MAPPING OF SUBMERGED AQUATIC VEGETATION IN LEWISTON RESERVOIR

Niagara Power Project
FERC No. 2216

Volume 1: Public

Volume 2: Non-Internet Public

Prepared for:

New York Power Authority

Prepared by:

Gomez and Sullivan Engineers, P.C.
E/PRO Engineering and Environmental Consulting, LLC

New York Power Authority

August 2005

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ABBREVIATIONS

EAV	emergent aquatic vegetation
FERC	Federal Energy Regulatory Commission
GIS	geographical information system
GPS	global positioning system
mph	miles per hour
NYPA	New York Power Authority
NYSDEC	New York State Department of Environmental Conservation
SAV	submerged aquatic vegetation
USACE	United States Army Corps of Engineers

EXECUTIVE SUMMARY

Fieldwork to map SAV in the Lewiston Reservoir was conducted in late-August and early September 2005. This mapping effort was requested by the NYSDEC because 1) it thought that the presence of SAV along two of the three transects along which Stantec collected habitat data in 2003 could be indicative of the potential presence of SAV in other areas of the reservoir and, 2) the initial mapping of aquatic habitat along the three transects was conducted in October; a time of year that is typically after the SAV growing season in western New York. The NYSDEC questioned whether the late timing of the work could result in the under-representation of SAV in the vicinity of the transects. The purpose of the investigation was to map the locations and extent of SAV beds, and identify the species composition and relative abundance of SAV in Lewiston Reservoir during the peak of the SAV growing season (generally late-July to mid-September).

Analysis of water level data for Lewiston Reservoir revealed that the best times to sample and map SAV would be on Thursday and Friday of any given week. The analysis indicated that the water would be too deep on Saturday through Wednesday for field personnel to effectively map SAV. This was verified during the fieldwork as the water level surface elevations were lowest on Thursday and Friday August 26 and 27, and Thursday and Friday September 2 and 3, 2004 (Figure 3.0-1).

Various search methods were used during the fieldwork. These included navigating along pre-determined transects with a boat and using an underwater camera and view tubes to search for SAV, examining the transects where limited SAV was observed by Stantec in 2002, examining dewatered areas late-afternoon on August 27 and September 3, 2004, and conducting helicopter reconnaissance in conjunction with a boat to identify and investigate potential areas of SAV.

No extensive SAV beds were observed and areal coverage was sparse. However, three patches of SAV approximately 50 by 50 feet in size were observed and mapped In these areas, SAV was limited to a scattered distribution of individual plants consisting of four species. In many instances, there were at least two to three feet of bare substrate between each plant. In all other areas of the Lewiston Reservoir,

the SAV that was observed was too sparse to map. Species of SAV that were documented in the Lewiston Reservoir included sago pondweed *(Potamogeton pectinatus)*, redhead grass *(Potamogeton richardsonii)*, common elodea *(Elodea canadensis)*, and wild celery *(Vallisneria americana)*. In addition to these vascular plants, two types of algae, Muskgrass *(Chara* sp.*)* and filamentous green algae *(Cladophora* sp.*)*, were common.

1.0 INTRODUCTION

The New York Power Authority (NYPA) is engaged in the relicensing of the Niagara Power Project in Lewiston, Niagara County, New York. The present operating license of the plant expires in August 2007. In preparation for the relicensing of the Niagara Project, NYPA is assembling information related to the ecological, engineering, recreational, cultural, and socioeconomic aspects of the Project. As part of this effort, biologists from NYPA, Riveredge Associates, Inc., Gomez and Sullivan Engineers, P.C., and E/PRO Engineering and Environmental Consulting, LLC examined the Lewiston Reservoir for the presence of submerged aquatic vegetation during August/September 2004.

1.1 Background

The 1,880-MW (firm power output) Niagara Power Project is one of the largest non-federal hydroelectric facilities in North America. The Project was licensed to the Power Authority of the State of New York (now the New York Power Authority) in 1957. Construction of the Project began in 1958, and electricity was first produced in 1961.

The Project has several components, shown in Figure 1.1-1. Twin intakes are located approximately 2.6 miles above Niagara Falls. Water entering these intakes is routed around the Falls via two large underground conduits to a forebay, lying on an east-west axis about 4 miles downstream of the Falls. The forebay is located on the east bank of the Niagara River. At the west end of the forebay, between the forebay itself and the river, is the Robert Moses Niagara Power Plant, NYPA's main generating plant at Niagara. This plant has 13 turbines that generate electricity from water stored in the forebay. Head is approximately 300 feet. At the east end of the forebay is the Lewiston Pump Generating Plant. Under non-peak-usage conditions (i.e., at night and on weekends), water is pumped from the forebay via the plant's 12 pumps/generators into the Lewiston Reservoir, which lies east of the plant. During peak usage conditions (i.e., daytime Monday through Friday), the pumps are reversed for use as generators, and water is allowed to flow back through the plant, producing electricity. The forebay, therefore, serves as headwater for the Robert Moses plant and tailwater for the Lewiston Plant.

South of the forebay is a switchyard, which serves as the electrical interface between the Project and the interstate transmission grid operated by the New York Independent System Operator.

In 2002, aquatic habitat was mapped along three transects in Lewiston Reservoir (Figure 1.1-2) as part of the analysis to determine the potential effects of water level and flow fluctuations on aquatic and terrestrial habitat (Stantec et al. 2005). A component of this mapping effort was to document the presence of submerged aquatic vegetation (SAV). Following this work, the New York State Department of Environmental Conservation (NYSDEC) suggested that NYPA map SAV throughout the entire reservoir during the peak of the growing season. This suggestion was made for the following reasons:

1. The NYSDEC thought that the presence of SAV along two of the transects, albeit limited in extent and areal coverage, may be indicative of the potential presence of SAV in other areas of the reservoir;

2. The initial mapping of aquatic habitat along the three transects was conducted in October, a time of year that is typically after the SAV growing season in western New York. The NYSDEC questioned whether the late timing of the work could result in the under-representation of SAV in the vicinity of the transects.

1.2 Investigation Area and Description of Water Level Fluctuations in Lewiston Reservoir

The investigation area for this study includes the watered portion of Lewiston Reservoir. Niagara Power Project operations determine the water level of Lewiston Reservoir. Project operations react to the demand for energy and the Niagara River flow. Operation of the Niagara Power Project can result in water level fluctuations in Lewiston Reservoir of 3-18 feet per day, and approximately 11-36 feet per week depending on the season and river flows (URS et al. 2005). Water levels are lowest in the evenings, and highest in the morning after the reservoir is filled overnight; the lowest elevation usually occurs on Friday evening of each week. Weekly drawdowns are typically greater (21-36 feet) during the tourist season than the non-tourist season (11-30 feet), when NYPA's allocated share of water for power generation is reduced during daytime hours to provide higher Falls flow for scenic purposes.

1.3 Investigation Objectives

The objectives of this investigation were to:

1. Identify the species composition and relative abundance of SAV in Lewiston Reservoir during the peak of the SAV growing season, which generally occurs from late-July to mid-September. For purposes of this investigation, SAV is defined as rooted, vascular plants. Non-vascular plant species (algae) such as *Chara* and *Clordophora* would not be counted toward the areal coverage.

2. Map the location and extent of SAV in Lewiston Reservoir during late-summer when the spatial extent and areal coverage of SAV beds are expected to be greatest. The areal coverage categories include:

   - Sparse (<25%);
   - Moderately Abundant (25 to 50%);
   - Abundant (51 to 75%);
   - Dense (>75%).

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FIGURE 1.1-1

NIAGARA POWER PROJECT COMPONENTS

[NIP – General Location Maps]

FIGURE 1.1-2

LEWISTON RESERVOIR HABITAT TRANSECTS IN 2002

[NIP – General Location Maps]

2.0 METHODS

Analysis of water level data for Lewiston Reservoir revealed that the best times to sample and map SAV would be on Thursday and Friday of any given week. The analysis indicated that the water would be too deep on Saturday through Wednesday for field personnel to effectively map SAV. Therefore, due to the limited time frame, several mapping approaches were developed, as discussed below. SAV species that could not be readily identified in the field were collected and later identified using a plant identification guide developed by Hotchkiss (1972).

2.1 Searching for SAV along Transects from a Boat

The initial plan for determining the location and extent of SAV involved using a boat and a sub-meter accuracy global positioning system (GPS) to navigate along a number of electronic, pre-established transects. Specifically, before conducting any fieldwork, an electronic shapefile (e.g., GIS coverage) of the Lewiston Reservoir and a shapefile with approximately 90 parallel transect lines (oriented in a south-north direction) were loaded into a Trimble GeoXT GPS. There was a distance of about 100 feet between each transect. These layers constituted the basemap for this investigation. Any SAV beds encountered along these transects would be mapped using the GPS, and information such as species composition, relative abundance, and areal coverage would be entered into a data dictionary that had also been loaded into the GPS.

The fieldwork began on Thursday, August 26, 2004. The boat crew navigated along several transects and used view tubes and an underwater camera to search for SAV. In addition, the boat crew occasionally collected bottom substrate and algal samples with a Ponar dredge. The field crew also examined the areas where Stantec mapped aquatic habitat along transects in 2002.

By mid-morning it became apparent that it would take weeks not days to do mapping along the transects by boat. So, a different approach was devised: mapping dewatered areas on foot and searching for SAV by helicopter.

2.2 Searching for SAV in Dewatered Areas

Some temporarily dewatered areas of the Lewiston Reservoir were examined for the presence of SAV on foot during the afternoons of August 27 and September 3, 2004. On these afternoons, field personnel were able to walk around in several areas within the reservoir that were dewatered and had firm substrates. Not all dewatered areas were accessible on foot because the substrates were too soft to walk on. These areas were observed with the use of binoculars from the reservoir perimeter road. When SAV was observed, a small circle was drawn on a paper basemap to depict the approximate location and a data point was entered into a GPS.

2.3 Helicopter Reconnaissance

A NYPA biologist and an E/PRO biologist flew transects in a helicopter over Lewiston Reservoir on September 3, 2004 to identify and locate SAV beds. If SAV beds or suspected SAV beds were observed, a buoy would be dropped from the helicopter to mark the location. Then, biologists in a boat on the reservoir would navigate to the buoy and look more closely for SAV and take a sample if SAV were found. This approach was chosen because the helicopter could cover the transects much faster than a boat. The initial helicopter flight was done early in the morning to take advantage of improved visibility. Visibility could be reduced by waves produced by winds that often begin blowing by mid-morning.

2.3.1 Observation of SAV in the Upper Niagara River

A NYPA biologist and an E/PRO biologist flew in a helicopter over the upper Niagara River to confirm that SAV could be visually observed from the same altitude as the Lewiston Reservoir reconnaissance.

2.3.2 Searching for SAV in the Lewiston Reservoir

Two biologists accompanied the helicopter pilot and searched for SAV beds. The helicopter flew a series of parallel transects (generally oriented north to south) during the morning and afternoon of September 3, 2004. When a potential SAV bed was spotted by the helicopter crew, a weighted buoy (weighted with diving weights attached with rope) was dropped from the helicopter. After a buoy was dropped, a boat crew navigated to it and began searching for SAV with view tubes and an underwater camera. The boat crew collected each buoy after examination of the general area was completed.

3.0 RESULTS

Water surface elevations in Lewiston Reservoir from August 21 through September 4, 2004 are presented in Figure 3.0-1. During this period, project operations were typical and no abnormal events occurred. The daily cycling and gradual weekly net decline of water levels in the reservoir is evident.

3.1 Searching for SAV along Transects from a Boat

Very little SAV was observed by the field crew navigating along transects in a boat. No extensive SAV beds were observed and areal coverage was sparse. Specifically, the SAV that was observed was limited to a few plants of four species: sago pondweed *(Potamogeton pectinatus)*, redhead grass *(Potamogeton richardsonii)*, common elodea *(Elodea canadensis)*, and wild celery *(Vallisneria americana)*. In addition to these vascular plants, two types of algae, Muskgrass *(Chara* sp.*)* and filamentous green algae *(Cladophora* sp.*)*, were common.

3.2 Searching for SAV in Dewatered Areas

The spatial distribution and species composition of SAV and algae was the same as observed during the boat surveys except one additional species of SAV, curly pondweed (*Potamogeton crispus*), was observed. No extensive SAV beds were observed and areal coverage was sparse. Three small patches of SAV approximately 50 feet by 50 feet in size were observed and mapped (Figure 3.2-1). The two predominant species in these patches were sago pondweed and redhead grass. Wild celery was also occasionally observed. However, in most instances individual plants of wild celery were not rooted to the substrate, whereas most of the individual plants of sago pondweed and redhead grass were rooted. The areal coverage of these patches was a sparse, scattered distribution of individual plants with at least two to three feet of bare substrate between each plant. Other than these three patches, SAV was too sparse to map and consisted of the occasional individual plant.

An accumulation of dead SAV was washed up against the interior riprap wall of Lewiston Reservoir. This accumulation was observed at the northeastern corner of the reservoir, was up to one foot

high and covered an area approximately 30 feet by 20 feet in size, and was composed of sago pondweed, redhead grass, and wild celery. Of these species, wild celery was the most common.

3.3 Helicopter Reconnaissance

3.3.1 Observation of SAV in the Upper Niagara River

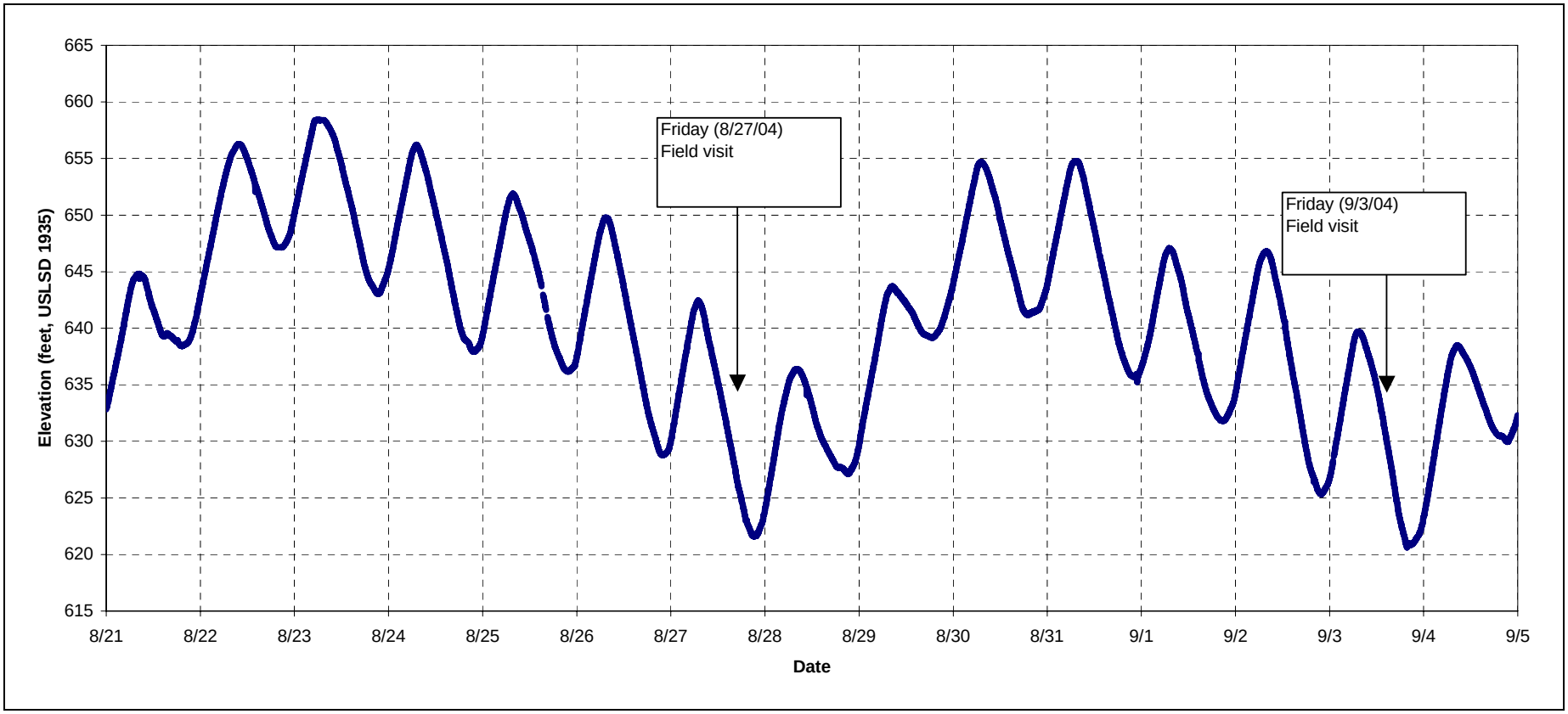
Extensive SAV beds were observed in the upper Niagara River during the helicopter flight. Large beds were observed in both the Tonawanda and Chippawa channels and along the near-shore areas of Grand Island. In addition, an extensive SAV bed was observed downstream of NYPA intakes.

3.3.2 Observation of SAV in Lewiston Reservoir

Five areas of suspected SAV were observed from the helicopter and buoys were dropped in these locations. The boat crew subsequently examined the areas in the vicinity of the buoys and a few plants were observed with the underwater camera. The species were the same as those found in the dewatered areas and SAV was too sparse to map.

FIGURE 3.0-1

LEWISTON RESERVOIR WATER SURFACE ELEVATION, AUGUST 21-SEPTEMBER 4, 2004



Note: Data obtained every 5 minutes from permanent water level gauge in Lewiston Reservoir.

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FIGURE 3.2-1

APPROXIMATE LOCATIONS OF OBSERVED SAV PATCHES

[NIP – General Location Maps]

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