a 28-day period can adversely impact the nesting success of common loons nesting on non-floating sites (Fair, 1979). Increases in water level can result in flooding of the nest, while decreases can hinder accessibility to the incubating loons. Reduced accessibility may cause greater time elapse as incubating adults perform nest switches, leaving eggs exposed to cooling or predation. Receding water levels may even render a nest entirely unreachable to incubating loons.

Water Quality
Loons are visual hunters; therefore, clear water is crucial for efficient foraging. A Michigan study (Gostomski and Evers 1998) documented marked differences in foraging rates between loons on Lake Superior versus at Seney National Wildlife Refuge: the study speculated that this discrepancy may be due, in part, to differences in water clarity in the two locations. Evers later summarized his findings for this study with the observation that time spent for foraging adults in turbid water was significantly greater than in clear water (Evers 2004). Barr (1996) documented that secchi disk readings of 1.5m or less alter loon foraging behavior. A study of total suspended solids in Seney National Wildlife Refuge, Michigan, documented a preference by breeding loon pairs for lakes that have less than 28 Nephelometric Turbidity Units (NTU), while lakes over that level were not used for nesting purposes (Evers 2004).

Foraging Habitat
Abundant small fish are necessary for sustenance and rearing young. Loons tend to forage in shallow (less than 5m) littoral zones within 50 to 150m from shore (Strong and Bissonette 1989, Ruggles 1994, McIntyre and Barr 1997). Preferred prey species (such as yellow perch, *Perca flavescens*) and size classes (10 to 15 cm) are often found in this zone (Barr 1996).

Chick Rearing Habitat
Ideal chick rearing habitat occurs in shallow, nearshore areas that are protected from wind and waves. Successful nursery areas must possess ample forage of adequate size classes for feeding young.

Human Disturbance
Human disturbance is well known to affect loon nesting and productivity (Lucas, 1967, Titus and Vandruff, 1981). Human disturbance includes (but is not limited to) the intrusion of boaters, anglers, sightseers etc. into a territory or near a nest site. Construction within a territory or near nest sites can also constitute human disturbance. Vermeer (1973) found a significant inverse correlation between the number of breeding loon pairs on lakes in east-central Alberta, and the amount of human disturbance occurring on those lakes. Robertson and Flood (1980) found that loons may relocate to marginal nest sites when their productivity is compromised. Human disturbance can certainly apply such pressure on nesting loons: in a Minnesota study, Titus and Vandruff (1981) found that loon pairs experiencing fewer human contacts produced more surviving young.

4.1.1 Study Objectives

The objective of this study is to evaluate and map potential loon nesting habitat at Au Train impoundment.

4.1.2 Methodology

This assessment included a field component as well as a literature review. All tasks regarding this study were performed by E·PRO Environmental Specialist Shearon Murphy, who has over 9 years experience observing, managing and handling common loons. During her site visit, she was assisted by Jamie Nuthals, Environmental Consultant for Wisconsin Public Service.

The literature review was performed to gather information regarding loon nesting habitat parameters which may not be readily apparent during a site visit. Information sought included: water quality (secchi disk and total suspended solids) data as available in relicensing studies; data regarding general fish abundance in littoral zones as available in relicensing studies; and water level operating regimes. In addition, several published studies as well as Michigan loon-related websites were consulted to gather information on the general common loon population in the area.

The field component of this assessment consisted of performing a site visit to the impoundment on June 12, 2006. During this site visit, all shorelines (including islands, coves and bays) were carefully inspected by boat. The boat was operated at a very slow speed, and was navigated as

close to shoreline as possible along the circumference of the lake as well as all islands. Areas of highly suitable habitat were inspected on foot. Frequent visual sweeps of the lake were made to look for loons on the open water.

During the site assessment, several observations were documented. These included:

- observations regarding presence or absence of territorial loons;
- detailed notes regarding presence and quality of critical habitat parameters,
- photographs of high quality habitat areas; and
- general location of all potential suitable nesting habitat areas using GPS.

Upon return from the site visit, the location of high quality/optimal potential common loon habitat areas were depicted on a GIS-based map.

4.2 Resource Assessment

4.2.1 Available Habitat

Several areas of potential nesting habitat, with varying degrees of suitability, were identified on Au Train: these are represented on Figure 4-1. The area containing the best overall habitat on the lake is a complex of islands, roughly ½ mile to the north of the Forest Lake State Forest Campground boat launch ("Island Complex 2"). [redacted] which would likely preclude loon nesting within the vicinity. An island located just to the south of this complex ("Island 3"), near the west shore, provides fair/good habitat, but may be limited by human disturbance from nearby campsites.

Another area of high quality nesting habitat is located in a series of small coves on the west shore, roughly halfway between the mouth of Johnson/Black Stream and the southern dike ("Cove 6 Complex"). This area is characterized by a protected cove with a small island within it. The island has shorelines that are suitable for common loon nesting, and the area provides shelter and littoral zones for the brooding of young. A small cove and island complex on the west shore, near the north end of the lake also ("Cove/Island 1") contains some good nesting habitat.

Finally, an island complex at the south end of the lake ("Island 7") contains good nesting habitat on the shorelines, but may be limited by exposure and overall shallowness throughout the area. Coves 4 and 5 contain potential, but suboptimal nesting habitat.

4.2.2 Presence of Loons

During the June 12 site visit, a pair of common loons was observed foraging along the east shore across from boat launch at the Forest Lake State Forest campground. They were noted several times throughout the day in the same general area. The pair vocalized at bald eagles as they passed overhead, but displayed no territorial behavior. At one point, the birds foraged within a few yards of the surveying biologists' boat without any indication of agitation due to human presence. The general shoreline area traversed by the pair is depicted on Figure 4-1: note that the pair used open water from near-shore to mid-lake along the area depicted.

Loons were also observed by other E·PRO personnel and their contractors, who visited the impoundment for various other studies in May and June: these observations are also depicted on Figure 4-1. A single loon was noted near the south end of the impoundment, by Heather Seiders, on June 1. A single loon was observed foraging along the east shoreline south of the boat launch, by Dave Dominie, on June 24. Lee Harper (Riveredge Associates) spent several days on the impoundment while performing numerous wildlife and habitat studies. Dr. Harper noted that loons were "observed commonly" on Au Train. He documented individuals in the area of Island Complex 2 on June 19 and June 25. The bird observed on the 19th revealed a single aluminum leg band. Loons were observed in the area of Cove 4 on June 22 and June 25. Another individual was observed near the Cove 6 Complex on June 22. In addition, three loons were observed flying over the lake on June 25 (not depicted).

Although several loons were observed using the impoundment during the summer of 2006, no territorial or nesting behavior was documented.

4.2.3 Limiting Factors

Au Train provides several areas with appropriate physical habitat for common loon nesting and brooding. Water clarity appears to be adequate for efficient foraging. Human disturbance appears to be likely to varying degrees, with higher probability near the existing campground and boat launch. The Application for Initial License, Volume II, Exhibit E, Environmental Report indicates that several fish species are present in the impoundment, and it documents several littoral areas that may harbor forage fish adequate for brooding. It does not, however, quantify the available forage base.

According to ordering paragraph B(2)(2) of the Au Train Hydroelectric Project's FERC license, the impoundment's capacity is calculated at elevation 780 feet, local datum. Article 401 of the license states that the project shall be operated in a modified run-of-river mode, with drawdowns as necessary to maintain a minimum discharge of 50 cubic feet per second. The prescribed absolute minimum water surface elevation is 772 feet, local datum. This suggests that is it possible that water level fluctuations exceeding the known range of tolerance for nesting loons could potentially occur during the summer months. This may not affect whether loons attempt to breed on the lake, but it may impact their success if they were to nest.

Overall, there appear to be no readily observable factors that would limit use of this impoundment by common loons for nesting.

4.2.4 Conclusions

This impoundment harbors some areas of high quality nesting habitat. This, coupled with the fact that loons were frequently observed here, suggests that the lake could potentially be used for nesting. The areas which contain the best available habitat include Cove/Island 1, Island Complex 2, and Cove 6 complex.

Map 4-1: Loon Survey

5.0 Aesthetic Resources

5.1 Introduction

5.1.1 Study Objective

The main objective of this study is to map and identify areas considered to have high aesthetic value; and describe "why these areas have high aesthetic value and who values the aesthetic resources." It was conducted by H. Dominie, Consulting.

5.1.2 Methodology

While it is often said that "beauty is in the eye of the beholder," i.e., one can't necessarily predict what another individual will find aesthetically pleasing, it is equally true that as a culture, and frequently across cultures, we share many visual preferences in common. For instance, most of us highly value landscapes with water, especially when in combination with dramatic relief (Zube 1973).

Available research on visual perceptions was relied upon in designing and conducting this study. Over the past four decades, researchers have made great strides in developing reliable and replicable procedures to identify and assess visual resources, and understand which landscape components are most valued and why.

The assessment procedure encompassed two major steps: To understand the visual attributes of the project area and who uses and values it, and develop and apply an appropriate visual resource assessment method, several tasks were undertaken. These are described below.

Task 1 – Developing the Assessment Method involved the following tasks:

- Reviewing prior UPPCO studies for the impoundment and current management plans; searching the web for any information on scenic lake assessment in Michigan and the Upper Peninsula in particular (and found nothing related) and studies from other places[1]; and speaking with fisheries biologists, land managers, campground managers, and outfitters familiar with the Upper Peninsula to learn which lakes and attributes are generally considered visually special and why.

[1] Hiawatha National Forest: Assessment Report for Transition to Scenery Management System, 2003
Huron-Manistee National Forests: Scenic Variety Indicators (courtesy Thomas Kokx Associates)
Jones, J. and H. Dominie (1997). Maine Land Use Regulation Commission: Scenic Lakes Assessment in Maine's Unorganized Towns
Maine Tomorrow. A Comprehensive Land Use Plan for the Moosehead Lake Region, for the Maine State Planning Office (visual analysis section by H. Dominie)
Millward, H. and D. Allen (1989) "The scenic resources of Nova Scotia: A macro-scale landscape assessment." As reported in: Natural History of Nova Scotia, Volume 1: Topics, Nova Scotia Museum of Natural History.
National Park Service: North Country National Scenic Trail Draft NE Minnesota Route Assessment and Environmental Assessment
Tahoe Regional Planning Agency (2003), Draft Proposed Scenic Review System for Shorezone.

- Reviewing GIS (geographic information system)-based maps or data provided by E·PRO identifying:
  - Elevation intervals, i.e. changes in elevation at intervals of 100 feet above the elevation of the lake surface within ½, 3, and 7 miles; and slope change within ½ mile;
  - Highly configured shorelines (i.e., those with greatest shoreline per unit of lake area);
  - Land cover (i.e., deciduous, conifers, mixed wood, wetland, open land, agriculture, and developed);
  - Topography;
  - Special features such as wildlife viewing areas;
  - Recreation facilities (informal trails, campsites, boat launches, boating activity, etc) and public roads of the project area; and
  - Public lands (for potential insight into public use patterns).

- Dividing the impoundment into "subunits" (created by landform configurations of islands, points, coves, and bends in the lake and generally no larger than ½ to one mile in length/width) and conducting a field visit by boat on May 22, 2006 to characterize, identify, and document the types, variety, and locations of visual features for each viewing area from the water, and on land at public use areas; and recording viewpoint locations with a GPS (geographical positioning system) unit.

- Identifying the range of landscape and cultural lake characteristics in the Upper Peninsula; selecting "reference lakes" in the UP to demonstrate where the UPPCO project lakes fit on the continuum of key characteristics including size, shoreline irregularity, and adjacent landform relief; and adjusting the Maine Scenic Lakes to fit the characteristics of the Upper Peninsula and identify high value areas on each lake.

- Consulting other studies contained in this report.

Task 2- Applying the Assessment Method involved the following tasks:

- Characterizing user patterns and expectations about the aesthetic resources at the impoundments, and by whom and why they are valued. In addition to resource management professionals familiar with inland lakes in the UP, local opinions about what is aesthetically valued and why on Au Train Reservoir were elicited through on-site interviews on September 3, 2006 and review of public meeting and focus group meeting summaries.

- Quantitatively ranking the aesthetic values at each impoundment to identify areas of high value; and

- Developing maps showing the results of the analysis and high value areas.

5.1.3 Criteria

As stated in the U.S. Forest Service scenery management handbook (1995), "People value all landscapes, but they regard those having the most positive combinations of variety, vividness, mystery, intactness, coherence, harmony, uniqueness, pattern, and balance as having the greatest potential for scenic attractiveness." It is also important to understand the significance of the visual features within their overall regional setting, and the range of attributes which are associated in that region with the type of landscape being evaluated.

The project lakes were evaluated initially on the basis of size, shoreline irregularity, and relief to place them at a "macroscopic level" on the continuum of lakes in the Upper Peninsula. Of the 22,164 interior water bodies in the Upper Peninsula, only 250 lakes or impoundments measure 150 acres or more in size, the threshold for inclusion as a reference lake in this report. Information for size and shoreline irregularity was obtained from the Michigan Department of Natural Resources data base. Variation in regional relief was determined by inspecting the *Michigan Atlas and Gazetteer* and selected USGS topographic quadrangle maps.

A quantitative ranking system was then applied to give readers a common framework for evaluating the parts of each reservoir. The system is based upon six criteria: natural character, shoreline irregularity, physical features such as islands and coves, topographic relief, vegetation diversity, and special or unique features. The thresholds for each criterion were derived from the range of regional attributes and research on public perceptions.

Information for assessing natural character, physical features, vegetation diversity, and special features was developed from on-lake site investigations of only the UPPCO project lakes.

How the criteria were measured and weighed and the bases for the decisions are summarized below. Shoreline irregularity, relief, and degree of naturalness have been found through visual perception studies generally to be the three most significant predictors of the scenic value of a lake. The findings of this study concur:

- Natural Character. A defining characteristic of UP lakes in general is their remote, undeveloped feel. Every resource management professional whom Dominie asked about what people most value in Upper Peninsula interior lakes put this quality at the top of the list (see acknowledgements). Interviews with users reveal that collectively the most important factors influencing their decision to use these particular reservoirs include in rank order: "scenery around shoreline" (95%), "remote setting" (84%), and "undeveloped shoreline" (84%), "few other people around" (81%), and "clean water" (81%). They frequently mentioned the "wild appearance," "being part of nature," "seclusion," "few people around," and "peacefulness" of the reservoirs. This finding is not a surprise, given research from public perception studies. Zube (1973) and Kaplan, et. al. (1972) found that the greater the degree of naturalism, the more likely an area is to be considered scenic.

  Development does not necessarily detract from a lake's scenic character. Steinitz (1988) found that people do not wish to see a "culturally modified" landscape, but they enjoy development which is "generic," i.e. evocative of a particular kind of landscape (such as

a commercial fishing dock on the ocean). Others have found that vegetative screening blending a structure with its surroundings is essential in determining whether or not it detracts from a scenic landscape (Wohwill and Harris 1980, Gobster 1983).

While natural character is weighted the most of all the criteria (physical features are weighted a close second), it is treated as a detractor because the baseline for the study is a lake without any relief, islands, bays or other remarkable physical, cultural, or vegetative features. The baseline lake would receive 0 points in its unaltered natural condition because it retains its full landscape integrity. The same lake, if it were suburbanized, would receive a negative 60 points, because it has significantly lost its expression of natural character.

The point system in Table 5-1 is adapted from the US Forest Service's Scenery Management System for assessing scenic integrity and the Recreation Opportunity System[2] for addressing aesthetic values related to sights, sounds, and smells which many users mentioned during the interviews.

Table 5-1: Natural Character Rating System (0 to negative 80 points)

SETTING	DESCRIPTION	VALUE	SCORE
Undisturbed, Wild	Landscape is unaltered with no deviation from its natural state. Its natural character is fully expressed and provides extensive opportunities to see, hear, or smell the natural resources.	Very High	0
Semi-wild	Landscape appears unaltered except for subtle or generic deviations (e.g. dams, dispersed campsites). Its natural character is largely expressed, and provides widespread opportunities to see, hear, or smell the natural resources.	High	-10
Rural	Landscape appears slightly altered with deviations such as unscreened structures, campgrounds, power lines, night lighting, and human activity which are evident but not dominant. Natural character is moderately expressed, and provides frequent opportunity to see, hear, or smell natural resources.	Moderate	-20
Suburban	Landscape appears moderately altered and deviations begin to dominate. Natural character is limited in expression and provides few opportunities to see, hear, or smell natural resources.	Low	-60
Urban	Landscape is significantly altered and deviations dominate. Natural character is little expressed and provides limited opportunities to see, hear, or smell natural resources.	Very Low	-80

- Shoreline Irregularity**.** Irregularity is a measure of the complexity of the shoreline edge. The human eye is drawn to and follows edges to make sense of the meaning of a

[2] Aukerman, R. G.E. Haas, V. Lovejoy, and D. Welch (2002). Water Recreation Opportunity Spectrum System Draft Guidebook. Aukerman and Associates, LLC and USDI Bureau of Reclamation.

landscape. Research indicates that the more islands, coves, and points that a water body has, the more interesting it is likely to be. Complexity in the landscape is widely accepted as being preferred and more scenic (Kaplan and Wendt 1972, McCarthy 1979).

Using the Michigan Department of Natural Resources data base, an index for each lake over 150 acres was created using a formula comparing the ratio of its perimeter to its surface area, with the ratio of a perfect circle being 1.0.[3] Since a circle is the minimum edge of any similarly-sized two dimensional shape, any shape which deviates from a circle increases the amount of edge.

Available data only allow comparison of a lake as a whole with other UP lakes because data is not available to assess the subunits of each of the six study impoundments. The number of physical features in each subunit therefore was used as a proxy to evaluate the relative edge length (see below).

- Physical Features. In this study, the number of islands, (relatively) prominent points, coves, inlets, rocky areas, slab ledges, and beaches were considered to add to complexity and aesthetic quality. Several studies have identified preferences for various physical features. Although features vary from region to region, the concept of preferences for certain types of features is applicable across regions. Empirical studies indicate strong preferences for rock outcrops (Miller 1984, Chenowith 1984), beaches (Zube and McLaughlin 1978, Palmer 1978), and complexity of landform (Herzog 1985, McCarthy 1979).

  This study confirms the importance of shoreline complexity. When asked about the features that make parts of the reservoirs more scenic than others, more people mentioned physical features, such as islands, beaches, and coves, than any other factor including natural character. Results varied by lake, depending upon the particular setting.

  Islands, narrows, and bends in the lake are especially important in increasing "mystery," which has been found to be an important landscape attribute (Kaplan 1977). Among the physical features in this study, islands, beaches, ledges and long distance views were rated higher based upon the frequency with which they were mentioned by local users. Each of the physical features in Table 5-2 was evaluated separately:

[3] Edge Index = the perimeter of the water body (in feet) divided by 2 times the square root of the product of (the number of acres of the water body times the number of square feet in an acre (i.e., 43,560 ft) times pi)

Table 5-2: Aesthetic Physical Features Rating System
(# of potential points; maximum points = 78)

Islands	Coves & Inlets	Prominent Points	Rocks and Ledges	Long Distance Views	Beaches
1-3 small (5)	1-3 small (3)	1-2 (3)	Pockets of large boulders/ledge (5)	1-1.9 miles (5)	1-2 pocket beaches (5)
4+ small or 1 large (10)	4+ small or 1 large (6)	3-4 (6)	Moderate boulders, ledge or rapids (10)	2+ miles (10)	3+ pocket beaches (10)
2+ large (15)	2+ large (9)	5+ (9)	Extensive boulders, ledge or rapids (15)	Distant landform ≥ 400' high (15)	1+ extensive (15)

* A large island is defined in this study as one with at least one dimension measuring 400 ft. A large cove or inlet is defined as one which is over 1/5 of a mile long or wide.

- Relief**.** Studies by Chenowith (1984) and Zube et. al. (1974) indicate that changes in relief are essential in evaluating scenic landscapes. Furthermore, Herzog (1985) tested preferences for 6 types of waterscapes and found mountain waterscapes (i.e., mountains enclosing a body of water) were most preferred. Relief was weighted after natural character and physical features based upon the results of local opinion in assessing the aesthetic quality of the various subunits of the UPPCO lakes. It should be noted, however, that on Au Train and Victoria people mentioned surrounding ridgelines and mountains first in describing why they were drawn to these impoundments, though they also mentioned their relatively unspoiled character as also important.

  Relief, both relative and dramatic (0 to 25 points each) was evaluated in two ways, in terms of the percent of the viewing area of each subunit:

  - Relative Relief**:** the relative change in relief between the lake surface and the surrounding area of the subunit which is visible, measured in 100 ft increments.

    7 points — >25% shore at least 100 ft higher
    15 points — >25% shore 200-299 ft
    25 points — > 25% shore 300 ft or more

  - Dramatic Relief**:** how quickly and sharply landforms (within ½ mile) rise from the subunit shoreline, measured as the ratio of the change in relief of a ridge, hill, or mountain over its distance from the shore.

    7 points — >25% shore rises 15 to 29%
    15 points — > 25% shore rises 30 to 49%
    25 points — > 25% shore rises >50%

  A third component of relief, layering−the degree of complexity of landforms−was not included in the final study as it was not found to be a noteworthy feature of the

reservoirs. Layering is usually measured by the number of ridgelines or other landforms which one may see layered behind, or in close proximity with, one another.

- Vegetation Diversity**.** A variety of vegetation types adds to visual interest and thus to aesthetic value. Researchers have recognized the value of including vegetation diversity in scenic evaluations (Mann 1975, U.S. Forest Service Scenic Quality Management System 1995). Five main cover types are found on the six UPPCO project lakes: predominantly deciduous, predominantly coniferous, mixed wood, emergent wetlands, shrub wetlands. Local users did not remark about the diversity of vegetation (number of types), but they did mention several special types which they value. The list of special types in this study includes birch stands, remnant "superstory" trees, emergent wetlands, extensive beds of trillium or other wildflowers, or conifers overhanging points. Seasonal fall color, when extensive, is also taken into account, and given more weight in response to people's comments.

Special Vegetation Types		Seasonal Color	
5 points	Limited/Scattered	5 points	Minimal
10 points	Moderate	10 points	Moderate
15 points	Extensive	15 points	Extensive

- Special Features**:** The opportunity to view wildlife has been found to increase the aesthetic value of an area (Leopold 1969, Mann 1975, Cooper and Shaw 1979). People frequently mentioned their enjoyment in seeing wildlife on the reservoirs. Only waterfowl, wading birds, and raptors which were seen on the water or in perching trees during the field visit were scored. Because the available information is so limited, low weight was given to this factor so as not to penalize a part of a reservoir where such birds were not sighted.

  5 points—waterfowl or wading birds
  10 pts—loons or raptors
  15 pts —waterfowl or wading birds and raptors or loons

  Other features which local people consider to add visual interest and give a special sense of place to these reservoirs include unusual elements such as flooded snags, lake diversity (Bond Falls for example, received points to account for the composite effect of the numerous coves which comprise the perimeter), waterfalls, and wildlife management areas. Each such feature was awarded 7/15/25 points, depending upon its extent.

5.2 Overall Visual Character and Setting

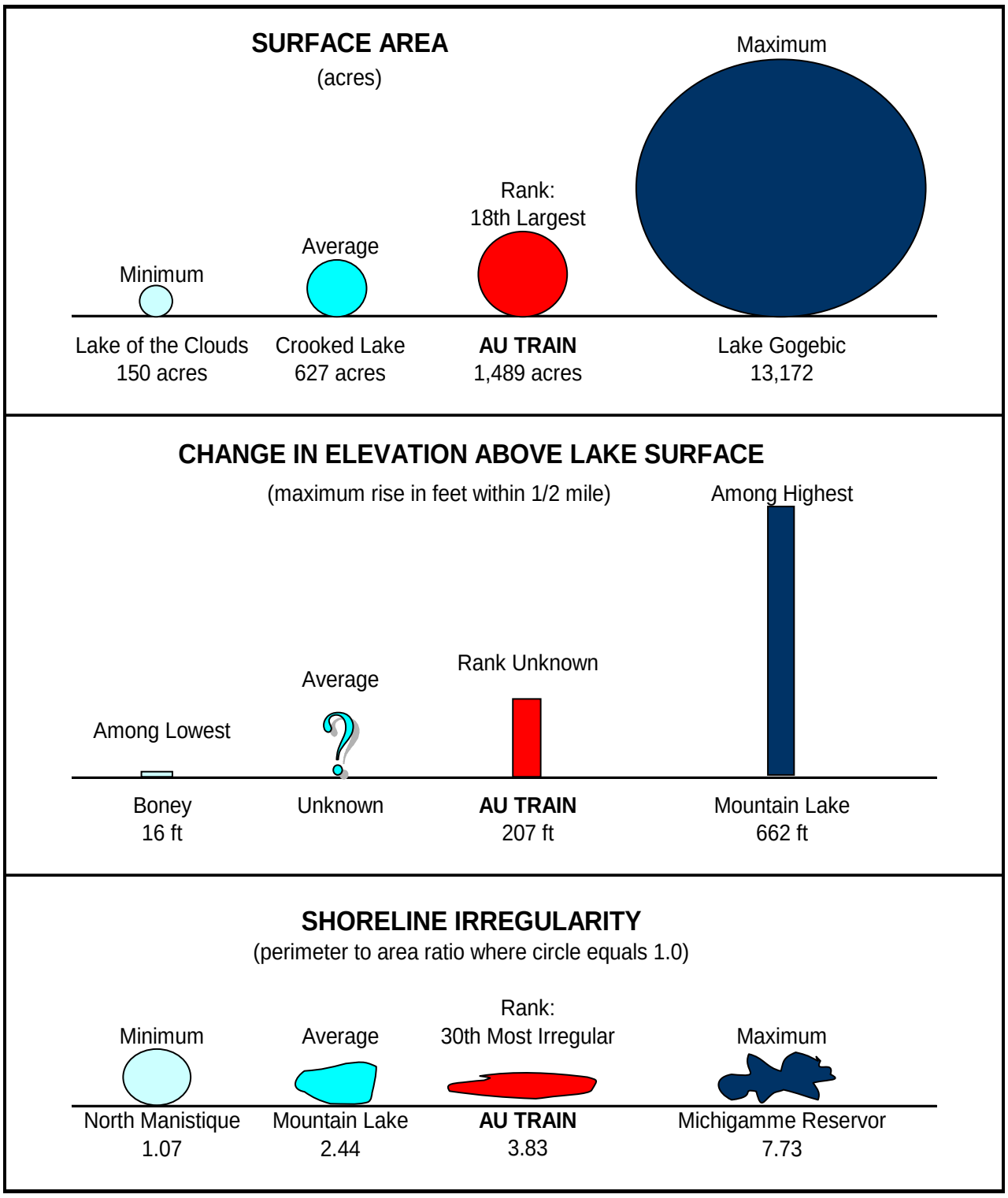
Au Train impoundment sits in the divide between the western and southern sections of the Upper Peninsula at an elevation of 777 feet. It is largely natural-appearing and remote feeling. The only development, other than that related to power generation at the north end and a broad dike flanking the south end, is the two formal campground facilities, a couple of homes at the north end and several camps along the southwestern shore.

Long and thin and tapering to the north, Au Train's other most defining physical characteristic is its elevated eastern shore which pushes up especially steeply in the southeastern portion (see figure 5-2). The surrounding ridges and shore are largely covered with deciduous forest with pockets of mixed vegetation; fall color is dramatic as a result. Conifers are much less evident except where they line the shore, top a ridgeline at the south end, and dominate the islands at the north end. The area at the south end where the vegetation abruptly changes to lower growth is managed by the Michigan Department of Natural Resources as a wildlife refuge.

Figure 5-1: Dramatic ridgeline meets the eastern shore

Figure 5-2 shows how the lake compares with other lakes in the Upper Peninsula. It is the 18th largest of the lakes over 150 acres in size—nine times smaller than Lake Gogebic (Gogebic County), the largest reference lake; and ten times larger than Lake of the Clouds in the Porcupine Mountains Wilderness area (Ontonagon County), the smallest.

Figure 5:2: Comparison of Au Train Lake with Upper Peninsula Lakes



The greatest change in relief from Au Train's water surface to the highest surrounding terrain within ½ mile of the shore is around 207 ft on the north eastern side; about three quarters of the eastern shore rises over 100 feet. The 207 ft difference is about one third that of the terrain surrounding Mountain Lake in the Huron Mountains in Marquette County, which exhibits some of the highest relief in the UP. But because the terrain slopes steeply (30-49%) in places at the shoreline, it is quite dramatic for an Upper Peninsula Lake.

Other aesthetic factors important to note about the impoundment as a whole include its water quality and fluctuations in water level. The water of the impoundment is colored as a result of high tannin concentrations which occur naturally. Water withdrawal can produce a marked aesthetic impact on the reservoir, especially the southern end where the water is most shallow.

5.3 Profile of Public Users

5.3.1 Types and Numbers of Users

There are currently two formal and nine informal recreation facilities located on the Au Train impoundment. Forest Lake Campground, on the northeast shore, is a formal campground (26 sites) and boat launching facility with a boat ramp, parking area for 15 vehicles with trailers and 15 passenger cars, and courtesy dock available to the public for launching on the lake.

Another smaller campground and boat launch are located on the southeastern shore. No formal parking area exists for this boat launch; however, there is enough space to park approximately three vehicles with trailers. Seven campsites flank both sides of the boat launch. Campers register with the Michigan Department of Natural Resources. Records show an average of 502 registrations/year accommodating 1,407 campers/year between 2001 and 2006. This averages 2.8 people per site with use peaking usually in July and August.

According to local people surveyed on September 3, 2006, fishing, camping, and walking are the most prevalent activities on the reservoir (see Table 5-3); people reported that swimming was not appealing to them there. Because of the two-year drawdown of the reservoir for maintenance reasons, few people were using the impoundment the day of the survey so the results cannot be considered representative. According to UPPCO representative Connie Granroth, some ice fishing, snowmobiling, snowshoeing, and cross-country skiing, and an annual dog sled race in February also occur.

People who live or have seasonal camps on the reservoir presumably enjoy the same activities. One homeowner was surveyed and reported that he enjoys the view afforded by the natural setting and occasionally fishes.

Table 5-3: Number of Parties Responding to Survey Questions About Why They Visit Au Train

1. In which activities do you and your family or friends participate:

1_Beach activities
5_Camping
1_Canoe/boat camping
2_Picnicking
3_Observing/photog nature
0_Swimming
5_Walking/hiking
2_Canoeing/kayaking
3_Motor boating
0_Waterskiing/tubing
0_Jetskiing
4_Enjoying scenery
5_Boat fishing
4_Shoreline fishing
0_Trapping
1_Waterfowl hunting
0_Deer hunting
1_Home/second home
Other:
1_Bird hunting
1_Metal detection
1_Looking at property
2_ATV riding
1_Drift wood collection!

2. There are many factors that may influence your decision when considering possible locations for recreation visits. Please tell me whether it was not at all important, slightly important, moderately important, very important, or extremely important in making the decision to come to this reservoir:

	Extremely Important	Very important	Moderately important	Slightly important	Not at all important
Beaches	1	0	0	1	3
Scenery around shoreline	3	2	0	0	0
Boat launch site	2	1	0	1	1
Fishing	3	1	0	0	1
Wildlife viewing	3	0	1	0	1
Few other people around	5	0	0	0	0
Clean water	3	0	0	1	1
Boating	2	1	1	1	0
Remote setting	4	1	0	0	0
Cost of trip	4	1	0	0	0
Developed campground	1	2	2	0	0
Remote campsites	2	0	0	0	2
Travel distance	2	1	1	0	1
Undeveloped shoreline	3	1	0	1	0
Dark night sky	5	0	0	0	0

Other factors mentioned: Quiet, secluded: 3; Primitive: 1; Fall colors: 1; Not applicable: 1

Figure 5-3: Fishing is enhanced by the maple and aspen backdrop

5.3.2 User Expectations

Recreationists in general are highly sensitive to the sights and sounds of their surroundings. Considerable research documents that this user group seeks high quality settings for their activities. People boating or fishing on Au Train or recreating or living on the shore will focus on the details and overall quality of their immediate surroundings, considered the "foreground" (0 to ¼-½ mile). In places offering longer distant "midground" views (¼-½ to 3-5 miles) from the lake or mountain, recreationists will be more likely to focus on the integrity of the landscape (whether development fits comfortably) and conflicts in color, form, shape, or scale.[4]

The six users who were surveyed all reported that they enjoy seeing wildlife (e.g. bear, deer, turtles, cranes, owls, and osprey) and the natural character of the reservoir most. Islands and irregular shore were also important to five of them and relief was important to four.

5.4 Subunit Aesthetic Quality Analysis

Au Train impoundment was divided into seven subunits, starting with number one at the dam at the north end and continuing down the lake as shown on Map 5-1.

5.4.1 Highest Value Areas

The scores in Table 5-4 were derived from ranking each subunit against the criteria explained in Section 5.1.3. Three of the top-ranked subunits scored relatively close. Subunits 6 and 7 scored high because of the islands and relief, opportunity to view wildlife, and lack of development. Subunit 2 scored third, in part, because of the complex of islands. Subunits 1, 3, and 5 tied for fourth place, pulling ahead of the rest because of their dramatic relief. Indeed, the entire eastern shore has high aesthetic quality, with an almost continuous sweep of ridges of varying elevations.

[4] Smarden, Palmer and Fellerman, editors, 1986. Foundations For Visual Project Analysis.

Table 5-4: Au Train Subunit Summary Scores

Subunit	Relief	Physical Features	Vegetation Diversity	Special Features	Degree of Naturalism	Score	Rank
1	30	35	20	20	20	85	4
2	10	40	20	30	0	100	3
3	10	30	25	30	10	85	4
4	5	35	20	25	10	75	5
5	20	30	20	25	10	85	4
6	15	29	25	45	10	104	1
7	15	26	25	45	10	101	2

Table 5-5 provides a detailed breakdown of how the subunits were rated. This table is followed by photographs which depict some of the most defining visual qualities of the three highest ranked subunits (figures 5-4 through 5-9).

Table 5-5: Au Train Aesthetic Quality Scores by Subunit

CRITERIA	Subunit 1 (Dam/North End)		Subunit 2 (Islands)		Subunit 3 (Campground)		Subunit 4		Subunit 5		Subunit 6 (Campground)		Subunit 7 (South End/Dike)	
	Description	Score	Description	Score	Description	Score	Description	Score	Description	Score	Description	Score	Description	Score
ATTRIBUTES WHICH ENHANCE NATURAL CHARACTER (0 to 237 points)														
RELIEF (50)														
Relative Change in Visible Relief (25)	~25% (E): 200+ ft; ~25% (E): 100+ ft	15	~50%(E):100+ft	5	~25%(E):100+ft	5	<25%(E): 100+ft	0	~50% (E); 100+ ft	5	<25% (E); 100+ ft	0	none	0
Dramatic Relief: rise to run w/in ½ mile (25)	~25%(E): 15-29% slope, ~25%(E): 30-49% slope, points(E): 50-65% slope	15	~35%(E): 15-29% slope, points(E): 30-49% slope	5	~40%(E):15-29% slope, points(E): 30-49% slope	5	~25%(E):15-29% slope, points(E):30-49% slope	5	~15%(E):15-29% slope, ~30%(E):30-49% slope, points(E): 50-65% slope	15	~15%(E):15-29% slope, ~30%(E): 30-49% slope	15	~25%(E): 15-29% slope, ~10%(E):30-49% slope	15
Subtotal		**30**		**10**		**10**		**5**		**20**		**15**		**15**
PHYSICAL FEATURES (72)														
Islands (15)	1 large, 2 small	10	2 large, 3 small	15	1 small (see unit 2)	5	0	0	1 small	5	1 large, 2 small (see unit 7)	10	1 large, 6 small	10
Coves and Inlets (9)	7- 8 small	6	5 small	6	5-6 small	6	4 small	6	1 large, 5 small	6	1-2 small	3	2-3 small	3
Prominent Points/Spits (9)	5	9	3 to 4	9	2 to 3	9	5	9	5 to 6	9	4	6	3	3
Sand Beaches (15)	0	0	0	0	0	0	0	0	1 small pocket at launch	0	0	0	0	
Rocks, Ledge (15)	negligible	0	negligible	0	negligible	0	medium-sized boulders along shore between way points 40 and 41	10	negligible	0	negligible	0	negligible	0
Long Distance Views (15)	2+ miles (spot view)	10	2+ miles	10	2+ miles	10	2+ miles	10	2+ miles	10	2+ miles	10	2+ miles	10
Subtotal		**35**		**40**		**30**		**35**		**30**		**29**		**26**
VEGETATION DIVERSITY (30)														
Special Types (15)	a few superstory trees	5	a few superstory trees	5	scattered birch; trillium	10	scattered birch	5	scattered birch	5	extensive trillium; scattered birch	10	extensive cattails, scattered birch	10
Extensive fall color (15)	yes	15	yes	15	yes	15	yes	15	yes	15	yes	15	yes	15
Subtotal		**20**		**20**		**25**		**20**		**20**		**25**		**25**
SPECIAL FEATURES (90)														
Observed Wildlife (15)	geese	5	eagle, loons, heron, geese	15	loon, geese, ducks, heron	15	loons, ducks, geese	10	loons	10	eagle, cranes, heron	15	eagle, loons, geese	15
Composite of many areas on lake (25)	1 of 7	15	1 of 7	15	1 of 7	15	1 of 7	15	1 of 7	15	1 of 7	15	1 of 7	15
Flooded snags (25)	none	0	none	0	none	0	none	0	none	0	none	0	none	0
Unusual or historic features or structures (25)	none	0	none	0	none	0	none	0	none	0	wildlife management area	15	wildlife management areaa	15
Subtotal		**20**		**30**		**30**		**25**		**25**		**45**		**45**
Positive Attribute Total		**105**		**100**		**95**		**85**		**95**		**114**		**111**
ATTRIBUTES WHICH DETRACT FROM NATURAL CHARACTER (0 to -80 points)														
	two homes (NE)/transmission lines (N) highly visible; night lighting; dam generic (yellow catwalk/ concrete abutment most conspicuous)	-20	none	0	W: campsites and grassy picnic area visible; boat launch tucked well into cove	-10	W: 2 camps without screening(one shared w/ subunit 5)	-10	W: 3 camps, 2 mobile homes w/out screening	-10	W: 1 cabin w/out screening/one narrow, cleared access corridor; E: boat launch looks like beach; campsites screened	-10	dike only visible sign of development	-10
TOTAL SCORE		**85**		**100**		**85**		**75**		**85**		**104**		**101**

Au Train: Highest Score (104 points)
Subunit 6: Campground (SE)

Figure 5-4: Dramatic relief defines the western shore

Figure 5-5: Trillium carpets the campground

Au Train: Second Highest Score (101 points)
Subunit 7: South End Dike

Figure 5-6: Emergent wetlands and lack of development provide quiet setting

Figure 5-7: Layers of vegetation create a pattern with strong edges

Au Train: Third Highest Score (100 points)
Subunit 2: Islands

Figure 5-8: Islands create enclosure and invite exploration

Figure 5-9: Eagles tend their young

5.5 Acknowledgements

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Jim Keebaugh, Kayaker, Eastern Focus Group Member

Map 5-1: Aesthetic Quality Assessment

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