# *Boundary Hydroelectric Project (FERC No. 2144)*

# *Study No. 17*
# *Rare, Threatened, and Endangered (RTE)*
# *Plant Species Inventory*
# *Interim Report*

**Prepared for**
**Seattle City Light**

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# Study No. 17: Rare, Threatened, and Endangered (RTE) Plant Species Inventory Interim Report Boundary Hydroelectric Project (FERC No. 2144)

## 1 INTRODUCTION

Study No. 17, the Rare, Threatened, and Endangered (RTE) Plant Species Inventory (RTE Plant Study), is being conducted in support of the relicensing of the Boundary Hydroelectric Project (Project), Federal Energy Regulatory Commission (FERC) No. 2144, as identified in the Revised Study Plan (RSP; SCL 2007a) submitted by Seattle City Light (SCL) on February 14, 2007, and approved by the FERC in its Study Plan Determination letter dated March 15, 2007. This interim report describes the efforts conducted through October, 2007, for the RTE Plant Study. No additional baseline survey work is planned for 2008; however, some additional field work may be necessary to assess the effects of erosion on RTE plants (see Section 7). Further, the full assessment of Project-related effects will be presented in the Updated Study Report (USR) in 2008.

## 2 STUDY OBJECTIVES

The goals of the RTE Plant Study are to provide information needed to determine the presence of RTE plants in the Project area, assess Project effects on these species, and direct management decisions related to RTE plant species.

Specific objectives of this study are as follows:

- Survey for and identify the RTE plant species occurring in the Project area.
- Map the location, distribution, and extent of RTE plant populations.
- Identify any threats to existing RTE plant populations (e.g., nearby infestations of invasive non-native species, erosion, herbivory) and their habitats, including potential Project effects.

The RTE Plant Study builds on a 2005 reconnaissance level survey of RTE plants conducted in the Project vicinity that was to provide baseline information for the Pre-Application Document (PAD). The primary goal of the 2005 RTE survey was to confirm locations of historic as well as relatively recently mapped occurrences of RTE plant species. Results of these surveys were summarized in the PAD (SCL 2006). In 2006, a number of additional RTE plant populations were located and mapped during invasive plant species surveys. It was not in the scope of the 2005 and 2006 reconnaissance surveys to completely map known or new RTE plant populations or to produce sighting forms documenting the RTE populations; this additional work was conducted under this study.

# 3 STUDY AREA

The study area for the RTE Plant Study extended approximately 18 miles along the Pend Oreille River from the Box Canyon tailrace downstream to the U.S.-Canada border (Figure 3.0-1). Specifically, the study area encompassed the following:

- Downstream of Metaline Falls – The reservoir fluctuation zone under existing Project operations and the land within the FERC Project boundary (Project area). The Project area includes most Project facilities, the area 200 horizontal feet (i.e., along the ground surface, perpendicular to the shoreline) beyond the high water level along both reservoir shorelines, and the transmission line right-of-way (ROW) from the powerhouse to the BPA interconnection.
- Upstream of Metaline Falls – The reservoir fluctuation zone and the land within approximately 200 horizontal feet beyond the high water level (approximately 2,019 feet NAVD 88 [2,015 feet NGVD 29])[1] along both reservoir shorelines extending to the FERC project boundary for the Box Canyon Project.[2, 3]
- The Boundary Wildlife Preserve (BWP) (155 acres) and adjoining SCL-owned property (85 acres).
- 100 feet around Project works areas that extend outside the Project boundary.
- 50 feet along both sides of Project-related roads, which include the road between the Boundary Dam and the Vista House, the road to the dam off County Road 2975, and the road from the Vista House to State Route (SR) 31.
- 100 horizontal feet along both sides of the river from Boundary Dam to the U.S.-Canada border (approximately 0.9 mile).

Concerning the reservoir fluctuation zone, the range of water surface elevations recorded during the survey periods for this study is presented below; these ranges represent typical operating conditions for the period in which data were collected. Existing conditions at the time of surveys were considered adequate to acquire all data required for this study:

- From Box Canyon Dam to Metaline Falls – Elevation 1,988–2,003 feet NAVD 88 (1,984–1,999 feet NGVD 29), as measured at the USGS gage 12396500

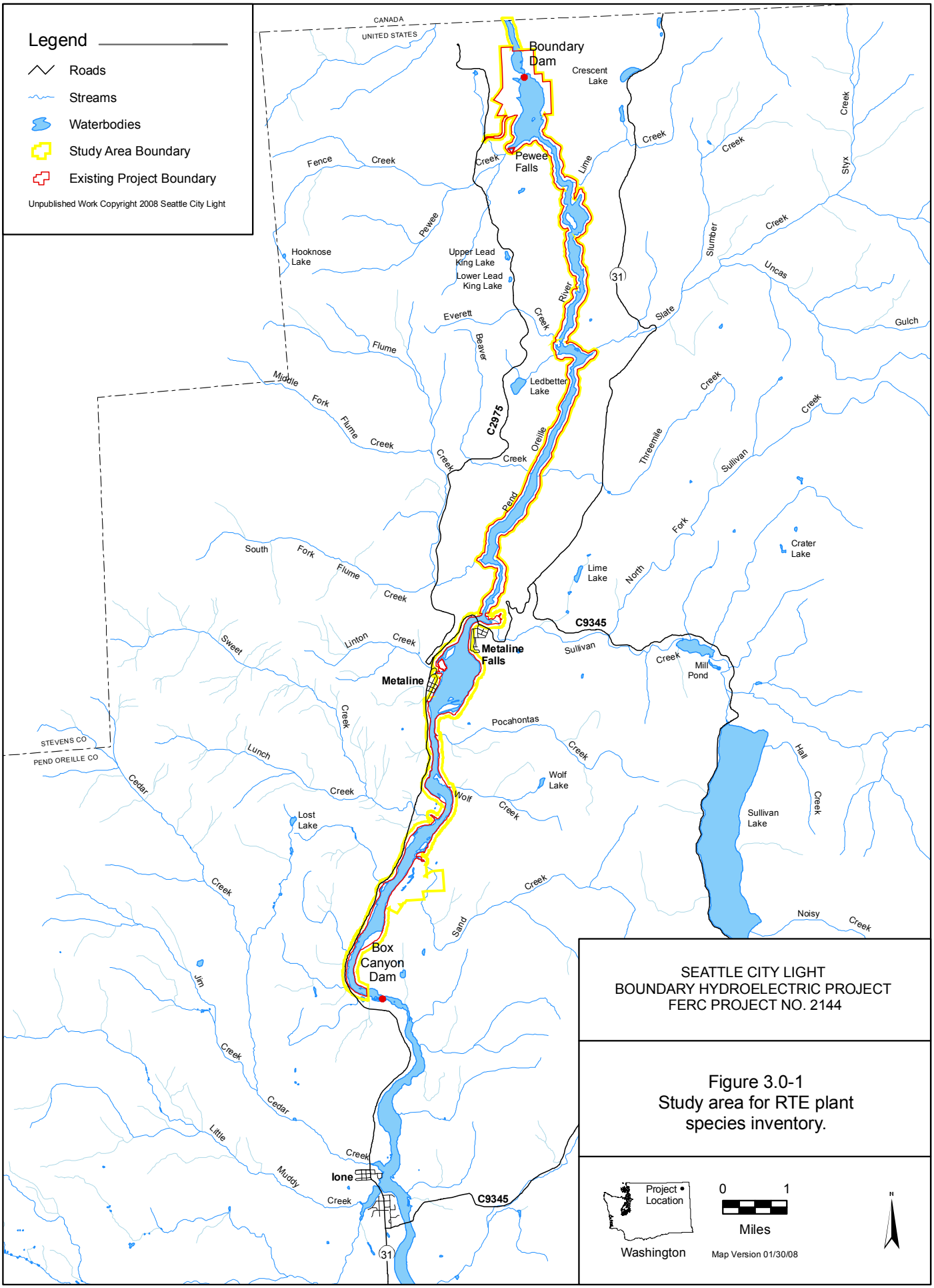
[1] SCL is in the process of converting all Project information from an older elevation datum (National Geodetic Vertical Datum of 1929 [NGVD 29]) to a more recent elevation datum (North American Vertical Datum of 1988 [NAVD 88]). As such, elevations are provided relative to both data throughout this document. The conversion factor between the old and new data is approximately 4 feet (e.g., the crest of the dam is 2,000 feet NGVD 29 and 2,004 feet NAVD 88).

[2] As indicated in this and other study reports in the Initial Study Report, SCL agrees it is appropriate to study the existing fluctuation range of the reservoir; however, for development of the Preliminary Licensing Proposal (PLP) and License Application, SCL will base its assessment of potential protection, mitigation, and enhancement measures on that portion of the fluctuation zone that is determined to be under the influence of Boundary Project operations, versus the effects of inflows and Metaline Falls that are beyond the control of the Project.

[3] Data for the riparian zone downstream of the Box Canyon Dam located within the FERC project boundary for the Box Canyon Project (FERC #2042) are included in this report; however, in the development of the Preliminary Licensing Proposal and License Application, SCL's assessment of potential protection, mitigation, and enhancement efforts will be limited to those effects that are determined to be under the influence of Boundary Project operations.

- From Metaline Falls to Boundary Dam – Elevation 1,987–1,993 feet NAVD 88 (1,983–1,989 feet NGVD 29), as measured at the SCL gage located in the Boundary forebay

(Note: The study area for the 2005 and 2006 RTE plant surveys was much larger than the study area for this RTE Plant Study [refer to the PAD (SCL 2006)]. Between Boundary Dam and Metaline Falls, it included the area between SR 31 on the east side of the reservoir, and County Road 2975 on the west side of the reservoir. Between Metaline Falls and Box Canyon Dam, it also included the area between SR 31 on the west side of the reservoir, and 0.25 mile east of the reservoir shoreline. A number of RTE plant populations located within the 2005 and 2006 reconnaissance study areas are outside of the 2007 study area and are not presented in this report.)


Legend
Roads
Streams
Waterbodies
Study Area Boundary
Existing Project Boundary
Unpublished Work Copyright 2008 Seattle City Light
CANADA
UNITED STATES
Boundary Dam
Crescent Lake
Pewee Falls
Hooknose Lake
Upper Lead King Lake
Lower Lead King Lake
Ledbetter Lake
Lime Lake
Crater Lake
Mill Pond
Wolf Lake
Lost Lake
Sullivan Lake
Metaline
Metaline Falls
Box Canyon Dam
Ione
C2975
C9345
31
STEVENS CO
PEND OREILLE CO
Fence Creek
Pewee Creek
Everett Creek
Beaver Creek
Middle Fork Flume Creek
South Fork Flume Creek
Flume Creek
Linton Creek
Sweet Creek
Lunch Creek
Cedar Creek
Jim Creek
Little Cedar Creek
Muddy Creek
Lime Creek
Slate Creek
Uncas Creek
Styx Creek
Slumber Creek
Gulch
Threemile Creek
Sullivan Creek
North Fork Sullivan Creek
Hall Creek
Noisy Creek
Sand Creek
Pocahontas Creek
Orelle River
Pend Oreille River
Project Location
Washington
0 1
Miles
Map Version 01/30/08
N
SEATTLE CITY LIGHT
BOUNDARY HYDROELECTRIC PROJECT
FERC PROJECT NO. 2144
Figure 3.0-1
Study area for RTE plant species inventory.

# 4 METHODS

The RTE Plant Study included four tasks:

1. Information Update and Pre-Field Review
2. RTE Plant Survey
3. Documentation and Effects Assessment
4. Resolution of Outstanding Issues

## 4.1. Information Update and Pre-Field Review

For this study, RTE species were defined to include all taxa with federal or state protective status, specifically the following:

- *Federally Listed or Proposed Species* — Species that are listed and protected under the Endangered Species Act (ESA) of 1973, as Endangered or Threatened, or proposed for listing.
- *Federal Candidates* — Species for which the U.S. Fish and Wildlife Service (USFWS) has sufficient information on their biological status and threats to propose them as endangered or threatened under the ESA, but for which development of a proposed listing regulation has not occurred because of other higher priority listing activities. Candidate species receive no statutory protection under the ESA. However, the USFWS encourages the formation of partnerships to conserve these species.
- *State Status* — Species listed by the Washington Department of Natural Resources, Natural Heritage Program (WNHP) on an advisory basis as Endangered, Threatened, Sensitive, and Review List 1 and 2. Species on the Watch List were included only if they were also federally listed or U.S. Forest Service (USFS) Sensitive.
- *USFS Sensitive Species* — Species on the Regional Forester's List of Sensitive Species for the Colville National Forest (USFS 2004, 2005a). The Regional Forester's List does not include species already protected under the ESA.
- *Bureau of Land Management (BLM) Sensitive Species* — Species on the Oregon and Washington BLM Special Status Species List (BLM 2005). The BLM list does not include species already protected under the ESA or state-listed as endangered or threatened.

The target RTE plant species list developed in 2006 for the RSP was updated in 2007 using information from the following sources:

- Washington Natural Heritage Program (http://www.dnr.wa.gov/nhp/);
- USFS Colville National Forest Botanist and Regional Forester's Sensitive Species List;
- BLM Botanist and BLM Special Status Species Lists;
- USFWS, Spokane Office.

The update resulted in a complete and current RTE plant list with current status, a description of typical habitat, and an assessment of whether potential habitat is present in the study area. The

assessment of potential habitat was based on the vegetation cover types produced for the PAD (SCL 2006) and elevation range in the study area.

Prior to beginning field surveys, botanists reviewed the morphological characteristics of target RTE plant species, in particular the 10 non-vascular species, to develop search images to improve detection and recognition abilities. This included reviewing similar species that are closely related or otherwise difficult to distinguish from the target species. It also included collecting information on diagnostic vegetative, floral, and fruit characteristics, and obtaining dichotomous keys for some taxa to aid in field identification. In addition, USFS and WNHP documentation for RTE plant populations that were not relocated during the 2005 and 2006 reconnaissance surveys was obtained and reviewed (where available).

A meeting was held in April 2007 with Kathy Ahlenslager, botanist for USFS Colville National Forest; Katy Beck, botanist; Michele Lynn, SCL Terrestrial Project Manager; and Rich Dwerlkotte, EDAW botanist, to discuss a RTE plant survey documentation protocol that would meet USFS standards and also be completed efficiently. The discussion primarily covered what would constitute an element occurrence on USFS land and how information required for USFS lands would be recorded. It was agreed that RTE plant occurrences on USFS lands would be recorded as distinct populations or element occurrences even though ecologically, many could be combined with populations on land under other ownership.

New rare plant occurrences recorded during the 2007 survey were determined to be new populations or combined with existing element occurrences using criteria published by NatureServe (2004). This habitat-based guidance is primarily based on the distance between occurrences, whether RTE plants share the same riparian/shore system, and how contiguous suitable habitat is between occurrences.

## 4.2. RTE Plant Survey

RTE plant surveys were conducted June 4–8, June 25–29, July 17–22, August 14–18, and September 2–4, 2007. These weeks were chosen so surveys would occur during periods throughout the growing season to capture the range of plant development and phenology required to increase the likelihood of observing and positively identifying RTE plant species. Many areas were visited more than once to adequately search for early- and late-blooming species.

Surveys for RTE plants were conducted using the "intuitive controlled method," whereby study area habitats with high potential to support these species were surveyed with greater intensity than areas with low potential (Nelson 1985). High potential habitats were identified based on the existing cover type map (SCL 2006), the locations of documented element occurrences from the SCL Geographic Information System (GIS), and field observations of habitat features that were too small to map (e.g., seeps). RTE plant surveys were conducted by walking; areas too steep to walk were surveyed from a boat using 7x50 millimeter binoculars.

RTE vascular plants were identified using *Flora of the Pacific Northwest* (Hitchcock and Cronquist 1973) and WNHP (2007). A variety of additional sources was utilized to verify tentative species identification, including other floras, published papers, and consultation with

appropriate taxonomic specialists. Plant collections were made when it was deemed necessary to identify a plant. Most pressed collections will eventually be deposited at the University of Washington herbarium (WTU). In addition, a comprehensive list of all vascular plant species observed and identified during the RTE plant survey was compiled.

Survey protocols for non-vascular plants (mosses and lichens) followed those for vascular plants found in the USFS *Threatened, Endangered and Sensitive Plant Survey Field Guide* and form (USFS 2005a). During the surveys, botanists looked for textural differences in the cover of non-vascular plants on trees and rocks. Habitat features with observed textural differences were investigated further for the presence of RTE non-vascular plants. Particular attention was given to mossy rocks, large tree trunks, and downed trees when they were encountered. Because so little is known about non-vascular plants in the study area, lichen specimens were collected and provided to the USFS for a baseline reference collection.

## 4.3. Documentation and Effects Assessment

The RTE plant information collected during the 2005 and 2006 reconnaissance surveys and reported in the RSP (SCL 2007a) served as the starting point for the documentation of RTE plants during the 2007 surveys. Mapped data (new populations) from the 2007 surveys were digitized using ESRI's GIS ArcMap software. The spatial data were used to amend the RTE plant shape files from the 2005 and 2006 reconnaissance surveys and to create a final map depicting the extent and location of each rare plant population in the study area. The boundaries of previously known populations were revised, as necessary, based on the assessments made during the 2007 survey.

A population may consist of one or many subpopulations, each of which is a discretely mapped polygon. The terms polygon and subpopulation are used interchangeably in this report. Nearly all of the previously known element occurrences in the study area were significantly enlarged and/or were combined with other subpopulations; for the sake of clarity, these units will be referred to as "populations" in this report.

In the context of this report, an element occurrence or "occurrence" refers to RTE populations that were a part of the WNHP or USFS RTE plant databases, whereas a "population" refers to RTE sites newly identified by SCL during the 2005, 2006, or 2007 RTE plant surveys. These new populations will become element occurrences when they are entered into the WNHP and USFS databases and given unique tracking numbers.

Population data were collected in the field on both new and previously known RTE plant sites. The location and extent of each RTE plant polygon was delineated on the Project's ortho-photographs (SCL 2005), and photographs were taken of the plants and their habitats. The NatureServe (2004) criteria were used to determine if each new RTE plant location should be mapped as a geographic extension of an existing element occurrence or population, or as a new population.

A comprehensive list of all vascular plant species observed and identified in the study area during the RTE surveys is provided in Appendix 1. Appendix 2 contains a list of all of the RTE

plants found during the surveys, designations for populations and subpopulations, tracking status information relative to previous surveys, river mile locations of polygons, presence on USFS and non-USFS lands, and general descriptive comments.

The WNHP Rare Plant Sighting Form and Instructions were used for collecting population attribute data on non-USFS land, including SCL, WDNR, BLM, and private lands (see Appendix 2 in the RSP). These forms were filled out for all new and previously documented RTE plant populations in the study area. The completed forms are provided in Appendix 3 and will be submitted to the WNHP.

Documentation of surveys conducted on USFS lands followed the protocol described in *Threatened, Endangered, and Sensitive Plants Survey Field Guide* (USFS 2005a). The RTE Plant Survey Field Form was used to document the dates and parameters of the surveys on USFS land. The USFS Element Occurrence Field Form (USFS 2005b) was used for collecting data on population attributes for each RTE plant population on USFS land. The completed USFS field forms are provided in Appendix 4 and will be submitted to the USFS. Documentation of RTE plant locations is considered confidential and will be distributed only to the USFS, WNHP, and other agencies, as appropriate.

Each RTE plant species occurrence was evaluated in the field for potential Project-related impacts and other threats. Data recorded included location relative to the reservoir fluctuation zone, recreation areas, and/or Project facilities; evidence of inundation, grazing, trampling, insect infestations, or disease; and proximity to erosion and/or invasive species infestations. An assessment of Project-related effects will be included in the USR.

## 4.4. Resolution of Outstanding Issues

During the 2005 and 2006 surveys, three issues related to RTE plant taxonomy and identification were identified for further research and resolution. These issues and the subsequent resolution follow:

- Orange balsamroot (*Impatiens aurella*) had unresolved taxonomic issues from the 2005 field season. In 2007, several flowering plants were examined and evaluated using a dichotomous key to species of the genus *Impatiens* in the Pacific Northwest (Zika 2006). Plants in the genus *Impatiens* in the study area were determined to be orange balsamroot. Orange balsamroot is a WNHP Review Group 1 species (WNHP 2007).
- The identification of yellow sedge (*Carex flava*) observed along the Project reservoir shoreline (PAD Figure 4.3.6, Occurrence CAFL-1; SCL 2006) was made when the perigynia were not quite mature, thus the identification could not be confirmed at that time. In 2007, inflorescences were collected when the perigynia were mature, and their identity as yellow sedge was confirmed using Hitchcock and Cronquist (1973) and the Flora of North America dichotomous keys to species of the genus *Carex*, Section Ceratocystis (Crins 2002).
- Purple meadowrue (*Thalictrum dasycarpum*) occurrences documented during the 2005 reconnaissance survey were identified using Hitchcock and Cronquist (1973); however, some specimens seemed to have characteristics that overlapped with western

meadowrue (*Thalictrum occidentale*). During the 2007 surveys, the Flora of North America dichotomous key to species of the genus *Thalictrum* was used to identify plants (Park and Festerling Jr. 1997) and confirm the identity of purple meadowrue in the study area.

# 5 PRELIMINARY RESULTS

## 5.1. Information Update and Pre-Field Review

The updated target list of RTE plant species with the potential to occur in the study area includes 60 vascular plant, 7 lichen, and 3 moss species (Table 5.1-1). Compared to the 2006 target list, there are five additional RTE vascular plants included on the 2007 list. A comprehensive list of all vascular plant species observed and identified in the study area during the RTE surveys is provided in Appendix 1.

**Table 5.1-1.** RTE plant species documented or suspected to occur in the study area.

| Scientific Name[1] | Common Name | USFWS Status[2] | USFS Status[3] | BLM Status[4] | WNHP Status[5] | Is Potential Habitat Present in Study Area? | Habitat Requirements/Information |
|---|---|---|---|---|---|---|---|
| **VASCULAR PLANTS** | | | | | | | |
| *Antennaria corymbosa* | Meadow pussy-toes | None | S | BA | T | No bogs | Bogs. Elev. 5,000 feet. |
| *Antennaria parvifolia* | Nuttall's pussy-toes | None | S | BA | S | Yes | Dry open areas, on sandy or gravelly riverbanks, openings of Ponderosa pine forests. Elev. 1,900 to 2,600 feet. |
| ***Astragalus microcystis*** | Least bladdery milk-vetch | None | S | BA | S | Yes | Open woods near shorelines, riverbanks, floodplains. Elev. 1,900 to 2,100 feet. |
| *Botrychium ascendens* | Triangular-lobed moonwort | None | S | BA | S | Yes | Dry meadows. Elev. 3,000 to 3,400 feet. |
| *Botrychium crenulatum* | Crenulate moonwort | None | S | BA | S | Yes | Western red cedar/western hemlock forests, stream banks, floodplains. Elev. 2,030 to 4,600 feet. |
| *Botrychium hesperium* | Western moonwort | None | S | BA | T | Yes | Dry to moist meadows. Elev. 2,760 to 6,300 feet |
| *Botrychium lineare* | Skinny moonwort | None | S | FC | T | Yes | Western redcedar/western hemlock forests, stream banks, floodplains. Elev. 2,000 to 4,000 feet. |
| *Botrychium paradoxum* | Two-spiked moonwort | None | S | BA | T | Yes | Meadows, perennial and intermittent streams. Elev. 2,500 to 3,600 feet. |
| *Botrychium pedunculosum* | Stalked Moonwort | None | S | BA | S | Yes | Dry to moist meadows, perennial streams. Elev. 2,500 to 3,300 feet. |
| ***Carex capillaris*** | Hair-like sedge | None | S | BA | S | Yes | Stream banks, wet meadows, wet ledges, marshy lake shores. Elev. 2,800 to 6,500 feet. |
| *Carex comosa* | Bristly sedge | None | S | BA | S | Yes | Marshes, lake shores, and wet meadows. Elev. 50 to 2,000 feet. |
| *Carex dioica* | Yellow bog sedge | None | S | BA | S | No sphagnum bogs | Sphagnum bogs, forested wetlands, and other wet marshy areas. Elev. 2,600 to 3,800 feet. |

**Table 5.1-1, continued…**

| Scientific Name[1] | Common Name | USFWS Status[2] | USFS Status[3] | BLM Status[4] | WNHP Status[5] | Is Potential Habitat Present in Study Area? | Habitat Requirements/Information |
|---|---|---|---|---|---|---|---|
| ***Carex flava*** | Yellow sedge | None | S | BA | S | Yes | Wet meadows, forested wetlands, bogs, and shores of streams and lakes. Elev. 2,000 to 4,300 feet. |
| *Carex foenea* | Bronze sedge | none | | BA | S | Yes | Standing water or moist ground near lakeshores and open areas. |
| *Carex hystericina* | Porcupine sedge | None | S | BA | W | Yes | Wet depressions, along creek drainages and hillside seeps. Elev. 500 to 2,600 feet. |
| *Carex magellenica spp. irrigua* | Boreal bog sedge | None | | BA | S | Yes | Fens, bogs, shady wet meadows, shrub wetlands and marshes. |
| *Carex praeceptorum* | Teacher's sedge | None | None | BT | R1 | No, elev. not high enough | Wet meadows and areas at higher elevations in mountains. |
| *Carex rostrata* | Beaked sedge | None | S | BA | S | No bogs or fens | Bogs and fens. Elev. 4,600 to 5,000 feet. |
| *Carex saxatilis* var. *major* | Russet sedge | None | S | BA | W | Yes | Wet meadows and margins of lakes and streams. |
| *Carex sychnocephala* | Many-headed sedge | None | S | BA | S | Yes | Moist or wet ground adjacent to marshes or along lake shores. Substrates vary from rather rocky to sandy and silty soils. |
| *Carex tenera var. tenera* | Quill sedge | None | | | T | Yes | Dry to moist open forests and meadows. |
| *Centunculus minimus* | Chaffweed | None | None | None | R1 | Yes | Moist ground, ephemeral wet areas elev. ~800 feet. |
| *Chrysosplenium tetrandrum* | Northern golden carpet | None | S | BA | S | Yes | Perennial and intermittent streams, seeps in rock outcrops. Elev. 2,000 to 4,000 feet. |
| *Cicuta bulbifera* | Bulb-bearing water-hemlock | None | S | BA | S | Yes | Edges of marshes, lake margins, in bogs, wet meadows, shallow standing water; slow moving streams, hummocks, and floating mats. Elev. 240 to 3,700 feet. |
| ***Cryptogramma stelleri*** | Steller's rock-brake | None | S | BA | S | Yes | Cliffs. Elev. 300 to 3,500 feet. |
| *Cypripedium parviflorum* | Yellow lady's-slipper | None | S | BS | T | Yes | Perennial streams on limestone rock under mixed conifer forest. Elev. 2,300 to 2,700 feet. |
| ***Dryas drummondii*** | Yellow mountain-avens | None | S | BA | S | Yes | In crevices of steep, rocky, dry cliffs, and on limestone rock along rivers. Elev. 1,900 to 6,800 feet. |

**Table 5.1-1, continued…**

| Scientific Name[1] | Common Name | USFWS Status[2] | USFS Status[3] | BLM Status[4] | WNHP Status[5] | Is Potential Habitat Present in Study Area? | Habitat Requirements/Information |
|---|---|---|---|---|---|---|---|
| *Dryopteris carthusiana* | Toothed wood fern | None | | None | R1 | No | In Washington, sphagnum swamps. |
| *Dryopteris cristata* | Crested shield-fern | None | S | BA | S | Yes | Wet meadows, forested wetlands. Often found on hummocks, downed woody debris or at the base of deciduous shrubs, often with alder. Elev. 2,100 to 4,100 feet. |
| *Eriophorum viridicarinatum* | Green keeled cotton-grass | None | S | BA | S | No fens, elev. to low | Fens and marshes. Elev. 2,900 to 4,650 feet. |
| *Gaultheria hispidula* | Creeping snowberry | None | S | BA | S | No sphagnum wetlands | Sphagnum wet lands or moist areas in coniferous woods. Elev. 2,960 to 3,360 feet. |
| *Geum rivale* | Water avens | None | S | BA | S | Yes | Wet meadows, bogs, riparian zones along perennial streams and moist old pastures. Does not occur under heavy shrub cover. Elev. 2,500 to 6,400 feet. |
| ***Hierochloe odorata*** | Common northern sweetgrass | None | None | None | R1 | Yes | Moist soil of low montane and subalpine slopes and meadows |
| ***Hypericum majus*** | Canadian St. John's-wort | None | S | BA | S | Yes | Along rivers, ponds, lakesides or other low, wet places; elev. 100 to 2,300 feet. |
| ***Impatiens aurella*** | Orange balsam | None | None | BT | R1 | Yes | Moist, open or shaded habitats. |
| *Lobelia kalmii* | Kalm's lobelia | None | S | BS | E | No marl or peat bogs | Marl or peat bogs, along shores and in other wet places. |
| *Lomatium sandbergii* | Sandberg desert-parsley | None | None | None | R1 | No, elev. too low | Open, rocky places at moderate to higher, subalpine habitats. |
| *Lycopodiella inundata* | Bog clubmoss | None | S | BA | S | No sphagnum bogs | Mostly in sphagnum bogs, seldom in other very wet places. Elev. 1,800 feet. |
| *Lycopodium dendroideum (=Diphasiastrum alpinum)* | Treelike clubmoss | None | S | BA | S | Yes | Rock outcrops, talus or boulder fields, significant moss and organic debris. Between a meadow or wetland and adjacent forest; near base of large boulders. Elev. 800 to 3,600 feet. |
| *Muhlenbergia glomerata* | Marsh muhly | None | S | BA | S | Yes | Stream banks, meadows, marshes, bogs, and shores of lakes and ponds. Elev. 2,900 to 3,500 feet. |

**Table 5.1-1, continued…**

| Scientific Name[1] | Common Name | USFWS Status[2] | USFS Status[3] | BLM Status[4] | WNHP Status[5] | Is Potential Habitat Present in Study Area? | Habitat Requirements/Information |
|---|---|---|---|---|---|---|---|
| ***Ophioglossum pusillum*** | Adder's-tongue | None | S | BS | T | Yes | Moist meadows, pastures, old fields, roadside ditches, and floodplain woods in seasonally wet, rather acid soil. Elev. 40 to 3,200 feet. |
| *Penstemon wilcoxii* | Wilcox's penstemon | None | None | None | S | Yes | Open or wooded areas, sometimes in rocky substrates in foothills and middle elevations. |
| *Physaria didymocarpa* var. *didymocarpa* | Common twinpod | None | S | BA | S | Yes | A variety of habitats, including river gravel bars, steep shale outcrops, rocky flats, gravelly prairies, talus slopes, dry hillsides, and road cuts. Elev. 2,000 feet. |
| *Platanthera obtusata* | Small northern bog orchid | None | S | BA | S | Yes | Damp or wet places in forests, marshes, bogs, meadows, and along stream banks. Areas with Engelmann spruce and/or western redcedar. Elev. 800 to 5,000 feet. |
| *Salix candida* | Hoary willow | None | S | BA | T | No fens | Fens. Elev. 2,400 to 3,000 feet. |
| *Salix maccalliana* | Maccall's willow | None | S | BA | S | No bogs or fens | Bogs and fens. Elev. 2,400 to 3,000 feet. |
| *Salix pseudomonticola* | Serviceberry willow | None | S | None | None | No fens or bogs | Fens and bogs. Elev. 2,900 feet. |
| ***Sanicula marilandica*** | Black snake-root | None | S | BA | S | Yes | Moist low grounds such as meadows, riparian floodplains, moist woods and marsh edges. Elev. 1,500 to 2,900 feet. |
| *Scutellaria angustifolia* spp. *micrantha* | Narrowleaf skullcap | None | None | None | R1 | Yes | In a variety of open, moist or dry, often rocky habitats east of the Cascade Range. |
| *Sisyrinchium montanum* | Strict blue-eyed-grass | None | None | None | T | No, elev too high | Steep west-facing slopes associated with small seeps/springs; elev. 700 feet. |
| ***Sisyrinchium septentrionale*** | Northern blue-eyed grass | None | S | BA | S | Yes | Primarily in open, wet meadows, sometimes in association with perennial streams or in a mosaic of forested wetlands. Elev. 2,200 to 3,850 feet. |
| *Spartina pectinata* | Prairie cordgrass | None | S | BA | S | Yes | Wet areas such as swales, edges of marshes and ponds, and along streams and riverbanks, in both fresh and saltwater. Elev. 2,000 feet. |

**Table 5.1-1, continued…**

| Scientific Name[1] | Common Name | USFWS Status[2] | USFS Status[3] | BLM Status[4] | WNHP Status[5] | Is Potential Habitat Present in Study Area? | Habitat Requirements/Information |
|---|---|---|---|---|---|---|---|
| *Spiranthes diluvialis* | Ute ladies'-tress | FT | FT | FT | E | Yes | Stabilized gravel bars that are moist throughout the growing season and inundated early in the growing season; old oxbows, riparian edges, high flow channels, and moist-wet meadows along perennial streams; elev. 720–1,500 feet. |
| *Subularia aquatica* | Water awlwort | None | | None | R1 | Yes | Submerged beneath shallow water at the margins of freshwater lakes, ponds and stream banks. |
| *Teucrium canadense* spp. *viscidum* | Woodsage | None | S | None | W | Yes | Wet areas around lakes and stream banks in low areas. Elev. 0 to 2,300 feet. |
| ***Thalictrum dasycarpum*** | Purple meadowrue | None | S | BA | S | Yes | Deciduous riparian woods, damp thickets, swamps, wet meadows, often adjacent to and/or within the floodplain. Elev. 200 to 2,200 feet. |
| *Utricularia intermedia* | Flat-leaved bladderwort | None | None | BA | S | No, elevation not high enough | Shallow ponds, slow-moving streams, and wet sedge or rush meadows. Elev. 4,000 feet. |
| *Utricularia minor* | Lesser bladderwort | None | None | BT | R1 | Yes | Shallow, standing, or slow-moving water. |
| *Vaccinium myrtilloides* | Velvet-leaved blueberry | None | S | BA | S | Yes | Western redcedar/ western hemlock forests. Elev. 2,000 to 3,000 feet. |
| ***Viola renifolia*** | Kidney-leaved violet | None | S | BT | S | Yes | Moist lowland forests. Elev. 2,270 to 4,355 feet. |
| **NON-VASCULAR PLANTS - LICHENS[6]** | | | | | | | |
| *Dermatocarpon luridum* | Brook lichen | None | S | None | P1 | Yes | Aquatic; on rocks, boulders, and bedrock in streams, rivers, or seeps, usually submerged to inundated most of the year. |
| *Leptogium burnetiae* var. *hirsutum* | Jellyskin | None | S | None | P2 | Yes | Typically epiphytic on trees but also on decaying rocks and mosses. |
| *Leptogium cyanescens* | Blue jellyskin | None | S | None | None | Yes | Bark of conifers and hardwood trees and logs, mossy rocks in cool, moist micro-sites. |

**Table 5.1-1, continued…**

| Scientific Name[1] | Common Name | USFWS Status[2] | USFS Status[3] | BLM Status[4] | WNHP Status[5] | Is Potential Habitat Present in Study Area? | Habitat Requirements/Information |
|---|---|---|---|---|---|---|---|
| *Nephroma bellum* | Naked kidney lichen | None | S | None | None | Yes | On branches and twigs of trees, especially conifers. Also on mossy rocky in humid forests. |
| *Peltigera neckeri* | Black saddle lichen | None | S | None | None | Yes | Mossy logs, soil, and tree bases in wet forest habitats. |
| *Peltigera pacifica* | Fringed pelt | None | S | None | None | Yes | Mossy logs, soil, and tree bases in wet forest habitats. |
| *Tholurna dissimilis* | Urn lichen | None | S | None | P1 | No, not subalpine | On twigs and branches of exposed conifers in humid subalpine habitats. |
| **NON-VASCULAR PLANTS – MOSSES[7]** | | | | | | | |
| *Schistostega pennata* | Luminous moss | None | S | None | None | Yes | Damp acidic rock, soil, and decaying wood in dark places, rock crevices or overhangs, animal burrows, on shaded banks, in crevices of root balls or fallen trees or around tree roots in dark, dense forests. |
| *Scouleria marginata* | Splashzone moss | None | S | None | None | Yes | Semi-aquatic; on rocks in the spray-zone of streams and waterfalls, typically submerged at least part of the year. |
| *Tetraphis geniculata* | Tetaphis moss | None | S | None | None | Yes | Moist conifer forest with large downed logs. Found on cut or broken ends or low sides of decay class 3, 4, or 5 rotted logs or stumps and occasionally on peaty banks in moist conifer forests from sea level to subalpine elevations. |

Notes:

1 Species names listed in **bold** indicate those documented in the study area.

2 USFWS Classification: FT=Listed as Threatened, likely to become endangered (WNHP 2007).

3 USFS Regional Forester's Sensitive Species, Region 6, updated July 2004 (USFS 2004). S = Sensitive.

4 Bureau of Land Management (BLM) Special Status Species, updated March 2005 (BLM 2005). BLM Special Status Species Categories:
BS = Bureau Sensitive – Nominated by BLM District Managers; must be listed by WNHP to be eligible.
BA = Bureau Assessment – Species known or suspected on BLM land that are not federally listed, state listed, or BS and that are listed by the WNHP but not eligible as BS.

**Table 5.1-1, continued…**

BT = Bureau Tracking – All species known or suspected on BLM land that are not federally listed, state listed, BS, or BA, and that are WNHP Review species or Watch species.
FC = Federal Candidate Species in Oregon and Washington.
FT = Federal Threatened Species in Oregon and Washington.

5 State Status: WNHP (2007) provides the following explanation of state status:
E = Endangered taxa are at critically low levels or their habitats have been degraded or depleted to a significant degree presenting the danger of becoming extinct or extirpated from Washington within the foreseeable future if factors contributing to their decline continue.
T = Threatened are likely to become Endangered in Washington within the foreseeable future if factors contributing to population decline or habitat degradation or loss continue.
S = Sensitive taxa are vulnerable or declining and could become Endangered or Threatened in the state without active management or removal of threats.
R = Review taxa are either R1 = Taxon in need of additional field work before a status can be assigned, or R2 = Taxon with unresolved taxonomic questions.
W = Watch List taxa that are less at risk in Washington than previously assumed.

6 WNHP lichen list is in the process of being revised; state status is based on 1997 list (WNHP 1997-2003). Priority status groups were developed by scientists using the same criteria as those used for vascular plants: occurrence pattern, vulnerability, threats, degree of protection, and taxonomy.

7 WNHP has not assigned mosses to priority groups due to lack of information (WNHP 2007).

## 5.2. RTE Plant Surveys

The RTE Plant Study documented 204 polygons or subpopulations, which were combined into 52 populations of 15 different vascular RTE plant species (Table 5.2-1).

**Table 5.2-1.** RTE plant populations and subpopulations (polygons) delineated during 2007 surveys.

| Taxon | No. of Populations | No. of Polygons |
|---|---|---|
| *Astragalus microcystis* (least bladdery milk-vetch) | 5 | 17 |
| *Carex capillaris* (hair-like sedge) | 1 | 1 |
| *Carex flava* (yellow sedge) | 3 | 19 |
| *Carex krausei* ssp. *porsildiana* (Porsild's sedge) | 1 | 1 |
| *Cryptogramma stelleri* (Steller's rock-brake) | 4 | 10 |
| *Dryas drummondii* (yellow mountain-avens) | 3 | 37 |
| *Hierochloe odorata* (common northern sweetgrass) | 2 | 3 |
| *Hypericum majus* (Canadian St. John's-wort) | 1 | 5 |
| *Impatiens aurella* (orange balsam) | 8 | 8 |
| *Muhlenbergia mexicana* var. *mexicana* (wirestem muhly) | 1 | 24 |
| *Ophioglossum pusillum* (adder's-tongue) | 2 | 2 |
| *Sanicula marilandica* (black snake-root) | 7 | 9 |
| *Sisyrinchium septentrionale* (northern blue-eyed grass) | 2 | 3 |
| *Thalictrum dasycarpum* (purple meadowrue) | 7 | 60 |
| *Viola renifolia* (kidney-leaved violet) | 5 | 5 |
| **Totals** | **52** | **204** |

In Table 5.2-2, the Global Rank (GRank) is given to characterize the relative rarity or endangerment worldwide of each RTE plant species located in the study area. In addition, the USFWS, USFS, BLM and WNHP status of each RTE plant is summarized (WNHP 2007).

**Table 5.2-2.** Global rank, USFWS, USFS, BLM, and WNHP status for each RTE plant species in the study area.

| Taxon | GRank[1] | USFWS[2] | USFS[2] | BLM[2] | WNHP[2] |
|---|---|---|---|---|---|
| *Astragalus microcystis* (least bladdery milk-vetch) | G5 | None | S | BA | S |
| *Carex capillaris* (hair-like sedge) | G5 | None | S | BA | S |
| *Carex flava* (yellow sedge) | G5 | None | S | BA | S |
| *Carex krausei* ssp. *porsildiana* (Porsild's sedge) | G5 | None | None | None | R2 |
| *Cryptogramma stelleri* (Steller's rock-brake) | G5 | None | S | BA | S |
| *Dryas drummondii* (yellow mountain-avens) | G5 | None | S | BA | S |
| *Hierochloe odorata* (common northern sweetgrass) | G5 | None | None | None | R1 |
| *Hypericum majus* (Canadian St. John's-wort) | G5 | None | S | BA | S |
| *Impatiens aurella* (orange balsam) | G4? | None | None | BT | R1 |
| *Muhlenbergia mexicana* var. *mexicana* (wirestem muhly) | G5 | None | None | None | R1 |
| *Ophioglossum pusillum* (adder's-tongue) | G5 | None | S | BS | T |
| *Sanicula marilandica* (black snake-root) | G5 | None | S | BA | S |
| *Sisyrinchium septentrionale* (northern blue-eyed grass) | G3G4 | None | S | BA | S |
| *Thalictrum dasycarpum* (purple meadowrue) | G5 | None | S | BA | S |
| *Viola renifolia* (kidney-leaved violet) | G5 | None | S | BT | S |

Notes:

1 Global Rank (GRank)

Global Rank characterizes the relative rarity or endangerment of the element world-wide. Two codes (e.g. G1G2) represent an intermediate rank.
G1 = Critically imperiled globally (5 or fewer occurrences).
G2 = Imperiled globally (6 to 20 occurrences).
G3 = Either very rare and local throughout its range or found locally in a restricted range (21 to 100 occurrences).
G4 = Apparently secure globally.
G5 = Demonstrably secure globally.
GH = Of historical occurrence throughout its range.
GU = Possibly in peril range-wide but status uncertain.
GX = Believed to be extinct throughout former range.
GNR = Not yet ranked.
Tn = Rarity of an infraspecific taxon. Numbers and codes similar to those for Gn ranks above.
? = Questionable.

2 See notes under Table 5.1-1.

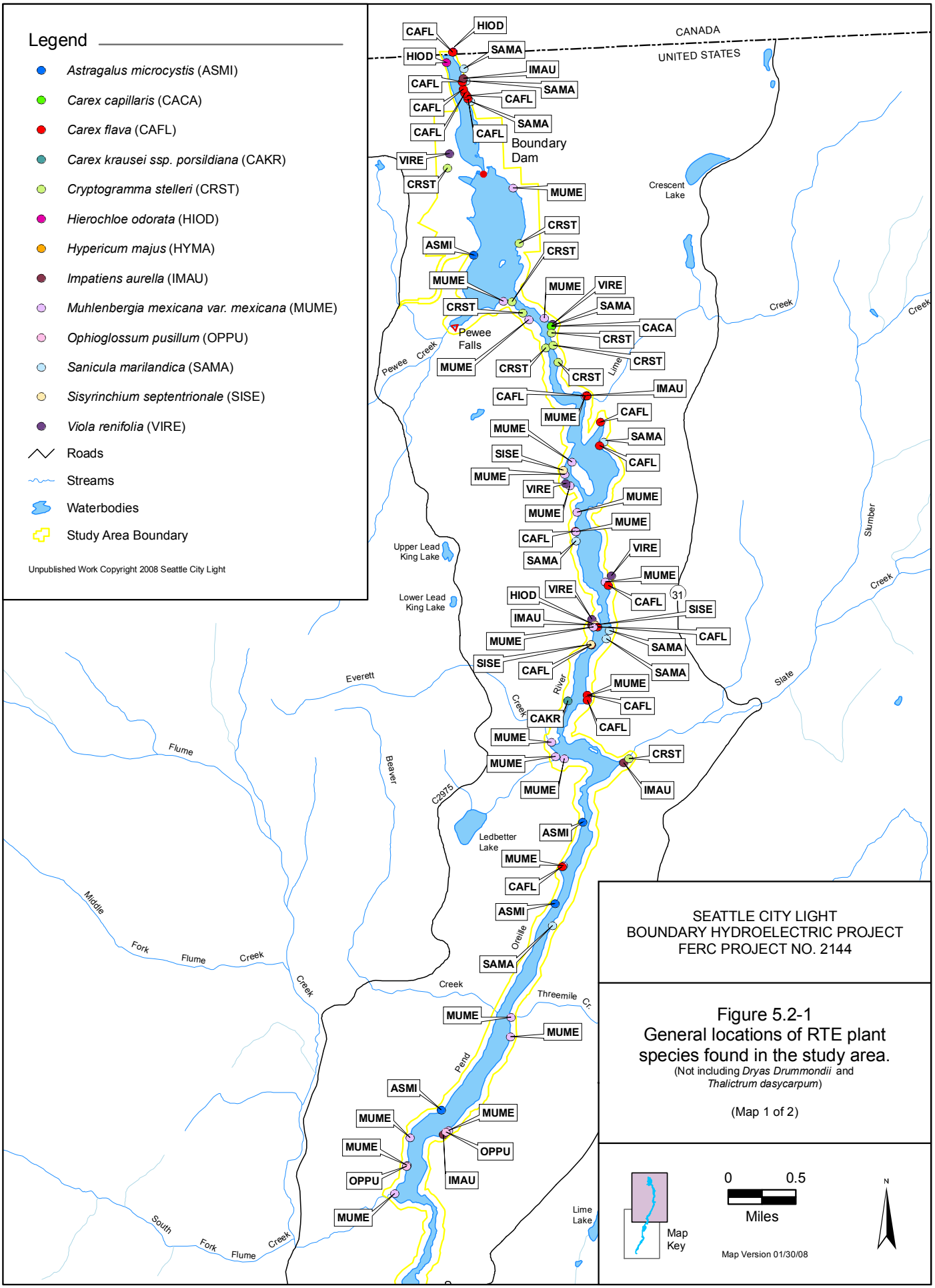
The locations of all RTE plant species populations are shown in Figures 5.2-1 and 5.2-2. Figure 5.2-1 displays the locations of 13 RTE species excluding populations of yellow mountain-avens and purple meadowrue. Because of the numerous populations of these two species, they are displayed separately in Figure 5.2 polygons.

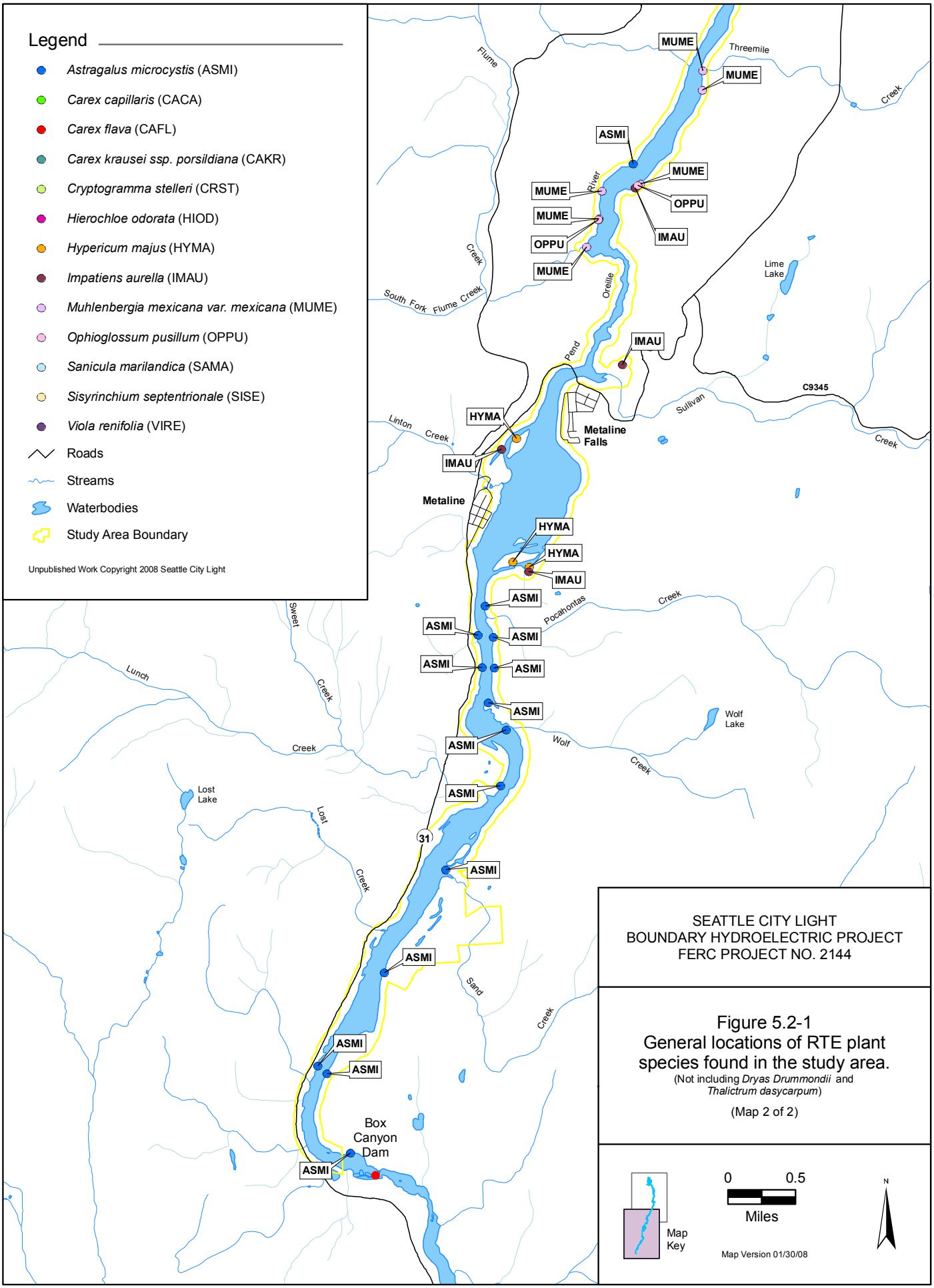
Appendix 2 contains a list of all of the RTE plants found during the surveys, designations for populations and subpopulations, tracking status information relative to previous surveys, river mile locations of polygons, presence on USFS and non-USFS lands, and general descriptive comments. The completed WNHP sighting forms for RTE populations on BLM, WDNR, SCL, and private lands are contained in Appendix 3. Completed element occurrence field forms for

RTE populations on USFS lands are contained in Appendix 4. Appendix 5 contains maps of all RTE populations and subpopulations located in the study area during 2007.

The 204 polygons or subpopulations of RTE plants documented during this survey represent 157 new polygons in addition to the 47 polygons mapped during the 2005 and 2006 reconnaissance surveys (SCL 2006). The size of many of the RTE plant populations known before the 2007 survey, some of which are element occurrences, was enlarged significantly.

Eleven RTE plant polygons mapped during the 2005/2006 reconnaissance surveys were outside of the study area for this study. Although they are present in the 2005/2006 survey area, two RTE plant species—bulb-bearing water-hemlock (*Cicuta bulbifera*) and marsh muhly (*Muhlenbergia glomerata*)—are completely outside of the 2007 study area boundary. The 2007 surveys did relocate 6 of the 12 pre-2005 occurrences recorded by the USFS or WNHP (and also not found during the 2005 and 2006 reconnaissance surveys). The six pre-2005 occurrences that were not found in 2005, 2006, or 2007 are designated as "not relocated" in Appendix 2.


Legend
Astragalus microcystis (ASMI)
Carex capillaris (CACA)
Carex flava (CAFL)
Carex krausei ssp. porsildiana (CAKR)
Cryptogramma stelleri (CRST)
Hierochloe odorata (HIOD)
Hypericum majus (HYMA)
Impatiens aurella (IMAU)
Muhlenbergia mexicana var. mexicana (MUME)
Ophioglossum pusillum (OPPU)
Sanicula marilandica (SAMA)
Sisyrinchium septentrionale (SISE)
Viola renifolia (VIRE)
Roads
Streams
Waterbodies
Study Area Boundary
Unpublished Work Copyright 2008 Seattle City Light
CANADA
UNITED STATES
Boundary Dam
Crescent Lake
Pewee Falls
Pewee Creek
Upper Lead King Lake
Lower Lead King Lake
Ledbetter Lake
Lime Lake
Everett
Flume
Middle Fork Flume Creek
South Fork Flume Creek
Beaver Creek
C2975 Creek
Creek
Oreille Creek
Threemile Cr.
Pend
Lime Creek
Slumber Creek
Slate Creek
31
SEATTLE CITY LIGHT
BOUNDARY HYDROELECTRIC PROJECT
FERC PROJECT NO. 2144
Figure 5.2-1
General locations of RTE plant species found in the study area.
(Not including Dryas Drummondii and Thalictrum dasycarpum)
(Map 1 of 2)
Map Key
0 0.5
Miles
N
Map Version 01/30/08


Legend
Astragalus microcystis (ASMI)
Carex capillaris (CACA)
Carex flava (CAFL)
Carex krausei ssp. porsildiana (CAKR)
Cryptogramma stelleri (CRST)
Hierochloe odorata (HIOD)
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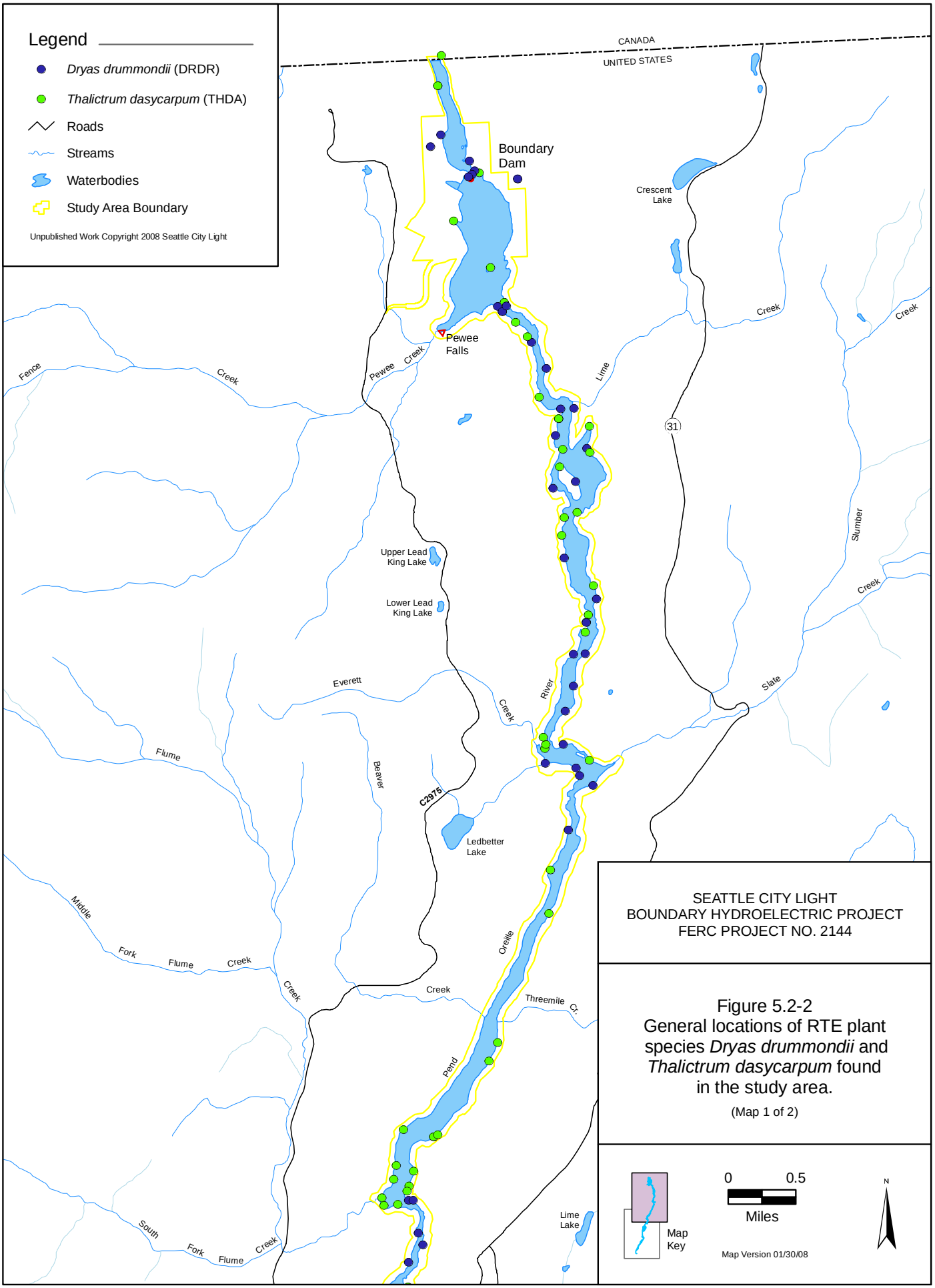
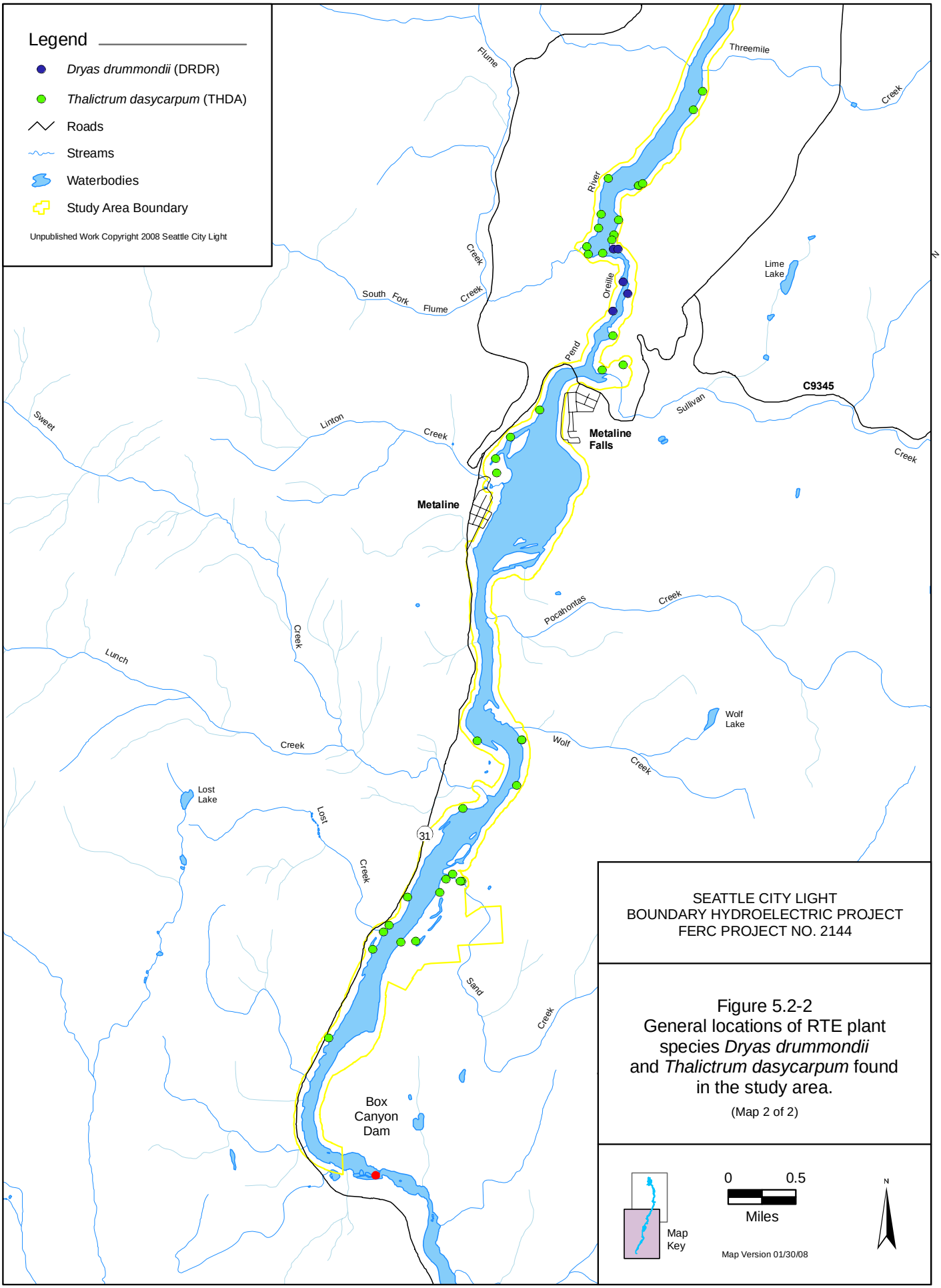
Impatiens aurella (IMAU)
Muhlenbergia mexicana var. mexicana (MUME)
Ophioglossum pusillum (OPPU)
Sanicula marilandica (SAMA)
Sisyrinchium septentrionale (SISE)
Viola renifolia (VIRE)
Roads
Streams
Waterbodies
Study Area Boundary
Unpublished Work Copyright 2008 Seattle City Light
Flume Creek
Threemile Creek
South Fork Flume Creek
Oreille River
Pend Oreille
Lime Lake
Linton Creek
Metaline
Metaline Falls
Sullivan Creek
C9345
Pocahontas Creek
Sweet Creek
Lunch Creek
Lost Creek
Lost Lake
Wolf Creek
Wolf Lake
Sand Creek
31
Box Canyon Dam
SEATTLE CITY LIGHT
BOUNDARY HYDROELECTRIC PROJECT
FERC PROJECT NO. 2144
Figure 5.2-1
General locations of RTE plant species found in the study area.
(Not including Dryas Drummondii and Thalictrum dasycarpum)
(Map 2 of 2)
Map Key
0 0.5
Miles
N
Map Version 01/30/08


Legend
Dryas drummondii (DRDR)
Thalictrum dasycarpum (THDA)
Roads
Streams
Waterbodies
Study Area Boundary
Unpublished Work Copyright 2008 Seattle City Light
CANADA
UNITED STATES
Boundary Dam
Pewee Falls
Crescent Lake
Upper Lead King Lake
Lower Lead King Lake
Ledbetter Lake
Lime Lake
Pewee Creek
Fence Creek
Lime Creek
Slumber Creek
Slate Creek
Everett Creek
Beaver Creek
Flume Creek
Middle Fork Flume Creek
South Fork Flume Creek
Threemile Ck.
Pend Oreille River
C2975
31
SEATTLE CITY LIGHT
BOUNDARY HYDROELECTRIC PROJECT
FERC PROJECT NO. 2144
Figure 5.2-2
General locations of RTE plant species Dryas drummondii and Thalictrum dasycarpum found in the study area.
(Map 1 of 2)
Map Key
0 0.5
Miles
N
Map Version 01/30/08


Legend
Dryas drummondii (DRDR)
Thalictrum dasycarpum (THDA)
Roads
Streams
Waterbodies
Study Area Boundary
Unpublished Work Copyright 2008 Seattle City Light
Flume
Threemile
Creek
River
Creek
South Fork Flume Creek
Oreille
Lime Lake
Pend
C9345
Sullivan
Sweet
Linton
Creek
Metaline Falls
Creek
Metaline
Pocahontas
Creek
Creek
Lunch
Creek
Wolf Lake
Wolf
Creek
Lost Lake
Lost
Creek
31
Sand
Creek
Box Canyon Dam
SEATTLE CITY LIGHT
BOUNDARY HYDROELECTRIC PROJECT
FERC PROJECT NO. 2144
Figure 5.2-2
General locations of RTE plant species Dryas drummondii and Thalictrum dasycarpum found in the study area.
(Map 2 of 2)
Map Key
0
0.5
Miles
Map Version 01/30/08
N

Four new RTE plant species were located in the study area during the 2007 surveys: hair-like sedge (*Carex capillaris*), Canadian St. John's-wort (*Hypericum majus*), common northern sweetgrass (*Hierochloe odorata*), and adder's-tongue (*Ophioglossum pusillum*). The 2007 surveys also found northern blue-eyed grass (*Sisyrinchium septentrionale*) along the reservoir shoreline. Formerly, this species had only been observed outside of the 2007 study area.

The 2007 surveys also documented two species in the study area—Porsild's sedge (*Carex krausei* ssp. *porsildiana*) and wire-stem muhly (*Muhlenbergia mexicana* var. *mexicana*)—that have subsequently been added to the WNHP rare plant list because of their probable rarity in the state (WNHP 2008a, 2008b). The study area population of Porsild's sedge represents the first documented occurrence of this species in Washington; the nearest known populations are in northeastern Canada. Herbarium collection data from Washington State University and the University of Washington suggest that there are few populations of wire-stem muhly in the state; the localities from which these collections were made are very old and some of those populations may no longer exist. The study area supports a number of small subpopulations of this species.

There were no observations and no historical records of the federally-listed Ute ladies'-tresses (*Spiranthes diluvialis*), the only federally-listed species potentially occurring in or near the study area. A similar species, hooded ladies'-tresses (*Spiranthes romanzoffiana*), was located in the Boundary tailrace and in the Canyon Reach. It is a common species in the Pacific Northwest.

None of the target non-vascular RTE species (mosses and lichens) potentially occurring in the study area were observed during the 2007 field surveys. Only one of these species, naked kidney lichen (*Nephroma bellum*), has been documented near the Project. Suitable habitat for this species and many of the other nine non-vascular plants on the target list is potentially present in the study area.

The taxonomy, status, habitat requirements, and distribution of the 15 RTE plant species documented in the study area are discussed below. Additionally, a general discussion of impacts to these species is presented here and in Section 5.3. A full assessment of effects on RTE plants (both Project-related and non-Project related) will be completed in 2008 and presented in the USR. Most of the range and morphological information in this section is adapted from WNHP (2007) and the *Vascular Plants of the Pacific Northwest* (Hitchcock et al. 1955–1969).

### 5.2.1. Least Bladdery Milk-vetch (*Astragalus microcystis*)

Least bladdery milk-vetch is in the pea family and is a taprooted plant with a low branching root crown. The stems are prostrate to slightly decumbent with 9 to 15 hairy, gray-green leaflets. Large specimens tend to become low mounds of dark green foliage. The pinkish to purplish flowers develop into a sessile, oval, slightly inflated fruit that is up to one-half inch long.

Least bladdery milk-vetch is a regional endemic with a range restricted to southern British Columbia, northern Idaho, western Montana, Wyoming, and Washington. In Washington, it is known from 26 recent occurrences in the Columbia Basin, Okanogan Highlands, Olympic Peninsula and the Southwest Washington physiographic provinces in Jefferson, Stevens, Pend

Oreille, Lincoln, and Clallam counties. Typical habitat for this state Sensitive species includes gravelly to sandy areas, from riverbanks to open woods. Hitchcock and Cronquist (1973) was used to positively identify this species.

In the study area, there are five populations of least bladdery milk-vetch, comprising 17 subpopulations (polygons), ranging from Project river mile PRM 17 to 34. Three of the populations are along the reservoir upstream of Metaline Falls and were found on USFS, BLM, SCL, WDNR, Pend Oreille Public Utility District #1, and private lands. The largest population extends 1.8 miles, is over 15 acres in size, and has several thousand plants. The least bladdery milk-vetch populations in the study area show a wide range of tolerances to different habitat conditions. Plants range from the upper portion of the littoral zone [elevation 1,989–1,994 feet NAVD 88 (1,985-1,990 feet NGVD 29)] to more than 100 feet above the this level on dry eroding slopes and the tops of reservoir banks. Its typical substrate includes hardpacked cobble, gravel, sand, silt loam soils, and eroding slate. Plants in the littoral zone were completely submerged by water when water levels were high. This species was also observed on a site covered with a fill-gravel substrate near Box Canyon Dam, and in forest openings at several locations. A habitat characteristic common to all sites supporting least bladdery milk-vetch is low vegetation cover where there is less competition for light and space. Least bladdery milkvetch is a species that often grows on steep eroding substrates or in the littoral zone and tolerates some natural disturbance processes like erosion and seasonal floods.

Species associated with least bladdery milk-vetch populations in the study area include Atkinson's tickseed (*Coreopsis atkinsoniana*), white sage (*Artemisia ludoviciana*), common gaillardia (*Gaillardia aristida*), field mint (*Mentha arvensis*), common St. John's wort (*Hypericum perforatum*), and oxeye daisy (*Leucanthemum vulgare*). Competition with weedy species such as common St. John's-wort, spotted knapweed (*Centaurea biebersteinii*), common tansy (*Tanacetum vulgare*), Dalmatian toadflax (*Linaria dalmatica*), narrowleaf plantain (*Plantago lanceolata*), oxeye daisy, and annual brome species (*Bromus* spp.) is a threat. Erosion and bank undercutting near the reservoir margin occur within portions of a number of least bladdery milkvetch subpopulations.

### 5.2.2. Hair-like Sedge (*Carex capillaris*)

Hair-like sedge is a medium-sized sedge with clustered stems. The terminal spike has male flowers or may have a few female flowers at the tips, while the lateral spikes are female on long, slender, nodding peduncles. The lowermost inflorescence bract is long sheathing. The perigynia are elliptic to lance-ovate, tapering to a short beak. The achene is three-sided.

The range of hair-like sedge is circumboreal. In North America, it ranges across the boreal regions south to northeastern Oregon, Nevada, Utah, New Mexico, Michigan, and New York. This State Sensitive species is only known from three other occurrences in Okanogan County. Typical habitat for this species includes stream banks, wet meadows, wet ledges, and marshy lakeshores. Hitchcock and Cronquist (1973) was used to positively identify this species. A specimen was also confirmed by J. Mastroguiseppe, a *Carex* expert (Mastroguiseppe 2007).

In the study area, a small population of hair-like sedge was found at a single location on USFS land in the canyon reach. The habitat for hair-like sedge is a palustrine emergent wetland, a seep-fed wet meadow just above the reservoir shoreline. The substrate is probably moist throughout the growing season. Plants are approximately 2 to 3 feet above full pool level (1,994 feet NAVD 88 [1,990 feet NGVD 29]). Associated species are redosier dogwood (*Cornus sericea*), western redcedar (*Thuja plicata*), russet buffaloberry (*Shepherdia canadensis*), wild sarsaparilla (*Aralia nudicaulis*), golden sedge (*Carex aurea*), oxeye daisy, and Douglas spiraea (*Spiraea douglasii*). There is some Canada thistle (*Cirsium arvense*) growing in the population. Non-native species such as yellow iris (*Iris pseudacorus*) and reed canarygrass (*Phalaris arundinacea*) occur in similar habitats upstream of this site and could be a threat if they were to establish at this site. While it is possible that there are more hair-like sedge populations in the vicinity, its relatively small population size and isolation from other populations make it potentially vulnerable.

### 5.2.3. Yellow Sedge (*Carex flava*)

Yellow sedge is typically less than 3 feet tall and has clustered stems with flat basal and stem leaves. The terminal spike has all male flowers or has a few female flowers at the tips. The lateral spikelets are sessile or have short stalks, and typically have all female flowers. The spikes of the inflorescence tend to be crowded with one or more subtending, sheathless bracts much longer than the inflorescence. The mature perigynia are yellowish with somewhat long-tapered, slightly recurved achenes arranged in short, prickly-looking spikes.

Yellow sedge ranges across the northern U.S. states and southern Canadian provinces. In Washington, this State Sensitive sedge is known from 35 occurrences in Pend Oreille, Stevens, Ferry, Lincoln, and Whatcom counties. Typical habitat includes wet meadows, forested wetlands, bogs and shores of streams and lakes. Hitchcock and Cronquist (1973) and WNHP (2007) were used to positively identify this species.

Three populations of yellow sedge, comprising 19 subpopulations, were found in the study area on USFS, BLM, and SCL lands. Two of the populations are between PRM 18 and 25 on the Boundary Reservoir, and the third population is located along the Boundary tailrace. Subpopulations range from one plant to many hundreds. Typical habitat of yellow sedge in the study area includes wet meadows along the reservoir shoreline, seeps, and stream-fed wetlands in or just above the littoral zone. Many of the subpopulations are inundated at full pool (1,994 feet NAVD 88 [1,990 feet NGVD 29]). Substrates range from gravelly to rich in organic matter. Yellow sedge typically grows with a diverse assemblage of forbs and graminoids. Associated species are knotsheath sedge (*Carex retrorsa*), fowl bluegrass (*Poa palustris*), lakeshore sedge (*Carex lenticularis*), and fowl mannagrass (*Glyceria striata*). In the study area, it is often found in close proximity to a number of other RTE plant species. Weed cover is quite high at some yellow sedge sites and includes oxeye daisy, reed canarygrass, common St. John's-wort, narrowleaf plantain, and yellow iris. Although current populations appear to be surviving under existing Project operations (based on presence), prolonged inundation during critical flowering and fruiting times could pose a threat to reproductive success. An analysis will be conducted in 2008 to determine the potential impact to RTE plants from inundation related to Project operations (for this and other species where similar conditions exist); the results of this analysis will be presented in the USR.

### 5.2.4. Porsild's Sedge (*Carex krausei* ssp. *porsildiana*)

One small population of Porsild's sedge was located in the study area—the first documented occurrence in Washington State. This species has temporarily been added to the Review Group 2 list by the WNHP, and will be evaluated for inclusion into either the Threatened or Endangered lists during the next revision of the main list (WNHP 2008). The known range of Porsild's sedge includes northeastern Canada, Greenland, and Iceland, so this occurrence represents a significant range extension of thousands of miles. Porsild's sedge is taxonomically very closely related to hair-like sedge, a Washington Sensitive species (Ball 2002). A single population of hair-like sedge was located on the reservoir approximately 3 miles away. The section of the genus *Carex* that contains these two species is in need of taxonomic revision, after which it is possible that Porsild's sedge may be combined with hair-like sedge into a single highly variable species. Some taxonomists consider the subspecies *porsildiana* to be taxonomically indistinct from the species *Carex krausei* as a whole. J. Mastroguiseppe, a *Carex* expert, provided the identity of the Boundary Reservoir specimen (Mastroguiseppe 2007).

The Porsild's sedge population was located on damp, steep limestone rubble at the base of a cliff at and just above full pool (1,994 feet NAVD 88 [1,990 feet NGVD 29]). This site is on BLM land and has a substrate that is probably moist most of the growing season. Associated species are California butterwort (*Pinguicula macroceras*), little green sedge (*Carex viridula*), western panicgrass (*Dichanthelium acuminatum* var. *fasciculatum*), early blue (*Viola adunca*), and mountain deathcamas (*Zigadenus elegans*). While it is possible that there are additional Porsild's sedge populations in the vicinity, probably the most significant threat to this species in the study area is its very small population size and isolation from other populations. Competition with weedy species does not seem to be a threat to this population; the area is remote enough that it is fairly well-protected from disturbance.

### 5.2.5. Steller's Rock-brake (*Cryptogramma stelleri*)

Steller's rock-brake is a fern with slender creeping rhizomes with sparse, delicate, thin colorless scales. Leaves are lanceolate to ovate, with a pinnatifid to twice-pinnate compound arrangement of leaflets. The fertile and sterile leaves are usually erect and scattered along the rhizome. The thin, delicate sterile leaves have lanceolate to wedge-shaped leaflets. The fertile leaves have narrower leaflets with inrolled margins or false indusia. The thread-like petioles are dark brown at the base and more greenish distally.

The distribution of Steller's rock-brake, a Washington Sensitive species, ranges from Alaska to Washington, to Ontario and Newfoundland in Canada, and to the upper mid-west and northeastern states. In the west, its distribution extends to isolated populations in Montana, Wyoming, Colorado, Utah, Nevada, and Oregon. In Washington, it is known from eight occurrences in Pend Oreille, Chelan, Stevens, and Okanogan counties. The typical habitat for Steller's rock-brake is moist, shaded limestone cliffs and ledges, on moss mounds, or in cracks at middle and upper altitudes in the mountains. In the study area, Steller's rock-brake is most reliably identifiable from May until mid-June after which the leaves turn brown and die. Hitchcock and Cronquist (1973) and WNHP (2007) were used to positively identify this species.

Four small populations of Steller's rock-brake were documented in the study area on USFS and SCL lands. Two historic occurrences were re-located on nearly vertical limestone cliffs in the downstream end of the Canyon Reach. Despite several dedicated surveys in past years, plants at these two occurrences had not been observed since they were documented in 1953, before Boundary Dam was built. A population of plants located in 2006 by the USFS botanist was re-located at Slate Creek. In addition, a small, new population was located near Boundary Dam. All of these populations are relatively small in size and in numbers of plants (3 to 23 plants). Individual plants are short-rhizomatous and may have few to many leaves. Less vigorous plants consist mostly of sterile leaves and very few fertile leaves. Habitat in the study area was typical: plants were growing on moist, shaded limestone cliffs and ledges, on moss mounds, and in cracks. Associated species are Douglas-fir (*Pseudotsuga menziesii*), western redcedar, mallow ninebark (*Physocarpus malvaceus*), Lewis' mockorange (*Philadelphus lewisii*), shrubby penstemon (*Penstemon fruticosus*), brittle bladderfern (*Cystopteris fragilis*), and smooth cliffbrake (*Pellaea glabella* var. *simplex*). Plants were observed at and above full pool (1,994 feet NAVD 88 [1,990 feet NGVD 29]) suggesting that this upland species may not tolerate inundation. No specific threats have been identified for populations of this species. Competition from weed species does not seem to be a threat at Steller's rock-brake populations.

### 5.2.6. Yellow Mountain-avens (*Dryas drummondii*)

Yellow mountain-avens is a semi-evergreen prostrate woody shrub with stems that produce roots where they contact soil; this growth process often produces large mats. This species has nodding flowers with yellow, erect petals that are often stipitate glandular and somewhat hairy. The hairy, twisted styles attached to young achenes expand at maturity into a characteristic fluffy, wind dispersal mechanism for the achene. The thickish, dark green leaves are roughly ¾ inch in length. The top surface of the leaf is creased and glabrous or hairy while the underside is white-wooly. The leaf blades are widest above the middle with rounded tips and a wedge-shaped base.

A Washington Sensitive species, yellow mountain-avens ranges from Alaska south into Washington and northeastern Oregon, and eastward across the lower Canadian provinces to the St. Lawrence River. This species is known from six occurrences in Pend Oreille, Snohomish, Stevens, Clallam and Jefferson counties. Typical habitat includes crevices of steep, rocky, dry cliffs, and on limestone rock along rivers. Hitchcock and Cronquist (1973) was used to positively identify this species.

In the study area, there are three populations, comprising 37 subpopulations of yellow mountain-avens, extending from PRM 17 to 27. Some of the subpopulations are quite large, ranging to over 3,000 feet in length and over 13 acres in area. Combined, the three populations are estimated to include tens of thousands of plants and occur on USFS, BLM, WDNR, SCL, and private lands. Yellow mountain-avens is primarily located on steep to vertical limestone cliffs abutting the reservoir from Metaline Falls downstream to Boundary Dam. Plants grow in limestone-derived soil and in cracks of limestone cliffs. This species is well adapted to the exposed and erosive nature of this substrate. Plants of all size classes were noted. Density varied from one or a few widely spaced plants, to clusters of several hundred growing in relatively dense concentrations. Most populations were observed with binoculars from a boat, so it was sometimes difficult to distinguish individual plants, as they often grow quite close together. Associated species include western redcedar, Douglas-fir, harebell (*Campanula*

*rotundifolia*), shrubby beardtongue (*Penstemon fruticosus*), Lewis' mockorange, roundleaf alumroot (*Heuchera cylindrica*), and kinnickinnick (*Arctostaphylos uva-ursi*). Weed species do not appear to be a threat to this species. Plants were observed just above the full pool level (1,994 feet NAVD 88 [1,990 feet NGVD 29]) to more than several hundred feet upslope, suggesting that they may not tolerate inundation. Erosion and bank undercutting near the reservoir margin occur within portions of several yellow mountain-avens subpopulations.

### 5.2.7. Common Northern Sweetgrass (*Hierochloe odorata*)

Common northern sweetgrass is a perennial, rhizomatous species that often has purple-tinged leaf bases. The inflorescence is 5 to 10 centimeters long and open-pyramidal. The spikelets are 5 to 6 millimeters long and three-flowered. The bottom two florets are male and the terminal floret is bisexual. The two glumes are unequal in size, but are longer than the lemmas.

In North America, common northern sweetgrass ranges from Alaska to Labrador, south to Oregon, Nevada, Arizona, New Mexico, South Dakota, the Great Lakes region, and Pennsylvania. Although it was known from a number of historic localities throughout Washington, there are currently14 occurrences scattered throughout the state. This species is included in Review Group 1, with more information needed about the degree of its rarity in the state. Typical common northern sweetgrass habitat includes moist slopes, meadows, and stream banks, from the foothills to subalpine elevations. This State Review Group 1 species is an important cultural plant for many Native Americans. Hitchcock and Cronquist (1973) was used to positively identify this species.

In the study area, common northern sweetgrass was found in a large population along the tailrace and at another small population north of Slate Creek. Both of these sites are on SCL land. It occurs in riparian habitat with upslope stream-fed seeps and in the littoral zone. It is associated with a diverse assemblage of forbs and graminoids. Associated species include paper birch (*Betula papyrifera*), western redcedar, wooly sedge (*Carex pellita*), common self-heal (*Prunella vulgaris*), aster species (*Aster* spp.), and bentgrass species (*Agrostis* spp). The tailrace population is potentially vulnerable to changes in upslope hydrology that could occur in association with operation and maintenance of FR3165200.

### 5.2.8. Canadian St. John's-wort (*Hypericum majus*)

Canadian St. John's-wort is an annual herbaceous species with upright stems and yellowish orange flowers about equal in length to the lanceolate sepals. The flowers have between 15 and 35 stamens. It flowers between July and September. Canadian St. John's-wort ranges from British Columbia east to Quebec, south through Pennsylvania, New Jersey, Illinois, Iowa, and Colorado. In Washington, it is known from 17 occurrences in Benton, King, Pend Oreille, Thurston, Whatcom, Franklin, and Skagit counties. Typical habitat for this state Sensitive species includes riparian habitats, ponds, lakesides, and other low wet, places. Hitchcock and Cronquist (1973) was used to positively identify this species.

In the study area, a population comprising five subpopulations of Canadian St. John's-wort was found at the north end of the reservoir on private and WDNR lands. The subpopulations are not very vigorous, with an average area of 10 by 20 feet and numbers ranging from 10 to 100 plants.

This species is an annual species and thus population numbers and locations may vary from year to year. Plants are often small and difficult to see in dense vegetation. In the study area, this species was typically found in the lower portion of the littoral zone where there is significantly less weed coverage, especially reed canarygrass (*Phalaris arundinacea*). Plants were found growing in silty substrates, in nearly flat slough areas, with a diverse assemblage of forbs and graminoids. Associated species are fringed loosestrife (*Lysimachia ciliata*), common sneezeweed (*Helenium autumnale*), Canada thistle (*Cirsium arvense*), small-flowered forget-me-not (*Myosotis laxa*), field mint, sedge species (*Carex* spp.), witchgrass (*Panicum capillare*), and slender rush (*Juncus tenuis*). During the survey, plants were observed in locations that were exposed and dry, as well as sites that were completely inundated with water. Although current populations appear to be surviving under existing Project operations (based on presence), prolonged inundation during critical flowering and fruiting times could pose a threat to reproductive success

### 5.2.9. Orange Balsam (*Impatiens aurella*)

Orange balsam is a glabrous annual forb with slightly yellowish-green, brittle, hollow stems. The species has a weak, often shallow-root system. Leaves have an opposite arrangement on young plants but become alternate on older plants. The characteristic leaf shape is ovate-elliptic with several coarse serrations along the margin. The fruits are capsules that spring open to forcibly eject the ripe seeds. The pale yellow to orange, spurred flowers arise from the leaf axils and are often in pairs.

The range of orange balsam includes eastern Washington, northern Idaho, Oregon, southeast British Columbia, and western Montana. It is known from 23 occurrences in 10 counties throughout Washington. Orange balsam was on the Review Group 2 list until recently. The taxonomic status of Review Group 2 species is under review by the WNHP. It is currently included in Review Group 1 to collect more information about the degree of its rarity in the state before a status can be assigned. Zika (2006) and Hitchcock and Cronquist (1973) were used to positively identify this species.

In the study area, eight populations of orange balsam were located along Boundary Reservoir and the tailrace. It was found on USFS, BLM, SCL, WDNR, and private lands. This species is an annual, so location and numbers of plants may vary somewhat from year to year. A majority of plants at some of the populations did not develop enough to flower or fruit, suggesting that sub-optimal local growing conditions exist. The habitat includes moist woods, moist herbaceous meadows, riparian habitats, spring-fed seeps, and other low wet, places. The largest and most vigorous populations are located in palustrine forested wetlands and have over a thousand plants. These forested wetlands are composed primarily of deciduous tree species such as black cottonwood (*Populus balsamifera* var. *trichocarpa*) and Sitka alder (*Alnus viridis* spp. *sinuata*). Other commonly associated species are western redcedar, redosier dogwood, willow species (*Salix* spp.), field mint, scouring rush (*Equisetum* spp.), and giant goldenrod (*Solidago gigantea*).

### 5.2.10. Wirestem Muhly (*Muhlenbergia mexicana* var. *mexicana*)

Wirestem muhly is a perennial, rhizomatous grass. It has single-flowered spikelets with glumes that are approximately the same length as the lemma. It can be differentiated from marsh muhly,

which was documented in the Project vicinity during the reconnaissance surveys, by the relative size of its glumes and lemmas and its habitat. Herbarium collection data from Washington State University and the University of Washington suggest that there are few populations of wirestem muhly in the state and that the localities from which these collections were made are very old and some of those populations may no longer be in existence.

Wirestem muhly has been added to the WNHP Review Group 1 list and will be evaluated for inclusion into either the Sensitive, Threatened or Endangered lists during the next revision of the main list in 2009 (WNHP 2008b). This species occurs in most of the U.S., except for the southeastern states. Its typical habitat includes mesic to wet areas such as moist prairies, woodlands, stream banks, roadsides, ditch banks, lake margins, swamps, bogs, and hot springs (Peterson 2003). Hitchcock and Cronquist (1973) and Peterson (2003) were used to positively identify this species. A wirestem muhly specimen was also confirmed by P. Zika (Zika 2007).

In the study area, 24 small subpopulations of wirestem muhly were found in the littoral zone along the reservoir margin on USFS, BLM, SCL, WDNR, and private lands. Habitats include moist, weedy meadows, seeps, and cracks of rocks. Many of the subpopulations are at least partially inundated at full pool (1,994 feet NAVD 88 [1,990 feet NGVD 29]). Substrates include organic matter, limestone rock, and gravel. Wirestem muhly typically grows with a diverse assemblage of forbs and graminoids including, Sitka alder (*Alnus viridis* spp. *sinuata*), white sweetclover (*Melilotus albus*), common tansy (*Tanacetum vulgare*), narrowleaf plantain (*Plantago lanceolata*), fringed loosestrife (*Lysimachia ciliata*), wooly sedge (*Carex pellita*), bentgrass (*Agrostis* spp.), and slender rush (*Juncus tenuis*).

### 5.2.11. Adder's-tongue (*Ophioglossum pusillum*)

Adder's-tongue is an unusual fern species with an upright fertile spike and a single undivided basal frond. It is identifiable from May through September, but can be difficult to see growing in the dense vegetation. It is a circumboreal species known from Alaska to the east coast, and many states and Canadian provinces in between. In Washington, adder's-tongue is included on the Threatened list and is known from 15 occurrences scattered through 8 counties. Typical habitat includes moist meadows, woods, boggy areas, pastures, old fields, roadside ditches, and floodplain woods in seasonally wet, rather acid soil. Hitchcock and Cronquist (1973) and WNHP (2007) were used to positively identify this species. In Hitchcock and Cronquist (1973), the synonym for this species is *Ophioglossum vulgatum* var. *pseudopodum*.

In the study area, two adder's-tongue populations, one with 50 plants, the other with 150, were located along the southern portion of the reservoir downstream of Metaline Falls on SCL and BLM lands. Both populations were found in the vicinity of several other RTE plant species. The populations are located in the upper portion of the littoral zone in moist, weedy meadows at the reservoir edge near the high water level. It appeared as though at least the bases of the plants were inundated at higher reservoir levels. Neither location appears to be associated with upslope seeps or hydrology. Associated species are fringed loosestrife (*Lysimachia ciliata*), bentgrass (*Agrostis* spp.), sedge species, white sweetclover (*Melilotus alba*), common St. John's-wort, oxeye daisy, narrowleaf plantain, scouring rush, and common tansy. Most of its plant associates are weeds with which competition is a significant threat. Prolonged inundation during critical sporulating times could pose a threat to reproductive success of this species. Also, both

populations are in the immediate vicinity of abandoned roads and might be affected if road use were to be re-established. While it is possible that there are additional adder's-tongue populations in the vicinity, threats to populations of this species in the study area include small population size and isolation from other populations.

### 5.2.12. Black Snake-root (*Sanicula marilandica*)

Black snake-root is an herbaceous perennial with fibrous roots and a short, simple root crown. There is a cluster of distinctive basal leaves which have long petioles and are palmately compound with 5 to 7 simple or lobed, oblanceolate leaflets. The flowering stems are solitary and up to 5 feet in height. The cauline leaves are sessile, typically subtend peduncles, and occur singly or in opposite pairs or whorls. The inflorescence is a compound umbel with umbelettes of round clusters of very tiny white-green flowers. The mericarp, or fruit, has long, recurved spines.

Black snake-root is distributed throughout Canada and south to Florida and New Mexico. In Washington, this species is known from 42 occurrences in the Eastern Cascades and Okanogan Highlands physiographic provinces, which include Stevens, Okanogan, Ferry, Spokane, and Pend Oreille counties. Typical habitat for this State Sensitive species is moist, low ground, such as meadows, riparian flood plains, moist woods, and marsh edges. Hitchcock and Cronquist (1973) was used to positively identify this species.

In the study area, seven populations of black snake-root were located in the reservoir downstream of Metaline Falls between PRM 16 and 23 on USFS, BLM, and SCL lands. Habitat for black snake-root includes seep-fed wet meadows along the reservoir shoreline, and seeps and small streams in forested areas adjacent to the reservoir. At most of the sites, the substrate is moist the entire growing season. Typical substrate is loamy soil with moss and duff layers. All but one of the populations is located at least several feet above the full pool level (1,994 feet NAVD 88 [1,990 feet NGVD 29]) and is presumably not affected by reservoir water-level fluctuations. Population size ranges from 1 to 200 plants. At most of the populations, approximately half of the plants were vegetative. Associated species include redosier dogwood, bunchberry dogwood (*Cornus canadensis*), oxeye daisy, Douglas spiraea, and liverleaf wintergreen (*Pyrola asarifolia).*

### 5.2.13. Northern Blue-eyed Grass (*Sisyrinchium septentrionale*)

Northern blue-eyed grass is an herbaceous perennial species in the iris family. This species has a caespitose or clumped growth form. The leaves are very narrow, grass-like, glaucous, green, and more or less erect. The inflorescence is terminal and subtended by bracts that are very unequal in length. The flowers are blue-violet to white with a yellow eye. The perianth parts are narrowly elliptic to oblanceolate and pointed at the tip.

Northern blue-eyed grass is a State Sensitive species and has been found from British Columbia eastward to Manitoba and south to northeastern Washington, northern Idaho and Montana. In Washington, northern blue-eyed grass is known from 36 occurrences in Stevens, Okanogan, Ferry and Pend Oreille counties. It occurs primarily in open wet meadows, adjacent to perennial

streams and sometimes in forested wetland mosaics. Henderson (1976) was used to positively identify this species.

Two small populations of northern blue-eyed grass were located in the study area on BLM and SCL lands. None of the three subpopulations are vigorous, with a range of 20 to 40 plants. It was found growing in the upper littoral zone in small, moist, weedy meadows at the forested edge adjacent to the reservoir. Plants were just below to somewhat above the full pool level (1,994 feet NAVD 88 [1,990 feet NGVD 29]). Basal portions of some plants were inundated when water levels were high. The substrate is probably damp much of the growing season. Because this species is challenging to locate if not in bloom, it is possible other populations are in the vicinity. In the study area, plants bloom in May to mid-June. Associated species are bentgrass species (*Agrostis* spp.), oxeye daisy, common St. John's-wort, narrowleaf plantain, wooly sedge, bluegrass species (*Poa* spp.), slender rush, and aster species.

### 5.2.14. Purple Meadowrue (*Thalictrum dasycarpum*)

Purple meadowrue is a rhizomatous, herbaceous perennial species that typically grows more than 8 feet tall. The somewhat leathery leaves are mainly cauline and typically three to four times ternately divided. The upper surface of the leaf is dark green, while the undersides are pale and often hairy. The ultimate leaf segments are typically dissected into three shallow lobes. The species has male and female flowers arranged in panicles on separate plants. The calyces are greenish-white and petals are absent. Male flowers have many dangly orange-gold stamens, while female flowers have a persistent style and stigma that mature as an attachment to the achene. Terminal leaflets of purple meadowrue have three very shallow lobes, which is a diagnostic characteristic that can be reliably used to distinguish it from columbine (*Aquilegia* spp.) and western meadowrue.

The range of purple meadowrue includes interior British Columbia, east to Saskatchewan, south to Texas, the Rocky Mountains, and the southwest U.S. to New Mexico and Arizona. This State Sensitive species is at the periphery of its range in Washington where it has been previously documented only in Pend Oreille County and only along the Box Canyon Reservoir on the Pend Oreille River (13 occurrences). Its habitat includes deciduous riparian woods, damp thickets, swamps, and wet meadows, often adjacent to and/or within the floodplain. Park and Festerling Jr. (1997) and Hitchcock and Cronquist (1973) were used to positively identify this species.

Purple meadowrue was mapped throughout the entire study area from Box Canyon Dam north to the Canadian border. It grows in a linear distribution along the reservoir margin (up to 5,000 feet long) and in enormous patches (covering up to 47 acres at the BWP). Sixty subpopulations were mapped, which were combined into 7 large populations. It was found on USFS, BLM, WDNR, SCL, and private lands and it is estimated that at least 20,000 plants are in the study area. The subpopulations range in size from a single plant to many thousands of plants. Purple meadowrue populations are typically associated with wet to mesic habitats. In the study area, the plant grows along the reservoir shoreline, in mesic areas with shallow groundwater, or in locations where seep runoff accumulates. Plants were found growing from the upper littoral zone to over 30 feet above the full pool level (1,994 feet NAVD 88 [1,990 feet NGVD 29]) and were observed in dense shrubs and herbaceous vegetation, forest openings, seeps, adjacent roads, and out of cracks on limestone cliffs.

Purple meadowrue grows in plant communities that are predominantly native (as at the tailrace population), but it also competes well with aggressive nonnative species like reed canarygrass and is sometimes the only native plant present in an area (as at some of the subpopulations in the reservoir upstream of Metaline Falls). Common associate species include Sitka alder, common snowberry (*Symphoricarpos albus*), redosier dogwood, reed canarygrass, oxeye daisy, common St. John's wort, Canada thistle, and tansy ragwort (*Tanacetum vulgare*). Yellow iris and purple loosestrife (*Lythrum salicaria*) are noxious weeds that occupy similar habitat and appear to be spreading in the reservoir. Purple meadowrue appears to tolerate some disturbance. For example, at a few localities, several purple meadowrue plants had been trampled where people created campsites. There were also observations of several plants that had been grazed by deer to within a foot or two of the ground. Erosion and bank undercutting near the reservoir margin occur within portions of a number of purple meadowrue subpopulations. It appears that the ecological conditions associated with the Boundary Reservoir favor this species. In the study area, purple meadowrue occurs with populations of many of the other RTE plant species.

### 5.2.15. Kidney-leaved Violet (*Viola renifolia*)

Kidney-leaved violet is a perennial species with short ascending rootstocks without horizontal rhizomes or an apparent stem. The leaves are kidney-shaped and have hairs along the veins on the leaf undersides. The flower stalks are usually shorter than the leaves. The flowers are white.

Kidney-leaved violet is distributed from Newfoundland west to British Columbia and south to New York, Colorado, and Washington. In Washington, this species has been documented in 20 occurrences in Clallam, Stevens, Spokane, Ferry and Pend Oreille counties. This State Sensitive species may be found from lowland coniferous forest to subalpine slopes. It is generally found in cool, moist, forested sites and sometimes along ditches and streams. Hitchcock and Cronquist (1973) and WNHP (2007) were used to positively identify this species.

In the study area, kidney-leaved violet is typically found in moist shady habitats in coniferous forests. Populations were typically associated with shallow groundwater or near streams, and were growing on an undulating mossy substrate. All populations are located at least several feet above full pool level (1,994 feet NAVD 88 [1,990 feet NGVD 29]) and are presumably not affected by Project-associated water level fluctuations. All populations are all along the reservoir downstream of Metaline Falls, between PRM 17 and 21, and were on USFS and BLM lands. Population numbers range from 10 to over 500 plants. Associated species are western redcedar, western hemlock (*Tsuga heterophylla*), grand fir (*Abies grandis*), Sitka alder, twinflower (*Linnaea borealis*), bunchberry (*Cornus canadensis*), common snowberry, false Solomon's-seal (*Maianthemum stellatum*), violet species (*Viola* spp.), and beadlily (*Clintonia uniflora*). Kidney-leaved violet is commonly found growing with other species of violet. Because the flowers bloom in May in the study area, identification was made with vegetative characteristics. No flowers were observed at any of the populations, but an average of 5 percent of the plants had fruit. Many plants had just two or three leaves.

## 5.3. Discussion

The RTE plant survey mapped and documented 204 polygons or subpopulations, which were combined into 52 populations of 15 different vascular RTE plant species (Figures 5.2-1 and 5.2-2). Multiple populations of RTE plants were located on lands with the following ownership designations: BLM, USFS, SCL, WDNR, and private lands.

Results of the 2007 survey suggest that four RTE plant species—yellow mountain-avens, least bladdery milk-vetch, orange balsam, and purple meadowrue—are locally abundant in the study area. Yellow mountain-avens is a predominant component of the vegetation growing on the limestone rock faces and cliffs along the lower reservoir. Similarly, least bladdery milk-vetch is relatively common on cobble bars, islands and steep eroding slopes. Enormous populations of purple meadowrue were observed in a variety of habitats throughout the study area and over 1,000 plants of orange balsam were observed in palustrine forested wetlands. These species may prove to be more common and less endangered in the state than previously believed.

Alternatively, RTE species such as hair-like sedge, Porsild's sedge, adder's-tongue, northern blue-eyed grass and Steller's rock-brake are relatively rare in the study area, with either few populations and/or populations with small numbers of plants. Some of these RTE plant species are rare in the region.

The following discussion addresses general types of impacts that were documented during the RTE plant surveys.

### 5.3.1. Herbivory, Disease, and Insect Infestations

The only RTE plant species on which herbivory was observed was purple meadowrue. At several subpopulations, 10 to 15 plants were grazed by deer to within several feet of the ground. Disease or insect infestations were not observed to affect any RTE plants in the study area (however, disease and insect infestations may not be readily observable). The overall impact of herbivory, disease, and insect infestations in the study area appears to be very low.

### 5.3.2. Recreation

A number of RTE plants have the potential to be impacted by recreational activities such as fishing, hiking, swimming, all-terrain vehicle use, and use of established and dispersed campsites along the reservoir. At a few locations, several purple meadowrue plants were trampled where people spent time on shore or created campsites. In one location, a trail near an established campground bisects a small population of northern blue-eyed grass. It is possible that some individual plants could get trampled from time to time. Generally, it appears that the overall impact of recreational activities is low. Further analysis of the impacts of recreation on RTE plant populations will be conducted in 2008 and presented in the USR.

### 5.3.3. Weeds

Competition with weedy plant species may pose the largest threat to RTE plant populations in the study area. Weed infestations commonly contribute to degradation and destruction of RTE

plant populations and native plant habitat. In 2005 and 2006, SCL conducted a survey and mapped noxious weed populations in the study area (SCL 2006, 2007b). Most of the widespread weed species are listed by the Washington State Noxious Weed Control Board (2007). Common noxious weed species in the study area include common St. John's-wort, yellow flag, oxeye daisy, Canada thistle, reed canarygrass, common tansy, spotted knapweed, and hawkweed (*Hieracium caespitosum*). Many of these noxious weed species are located in multiple habitat types.

Most of the weeds found in the study area are subdominant to dominant in the moist, forb and graminoid meadows in the littoral zone, lacustrine emergent wetlands, and palustrine emergent wetlands along the reservoir shoreline. These habitats also support populations of most of the 15 RTE plant species documented in the study area. Although the influence of existing Project operations on the establishment, persistence, and spread of weeds is unknown, it is possible that water level fluctuations favor weed species to the detriment of RTE plant species in some locations; this issue will be further explored in 2008.

In contrast, some habitats that support RTE plant populations in the study area have a relatively low cover of weeds. One such habitat type is the seepy, riparian fringe along the tailrace north of Boundary Dam. The steep rocky cliffs in much of the canyon reach and some upland forest habitats also have a very low cover of weeds. In general, RTE and native plant species are most vigorous in plant communities that have a relatively low cover of weed species.

Some of the largest weed infestations in the study area consist of dense swards of reed canarygrass growing on sandy alluvial bars, islands, and terraces upstream of Metaline Falls, including the BWP. Some of these infestations are many acres in size. Purple meadowrue is one of the few native species that persists in these dense stands of reed canarygrass.

During the 2005 and 2006 noxious weed surveys, 18 infestations of yellow iris were mapped along the reservoir margins within the study area (SCL 2007b). During the 2007 surveys, 69 infestations of yellow iris were mapped, indicating that this species is expanding its density and range along the margins of Boundary Reservoir. Of the 58 yellow iris infestations downstream of Metaline Falls, 14 are on the west side of the tailrace north of Boundary Dam. Many of these yellow iris infestations are in the vicinity of RTE plant populations. Although individual clumps are found along the rocky reservoir shoreline, multiple rhizomatous patches were observed in low gradient coves and inlets with sandy and silty substrates (typically palustrine and lacustrine emergent wetlands). Most of these infestations are small to medium-sized. In other areas in eastern Washington, yellow iris rhizomes spread to form dense stands in wetlands that exclude native wetland species.

Although not common in the study area, the only noxious weed found that has been designated for control in Pend Oreille County is purple loosestrife. Some of the previously mapped infestations along the reservoir have been receiving control efforts by Pend Oreille County weed control specialists (SCL 2007a). In the study area, infestations of purple loosestrife are in the vicinity of some RTE plant populations. Although current infestation levels are relatively low, suitable habitat for both purple loosestrife and yellow iris are widespread along the reservoir.

Further analysis of the impacts of weeds on RTE plant populations will be conducted in 2008 and presented in the USR.

### 5.3.4. Water Level Fluctuations

For plants that grow in the littoral zone along Boundary Reservoir, there is an elevation below which they cannot tolerate the depth, duration, or frequency of inundation. Some species are more tolerant of inundation than others and can therefore grow lower in the littoral zone. The plant species that grow in the lowest level of this zone are typically small annual species. Even though plants might not be killed directly, prolonged inundation during critical flowering and fruiting times could pose a threat to their reproductive success.

Subpopulations of eight RTE plant species growing in the littoral zone were observed to be partially or totally inundated during high water. These include least bladdery milk-vetch, yellow sedge, common northern sweetgrass, Canadian St. John's-wort, wirestem muhly, adder's-tongue, northern blue-eyed grass, and purple meadowrue. The presence and persistence of these species in the littoral zone suggest that they are at least somewhat adapted to variable hydrological conditions (see Table 5.1-1), including those created by existing Project operations. It is not possible to determine whether their population numbers are increasing, decreasing, or remaining constant in either population numbers or areal extent without additional observation. The effect of reservoir level fluctuations on weed species needs to be further explored, but the potential exists that aspects of the fluctuation regime could favor weed species to the detriment of RTE and native plant species. While the relationship between water level fluctuations and the establishment of weed species will be difficult to interpret with certainty, in 2008, SCL will conduct a limited analysis in an attempt to gain a better understanding of this relationship. In much of the Boundary Reservoir, weed species are currently dominant to subdominant in the littoral zone.

### 5.3.5. Erosion

Shoreline erosion in the Boundary Reservoir may have direct and/or indirect effects on RTE plants and their habitats (see the Study 1 Erosion Interim Report [SCL 2008] for a discussion of the various substrates and their relative vulnerability to erosion). Shoreline erosion was observed at some populations of least bladdery milk-vetch, a species that often grows in rocky substrates within the reservoir fluctuation zone. Some plants growing in the littoral zone had taproots up to a foot in length exposed by erosion. In addition to least bladdery milk-vetch, shoreline erosion is affecting populations of Steller's rock-brake, yellow mountain-avens, orange balsam, wirestem muhly, black snake-root, purple meadowrue, and kidney-leaved violet. Erosion also occurs on steep, tall cutbanks as a result of precipitation and upslope water flow, but most of this erosion is well above the level of Boundary Reservoir. The information developed under the Erosion Study (Study 1) will be utilized to determine the impacts of erosion on RTE plant populations. The results of this analysis will be presented in the USR.

### 5.3.6 Upslope Hydrologic Disturbance

Disturbances to hydrologic features upslope from Boundary Reservoir (e.g., seeps, creeks, underground drainages, and groundwater) could potentially negatively impact a number of downslope populations of RTE plant species in the study area. RTE plant species associated with upslope hydrologic features include hair-like sedge, kidney-leaved violet, black snakeroot, and some populations of orange balsam, common northern sweetgrass, and purple meadowrue. Potential disturbances to upslope hydrologic features could be associated with construction or maintenance of transportation routes; mining operations; transmission lines; land clearing; or other types of hydrologic alterations. SCL will review the locations of Project-related activities that could have the potential to alter these important hydrologic features; the results of this review will be presented in the USR.

### 5.3.7 Project Maintenance

Project-related maintenance of facilities, roads, and transmission line rights-of-way (ROWs) could potentially affect subpopulations of several RTE plant species. However, few RTE plant populations were found near Project facilities. The location of a yellow mountain-avens population along the access road to Boundary Dam makes it potentially vulnerable to disturbances associated with Project-related activity. Several purple meadowrue plants are located near the forebay boat launch and may be subject to trampling. A population of kidney-leaved violet is associated with a small creek that is upslope of a drainage ditch along a road near the dam. Maintenance of the road or other alterations to the drainage/creek could adversely affect RTE plants downslope. .

## 6 SUMMARY

The 2007 RTE plant survey of the Boundary Hydroelectric Project study area mapped and documented a total of 204 polygons or subpopulations, which were combined into 52 populations of 15 different vascular RTE plant species. In comparison with other RTE plant surveys of similar sized areas, this study area has a relatively large number of both RTE species and number of subpopulations. Several factors present in the study area contribute to this including the relatively low levels of disturbance, overall habitat diversity, and the presence of specialized substrates such as limestone. In addition, the area is part of the inland temperate rain forest, which is unique in the state, and a number of plant species are at the edge of their range in the area.

Populations of nine RTE species grow in the littoral zone where frequently fluctuating water levels alternately expose and inundate the substrate and vegetation during the growing season. RTE plant species that grow along the reservoir shoreline in littoral and lacustrine and palustrine wetland habitats are the species most likely to be affected by water level fluctuations, competition from weeds, and recreation. These species often grow in close proximity to each other and include yellow sedge, northern blue-eyed grass, common northern sweetgrass, adder's-tongue, Canadian St. John's-wort, wirestem muhly, Porsild's sedge, orange balsam, and purple meadowrue. Alternatively, populations of Steller's rock-brake and yellow mountain-avens are

found on steep, dry limestone cliffs. Further analysis of the impacts of erosion, recreation, weeds, and Project operations and maintenance on RTE plant populations will be presented in the USR.

## 7 VARIANCES FROM FERC-APPROVED STUDY PLAN AND PROPOSED MODIFICATIONS

No deviations from the FERC-approved RSP (SCL 2007a) were made.
In the course of conducting this study, the need to conduct limited additional work was identified. This includes more detailed analysis of the following potential impacts to RTE plant populations: Project-related recreation; reservoir fluctuations and the related potential to favor the establishment of weed species; erosion; and Project-related impacts to upslope hydrologic features. The details of these analyses remain to be developed and will be discussed with relicensing participants before work begins.

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# Appendix 1. Complete List of Vascular Plant Species Observed in the Boundary Hydroelectric Project Study Area, 2007

**Table A.1-1.** Complete list of vascular plant species observed in the Boundary Hydroelectric Project study area, 2007.

| Taxon | Nonnative / Washington Noxious Weed Status [1] | Washington Rare Plant State Status [2] |
|---|---|---|
| *Abies grandis* | | |
| *Acer douglasii* | | |
| *Acer macrophyllum* | | |
| *Acer negundo* | x | |
| *Achillea millefolium* | | |
| *Actaea rubra* | | |
| *Adenocaulon bicolor* | | |
| *Agropyron cristatum* | x | |
| *Agropyron repens* | x | |
| *Agropyron smithii* | | |
| *Agropyron spp.* | | |
| *Agrostis capillaris* | x | |
| *Agrostis exarata* | | |
| *Agrostis gigantea* | x | |
| *Agrostis scabra* | | |
| *Agrostis spp.* | | |
| *Agrostis stolonifera* | | |
| *Alisma plantago-aquatica* | | |
| *Allium cernuum* | | |
| *Allium schoenoprasum* | | |
| *Alnus incana spp. tenuifolia* | | |
| *Alnus viridis spp. sinuata* | | |
| *Alyssum alyssoides* | x | |
| *Amaranthus powellii* | | |
| *Amelanchier alnifolia* | | |
| *Anaphalis margaritacea* | | |
| *Anemone multifida var. multifida* | | |
| *Angelica arguta* | | |
| *Antennaria racemosa* | | |
| *Antennaria rosea* | | |
| *Antennaria spp.* | | |
| *Anthriscus scandicina* | x | |
| *Apocynum androsaemifolium* | | |
| *Apocynum cannabinum* | | |
| *Apocynum medium* | | |
| *Aptera interrupta* | x | |
| *Arabidopsis thaliana* | x | |
| *Arabis glabra* | x | |
| *Arabis holboelii* | | |
| *Aralia nudicaulis* | | |
| *Arctium minus* | x | |
| *Arctostaphylos uva-ursi* | | |
| *Arenaria serpyllifolia* | x | |
| *Arnica latifolia* | | |
| *Arnica spp.* | | |
| *Arrhenatherum elatius* | x | |
| *Artemisia douglasiana* | | |
| *Artemisia lindleyana* | | |
| *Artemisia ludoviciana* | | |
| *Artemisia ludoviciana var. incompta* | | |
| *Artemisia spp.* | | |
| *Asarum caudatum* | | |
| *Asparagus officinalis* | x | |
| *Asplenium trichomanes-ramosum (viride)* | | |
| *Aster conspicuus* | | |
| *Aster eatonii* | | |
| *Aster foliaceus* | | |
| *Aster hesperium* | | |
| *Aster laevis* | | |
| *Aster modestus* | | |
| *Aster occidentalis* | | |
| *Aster spp.* | | |
| *Astragalus canadensis* | | |
| *Astragalus microcystis* | | S |
| *Astragalus robbinsii* | | |
| *Athyrium filix-femina* | | |
| *Beckmannia syzigachne* | | |
| *Berberis aquifolium* | | |
| *Berberis nervosa* | | |
| *Berberis repens* | | |
| *Betula papyrifera* | | |
| *Bidens cernua* | | |
| *Bidens cf. tripartita* | | |
| *Bidens spp.* | | |
| *Botrychium multifidum* | | |

**Table A.1-1.** Complete list of vascular plant species observed in the Boundary Hydroelectric Project study area, 2007 (continued).

| Taxon | Nonnative / Washington Noxious Weed Status [1] | Washington Rare Plant State Status [2] |
|---|---|---|
| *Botrychium virginianum* | | |
| *Bromus ciliatus* | | |
| *Bromus inermis* | x | |
| *Bromus japonicus* | x | |
| *Bromus mollis* | x | |
| *Bromus secalinus* | x | |
| *Bromus spp.* | | |
| *Bromus tectorum* | x | |
| *Bromus vulgaris* | | |
| *Calamagrostis canadensis* | | |
| *Calamagrostis rubescens* | | |
| *Callitriche verna* | | |
| *Calypso bulbosa* | | |
| *Campanula rotundifolia* | | |
| *Cardamine pensylvanica* | | |
| *Carex amplifolia* | | |
| *Carex aperta* | | |
| *Carex aquatilis* | | |
| *Carex athrostachya* | | |
| *Carex aurea* | | |
| *Carex bebbii* | | |
| *Carex brevior* | | |
| *Carex capillaris* | | S |
| *Carex cusickii* | | |
| *Carex deweyana* | | |
| *Carex disperma* | | |
| *Carex flava* | | S |
| *Carex geyeri* | | |
| *Carex interior* | | |
| *Carex krausei ssp. porsildiana* | | R2 |
| *Carex laeviculmis* | | |
| *Carex lenticularis* | | |
| *Carex leptalea* | | |
| *Carex pachystachya* | | |
| *Carex pellita* | | |
| *Carex retrorsa* | | |
| *Carex rossii* | | |
| *Carex sitchensis* | | |

| Taxon | Nonnative / Washington Noxious Weed Status [1] | Washington Rare Plant State Status [2] |
|---|---|---|
| *Carex spp.* | | |
| *Carex stipata* | | |
| *Carex utriculata* | | |
| *Carex vesicaria* | | |
| *Carex viridula* | | |
| *Carex vulpinoidea* | | |
| *Castilleja hispida* | | |
| *Castilleja miniata* | | |
| *Ceanothus sanguineus* | | |
| *Ceanothus velutinus* | | |
| *Centaurea (biebersteinii) stoebe var. micranthos* | B | |
| *Ceratophyllum demersum* | | |
| *Chamaesyce serpyllifolia* | | |
| *Chenopodium album* | x | |
| *Chimaphila menziesii* | | |
| *Chimaphila umbellata* | | |
| *Chrysopis villosa* | | |
| *Cicuta douglasii* | | |
| *Cinna latifolia* | | |
| *Cirsium arvense* | C | |
| *Cirsium undulatum* | | |
| *Cirsium vulgare* | C | |
| *Clarkia pulchella* | | |
| *Clematis columbiana* | | |
| *Clintonia uniflora* | | |
| *Collinsia parviflora* | | |
| *Collomia grandiflora* | | |
| *Collomia linearis* | | |
| *Convolvulus arvensis* | x | |
| *Convolvulus spp.* | x | |
| *Conyza canadensis* | | |
| *Corallorhiza maculata* | | |
| *Coreopsis atkinsoniana* | | |
| *Cornus canadensis* | | |
| *Cornus sericea* | | |
| *Corylus cornuta* | | |
| *Crassula aquatica* | | |
| *Crataegus columbiana* | | |
| *Crataegus douglasii* | | |

**Table A.1-1.** Complete list of vascular plant species observed in the Boundary Hydroelectric Project study area, 2007 (continued).

| Taxon | Nonnative / Washington Noxious Weed Status [1] | Washington Rare Plant State Status [2] |
|---|---|---|
| *Crepis atribarba spp. atribarba* | | |
| *Crepis atribarba spp. originalis* | | |
| *Crepis spp.* | | |
| *Cryptantha affinis* | | |
| *Cryptogramma acrostichoides* | | |
| *Cryptogramma stelleri* | | S |
| *Cynoglossum offinale* | B | |
| *Cystopteris fragilis* | | |
| *Dactylis glomerata* | x | |
| *Danthonia spicata* | | |
| *Daucus carota* | B | |
| *Delphineum cf. nuttallianum* | | |
| *Deschampsia caespitosa* | | |
| *Dianthus armeria* | x | |
| *Dichanthelium acuminatum var. fasciculatum* | | |
| *Dipsacus sylvester* | x | |
| *Disporum hookeri* | | |
| *Disporum trachycarpum* | | |
| *Downingia elegans* | | |
| *Draba nemorosa* | | |
| *Dryas drummondii* | | S |
| *Dryopteris cf arguta* | | |
| *Dryopteris expansa* | | |
| *Dryopteris spp.* | | |
| *Drypoteris felix-mas* | | |
| *Echinochloa crus-gali* | x | |
| *Eleocharis acicularis* | | |
| *Eleocharis ovata* | | |
| *Eleocharis palustris* | | |
| *Elodea canadensis* | | |
| *Elymus canadensis* | | |
| *Elymus glaucus* | | |
| *Elymus spp.* | | |
| *Epilobium angustifolium* | | |
| *Epilobium ciliatum* | | |
| *Epilobium glandulosum* | | |
| *Epilobium spp.* | | |
| *Epilobium watsonii* | | |
| *Equisetum arvense* | | |
| *Equisetum fluviatile* | | |
| *Equisetum hyemale* | | |
| *Equisetum laevigatum* | | |
| *Equisetum scirpoides* | | |
| *Equisetum spp.* | | |
| *Equisetum sylvaticum* | | |
| *Equisetum variegatum* | | |
| *Erigeron philadelphicus* | | |
| *Erigeron spp.* | | |
| *Erigeron strigosus* | x | |
| *Erysimum cheiranthoides* | | |
| *Euphrasia officinalis* | x | |
| *Festuca arundinacea* | x | |
| *Festuca idahoensis* | | |
| *Festuca occidentalis* | | |
| *Festuca pratense* | x | |
| *Festuca spp.* | | |
| *Festuca subulata* | | |
| *Fragaria vesca* | | |
| *Fragaria virginiana* | | |
| *Gaillardia aristata* | | |
| *Galium aparine* | | |
| *Galium boreale* | | |
| *Galium spp.* | | |
| *Galium trifidum* | | |
| *Galium triflorum* | | |
| *Gaultheria ovatifolia* | | |
| *Gayophytum diffusum* | | |
| *Geocaulon lividum* | | |
| *Geranium cf molle* | x | |
| *Geum allepicum* | | |
| *Geum macrophyllum* | | |
| *Glecoma hederacea* | x | |
| *Glyceria grandis* | | |
| *Glyceria spp.* | | |
| *Glyceria striata* | | |

**Table A.1-1.** Complete list of vascular plant species observed in the Boundary Hydroelectric Project study area, 2007 (continued).

| Taxon | Nonnative / Washington Noxious Weed Status [1] | Washington Rare Plant State Status [2] |
|---|---|---|
| *Glycyrrhiza lepidota* | | |
| *Gnaphalium palustre* | | |
| *Gnaphalium spp.* | | |
| *Goodyera oblongifolia* | | |
| *Gratiola neglecta* | | |
| *Gymnocarpium dryopteris* | | |
| *Helenium autumnale* | | |
| *Heracleum lanatum* | | |
| *Heuchera cylindrica* | | |
| *Hieracium albiflorum* | | |
| *Hieracium aurantiacum* | B | |
| *Hieracium caespitosum* | B | |
| *Hieracium cynoglossoides* | | |
| *Hierochloe odorata* | | R1 |
| *Hippurus vulgaris* | | |
| *Holodiscus discolor* | | |
| *Hordeum geniculatum* | x | |
| *Hypericum formosum* | | |
| *Hypericum majus* | | S |
| *Hypericum perforatum* | C | |
| *Impatiens aurella* | | R1 |
| *Ipomopsis aggregata* | | |
| *Iris pseudacorus* | C | |
| *Juncus alpinus* | | |
| *Juncus articulatus* | | |
| *Juncus bufonius* | | |
| *Juncus effusus* | | |
| *Juncus ensifolius* | | |
| *Juncus longistylis* | | |
| *Juncus nodosus* | | |
| *Juncus saximontanus* | | |
| *Juncus tenuis* | | |
| *Juniperus communis* | | |
| *Juniperus scopulorum* | | |
| *Koeleria cristata* | | |
| *Lactuca muralis* | x | |
| *Lactuca serriola* | x | |
| *Larix occidentalis* | | |
| *Lathyrus latifolius* | | |
| *Lathyrus ochroleucus* | | |

| Taxon | Nonnative / Washington Noxious Weed Status [1] | Washington Rare Plant State Status [2] |
|---|---|---|
| *Lemna spp.* | | |
| *Leucanthemum vulgare* | B | |
| *Lilium columbianum* | | |
| *Limosella acaulis* | | |
| *Limosella aquatica* | | |
| *Linaria dalmatica* | B | |
| *Lindernia dubia* | | |
| *Linnaea borealis* | | |
| *Linum lewisii* | C | |
| *Listera caurina* | | |
| *Listera convallarioides* | | |
| *Listera cordata* | | |
| *Lithophragma spp.* | | |
| *Logfia (Filago) arvensis* | x | |
| *Lomatium ambiguum* | | |
| *Lomatium cf geyeri* | | |
| *Lomatium dissectum* | | |
| *Lomatium triternatum* | | |
| *Lonicera ciliosa* | | |
| *Lonicera involucrata* | | |
| *Lonicera utahensis* | | |
| *Lotus purshiana* | | |
| *Lupinus polyphyllus* | | |
| *Lupinus sericeus* | | |
| *Lupinus spp.* | | |
| *Luzula multiflora* | | |
| *Luzula parviflora* | | |
| *Lycopodium complanatum* | | |
| *Lycopus americanus* | | |
| *Lycopus spp.* | | |
| *Lycopus uniflorus* | | |
| *Lysichitum americanum* | | |
| *Lysimachia ciliata* | | |
| *Lysimachia nummularia* | x | |
| *Lysimachia thyrsiflora* | | |
| *Lythrum salicaria* | B-designate | |
| *Maianthemum racemosa* | | |
| *Maianthemum stellata* | | |
| *Malus spp.* | x | |

**Table A.1-1.** Complete list of vascular plant species observed in the Boundary Hydroelectric Project study area, 2007 (continued).

| Taxon | Nonnative / Washington Noxious Weed Status [1] | Washington Rare Plant State Status [2] |
|---|---|---|
| *Marsilea vestita* | | |
| *Matricaria spp.* | | |
| *Medicago cf falcata* | x | |
| *Medicago lupulina* | x | |
| *Melilotus alba* | x | |
| *Melilotus officinalis* | x | |
| *Mentha arvensis* | | |
| *Mentzelia laevicaulis* | | |
| *Mimulus guttatus* | | |
| *Mimulus moschatus* | | |
| *Mitella spp.* | | |
| *Moneses uniflora* | | |
| *Muhlenbergia andina* | | |
| *Muhlenbergia mexicana var. mexicana* | | R1 |
| *Myosotis arvensis* | x | |
| *Myosotis discolor* | x | |
| *Myosotis laxa* | | |
| *Myosotis scorpioides* | x | |
| *Myosotis stricta* | x | |
| *Myriophyllum spicatum* | B | |
| *Nepeta cataria* | x | |
| *Oenothera villosa spp. strigosa* | | |
| *Ophioglossum pusillum* | | T |
| *Oplopanax horridum* | | |
| *Orthilia secunda* | | |
| *Oryzopsis asperifolia* | | |
| *Osmorhiza chilensis* | | |
| *Oxalis corniculata* | x | |
| *Pachistima myrsinites* | | |
| *Panicum capillare* | x | |
| *Panicum spp.* | | |
| *Parnassia palustris v. parviflora* | | |
| *Parthenocissus vitacea* | x | |
| *Pellaea glabella spp. simplex* | | |
| *Penstemon fruticosus* | | |
| *Phacelia hastata* | | |
| *Phacelia heterophylla* | | |
| *Phacelia linearis* | | |

| Taxon | Nonnative / Washington Noxious Weed Status [1] | Washington Rare Plant State Status [2] |
|---|---|---|
| *Phalaris arundinacea* | C | |
| *Philadelphus lewisii* | | |
| *Phleum pratense* | x | |
| *Physocarpus malvaceus* | | |
| *Physostegia parviflora* | | |
| *Picea engelmannii* | | |
| *Pinguicula macroceras* | | |
| *Pinus contorta* | | |
| *Pinus monticola* | | |
| *Pinus ponderosa* | | |
| *Piperia elegans* | | |
| *Piperia unalascensis* | | |
| *Plagiobothrys scouleri* | | |
| *Plantago lanceolata* | | |
| *Plantago major* | | |
| *Platanthera dilatata* | | |
| *Platanthera hyperborea* | | |
| *Platanthera orbiculata* | | |
| *Plectritis macrocera* | | |
| *Poa bulbosa* | x | |
| *Poa compressa* | x | |
| *Poa palustris* | | |
| *Poa pratensis* | | |
| *Poa secunda* | | |
| *Polemonium pulcherrimum spp. pulcherrimum* | | |
| *Polygonum amphibium* | | |
| *Polygonum aviculare* | x | |
| *Polygonum convolvulus* | x | |
| *Polygonum douglasii* | | |
| *Polygonum lapathifolium* | | |
| *Polygonum persicaria* | x | |
| *Polygonum spp.* | | |
| *Polypodium hesperium* | | |
| *Polystichum imbricans* | | |
| *Polystichum lonchitis* | | |
| *Populus balsamifera var. trichocarpa* | | |
| *Populus alba* | x | |

**Table A.1-1.** Complete list of vascular plant species observed in the Boundary Hydroelectric Project study area, 2007 (continued).

| Taxon | Nonnative / Washington Noxious Weed Status [1] | Washington Rare Plant State Status [2] |
|---|---|---|
| *Populus tremuloides* | | |
| *Potamogeton cf. gramineus* | | |
| *Potamogeton cf. pectinatus* | | |
| *Potamogeton crispus* | x | |
| *Potamogeton richardsonii* | | |
| *Potamogeton spp.* | | |
| *Potentilla anserina* | | |
| *Potentilla fruticosa* | | |
| *Potentilla gracilis* | | |
| *Potentilla norvegica* | | |
| *Potentilla palustris* | | |
| *Potentilla recta* | B | |
| *Potentilla spp.* | | |
| *Prunella vulgaris* | | |
| *Prunus emarginata* | | |
| *Prunus virginiana* | | |
| *Pseudoroegneria spicata* | | |
| *Pseudotsuga menziesii* | | |
| *Pteridium aquilinum* | | |
| *Pteryxia terebinthina var. foeniculacea* | | |
| *Pyrola asarifolia* | | |
| *Pyrola chlorantha* | | |
| *Pyrola picta* | | |
| *Ranunculus aquatilis* | | |
| *Ranunculus flammula* | | |
| *Ranunculus macounii* | | |
| *Ranunculus repens* | x | |
| *Ranunculus spp.* | | |
| *Ranunculus uncinatus* | | |
| *Rhamnus purshiana* | | |
| *Rhododendron albiflorum* | | |
| *Rhus glabra* | | |
| *Ribes lacustre* | | |
| *Ribes laxiflorum* | | |
| *Ribes lobbii* | | |
| *Ribes sanguineum* | | |
| *Ribes spp.* | | |

| Taxon | Nonnative / Washington Noxious Weed Status [1] | Washington Rare Plant State Status [2] |
|---|---|---|
| *Rorippa curvipes (obtusa)* | | |
| *Rorippa islandica* | | |
| *Rorippa spp.* | | |
| *Rosa acicularis* | | |
| *Rosa gymnocarpa* | | |
| *Rosa nutkana* | | |
| *Rosa spp.* | | |
| *Rosa woodsii* | | |
| *Rubus idaeus* | | |
| *Rubus leucodermis* | | |
| *Rubus parviflorus* | | |
| *Rudbeckia hirta* | x | |
| *Rumex acetosella* | x | |
| *Rumex crispus* | x | |
| *Rumex occidentalis* | | |
| *Rumex spp.* | | |
| *Sagina procumbens* | x | |
| *Sagittaria cuneata* | | |
| *Salix bebbii* | | |
| *Salix exigua* | | |
| *Salix lucida* | | |
| *Salix melanopsis* | | |
| *Salix prolixa (rigida)* | | |
| *Salix scouleriana* | | |
| *Salix sitchensis* | | |
| *Salix spp.* | | |
| *Sambucus cerulea* | | |
| *Sambucus racemosa* | | |
| *Sanicula marilandica* | | S |
| *Scirpus atrocinctus (cyperinus)* | | |
| *Scirpus microcarpus* | | |
| *Scirpus validus* | | |
| *Scutellaria angustifolia* | | |
| *Scutellaria galericulata* | | |
| *Scutellaria lateriflora* | | |
| *Sedum lanceolatum* | | |
| *Sedum leibergii* | | |
| *Sedum spp.* | | |
| *Sedum stenopetalum* | | |
| *Selaginella cf. wallacei* | | |

**Table A.1-1.** Complete list of vascular plant species observed in the Boundary Hydroelectric Project study area, 2007 (continued).

| Taxon | Nonnative / Washington Noxious Weed Status [1] | Washington Rare Plant State Status [2] |
|---|---|---|
| *Selaginella densa* | | |
| *Senecio hydrophilus* | | |
| *Senecio indecorus* | | |
| *Senecio spp.* | | |
| *Senecio triangularis* | | |
| *Senecio vulgaris* | x | |
| *Setaria viridis* | x | |
| *Shepherdia canadensis* | | |
| *Silene cserei* | x | |
| *Silene cucubalus* | x | |
| *Silene menziesii* | | |
| *Silene noctiflora* | x | |
| *Sisymbrium altissimum* | x | |
| *Sisymbrium loesellii* | x | |
| *Sisyrinchium septentrionale* | | S |
| *Sium suave* | | |
| *Solanum dulcamara* | x | |
| *Solidago canadensis* | | |
| *Solidago gigantea* | | |
| *Solidago spp.* | | |
| *Sonchus arvensis* | B | |
| *Sonchus uliginosus* | x | |
| *Sorbus aucuparia* | x | |
| *Sparganium emersum/angustifolium* | | |
| *Sphenopholis obtusata* | | |
| *Spiraea douglasii* | | |
| *Spiranthes romanzoffiana* | | |
| *Spirea betulifolia* | | |
| *Sporobolus cryptandrus* | | |
| *Stachys palustris* | | |
| *Stellaria calycantha* | | |
| *Stellaria media* | x | |
| *Streptopus amplexicaulis* | | |
| *Suksdorfia violacea* | | |
| *Symphoricarpos albus* | | |
| *Symphytum officinale* | x | |
| *Tanacetum vulgare* | C | |
| *Taraxacum officinale* | x | |

| Taxon | Nonnative / Washington Noxious Weed Status [1] | Washington Rare Plant State Status [2] |
|---|---|---|
| *Taxus brevifolia* | | |
| *Thalictrum dasycarpum* | | S |
| *Thalictrum occidentalis* | | |
| *Thuja plicata* | | |
| *Tiarella trifoliata* | | |
| *Toxicodendron rydbergii* | | |
| *Tragopogon dubius* | x | |
| *Trifolium arvense* | x | |
| *Trifolium dubium* | x | |
| *Trifolium pratense* | x | |
| *Trillium ovatum* | | |
| *Trisetum canescens* | | |
| *Trisetum spicatum* | | |
| *Triteleia grandiflora var. grandiflora* | | |
| *Tsuga heterophylla* | | |
| *Typha latifolia* | | |
| *Ulmus pumila* | x | |
| *Urtica dioica* | | |
| *Utricularia sp* | | |
| *Vaccinium membranaceum* | | |
| *Vaccinium spp.* | | |
| *Verbascum thapsus* | x | |
| *Veronica americana* | | |
| *Veronica anagallis-aquatica* | | |
| *Veronica chamaedrys* | x | |
| *Veronica officinalis* | x | |
| *Veronica peregrina var. xalapensis* | | |
| *Veronica spp.* | | |
| *Viburnum opulus* | | |
| *Vicia americana var truncata* | | |
| *Viola adunca* | | |
| *Viola glabella* | | |
| *Viola nephrophylla* | | |
| *Viola renifolia* | | S |
| *Viola spp.* | | |
| *Woodsia oregana* | | |

**Table A.1-1.** Complete list of vascular plant species observed in the Boundary Hydroelectric Project study area, 2007 (continued).

| Taxon | Nonnative / Washington Noxious Weed Status [1] | Washington Rare Plant State Status [2] |
|---|---|---|
| *Xanthium strumarium minus* | x | |
| *Zannichellia spp.* | | |
| *Zigadenus elegans* | | |

Notes:

1 Nonnative status from the Washington State Noxious Weed Board
http://www.nwcb.wa.gov/weed_list/weed_list.htm
X = nonnative without state status;
A = Class A Noxious Weeds: designated noxious weed that is limited in distribution in Washington. State law requires that these weeds be eradicated;
B = Class B Noxious Weeds: designated noxious weed that is either absent from or limited in distribution in some portions of the state but very abundant in other areas. The goals are to contain the plants where they are already widespread and prevent their spread into new areas.
C = Class C Noxious Weeds: Non-native plants that are already widespread in Washington State. Counties can choose to enforce control, or they can educate residents about controlling these noxious weeds.

2 State Status from the Washington Department of Natural Resources
http://www.dnr.wa.gov/nhp/refdesk/lists/plantrnk.html#key
E = Endangered. In danger of becoming extinct or extirpated from Washington.
T = Threatened. Likely to become Endangered in Washington.
S = Sensitive. Vulnerable or declining and could become Endangered or Threatened in the state.
X = Possibly extinct or Extirpated from Washington.
P1 = Priority 1. Rare nonvascular plant but with insufficient information to assign another rank.
P2 = Priority 2. Nonvascular plant of concern but with insufficient information to assign another rank.
R1 = Review group 1. Of potential concern but needs more field work to assign another rank.
R2 = Review group 2. Of potential concern but with unresolved taxonomic questions.
W = Watch. More abundant and/or less threatened than previously thought

# Appendix 2. RTE Location Information Including 2007 Status, Sighting Form Names and Subpopulations Mapped in the Boundary Hydroelectric Project Study Area, 2007

NOTE: Because of the potentially sensitive nature of information regarding RTE plant species, the information contained in Appendix 2 is not being distributed to the general public. This information has been filed with FERC with a Privileged designation in Volume 5 of the ISR submittal. It may be obtained by request to Seattle City Light or FERC, subject to confidentiality provisions.

# Appendix 3. WNHP Rare Plant Sighting Forms for RTE Populations on Non-USFS Land, Boundary Hydroelectric Project Study Area, 2007

NOTE: Because of the potentially sensitive nature of information regarding RTE plant species, the information contained in Appendix 3 is not being distributed to the general public. This information has been filed with FERC with a Privileged designation in Volume 5 of the ISR submittal. It may be obtained by request to Seattle City Light or FERC, subject to confidentiality provisions.

# Appendix 4. USFS Element Occurrence Field Forms for RTE Populations on USFS Land, Boundary Hydroelectric Project Study Area, 2007

NOTE: Because of the potentially sensitive nature of information regarding RTE plant species, the information contained in Appendix 4 is not being distributed to the general public. This information has been filed with FERC with a Privileged designation in Volume 5 of the ISR submittal. It may be obtained by request to Seattle City Light or FERC, subject to confidentiality provisions.

# Appendix 5. Maps of RTE plant polygons located in the Boundary Hydroelectric Project Study Area, 2007

NOTE: Because of the potentially sensitive nature of information regarding RTE plant species, the information contained in Appendix 5 is not being distributed to the general public. This information has been filed with FERC with a Privileged designation in Volume 5 of the ISR submittal. It may be obtained by request to Seattle City Light or FERC, subject to confidentiality provisions.