

**BOTANICAL RESOURCES
FINAL STUDY REPORT**

**COVER TYPE MAPPING,
RARE THREATENED AND ENDANGERED PLANT SURVEYS,
AND
INVASIVE PLANT SPECIES SURVEYS
WELLS HYDROELECTRIC PROJECT**

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ABSTRACT

In 2005, Public Utility District No. 1 of Douglas County (Douglas PUD) conducted a botanical resources study to collect information pertinent to the Wells Hydroelectric Integrated Licensing Process. During the study, 13 occurrences of four rare plants were observed and documented in the Wells Project Area, including little bluestem (*Schizachyrium scoparium*), chaffweed (*Centunculus minimus*), northern sweetgrass (*Hierochloe odorata*), and brittle prickly-pear (*Opuntia fragilis*). Ute ladies' tresses (*Spiranthes diluvialis*), a federally listed threatened species of orchid, was not observed during rare plant surveys conducted in 2005 despite the presence of suitable wetland habitat in the Wells Project Area.

Noxious weed surveys in the Wells Project Area mapped and documented 99 occurrences of four Class B-designate weed species, including purple loosestrife (*Lythrum salicaria*), dalmation toadflax (*Linaria dalmatica*), leafy spurge (*Euphorbia esula*), and perennial pepperweed (*Lepidium latifolium*). Although not mapped, two Class B weeds—Russian knapweed (*Acroptilon repens*) and diffuse knapweed (*Centaurea diffusa*)—were common in upland or transitional upland/wetland habitats; two Class C weeds—reed canarygrass (*Phalaris arundinacea*) and yellow flag (*Iris pseudacorus*)—were common species in Project Area wetlands and along reservoir shorelines.

Cover types were mapped and field verified on 2,539 acres of land within the Wells Project Area. Upland and wetland habitats comprised 32 percent and 31 percent of the Project Area, respectively; 26 percent of the land was agricultural and another 6.9 percent shows evidence of development. The remaining areas mapped included Upland Rock Habitats, Littoral Zone, and Bare-Disturbed-Eroded which comprised, in total, less than 5 percent of the Project Area.

1.0 INTRODUCTION

This report presents the results of the botanical resources studies that were conducted for the Wells Hydroelectric Project (Wells Project), which is located on the Columbia River in the State of Washington. The Wells Project is owned and operated by Public Utility District No. 1 of Douglas County (Douglas PUD), and is undergoing the process of being relicensed with the Federal Energy Regulatory Commission (FERC). The botanical resource studies described in this report were conducted to provide baseline information for the Pre-Application Document (PAD) being prepared by Douglas PUD.

1.1 General Description of the Wells Hydroelectric Project

The Wells Hydroelectric Project extends along the Columbia River from river mile (RM) 515.8 to RM 544.8 (Figure 1.1-1). Wells Dam is located approximately 30 river miles downstream from the Chief Joseph Project, owned and operated by the United States Army Corps of Engineers (COE), and 42 miles upstream from the Rocky Reach Hydroelectric Project owned and operated by Chelan County Public Utility (Chelan PUD). The nearest town is Pateros, Washington, located approximately 8 miles upstream from the Wells Project.

The Wells Project is the chief generating resource for Douglas PUD. It includes ten generating units with a nameplate rating of 774,300 kVA and a peaking capacity of approximately 840 MW. The design of the Wells Project is unique in that the generating units, spillways, switchyard, and fish passage facilities were combined into a single structure referred to as the hydrocombine. Fish passage facilities reside on both sides the hydrocombine, which is 1,130 feet long, 168 feet wide, with a crest elevation of 795 feet.

The Wells Reservoir is 29.5 miles long. The Methow and Okanogan rivers are tributaries of the Columbia River within the Wells Reservoir. The Wells Project boundary extends approximately 1.5 miles up the Methow River and 15.5 miles up the Okanogan River. The normal maximum surface area of the reservoir is 9,740 acres with a gross storage capacity of 331,200 acre-feet and usable storage of 97,985 acre-feet at elevation 781 feet. The maximum water surface elevation of the reservoir is 781 feet.

1.2 Relicensing Process

The current Wells Project license will expire on May 31, 2012. Douglas PUD is using the Integrated Licensing Process (ILP) as required by FERC regulations issued July 23, 2003 (18 CFR Part 5). The first major step in this process is preparation of a Pre-Application Document (PAD), with the purpose of providing the FERC with exiting information relevant to the Wells Project. For botanical resources, the PAD is to include descriptions of the following:

- Rare, threatened, and endangered (RTE) plants species, including federal- and state-listed species known to be present in the Wells Project Area and their distribution, as well as their habitat requirements and any biological opinions, status reports, recovery plans, and designated critical habitat (18 CFR § 5.6(v, vi, vii)).

- Wetland, riparian, and littoral habitats, including a list of plants species in these habitats, a map, and estimates of acreage for each habitat type;
- Invasive species in the Wells Project vicinity; and
- Upland habitats in the Wells Project vicinity, including the Wells Project transmission line corridor, and a listing of plant species in these habitats.

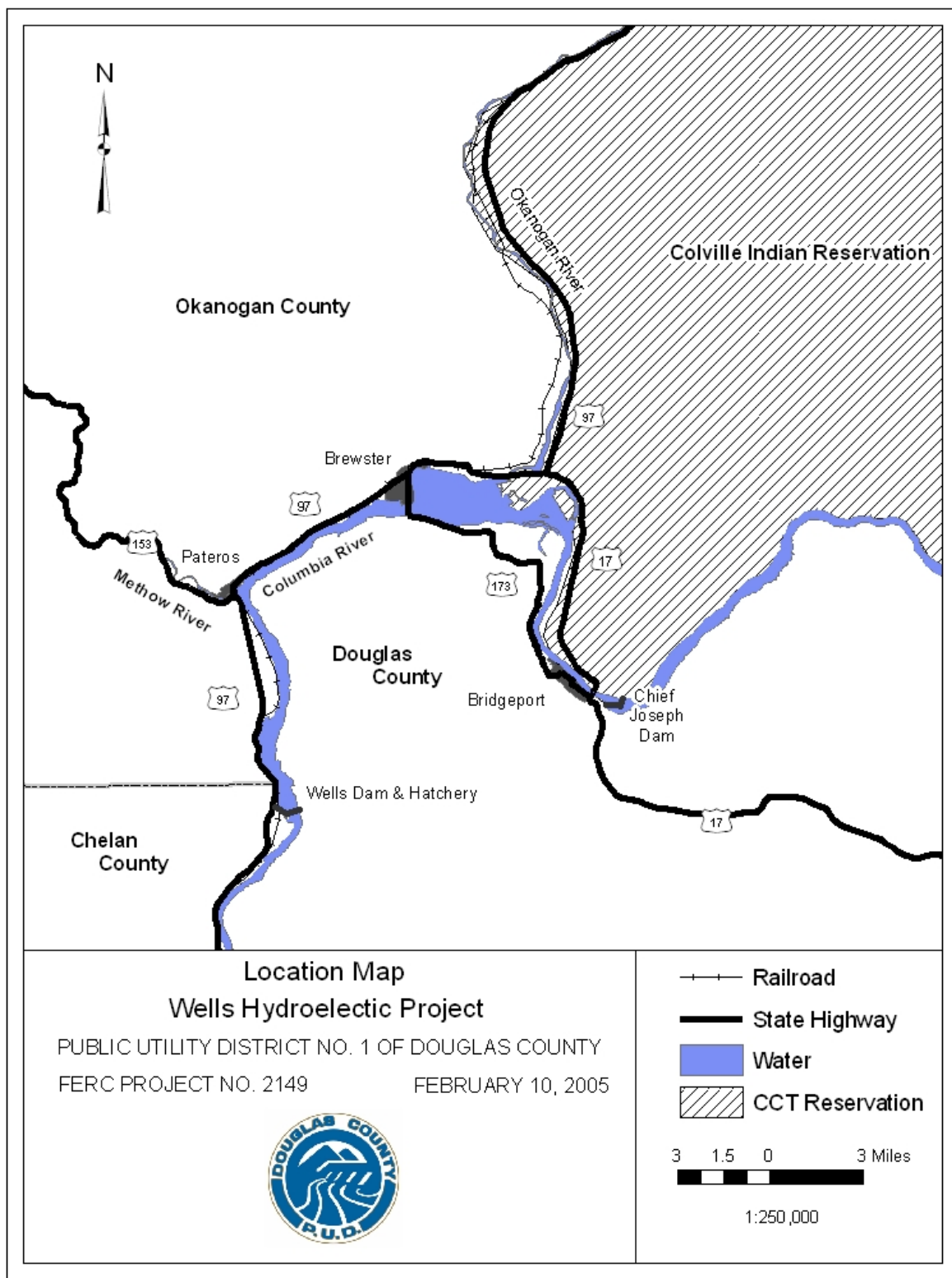


Figure 1.1-1. Location Map of the Wells Project.

2.0 STUDY GOAL

The overall goal of the botanical resources study is to provide Douglas PUD with information to direct land management decisions, avoid damage to habitats on Wells Project lands that support RTE species, and minimize the spread of invasive species. In addition, this study provides information required by the FERC to meet the requirements for the PAD, as identified in CFR 18 § 5.6 (v), (vi), and (vii). The botanical resource study has three primary objectives:

- (1) Determine the presence of RTE plants on Wells Project lands. For inclusion in the PAD, the FERC defines RTE species as listed rare, threatened, and endangered, candidate, or special status species (CFR 18.5.6 (vii)). In Washington, the term RTE is typically defined to include the following species:
 - Federally listed as threatened or endangered;
 - Proposed for federal listing as threatened or endangered;
 - Federal species of concern;
 - State listed as threatened or endangered; or
 - State listed as sensitive.
- (2) Identify any infestations of invasive plant species on Wells Project lands. For the Wells Project, invasive species include Washington State Class A and B-designate noxious weeds.
- (3) Field verify the preliminary cover type maps developed for the Wells Project by Douglas PUD and develop a list of plant species by cover type.

3.0 STUDY AREA

The study area consists of all lands lying between the Wells Project boundary and the shorelines of the Columbia, Methow, and Okanogan rivers. The Wells Project boundary extends from the tailrace of Wells Dam (River Mile [RM] 515.8) upstream to the tailrace of Chief Joseph Dam (RM 544.5). The boundary also extends to RM 15.5 on the Okanogan River and RM 1.5 on the Methow River. The distance from the shoreline to the Wells Project boundary varies depending on where backwater inundates the shoreline at high pool levels, but is generally less than 50 feet. Approximately 2,539 acres of land are associated with the Wells Hydroelectric Project. For discussion purposes, the study area was divided into five zones:

- **Zone 1** - Wells Dam tailrace (U.S. Geological Survey [USGS] RM 514.4) to the upstream end of Pateros (USGS River Mile 524), including 1.5 miles of the Methow River upstream of the confluence;
- **Zone 2** - Pateros to the Brewster Bridge (USGS RM 530);
- **Zone 3** - Brewster Bridge to the north end of Park Island (USGS RM 538.3);

- **Zone 4** - Park Island to Chief Joseph Dam; south east to Bridgeport (USGS RM 544.3)
- **Zone 5** - The Okanogan River, from the confluence to USGS RM 15.5.

4.0 METHODOLOGY

This section summarizes the methods for the RTE plant and invasive species inventories and for field verifying the cover type mapping.

4.1 RTE Plant Inventory

The RTE plant inventory included the following tasks: (1) pre-field review; (2) field surveys; and (3) documentation and mapping of results. Each task is described below.

4.1.1 Pre-field Review

The pre-field review task consisted of developing a “target” list of RTE plant species to guide field surveys. The pre-field review task was initiated by sending letters to the U.S. Fish and Wildlife Service (FWS) and Washington Natural Heritage Program (WNHP) requesting the latest information on RTE plant species known to occur or potentially occurring in or near the Wells Project Area. The target list of RTE species potentially occurring in the study area was developed based on input from the FWS and WNHP, as well as information from the rare plant surveys conducted for the nearby Rocky Reach Hydroelectric Project (Calypso Consulting 2000). Information on habitat requirements, such as elevation, soils, and associated vegetation community, was used to refine the list to include those species most likely to be found in or near the Wells Project Area. This information was also used to identify the habitats to be surveyed, with an emphasis on those that support RTE species with federal or state status as threatened or endangered. Botanists from the WNHP were also asked for any additional information related to RTE species that may occur in the area.

Prior to beginning field surveys, botanists reviewed the morphological characteristics of target RTE plant species to develop a search image to ensure detection and recognition abilities. This process included reviewing herbarium specimens and collecting information on vegetative, floral, and fruit characteristics for each target species and other species that are closely related or otherwise difficult to distinguish from the target RTE species.

Based on information provided by the WNHP, FWS (see letters in Appendix A), and rare plant surveys conducted for the nearby Rocky Reach Hydroelectric Project (Calypso 2000), a target list of 46 potentially occurring RTE plant species was compiled for the study area (Table 4.1-1). Of these, only one species, Ute ladies' tresses (*Spiranthes diluvialis*), is federally listed as threatened; there are no federal endangered species known or suspected to occur in or near the study area. Ute ladies' tresses is also state-listed as endangered by the WNHP; there are 14 other rare state-listed threatened or endangered plant species potentially occurring in the study area, as well as one species that is potentially extirpated in Washington. There are an additional 30 plant species potentially occurring in the study area that are state-listed as sensitive or under review for possible state listing Table 4.1-1.

4.1.2 Field Surveys

Surveys for RTE plants in the study area for the Wells Project involved visually searching suitable habitat. Shoreline areas, which are narrow and easily searched, were surveyed on foot or from a boat. Larger areas, such as Washburn Island and Cassimer Bar, were surveyed on foot using the random meander approach described in Nelson (1985).

The RTE species on the target list determined the habitats to be searched and the level of survey effort. Habitats with a high probability of supporting one or more RTE plants that are federally or state listed as threatened or endangered received thorough coverage. Habitats with a lower likelihood of supporting these species were surveyed less intensively. Habitats that did not appear suitable for any RTE species were not searched. RTE species that are state-listed sensitive plant species were recorded and mapped when encountered, but surveys were not focused on these species.

Survey timing is critical to the success and validity of the RTE plant inventory and was determined using information from the literature, the WNHP website, and the Rocky Reach studies. The dates for each survey were based on the flowering times for the four federal and state-listed threatened and endangered species found at Rocky Reach, as well several others potentially occurring in the study area, and local temperature/moisture conditions. Surveys were conducted from May 16-20, June 27-30, and August 7-10, 2005.

4.1.3 Documentation/Mapping

RTE plants were identified in the field using the Flora of the Pacific Northwest (Hitchcock and Cronquist 1973) and the Field Guide to Selected Rare Plants of Washington (WNHP 2005). A variety of sources was utilized to verify tentative species identification including other floras, published papers, and herbarium specimens. A list of all plant species identified during the field surveys was also compiled.

WNHP sighting forms were completed for each RTE plant population found in the study area. Data collected included population size and area, phenology, habitat, slope, aspect, elevation, soils, and associated species. Factors affecting survival of RTE species (e.g., deer browse, disturbance, etc.) were also noted, if applicable. The population locations were mapped on Wells Project maps, with global positioning system (GPS) coordinates collected to verify the mapped location. Photographs were also taken of each RTE plant and their habitat. Population size for RTE species was visually estimated (for large populations) or counted (for small populations).

Table 4.1-1. Target List of RTE Plant Species Potentially Present within the Wells Project Study Area.

<i>Scientific Name</i>	Status ^{1,2}		Habitat Information ³
Common Name	State/ Federal		
<i>State or Federally Listed as Threatened, Endangered, Potentially Extirpated, or Species of Concern</i>			
<i>Ammania robusta</i> Grand Red Stem	T		Mudflats with fine sandy and silty soils along margins of ponds, rivers, and other wet places. Flower Date: May and June; Elevation: Columbia River
<i>Astragalus arrectus</i> Palouse Milk-vetch	T		Grassy hillsides, sagebrush flats, river bluffs, & open ponderosa pine/Douglas-fir forests in grassy or shrub-dominated openings growing on all aspects in soil ranging from rocky & dry to moist & rich. Flower Date: late-May to early June; Elevation: 1000 – 4000 ft (C)
<i>Astragalus sinuatus</i> Whited's Milk-vetch	E	SC	Rocky hillsides associated with the big sagebrush /bluebunch wheatgrass association. Soils consist of wind-deposited silts mixed with small amounts of volcanic ash over basalt bedrock. Flower Date: mid-April to early-May; Elevation: 800-2000 ft (C)
<i>Astragalus tenellus</i> Loose-flower Milk-vetch	T		Frequently found on steep alkaline clay & also on calcareous soil in grasslands. Flower Date: June to July; Elevation: > 800 ft (D)
<i>Carex tenuiflora</i> Sparse-leaved Sedge	T		Bogs, fens, swamps, wet grassy areas, occasionally in seepage areas in forests. Occurs in a sedge marsh & sphagnum bog maintained by a beaver dam. Flower Date: late-July to mid-August (O)
<i>Juncus tiehmii</i> Tiehm's Rush	T		Seepy, moss-covered silt at the base of basalt cliffs & in steep, mossy, moist benches within shrub steppe ecosystems. Flower Date: mid-spring to early-fall; Elevation: 980-10170 ft (D)
<i>Lipocarpa aristulata</i> Halfchaff Awned Sedge	T		Along shorelines and islands below high water on silty substrates. Flower Date: June to September; Elevation: 360 to 420 ft
<i>Mimulus washingtonensis</i> Washington Monkey-flower	X		Low elevation, wet, open places. Flower Date: May to September; Elevation: low (O)
<i>Ophioglossum pusillum</i> Adder's-tongue	T		Bogs, fens, damp sand, pastures, wet meadows, grassy swales, moist woods, rich swamplands, mud creeks, & cedar swamps. Sometimes occurs on dry, sandy beaches or hillsides; the subterranean gametophyte may be an adaptation to seasonal drying &/or fire. Flower Date: June to September; Elevation: 40-2300 ft (C,D)

Table 4.1-1. Target List of RTE Plant Species Potentially Present within the Wells Project Study Area.

<i>Scientific Name</i> Common Name	Status^{1,2}		Habitat Information³
	State/Federal		
<i>Petrophyton cinerascens</i> Chelan Rockmat	E	SC	Crevices & on ledges of open, east- or west-facing cliffs & rock (non-basalt) outcrops along the Columbia River in central WA. Flower Date: late-July to late-August; Elevation: 800-1800 ft (C,D)
<i>Platanthera sparsiflora</i> Canyon Bog-orchid	T		Open, wet areas, seeps, & bogs. Flower Date: late-may to August; Elevation: 800-5200 ft (O)
<i>Rotala ramosior</i> Lowland Toothcup	T		Damp areas in fine sand & silt around wetlands, lake & pond margins, & along free-flowing river reaches. Flower Date: June to August; Elevation: 200-2300 ft (C)
<i>Schizachyrium scoparium</i> var. <i>scoparium</i> Little Bluestem	T		Along the Columbia River, this species is located within remnant riparian vegetation. Flower Date: July to August; Elevation: 750 ft (D)
<i>Sisyrinchium montanum</i> Strict Blue-eyed-grass	T		Mossy, vernal moist seeps on hillsides in silt-loam substrate just above the high water level of the Columbia River. Flower Date: April to July; Elevation: > 750 ft (D)
<i>Spiranthes diluvialis</i> Ute Ladies' Tresses	E	LT	Stabilized gravel bars on the Columbia River that are moist throughout the growing season & inundated early in the growing season. Flower Date: mid-July to August; Elevation: 720-1500 ft (C,O)
<i>Trifolium thompsonii</i> Thompson's Clover	T	SC	Open ponderosa pine woods to areas dominated by bluebunch wheatgrass & herbs. Ridgelines, steep slopes, alluvial fans, & canyon bottoms. It also occurs on the deeper soils in areas characterized by "biscuit-swale" topography. Flower Date: mid-May to mid-July; Elevation: 140-3760 ft (C,D)
<i>State-Listed as Sensitive or Review</i>			
<i>Astragalus misellus</i> var. <i>pauper</i> Pauper Milk-vetch	S		Open gentle slopes of ridgetops & upper slopes; rarely middle or lower slopes, mostly along the western margin of the Columbia Basin. Flower Date: April to mid-May; Elevation: 500-3000 ft (D)

Table 4.1-1. Target List of RTE Plant Species Potentially Present within the Wells Project Study Area.

<i>Scientific Name</i> Common Name	Status^{1,2} State/Federal	Habitat Information³
<i>Camissonia pygmaea</i> Dwarf Evening-primrose	S	Unstable soil or gravel in steep talus, dry washes, banks, & roadcuts. Flower Date: June to August; Elevation: 500-1850 ft (D)
<i>Carex comosa</i> Bristly Sedge	S	Marshes, lake shores, & wet meadows. Flower Date: May to July; Elevation: 50-2000 ft (C)
<i>Carex sychnocephala</i> Many-headed Sedge	S	Moist or wet ground adjacent to marshes or along lake shores. Substrates vary from rather rocky to sandy & silty soils. Flower Date: July to Sept.; Elevation: ~800 ft (O)
<i>Centunculus minimus</i> Chaffweed	R1	Moist ground, ephemeral wet areas. Flower Date: May to June; Elevation: ~800 ft (C)
<i>Cicuta bulbifera</i> Bulb-bearing hemlock	S	Along edges of marshes, lake margins, & slow moving streams; in bogs, wet meadows, shallow standing water, hummocks, & floating mats. Flower Date: Growing season; Elevation: 240-3700 ft (C)
<i>Cryptantha leucophaea</i> Gray Cryptantha	S SC	Grows on sandy substrate along the Columbia River within the Columbia Basin physiographic province. Flower Date: May to June; Elevation: 300-2500 ft (D)
<i>Cryptogramma stelleri</i> Steller's Rockbrake	S	Cliffs. Flower Date: April to Oct.; Elevation: 300-3500 ft (C,O)
<i>Cyperus bipartitus</i> Shining Flatsedge	S	Open to dense, often low-growing riverine wetlands in small embayments & backwaters of the Columbia River. Flower Date: August (fall); Elevation: 350-1200 ft (D)
<i>Eleocharis rostellata</i> Beaked Spike-rush	S	Streambanks, lake margins, around springs, & in marshes. Flower Date: June to August; Elevation: 500-1850 ft (O)
<i>Erigeron piperianus</i> Piper's Daisy	S	Dry, open places, often with sagebrush on level ground to moderate slopes of all aspects. Soil is well drained & generally somewhat alkaline. Flower Date: May to June; Elevation: 400-2250 ft (D)

Table 4.1-1. Target List of RTE Plant Species Potentially Present within the Wells Project Study Area.

<i>Scientific Name</i> Common Name	Status^{1,2} State/Federal	Habitat Information³
<i>Githopsis specularioides</i> Common Blue-cup	S	Open places at lower elevations, such as thin soils over bedrock outcrops, talus slopes, & gravelly prairies. Flower Date: mid-April to June; Elevation: 200-2500 ft (C)
<i>Hackelia hispida</i> var. <i>disjuncta</i> Sagebrush Stickseed	S	Rocky talus & sparsely vegetated areas within an arid region at elevations. Flower Date: May to June; Elevation: 600-2100 ft (C,D)
<i>Hierochloe odorata</i> Northern Sweetgrass	R1	Moist soil from alpine to low montane elevations, possibly lower. Flower Date: April to July (C,O)
<i>Iliamna longisepala</i> Longsepal Globemallow	S	Open hillsides & along gravelly streamside in shrub steppe & the adjacent forested slopes of the eastern flank of the Cascades. Flower Date: June to August; Elevation: 500-4500 ft (C,D)
<i>Juncus uncialis</i> Inch-high Rush	S	Vernal pools, depressions, & swales. Flower Date: June; Elevation: 2100-2290 ft (D)
<i>Mimulus suksdorfii</i> Suksdorf's Monkey-flower	S	Moist pockets & drainages, sagebrush steppe vegetation type, often in microhabitats that have undergone local disturbance from small erosive events (e.g., slumps, slides, bioturbidity, & frost boils). Flower Date: mid-April on; (C,D)
<i>Nicotiana attenuata</i> Coyote Tobacco	S	Dry, sandy bottom lands, dry rocky washes, & other dry open places. Flower Date: June to Sept.; Elevation: 400-1,000 ft (C,D)
<i>Opuntia fragilis</i> Brittle Prickly-pear	R1	Dry hillsides & open ground on east side of Cascade Range. Flower Date: May to June (O)
<i>Oxytropis campestris</i> var. <i>gracilis</i> Slender Crazyweed	S	Glacial outwash terraces near ephemeral ponds in sandy loam soil & near the coast on steep, dry, south-facing rock outcrops with shallow soil & some herbaceous cover in the salt spray zone. Flower Date: May to June (O)
<i>Pediocactus simpsonii</i> var. <i>robustior</i>	R1	Low mountains & desert valleys. Flower Date: May to July (D)

Table 4.1-1. Target List of RTE Plant Species Potentially Present within the Wells Project Study Area.

<i>Scientific Name</i> Common Name	Status ^{1,2} State/Federal	Habitat Information ³
Hedgehog Cactus		
<i>Penstemon eriantherus</i> var. <i>whitedii</i> Fuzzytongue Penstemon	S	On west-facing slopes of small canyons, & in dry & rocky habitats in the foothills of the Cascade Range & in the Columbia Basin. Flower Date: May to June; Elevation: 525-3835 ft (C,D)
<i>Potamogeton filiformis</i> var. <i>occidentalis</i> Western Fineleaf Pondweed	R1	Shallow, standing, or slow-moving water. Flower Date: July to August (O)
<i>Scutellaria angustifolia</i> ssp. <i>micrantha</i> Narrowleaf Skullcap	R1	In a variety of open, moist, or dry, often rocky habitats east of the Cascade Range. Flower Date: May to June; Elevation: 2500-5700 ft (O)
<i>Silene douglasii</i> var. <i>monantha</i> Douglas' Silene	R2	Sagebrush plains to montane slopes. Flower Date: Late-May to July (C,O)
<i>Spiranthes porrifolia</i> Western Ladies'-tresses	S	Wet meadows, along streams, in bogs, & on seepage slopes. Flower Date: May to August; Elevation: 60-6800 ft (C,O)
<i>Thelypodium sagittatum</i> ssp. <i>sagittatum</i> Arrow Thelypody	S	Lower mountain valleys to desert plains in (alkaline) drying meadows. Flower Date: June to July (D)
<i>Trichostema oblongum</i> Oblong Bluecurls	R1	Moist, open place, often in disturbed sites. Flower Date: July to August (D)
<i>Trimorpha elata</i> Tall Bitter Fleabane	S	Wet, swampy places in open areas & alongside creeks. Plants in Washington have been found growing slightly upland from the wettest areas. Flower Date: June to Sept. (O)

Table 4.1-1. Target List of RTE Plant Species Potentially Present within the Wells Project Study Area.

<i>Scientific Name</i>	Status ^{1,2}	Habitat Information ³
Common Name	State/Federal	
<i>Utricularia minor</i>	R1	Shallow, standing, or slow-moving water. Flower Date: June to Sept. (O)
Lesser Bladderwort		

¹ State Status of plant species is determined by the Washington Natural Heritage Program. Factors considered include abundance, occurrence patterns, vulnerability, threats, existing protection, & taxonomic distinctness.

E = Endangered. In danger of becoming extinct or extirpated from Washington.

T = Threatened. Likely to become Endangered in Washington.

S = Sensitive. Vulnerable or declining & could become Endangered or Threatened in the state.

X = Possibly extinct or extirpated from Washington.

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.

² Federal Status under the U.S. Endangered Species Act (ESA) as published in the Federal Register:

LE = Listed Endangered. In danger of extinction.

LT = Listed Threatened. Likely to become endangered.

SC = Species of Concern. An unofficial status, the species appears to be in jeopardy, but insufficient information to support listing.

³ Source: WNHP 2005: (C)=Chelan County; (D)=Douglas County; (O)=Okanogan County.

4.2 Invasive Species Inventory

The invasive plant species inventory consisted of the following tasks: (1) pre-field review; (2) field surveys; and (3) documentation and mapping of results. Each task is described below.

4.2.1 Pre-field Review

The invasive species inventory for the Wells Project focused on plants listed in Washington State as Class A and Class B-designate weeds by the Noxious Weed Control Board (NWCB). Class A weeds are non-native species with a limited distribution in the state; eradication of all Class A weeds is required by state law. Because of differences in distribution, treatment of Class B weeds varies between regions of the state. In regions where a Class B weed is unrecorded or of limited distribution, prevention of seed production is required; in these areas, the weed is a "Class B-designate," meaning it is designated for control by state law. As part of the pre-field planning, the State list of Class A and B-designate species was reviewed to develop an understanding of the invasive plants likely to be found in the Wells Project Area.

4.2.2 Field Surveys

Surveys for invasive plant species were conducted in coordination with the RTE plant surveys and field verification of the vegetation cover type mapping (see Section 4.3). Consequently, invasive species surveys were focused on shorelines and wetland habitats, which received nearly 100 percent coverage. Large upland areas on Washburn Island and Cassimer Bar received less extensive survey effort; approximately 50-60 percent of these areas were inventoried for invasive plants. Since many of the Class A and Class B-designate species mature later in the growing season, most of the survey effort was focused in the June-August time period when these species were easiest to see and identify.

4.2.3 Documentation/Mapping

Infestations of Class A or B-designate invasive species were mapped on Wells Project maps, and GPS coordinates were collected to verify the mapped location. Each infestation was mapped as a point on a map and digitized into a Geographic Information System (GIS). Infestations were mapped if they were estimated to exceed about 0.1 acre. Area estimates are provided in the GIS attribute data for infestations that were assessed in the field. Data gathered for each infestation included the estimated total number of plants and the aerial cover and density by cover by class, as developed by the North American Weed Management Association (NAWMA 2003): trace (T=<1%), low (L=1-5%), moderate (M=5.1-25%), and high (H=25.1-100%). Areas that supported only scattered individuals of Class A or B-designate species were noted but not mapped. Similarly, Class B and C invasive species were noted if observed in the study area, but were not mapped.

4.3 Cover Type Verification

Preliminary maps of cover types in the study area were verified in the field in conjunction with the RTE and invasive species surveys. The preliminary maps were prepared by a Douglas PUD biologist using "heads-up" digitizing, which is an in-office process that involves manually

delineating cover type polygons onto aerial orthophotos by tracing a mouse pointer over features displayed on a computer monitor. The cover type classification system was also developed by Douglas PUD and was derived from systems developed by Daubenmire (1970) for upland vegetation in eastern Washington and Cowardin et al. (1979) for wetlands. The classification system also included descriptors for areas where land use has obviously modified the landscape via agriculture, urban, residential, or industrial developments, etc. Verification involved ground-truthing the accuracy of the cover type polygons as delineated on the preliminary map, confirming or correcting the assigned cover type classification, and assigning missing classifications. Corrections to boundaries and cover type designations were made directly on field copies of the maps.

Additional data were collected during field verification to describe the range of characteristics associated with the mapped cover type classes, including species composition, stand structure, habitat quality, and land use. These data included:

- Plant species composition, primarily the dominant and more prominent associated species in each vegetation layer (tree, shrub, and herbaceous layers);
- Structural data, including estimates of average heights and aerial cover of each vegetation layer; and
- Predominant land use(s) associated with each cover type.

Rare, unique, and particularly high quality vegetation/habitat types were also noted for their potential contribution to habitat diversity within the Wells Project Area and vicinity.

5.0 RESULTS

This section presents the results of the inventories for RTE plants and invasive species. It also summarizes the cover types mapped in the study area.

5.1 RTE Plant Inventory

Field surveys for RTE plants were conducted three times over the 2005 growing season: May 16-20, June 27-30, and August 7-10. These surveys documented 13 occurrences of 4 RTE plants in the study area (Table 5.1-1). The four RTE species documented include little bluestem (*Schizachyrium scoparium*), chaffweed (*Centunculus minimus*), northern sweetgrass (*Hierochloa odorata*), and brittle prickly-pear (*Opuntia fragilis*). The locations and distribution of these species are shown on the maps in Appendix B, and information on each species is briefly summarized below.

Table 5.1-1. RTE Plant Species Documented in the Study Area.

Species	General Location	Status
<i>Centunculus minimus</i> Chaffweed	Four occurrences were observed along shorelines south of Brewster.	WNHP – Review 1
<i>Hierochloe odorata</i> Northern Sweetgrass	Two occurrences were observed; one on south end of Washburn Island and the other on the south side Columbia River just downstream of the State Highway 17 bridge.	WNHP – Review 1
<i>Opuntia fragilis</i> Brittle Prickly-pear	Six documented occurrences are widely distributed along Wells Reservoir.	WNHP – Review 1
<i>Schizachyrium scoparium</i> Little Bluestem	One occurrence was mapped as five subpopulations just downstream of the State Highway 17 bridge on the south side of the Columbia River.	State Threatened

- **Little bluestem** (*Schizachyrium scoparium*) was the only state-listed threatened species observed in the study area. It was found just downstream of Chief Joseph Dam. Typically more common in Idaho and farther east, the population observed along Wells Reservoir is only the fourth documented record of this species in the State of Washington. Little bluestem is also known to occur at the upstream ends of Rocky Reach and Rock Island reservoirs. The habitat for populations along Rocky Reach, Rock Island, and Wells reservoirs is more riverine in character than the lacustrine habitat typically associated with reservoir shorelines (K. Beck, Beck Botanical Consulting, personal communication). These reaches are characterized by flowing water that is obvious during all but the highest pool levels; flows are particularly swift at lower pool levels. The little bluestem site at Wells Reservoir is further characterized by alluvial deposition (beaches and bars) along some portions of the shoreline and polished bedrock banks, indicating long-term exposure to flowing water.

Five occurrences comprising one population of little bluestem were mapped along 1,500 feet of shoreline. The granitic, coarse sandy substrate supports transitional riparian vegetation between wet shoreline emergent wetland and shrub steppe dominated uplands. The topographic position of most occurrences averages approximately 10 to 15 feet from the shoreline and 2 to 5 feet elevation above the mean water surface. Associated species include Rocky Mountain juniper (*Juniperus scopulorum*), Siberian elm (*Ulmus pumila*), white sweetclover (*Melilotus alba*), Gray's biscuit root (*Lomatium grayi*), Scribner's rosette grass (*Panicum scribnerium*), white sagebrush (*Artemisia ludoviciana*), and diffuse knapweed (*Centaurea diffusa*). The largest occurrence has several perennial bunchgrass associates, including needle-and-thread grass (*Heterostipa comata*), sand dropseed (*Sporobolus cryptandrus*), Fendler three-awn (*Aristida longiseta*), prairie junegrass (*Koeleria cristata*), and alkali bluegrass (*Poa juncifolia*).

- **Chaffweed** (*Centunculus minimus*) is a review list 1 species previously known from seven Washington counties including Pend Oreille, Spokane, Klickitat, Whitman,

Wahkiakum, Chelan, and Benton counties. Its observation during the Wells Reservoir study is the first record for Douglas County.

Four occurrences of chaffweed were observed on frequently inundated, low-gradient mud-gravel banks with little competing vegetation. At least some of the plants observed again in August had dehiscent capsules that presumably produced mature seed. The cover and density of chaffweed in all four sites was low, consisting of only a few scattered plants. Likewise, associated plant species also occurred at low density and cover. Associated species included mudwort (*Limosella acaulis*, *L. aquatilis*), water pygmyweed (*Crassula aquatica*), bay forget-me-not (*Myosotis laxa*), sleeping popcornflower (*Plagiobothrys scouleri* ssp. *penicillatus*), hedge-hyssop (*Gratiola neglecta*), spikerush (*Eleocharis ovata*, *E. palustris*), and toad rush (*Juncus bufonius*). One chaffweed site included shining flatsedge (*Cyperus bipartitus*), a WNHP watch list species. This particular site is somewhat unique among the four chaffweed sites because a portion of the low gradient mudflat was both above the most frequently inundated shoreline zone and not dominated by taller, dense emergent wetland vegetation that is so common along Wells Reservoir.

- **Northern sweetgrass** (*Hierochloa odorata*) is a review list 1 species known from 16 Washington counties, primarily in the central and eastern parts of the state. Its occurrence along Wells Reservoir during this study is the first record for Douglas County (WNHP 2005).

Sand-silt-gravel banks that are frequently inundated and also support emergent wetland vegetation are common and abundant along Wells Reservoir. Northern sweetgrass was observed at two sites, growing at the upper elevation end of low-gradient banks. These sites were inundated by approximately 6 inches of water during high pool. At the Washburn Island site, the associated species provided approximately 80 percent cover and included Baltic rush (*Juncus balticus*), coyote willow (*Salix exigua*), yellow flag (*Iris pseudacorus*), woolly sedge (*Carex lanuginosa*), and fowl mannagrass (*Glyceria striata*). The other site is located near the little bluestem population, and supports primarily Baltic rush and woolly sedge with scattered northern sweetgrass.

- **Brittle prickly-pear** (*Opuntia fragilis*) is a review list 1 species known from 16 Washington counties, both east and west of the Cascade Range and including Douglas County. The WNHP has plans to remove this species from the review list in the near future because it readily hybridizes with the more widespread hairspine prickly-pear cactus (*Opuntia polycantha*) (F. Caplow, WDNR, personal communication).

Brittle prickly-pear was predominantly found in sandy soils supporting shrub steppe vegetation in all parts of the study area, including the Okanogan River reach. Common associated species include antelope bitterbrush (*Purshia tridentata*), big sagebrush (*Artemisia tridentata*), grey rabbitbrush (*Chrysothamnus nauseosus*), needle-and-thread grass, snow buckwheat (*Eriogonum niveum*), pale evening primrose (*Oenothera pallida*), and bastard toadflax (*Comandra umbellata*).

Brittle prickly-pear was observed at six sites during searches for the listed threatened or endangered species potentially occurring in upland habitats. The upland habitat within the Wells Project boundary is very narrow and unlikely to be affected by reservoir operations in most areas. Searches in upland habitats were focused on areas most likely to be affected by bank erosion and access associated with Project maintenance and operation. It is likely that brittle prickly-pear is more widespread and abundant than documented by the surveys.

Three watch list species that were not included as part of the RTE survey—porcupine sedge (*Carex hystericina*) (>20 observations), shining flatsedge (one observation), and giant helleborine (*Epipactis gigantea*) (two observations)—were also documented in the study area but were not mapped. The WNHP has recently downgraded these from sensitive to watch list species because they are more abundant and less at-risk than previously thought.

Despite considerable effort and apparent suitable habitat, Ute ladies' tresses, which is federally listed as threatened, was not observed in the study area. Occurring in several ephemeral wetlands along the shoreline of the Rocky Reach Reservoir, this species was expected to be found in similar habitats along Wells Reservoir. Although this species can remain dormant during drought conditions, known populations along Rocky Reach were observed growing and flowering during the June and August 2005 survey periods, so it is unlikely that it would have been dormant in the Wells Project study area.

5.2 Invasive Species Inventory

The 2005 list of Class A and B weed species in Washington is provided in Appendix C (NWCB 2005). There are 30 weed species listed as Class A in the state and over 50 Class B-designate species identified for all or portions of Region 3, which includes Douglas, Chelan, and Okanogan counties. Some of these weeds occur primarily in habitats not found in the study area. The Okanogan County Weed Board lists only five Class B-designate species as documented in the county. The Class A and B-designate species were the primary focus of the invasive species inventory because, if found, the NWCB requires control or management measures to be implemented. However, observations of widespread and abundant Class B (non-designate) and Class C weeds are also discussed below to provide a more complete inventory of invasive species in the Wells Project Area, and because local Weed Control Boards have the option to require control for these species. Douglas County currently has no Weed Control Board and does not track or control noxious weed species in any formal way. The Washington State University Agricultural Extension Service, however, provides weed management information and services to Douglas County government and residents.

Surveys for invasive plants did not document any Class A weed species in the study area. There were, however, 99 occurrences of four Class B-designate weed species recorded and mapped (see maps in Appendix D). Two Class B weeds (Russian knapweed and diffuse knapweed) and two Class C weed species (reed canarygrass [*Phalaris arundinacea*] and yellow flag) were widespread but not mapped during field work. Control efforts for Class B weeds are not mandated by the state but are left to the discretion of the local County Weed Control Boards.

Information on each of the Class B-designate, Class B, and Class C weed species is summarized below.

Class B-designate Weeds

- **Purple loosestrife** (*Lythrum salicaria*) is a rhizomatous perennial, emergent aquatic plant believed to originate in Europe and Asia. It was first observed in eastern Washington in the 1940s and by about 1990 had invaded over 55,000 acres of desert wetland and shoreline habitat. This species develops a persistent taproot early in the seedling stage and a spreading root stock as the plant matures. When mature, the taproot and major root branches become thick and woody; the above-ground stems are produced annually and can reach 9 feet tall and form a crown up to 5 feet wide. A single mature plant can produce over 2 million seeds and can also reproduce vegetatively (NWCB 2005).

In general, purple loosestrife is common and widespread along Wells Reservoir, often occurring as only a few stems at any given location. Population trends for purple loosestrife in the study area wetlands are unknown. Currently, most mixed wetlands (as defined in Section 5.3.4 of this report) have a strong component of native plants that form the dominant cover and may be resistant to invasion if undisturbed. Several mixed wetland sites showed evidence of biological control agents—beetles—effectively devouring small purple loosestrife clones.

Purple loosestrife is the most widespread Class B-designate weed species mapped in the study area, with about 68 infestations occurring along sections of the reservoir shoreline (see maps in Appendix D). The buried rhizome of this species can produce many stems. Counting individual plants is impractical because it would require digging up plants to determine each individual. Therefore, the number of stems was estimated for each infestation. Forty-three of the 59 infestations had fewer than 100 purple loosestrife stems, 10 infestations had greater than 100 stems, 3 infestations had greater than 1,000 stems, and 3 infestations had greater than an estimated 10,000 stems. Nine additional observations of purple loosestrife were made by wildlife biologists conducting avian surveys in the study area, although no area and cover data were collected at these sites.

- **Dalmatian toadflax** (*Linaria dalmatica*) is a short-lived perennial plant native to the Dalmatian coast of Europe and nearby countries. It grows primarily in upland grass and shrubland communities and was first found in eastern Washington in the 1920s. The species spreads by horizontal, creeping roots and by seed. Mature Dalmatian toadflax plants are strongly competitive, particularly with shallow-rooted perennials and winter annuals. Studies indicate that grasslands without Dalmatian toadflax may produce two and a half times as much grass as areas with toadflax. Because of its competitive ability, Dalmatian toadflax is a concern in pastures and rangelands, as well as in natural areas, where it may out-compete more desirable, native species (NWCB 2005).

Dalmatian toadflax occurs throughout the study area, primarily in upland habitats, and 20 infestations of this species were mapped (see maps in Appendix D). The size and density of mapped infestations are indeterminate because at most sites Dalmatian toadflax is

ubiquitous in disturbed and undisturbed sites, and it is almost impossible to delineate discrete infestations within the study area. The regional distribution of this species is not precisely known, although the presence of Dalmatian toadflax in contaminated seed mixes planted as part of the Conservation Resource Program has created large infestations of this species in parts of eastern Washington (D. Whaley, WSU Extension Service, personal communication).

- **Perennial pepperweed** (*Lepidium latifolium*) is an aggressive, rhizomatous species that rapidly colonizes pastures, riparian habitats, and disturbed sites in moist areas. Originally from the Mediterranean basin, it now occurs throughout the western United States. The species reproduces by seed and creeping rhizomes, which can spread 3-6 feet annually. It is adapted to using water with a high salt content and may act as a salt pump, removing salts from soil solution and depositing them on the soil surface. The species can quickly form a monoculture and completely displace more desirable species, posing a particular threat to natural areas and hayfields. In riparian zones, perennial pepperweed interferes with the regeneration of willow (*Salix* sp.) and cottonwood (*Populus* sp.) species, and accumulations of the species' semi-woody stems degrade nesting habitat for wildlife (NWCB 2005)

Perennial pepperweed infestations were observed at ten locations in the study area (see maps in Appendix D). The buried rhizome of this species can produce many stems. Counting individual plants is impractical because it would require digging up plants to determine each individual. Therefore, the number of stems was estimated for each infestation. One of the ten infestations consisted of more than 1,000 stems on approximately 1 acre of wetland at Cassimer Bar. The remaining nine infestations in the study area were less than 1,000 square feet in area and consisted of approximately 5 to 75 stems. The habitat at these sites included mixed wetlands along the reservoir and several adjacent washes. The infestations in washes are very small and restricted to areas with subsurface moisture. Wetland sites with dense, intact native vegetation cover may prevent or limit the expansion of perennial pepperweed.

- **Leafy spurge** (*Euphorbia esula*) is a perennial plant, originally from Europe but now widespread in the United States and particularly problematic in the central states. It is unpalatable to most animals and can reduce livestock carrying capacity by 20-50 percent, resulting in substantial economic impacts. The species reproduces by seed, which can be shot 20 feet or more when the capsule ripens and explodes. It also has numerous stem buds that can initiate growth when broken into small segments by tillage, and are transported by birds, grazing animals, or in soil. These characteristics allow it to spread aggressively and persist once established (NWCB 2005).

Leafy spurge was observed and mapped in only one location (see maps in Appendix D). The color and growth form of this species make it easily discernable, and it does not appear to be prevalent in the Project Area.

Class B Weeds

- **Diffuse knapweed** - Diffuse knapweed is a biennial with a deep taproot. It produces the allelopathic chemical cnicin and is very aggressive, forming dense colonies in agricultural settings, over-grazed rangelands, along riverbanks, and roadsides as well as any number of other disturbed habitats (Carpenter and Murray 1998). Diffuse knapweed produces three types of seeds, each of which germinates under different conditions, thus distributing seed germination over different time periods. These different seed types hamper control efforts as diffuse knapweed is able to re-infest treated sites from dormant seed reserves in the soil. It is one of the most widespread rangeland weeds in the western United States (Carpenter and Murray 1998).

Diffuse knapweed is widespread in the Wells Project Area and is the most frequently encountered weed species in upland habitats. However, only at Cassimer Bar in some of the dry, overgrazed, weedy grassland does this species occupy large, continuous areas.

- **Russian knapweed** - Russian knapweed is a rhizomatous species that grows 1 to 3 feet tall and forms large, often dense, and long-lived infestations. It is frequently found growing in agricultural settings and other mesic disturbed habitats. It is believed to have been introduced into eastern Washington in contaminated alfalfa seed mixes (NWCB 2005).

Russian knapweed colonies were observed in many of the dry washes associated with seasonal streams. The largest infestations typically occurred on the banks of the washes, although small colonies also grew in coarse sand, gravel, and cobble substrates in the channel beds of the washes. The distribution of this species was primarily in Zones 1 and 4 along the eastern reservoir shorelines, but was also noted along the Okanogan River in Zone 5.

Class C Weeds

- **Reed canarygrass** – Reed canarygrass is a rhizomatous perennial grass that can reach 3 to 6 feet in height. This species is extremely aggressive, persistent, and forms dense infestations in wetland habitats that threaten the native plant diversity of these areas. This species is native to portions of North America, but cultivars are planted in many areas as forage for livestock. The cultivar strains often escape cultivation and are believed to be more aggressive than the native strains (NWCB 2005).

Reed canarygrass is often the predominant species on very steep rocky shorelines that have only a narrow zone capable of supporting hydrophytic vegetation. Most frequently, these sites support only a few scattered individual hydrophytic plants. Reed canarygrass, however, forms large, pure swards in several shoreline sites downstream of Pateros on the west side of the reservoir. It is also present at low amounts in most emergent wetlands, and expansive stands sometimes occur just above the cattail (*Typha latifolia*) zone along the Okanogan River and at Cassimer Bar and the Wells Wildlife Area. It is

not clear if it is currently expanding its range or whether its expansion is inhibited by existing dense, tall emergent wetland vegetation.

- **Yellow flag** – Yellow flag iris is native to portions of Europe, Asia, and Africa. It is a clumping perennial herb with thick fleshy rhizomes that can form dense horizontal mats that threaten native species diversity. It is frequently planted as an ornamental for its showy flowers. Yellow flag is known to spread by rhizomes and seed frequently using water as the primary dispersal agent (Tu 2003).

Yellow flag was observed along almost all reservoir shorelines with a gentle gradient. This species dominates some of these sites locally, particularly around the Wells Wildlife Area, and is a minor component of the wetland species assemblage at the water's edge where it co-occurs with native sedges, spike rushes, and rushes. Yellow flag appears to be able to colonize a lower topographic position at the water's edge than most native species. Once established, it can extend its rhizomes, partially buried, across most muddy surfaces, thereby excluding other species.

5.3 Cover Type Mapping

The 12,217-acre study area for the Wells Project includes the approximately 9,678-acre reservoir and about 2,539 acres of land within the Project boundary. The extent of reservoir and associated land in the Project Area on any given day varies depending on Project operations and Columbia River flows. Study area acreages were calculated from the available aerial orthophotos, which were taken at a time when the reservoir was at a level lower than the normal maximum (9,740 acres at 781 feet).

In total, 44 cover types were identified on the lands within study area (Table 5.3-1; Appendix E). The mapped cover types have been grouped into seven different categories: Upland Vegetation, Upland Rock Habitats, Wetland/Riparian Vegetation, Littoral Zone – Wash, Bare – Disturbed – Eroded, Agricultural, and Developed. Upland Vegetation, Wetland/Riparian Vegetation, and Agriculture are the most abundant cover type categories (covering 32, 31, and 26 percent, respectively). The most prevalent Upland Vegetation type is Shrub Steppe at 502 acres, followed by the Grass and Grass/Weed cover types, at 126 and 157 acres, respectively (Table 5.3-1). The tree-, shrub-, and herb-dominated Wetland/Riparian Vegetation cover types are all similarly abundant, and combined occupy 743 acres of the study area. A full description of the various categories and cover types, as well as their abundance and distribution within the five study area zones, is presented below. Information on associated species for each of the cover types is provided in Appendix F.

Table 5.3-1. Acreage of Cover Types on Lands Within the Study Area for the Wells Hydroelectric Project.

Cover Category Cover Type	Code	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Total on Study Area Lands	Percent of the Study Area Land ¹
		Acres	Acres	Acres	Acres	Acres	Acres	Percent
Upland Vegetation								
Conifer Types								
Conifer	CO	0.11	0.01	0.4	0.71	0.25	1.5	0.06
Conifer/Shrub	CS			1.83			1.8	0.07
Bitterbrush/Ponderosa Pine	BP					2.0	2.0	0.08
Sub-Total		0.11	0.01	2.23	0.71	2.25	5.3	0.21
Percent of Zone		0.02	0.01	0.59	0.19	0.19		
Shrub Steppe	SS	220.9	8.79	34.72	131.2	105.91	501.5	19.76
Percent of Zone		45.30	6.67	9.14	35.26	9.07		
Grass Type								
Grass	GA	15.65	5.9	31.42	17.45	55.84	126.3	4.97
Grass & Forbs	GF			3.01		5.81	8.8	0.35
Grass & Shrub	GS			0.63			0.6	0.02
Sub-Total		15.65	5.9	35.06	17.45	61.65	135.7	5.35
Percent of Zone		3.21	4.48	9.23	4.69	5.28		
"Weedy" Disturbed Types								
Shrub & Weed	SW					3.16	3.2	0.12
Forbs & Weeds	FW					0.79	0.8	0.03
Grass & Weeds	GW	0.05		2.68	0.42	154.1	157.3	6.19
Knapweed	KW	0.08	0.01	0.06	0	1	1.2	0.05
Weeds	WE			0.15		0.87	1.0	0.04
Sub-Total		0.13	0.01	2.89	0.42	159.92	163.4	6.44
Percent of Zone		0.03	0.01	0.76	0.11	13.70		0.47
Upland Vegetation Total		236.8	14.7	74.9	149.8	329.7	805.9	31.75
Percent of Zone		48.55	11.16	19.72	40.25	28.25		
Upland Rock								
Talus	TU	1.74					1.7	0.07
Rock Outcropping	RO	7.81	0.24		2.03	0.08	10.2	0.4
Rock	RK	0.19		0.01		0.03	0.2	0.01
Upland Rock Habitat Total		9.7	0.2	0.0	2.0	0.1	12.1	0.48
Percent of Zone		2.00	0.18	0.00	0.55	0.01		
Wetland/Riparian Vegetation								
Riparian Deciduous Tree	RDT	5.88	7.65	9.42	14.69	104.24	141.9	5.59
Percent of Zone		1.21	5.81	2.48	3.95	8.93		
Riparian Shrub	RS	27.58	10.08	32.08	98.93	145.29	314.0	12.37

Table 5.3-1. Acreage of Cover Types on Lands Within the Study Area for the Wells Hydroelectric Project.

Cover Category Cover Type	Code	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Total on Study Area Lands	Percent of the Study Area Land ¹
		Acres	Acres	Acres	Acres	Acres	Acres	Percent
Percent of Zone		5.66	7.65	8.45	26.59	12.45		
Emergent Wetland	EW	21.36	20.93	63.0	8.88	85.43	199.6	7.86
Emergent Wetland - Meadow	EW-M					87.12	87.1	3.43
Ponds	PO	8.83	0.39	3.96	0.78	32.15	46.1	1.82
Sub-Total		30.19	21.32	66.96	9.66	204.7	332.8	13.11
Percent of Zone		6.19	16.18	17.63	2.60	17.54		
Wetland/Riparian Vegetation Total		63.7	39.1	108.5	123.3	454.2	788.7	31.07
Percent of Zone		13.05	29.63	28.56	33.13	38.91		
Littoral Zone - Wash								
Silt, Sand, Gravel	SSG	36.86	13.45	1.53	5.08	4.28	61.2	2.41
Littoral-Wash Total		36.9	13.5	1.5	5.1	4.3	61.2	2.41
Percent of Zone		7.56	10.21	0.40	1.37	0.37		
Bare - Disturbed - Eroded								
Disturbed	DI	8.37	0.95	3.63	5.37	7.7	26.0	1.02
Bare Ground	BG	0	0.25	2.72		0.18	3.2	0.12
Eroded	ER	15.98	0.06	2.11	0.22	0.98	19.4	0.76
Bare-Disturbed-Eroded Total		24.4	1.3	8.5	5.6	8.9	48.5	1.91
Percent of Zone		4.99	0.96	2.23	1.50	0.76		
Agriculture								
Idle Agriculture	IF			5.26		75.23	80.5	3.17
Alfalfa	AL			123.01		157.7	280.7	11.06
Crop	CR			23.53	32.31		55.8	2.2
Fallow	FA			17.37	27.12	8.35	52.8	2.08
Orchard	OR	2.31	44.52	1.76	12.74	44.09	105.4	4.15
Pasture	PA					72.43	72.4	2.85
Agriculture Total		2.3	44.5	170.9	72.2	357.8	647.7	25.51
Percent of Zone		0.47	33.79	45.01	19.40	30.65		
Developed								
Concrete Structure	CON			0.05		0.06	0.1	0
Highway	HI	4.75	1.48			2.13	8.4	0.33
Industrial	IN	0	0.89		2.74		3.6	0.14
Landscaped	LA	2.96	7.06	1.56	2.32	1.12	15.0	0.59
Railroad	RA	3.36	1.23			0.76	5.4	0.21
Recreation	RE	10.08	0.89	5.09	3.99	0.51	20.6	0.81
Rip-Rap	RR	20.36	5.96	5.64	0.01	6.43	38.4	1.51
Road	RD	2.05	0.54	3.12	5.1	1.13	11.9	0.47

Table 5.3-1. Acreage of Cover Types on Lands Within the Study Area for the Wells Hydroelectric Project.

Cover Category Cover Type	Code	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Total on Study Area Lands	Percent of the Study Area Land ¹
		Acres	Acres	Acres	Acres	Acres	Acres	Percent
Structure	ST	0.01	0.49			0.19	0.7	0.03
Wells Dam	WD	37.06					37.1	1.46
Wells Hatchery	WH	33.36					33.4	1.31
Developed Total		114.0	18.5	15.5	14.2	12.3	174.5	6.87
Percent of Zone		23.37	14.07	4.07	3.81	1.06		
Grand Totals		487.7	131.8	379.8	372.1	1167.3	2538.6	100

¹ Percent of land calculated for each cover type based on Total Land (2,538.6 acres), which excludes the Wells Reservoir pool area.

5.3.1 Upland Vegetation

5.3.1.1 Conifer Type

These cover types were mapped on only 5.3 acres or 0.21 percent of study area lands (Table 5.3-1). The Conifer and Conifer/Shrub types occurred in all five zones, although the majority of Conifer/Shrub (1.83 acres) was in Zone 3 along the southern shoreline just upstream of the bridge at Brewster. The Ponderosa Pine /Bitterbrush cover type occupied 2.0 acres, all in Zone 5.

Conifer cover types are often dominated by ponderosa pine (*Pinus ponderosa*) in open stands along the reservoir. The understory is shrub steppe species, or a mix of introduced and native riparian shrub species in locations near the reservoir. One stand mapped along the Okanogan River is unique within the study area. Long stabilized dunes support an open stand of ponderosa pine with bitterbrush in the shrub layer. Brittle prickly-pear, veiny dock (*Rumex venosus*), pale evening primrose, needle-and-thread grass, Indian ricegrass (*Oryzopsis hymenoides*), and sand dropseed are typical herb layer species.

5.3.1.2 Shrub Steppe Type

This cover type was mapped on 502 acres or 20 percent of the study area lands. Shrub steppe vegetation occurred on 221 acres or 45.3 percent of Zone 1 and 131 acres or 35.3 percent of Zone 4. Zone 5 has 106 acres, but this cover type only occupied 9.1 percent of the zone vegetation.

The shrub steppe cover type is the most common upland vegetation type within and beyond the study area. Big sagebrush, bitterbrush, and grey rabbitbrush are the most dominant shrub layer species. Snow buckwheat, Gray's biscuitroot, bluebunch wheatgrass (*Pseudoroegneria spicata*), cheatgrass (*Bromus tectorum*), one-sided bluegrass (*Poa secunda*), threadleaf fleabane (*Erigeron filifolius*), and fernleaf biscuitroot (*Lomatium dissectum*) are among the more common herb layer

species. Shrub steppe vegetation on sandier substrates also may support field sagewort (*Artemisia campestris*), needle-and-thread grass, bastard toadflax, wingnut cryptantha (*Cryptantha pterocarya*), and pale evening primrose in the herb layer.

5.3.1.3 Grass Type

The grass cover types were mapped on 136 acres or 5.4 percent of study area lands. Zones 5 and 3 had the most grass cover types with 62 and 35 acres, respectively.

Grass cover types are difficult to describe because they represent transitional vegetation and are typically associated with historical ground disturbance. In some areas with more mesic or moist growing conditions, species composition may include reed canarygrass, tall fescue (*Festuca arundinacea*), smooth brome (*Bromus inermis*), tall wheatgrass (*Elytrigia pontica*), streambank wheatgrass (*Agropyron dasystachyum*), and quackgrass (*Elymus repens*). While some grass cover types may contain reed canarygrass, streambank wheatgrass, or quackgrass, these species are more typically found in emergent wetlands. There are a few locations in the study area that are dominated by perennial grasses, including sites that support little bluestem. Disturbed areas that once supported shrub steppe vegetation are often dominated by annual grass species such as cheatgrass, hairy brome (*Bromus japonicus*), and annual fescue (*Vulpia* spp.).

5.3.1.4 “Weedy” Disturbed Type

“Weedy” cover types were mapped on 163 acres or 6.4 percent of study area lands. Over 97 percent of this cover type was mapped in Zone 5 in fields adjacent to the Okanogan River and in degraded, shrub steppe communities on Cassimer Bar. The weedy cover types are similar to the upland shrub steppe and grassland communities except that they typically occur on sites with more recent disturbance. These more recently disturbed cover types are characterized by a high proportion of non-native invasive and noxious weed species, which distinguish them from the less disturbed upland. Diffuse knapweed is probably the most common and abundant noxious weed found in these types, although tall pepperweed (*Lepidium latifolium*) was abundant enough at one site to be designated as part of the Weed cover type. It should be noted that most of the B-designate noxious weed infestations mapped within the study area (Appendix D) do not occur in the cover types designated as “Weedy.” These infestations are more often small inclusions within other cover types such as Riparian Shrub or Emergent Wetlands.

Species commonly observed in the weedy cover types include diffuse knapweed, mullein (*Verbascum thapsus*), yellow salsify (*Tragopogon dubius*), St. John’s wort (*Hypericum perforatum*), smooth brome, cheatgrass, Mexican fireweed (*Kochia scoparia*), orchard grass (*Dactylis glomerata*), tall fescue, morning glory (*Convolvulus arvensis*), prickly lettuce (*Lactuca serriola*), and hairy whitetop (*Cardaria pubescens*).

5.3.2 Upland Rock

The Upland Rocky cover types are found primarily in Zone 1 along the eastern shoreline of the reservoir downstream of Pateros, and also occur in Zone 4 at several locations between the town of Bridgeport and the Wells Wildlife Area. The vegetation observed in rocky areas had many species in common with Shrub Steppe, but also included plants typical of moist, rocky crevices

and aspects. These species included Douglas maple (*Acer glabrum*), smooth sumac (*Rhus glabra*), mock orange (*Philadelphus lewisii*), poison ivy (*Rhus radicans*), service berry (*Amelanchier alnifolia*), chokecherry (*Prunus virginiana*), and western white clematis (*Clematis ligusticifolia*).

5.3.3 Wetland/Riparian Vegetation

5.3.3.1 Riparian Deciduous Tree Type

The Riparian Deciduous Tree cover type was mapped on 142 acres or 5.6 percent of land within the study area. This cover type was mapped on 6 to 15 acres in Zones 1 to 4, but 104 acres in Zone 5, which includes Cassimer Bar and the Okanogan River.

Native tree species in the riparian areas include black cottonwood (*Populus balsamifera* ssp. *trichocarpa*) and a few nearly tree-sized Rocky Mountain juniper, Bebb's willow (*Salix bebbiana*), and Sitka alder (*Alnus viridis* ssp. *sinuata*). However, most riparian deciduous trees are dominated by non-native species including white cottonwood (*Populus alba*), Russian olive (*Eleaegnus angustifolia*), silver maple (*Acer saccharinum*), eastern cottonwood (*Populus deltoidea*), Siberian elm, and white mulberry (*Morus alba*). Most Riparian Deciduous Tree stands occurred in proximity to reservoir and pond margins and typically had at least some common riparian shrub and emergent wetland species. The understory species in some Riparian Deciduous Tree stands are not distinctly hydrophytic in character and often include species common in the weed cover types, primarily due to past ground disturbance.

5.3.3.2 Riparian Shrub Type

The Riparian Shrub cover type was mapped on 314 acres or 12.4 percent of study area lands. This cover type occurred on approximately 100 acres or more in each of Zones 4 and 5, but on less than 35 acres in each of the other three zones.

The Riparian Shrub cover type contains a high proportion of both native and non-native species. Coyote willow, Bebb's willow, Sitka alder, and western birch (*Betula occidentalis*) are widespread native species, but only coyote willow forms dense, and sometimes large, thickets. Saplings of black cottonwood, Oregon ash (*Fraxinus latifolia*), shining willow (*Salix lucida* ssp. *lasiandra*), Siberian elm, and white mulberry are common within at least some riparian shrublands. Wood rose (*Rosa woodsii*) is ubiquitous and is the co-dominant shrub in many stands. Multiflora rose (*Rosa multiflora*) and an unidentified species of exotic shrubby honeysuckle (*Lonicera* sp.) are particularly common upstream of Brewster. Russian olive shrubs are abundant at Cassimer Bar.

The Okanogan River has a diverse, unique blend of riparian shrub species with a generally dense structure. The most common riparian shrubs include wood rose, hawthorn (*Crataegus douglasii*, *C. columbiana*), dogwood (*Cornus sericea*), snowberry (*Symphoricarpos alba*), Bebb's willow, Sitka alder, coyote willow, and shining willow.

5.3.3.3 Emergent Wetland Type

Emergent Wetlands (including the Emergent Wetland – Meadow type) were mapped on 287 acres or 11.1 percent of study area lands. This cover type was most abundant in Zone 5, where approximately 60 percent of all Emergent Wetlands were mapped, primarily on Cassimer Bar. There were only 8.9 acres of Emergent Wetland mapped in Zone 4—a sharp contrast to the 173 acres of Emergent Wetland mapped in Zone 5. Zones 1 and 2 each had approximately 20 acres of Emergent Wetland vegetation, while Zone 3 had 63 acres.

Emergent Wetlands include reservoir shorelines where wetland plants typically occur at or above the littoral zone along the reservoir. Emergent Wetlands are usually comprised of tall, herbaceous vegetation, and may have a few riparian shrubs and/or deciduous trees. One type of Emergent Wetland includes a diverse mixture of native and non-native species and is referred to as “mixed wetland.” Many of the dominant species are tall, non-native species including yellow flag, purple loosestrife, reed canarygrass, tansy ragwort (*Tanacetum vulgare*), St. John’s wort, sweet white clover (*Melilotus alba*), and Canada thistle (*Cirsium arvense*). Common and abundant, tall, native wetland species include bulrush (*Scirpus validus*), narrowleaf cattail, Canada goldenrod (*Solidago canadensis*), milkweed (*Asclepias speciosa*), and western goldenrod (*Euthamia occidentalis*). Predominant lower-growing herbaceous species include bugle weed (*Lycopus americana*, *L. asper*), rush (*Juncus balticus*, *J. effusus*, *J. longistylis*), western panicgrass (*Panicum acuminatum*), woolly sedge, fox sedge (*Carex vulpinoidea*), spurless forget-me-not (*Impatiens ecalcarata*), loosestrife (*Lysimachia thrysiflorus*, *L. ciliata*), *Galium* sp., horsetail (*Equisetum hyemale*, *E. arvense*), marsh spikerush (*Eleocharis palustris*), and Kentucky bluegrass (*Poa pratensis*). Common sedges observed in Emergent Wetlands include porcupine sedge, short beaked sedge (*Carex brevior*), Bebb’s sedge (*Carex bebbii*), knotsheath sedge (*Carex retrorsa*), lakeshore sedge (*Carex lenticularis*), and smallwing sedge (*Carex microptera*). Jointleaf rush (*Juncus articulatus*) and poverty rush (*Juncus tenuis*) are ubiquitous species in Emergent Wetlands.

The species composition of the Emergent Wetland cover type changes with the reservoir shoreline elevation, width, and slope of the shoreline. The lowest elevation shoreline position within this cover type is frequently inundated and composed of mud and gravel substrates. Wide, low gradient shorelines are often dominated by cattail, yellow flag, and bulrush, particularly in backwater areas along the Okanogan River. Some of the wider, low-gradient shorelines support a relatively uncommon “mudflat” habitat, as described for chaffweed, a review list 1 species. In contrast to the cattail-bulrush-yellow flag vegetation, these mudflat habitats have very low vegetation cover.

The higher elevation shoreline positions are moist rather than wet. These areas are generally grass-dominated and support fewer hydrophytic species compared to lower elevations. Higher positions along steep, narrow shorelines are dominated by reed canarygrass in many sites and red fescue (*Festuca rubra*) in a few sites.

At Cassimer Bar there are low-lying, swale-like areas adjacent to the wetter cattail-bulrush wetlands that have been mapped as Emergent Wetland – Meadow (EW-M). These areas are more moist than wet, yet still have a high proportion of hydrophytic species. The EW-M cover

type was mapped at Cassimer Bar primarily because the distinction was obvious and prevalent on the aerial images; elsewhere in the study area, these “drier” wetlands are very narrow and generally are included in the predominant nearby Emergent Wetland or Grass cover types. Species comprising the EW-M cover type at Cassimer Bar included foxtail barley (*Hordeum jubatum*), red top (*Agrostis alba*), curly dock (*Rumex crispus*), common rush (*Juncus effusus*), chairmakers bulrush (*Scirpus americanus*), bay forget-me-not, Baltic rush, and Canada thistle.

The Emergent Wetlands on the Methow River islands are similar to wetlands elsewhere in the study area. However, some species and species assemblages are unique to the islands. One wetland had an extensive stand of little green sedge (*Carex oederi*) and the only observations of inland sedge (*Carex interior*) and golden sedge (*Carex aurea*). Blister sedge (*Carex vesicaria*) is more abundant here than elsewhere in the study area.

5.3.3.4 Ponds

Ponds were mapped on 46 acres or just 1.8 percent of study area lands. The vegetation associated with ponds was similar to species found in the Emergent Wetland, Riparian Shrub, and Riparian Deciduous Tree cover types. Aquatic species in ponds were usually not particularly abundant, but did include Eurasian watermilfoil (*Myriophyllum spicatum*), curly pondweed (*Potamogeton crispus*, *Potamogeton* sp.), and Canadian waterweed (*Elodea canadensis*).

5.3.4 Littoral Zone - Wash

There were 61.2 acres in the study area that were mapped as Sand, Silt, and Gravel. These areas are most often represented by alluvial deposits in dry washes. Subsurface moisture in many of the washes supports emergent wetland vegetation either within the banks of the active channel, or near the reservoir margin. These wetlands often alternate or intermix with the dry, coarse alluvial substrates. The Silt, Sand, and Gravel areas tend to support a sparse vegetation cover consisting of species such as Dalmatian toadflax, Russian thistle (*Salsola kali*), tall whitetop, and Canada thistle, but also include some native shrub steppe species. Some (but not all) of the areas mapped as Silt, Sand, and Gravel were reclassified as Erosion during field verification; there may be additional areas that should be classified as eroded rather than Silt, Sand, and Gravel.

5.3.5 Bare - Disturbed – Eroded

A total of 49 acres or just 1.9 percent of study area lands were designated as Bare, Disturbed, or Eroded. These cover types were applied to areas where vegetation is absent or at least appeared to be absent in the aerial photography. Approximately 24 acres in Zone 1 were designated as Eroded (16 acres) or Disturbed (8.4) types. Areas mapped as Bare Ground, Disturbed, or Eroded in other zones included approximately 8 acres in Zones 3 and 5, 5.6 acres in Zone 4, and less than 1.5 acres in Zone 2.

The Eroded designation was applied to steep, sandy banks along the reservoir that are actively eroding and are usually lacking vegetation. The Disturbed and Bare Ground categories are likely similar, although no polygons in the latter category were visited during field verification. Many

of the disturbed sites that were visited did not have a clear association with any particular land use or development so they were included in the “Disturbed” category.

5.3.6 Agriculture

Agriculture cover types account for 26 percent of study area lands, particularly in Zones 3 and 5. Orchards are most abundant in Zones 2 and 5 but also occur in the other three zones. There were 281 acres (11 percent of study area lands) of alfalfa field mapped in Zones 3 and 5. Pasture lands occurred exclusively in Zone 5, primarily along the Okanogan River.

Agricultural areas are designated as one of the following: Crop (usually applied to non-hay crops), Idle Agriculture, Alfalfa, Fallow, Orchard, or Pasture. In some areas, it is difficult to distinguish pasture or idle agricultural fields from emergent wetland and riparian shrub communities, particularly in low-lying areas with saturated soils. The wet habitat designations typically took priority over agricultural designations where it was apparent that pastures and/or idle agricultural fields were reverting back to wetlands.

5.3.7 Developed

Developed areas were designated as one of the following: Concrete Structure, Highway, Industrial, Landscaped, Railroad, Recreation, Rip-Rap, Road, Structure, Wells Dam, or Wells Hatchery. Developed areas were mapped on 174.5 acres or 6.87 percent of the Wells Project Area. The highest proportion of developed areas occurs in Zone 1 due to the presence of Wells Dam, Wells Fish Hatchery, and riprap associated with the railroad. Recreation facilities were most prevalent in Zones 1 and 3.

6.0 DISCUSSION

In general, development is minimal within the Wells Project vicinity, with only 7 percent of the study area lands categorized as Developed. However, another 26 percent of the study area is agricultural and much of the land reflects a legacy of past private ownership, multiple land use directives, and encroaching development pressures. And yet, Upland Vegetation is the largest single cover type category (32 percent of the study area), with the majority represented by native shrub steppe vegetation (20 percent of the total area). In addition, 29 percent of the land in the study was categorized as Wetland/Riparian Vegetation.

The RTE plant species in the study area include little bluestem, northern sweetgrass, chaffweed and brittle prickly-pear. Little bluestem, a state threatened species, was observed growing in proximity to the reservoir shoreline near the Highway 17 bridge just downstream of Chief Joseph Dam. This population was estimated to be rooted approximately 1 to 4 feet above the normal pool level. Most plants at the site appeared to be mature, flowering individuals in August 2005. However, no data are currently available on the reproductive success of this population except that no young plants were observed. The potential relationship between pool elevation and the presence of this species has not been clearly established.

Brittle prickly-pear is a review list 1 species observed in sandy habitats at six locations within the Wells Project Area. At two of the six sites, the plants were observed near the tops of tall, eroding sandy banks. Some of these plants could potentially be destroyed as the bank continues to erode over time. However, this species is scheduled to be downgraded by the WNHP because it readily hybridizes with the common and widespread hairspine prickly-pear cactus (*Opuntia polyacantha*).

The WNHP review list 1 species, northern sweetgrass and chaffweed, both occur in habitats that are frequently inundated and exposed by fluctuating reservoir levels. The habitat for the four documented occurrences of chaffweed consists of gently sloping, muddy shorelines with little competing vegetation. The long-term viability of this species in this habitat has not been documented although the presence of this annual species suggests that it is reproducing successfully (see below for additional discussion of this species). Northern sweetgrass was associated with different habitats in the two locations where it was observed. One was a steep sandy beach with few competing species; the other was a gently sloping gravelly shoreline with a dense cover of competing, low-growing, herbaceous vegetation. The long-term viability of this species in these two sites is not known.

Wells Reservoir provides the water that supports a variety of wetland cover types that were less abundant or did not occur in the former Columbia and Okanogan River basins. These wetlands are composed of species requiring high and relatively consistent soil moisture during the growing season and that can also withstand frequent water level fluctuations. Thus, the elevation/inundation gradient along the reservoir shoreline has a substantial influence on species composition. Almost all of the wetlands within the study area include non-native invasive plant species, which readily colonize disturbed areas. In contrast, the WNHP review list 1 species, northern sweetgrass and chaff weed, are unusual because they appear to be well established within the reservoir fluctuation zone. However, the presence and abundance of non-native invasive plants affects the quality of many wetlands in the study area by reducing species diversity and changing structural characteristics that are important to wildlife. The principal noxious weeds affecting wetlands in the Wells Project Area wetlands are reed canarygrass, purple loosestrife, perennial pepperweed, and yellow flag.

The most abundant upland vegetation types within the study area are the shrub steppe and grass- or herb-dominated cover types. The grass-dominated cover types, in particular, often reflect past disturbance and include a number of invasive, non-native species. Many grass-dominated areas include Dalmatian toadflax, the only abundant B-designate noxious weed in the study area that occurs in upland habitats. This species usually occurs as scattered individual plants in most upland habitats, although 20 larger infestations were mapped in the study area. The documented infestations within the study area were definitely not the “fields of yellow flowers” that can make this species so obvious in some areas of eastern Washington.

Overall, shrub steppe probably represents the most abundant, highest quality native vegetation community in the study area; however, there are several other botanically unique or interesting habitat types, including the following:

- A portion of the reservoir shoreline near Chief Joseph Dam supports a population of little bluestem, a state threatened species. This section of shoreline has a more riverine character, at least at low flows, and represents a very uncommon habitat type that supports a state-threatened species.
- Low gradient mud flats in a few locations generally downstream of Brewster support an uncommon plant association and a couple of rare plant species; the association includes water pygmyweed, sleeping popcornflower, bay forget-me-not, western pearlwort (*Sagina occidentalis*), mudwort, hedge-hyssop, and needle spikerush (*Eleocharis acicularis*), as well as the rare plants chaffweed (review list 1) and shining flatsedge (watch list). These habitats are frequently inundated, which may exclude invasive or taller hydrophytic species, such as yellow flag and purple loosestrife.
- Woody riparian vegetation along the Okanogan River grows in long stretches of uninterrupted stands with complex structural diversity. This area appears to provide high quality habitat for a variety of wildlife.
- Lands along the eastern shoreline generally downstream of Pateros have relatively intact shrub steppe, rock outcrop, and sandy habitats; most of this area is relatively inaccessible and somewhat protected from development. However, portions of the shoreline consist of steep, sandy substrates that are actively eroding into the reservoir. Brittle prickly-pear, a review list 1 species, was observed in stable sand substrates in proximity the top edge of these eroding slopes.

Overall, the vegetation in the study area is typical of north central Washington and reflects a history of agriculture, grazing, and hydropower development. Despite disturbances and weed infestations, however, there are some locations that support a number of RTE plants and intact native shrub steppe and riparian vegetation communities.

7.0 REFERENCES

- Beck, Kathryn, Botanical Contractor, Beck Consulting Services. Personal conversation with Richard Dwerlkotte, Botanist, EDAW Inc., Seattle, WA. May 18, 2005.
- Caplow, Florence, Rare Plant Botanist, Washington Department of Natural Resources, Washington Natural Heritage Program. Phone conversation with Jim McGee, Wildlife Biologist, Douglas County Public Utility District. January 8, 2006.
- Carpenter, A.T. and T.A. Murray. 1998. Element stewardship abstract for *Centaurea diffusa*. The Nature Conservancy. <http://tncweeds.ucdavis.edu/esadocs/documnts/centdif.html> (Accessed October 2005).
- Calypso Consulting. 2000. A rare plant survey of the Rocky Reach Reservoir. Report of Calypso Consulting for Chelan PUD, Wenatchee, Washington.
- Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U. S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. Jamestown, ND: Northern Prairie Wildlife Research Center Home Page. <http://www.npwrc.usgs.gov/resource/1998/classwet/classwet.htm> (Version 04DEC98) (Accessed October 2005).
- Daubenmire, R. 1970. Steppe Vegetation of Washington. Washington Agriculture Experiment Station. Technical Bulletin 62. 131pp.
- Hitchcock L.C., and A. Cronquist. 1973. Flora of the Pacific Northwest, An illustrated manual. University of Washington Press, Seattle, Washington.
- NAWMA (North American Weed Management Association). 2003. Mapping standards. Available at URL = <http://www.nawma.org/documents/MappingStandards/InvasivePlantMappingStandards.pdf> (Accessed October 2005)
- Nelson, J.R. 1985. Rare plant survey techniques for impact assessment. Pages 159-166 In Thomas S. Elias (ed.). Conservation and management of rare and endangered plants. Proceedings of a conference of the California Native Plant Society. Sacramento, California.
- NWCB (Washington State Noxious Weed Control Board). 2005. Available at URL = http://www.nwcb.wa.gov/weed_info/weed_info1.htm (Accessed October 2005).
- Tu, Mandy. 2003. Element stewardship abstract for *Iris pseudacorus*. The Nature Conservancy. Available at URL = <http://tncweeds.ucdavis.edu/esadocs/documnts/irisps.html> (Accessed October 2005)
- Whaley, Dale K., Coordinator, Integrated Noxious Weed Invasive species Project for Chelan, Kittitas, Klickitat, Douglas Counties/ Washington State University Extension Service. Telephone conversation with Richard Dwerlkotte, Botanist, EDAW Inc., Seattle, WA. October 25, 2005.

WNHP (Washington Natural Heritage Program). 2005. Field Guide to Selected Rare Plants of Washington. Washington Department of Natural Resources, Olympia, Washington.

Appendix A

Agency Letters



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Central Washington Field Office
215 Melody Lane, Suite 119
Wenatchee, Washington 98801



April 4, 2005

In Reply Refer To:

USFWS Reference: 1-9-2005-SP-0178

Hydrologic Unit Codes: 17-02-00-06, 17-02-00-10

Re: Wells Hydroelectric Project Wildlife and Plant Survey

Richard Dwerlkotte
EDAW Inc.
815 Western Avenue, Suite 300
Seattle, Washington 98104

Dear Mr. Dwerlkotte:

We have received your request for information on endangered and threatened species and their habitats that may be present near the Wells Hydroelectric project in Chelan and Douglas Counties, Washington. The following threatened and endangered species, and candidate species may be present:

Endangered

Gray wolf (*Canis lupus*)

Pygmy rabbit (*Brachylagus idahoensis*) – Columbia Basin distinct population segment

Threatened

Bald eagle (*Haliaeetus leucocephalus*)

Bull trout (*Salvelinus confluentus*) – Columbia River distinct population segment

Canada lynx (*Lynx canadensis*)

Spiranthes diluvialis (Ute ladies'-tresses)

Candidate

Greater sage grouse (*Centrocercus urophasianus*) – Columbia Basin distinct population segment

Yellow-billed cuckoo (*Coccyzus americanus*)

This list fulfills the requirements of the U. S. Fish and Wildlife Service (Service) under Section 7(c) of the Endangered Species Act of 1973, as amended (Act).

Preparation of a Biological Assessment (BA) would be prudent when listed or proposed species, or designated or proposed critical habitat, occur within the project area. Should the BA

Mr. Richard Dwerlkotte

determine that a listed species is likely to be affected by the project, the involved federal agency should request section 7 consultation with the Service. If a proposed species is likely to be jeopardized by the project, or proposed critical habitat is likely to be adversely modified or destroyed, regulations require conferencing between the involved federal agency and the Service.

If the BA concludes that the project will have no effect on any listed or proposed species, we would appreciate receiving a copy for our information.

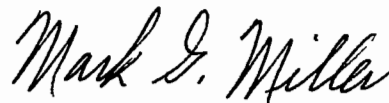
Candidate species receive no protection under the Act, but are included for your use during planning of the project. Candidate species could be formally proposed and listed during project planning, thereby falling within the scope of section 7 of the Act. Protection provided to candidate species now may preclude possible listing in the future. If evaluation of the subject project indicates that it is likely to adversely impact a candidate species, we encourage you to modify the project to minimize/avoid these impacts.

Several species of anadromous fishes that have been listed by NOAA Fisheries (NOAA) may occur in the project area. Please contact NOAA in Ellensburg, Washington; at (509) 962-8911 to request a list of those listed species.

If you would like information concerning State listed species or species of concern, you may contact the Washington Department of Fish and Wildlife, at (360) 902-2543, for fish and wildlife species; or the Washington Department of Natural Resources, at (360) 902-1667, for plant species.

Should the project plans change significantly, or if the project is delayed more than 90 days, you should request an update to this response. Thank you for your efforts to protect our nation's species and their habitats. If you have any questions concerning the above information, please contact Tim McCracken at (509) 665-3508, extension 17.

Sincerely,

A handwritten signature in black ink that reads "Mark G. Miller". The signature is written in a cursive, flowing style.

Mark G. Miller, Project Leader
Central Washington Field Office



March 30, 2005

Richard Dwerlkotte
EDAW Inc
815 Western Ave – Ste 300
Seattle WA 98104

**SUBJECT: Wells Hydroelectric Project, Douglas County
(T28-30N R23E; T28-32N R24E; T29-32N R25E; T29N R26E)**

We've searched the Natural Heritage Information System for information on rare plants and high quality native wetland and terrestrial ecosystems in the vicinity of your project. A summary of this information is enclosed. In your planning, please consider protection of these significant natural features. Please contact us for consultation on projects that may have an effect on these rare species or high quality ecosystems.

The information provided by the Washington Natural Heritage Program is based solely on existing information in the database. There may be significant natural features in your study area of which we are not aware. These data are being provided to you for informational and planning purposes only - the Natural Heritage Program has no regulatory authority. This information is for your use only for environmental assessment and is not to be redistributed. Others interested in this information should be directed to contact the Natural Heritage Program.

The Washington Natural Heritage Program is responsible for information on the state's rare plants as well as high quality ecosystems. For information on animal species of concern, please contact Priority Habitats and Species, Washington Department of Fish and Wildlife, 600 Capitol Way N, Olympia WA 98501-1091, or by phone (360) 902-2543.

Please visit our internet website at <http://www.dnr.wa.gov/nhp> for more information. Lists of rare plants and their status, rare plant fact sheets, as well as rare plant survey guidelines are available for download from the site. Please call me at (360) 902-1667 if you have any questions.

Sincerely,

Sandy Swope Moody, Environmental Review Coordinator
Washington Natural Heritage Program

Enclosures

Asset Management & Protection Division, PO Box 47014, Olympia WA 98504-7014
FAX 360-902-1789



WASHINGTON NATURAL HERITAGE INFORMATION SYSTEM
ENDANGERED, THREATENED AND SENSITIVE PLANT SPECIES &
HIGH QUALITY WETLAND ECOSYSTEMS AND HIGH QUALITY TERRESTRIAL ECOSYSTEMS
IN THE VICINITY OF WELLS HYDROELECTRIC PROJECT, DOUGLAS COUNTY
REQUESTED BY EDAW INC

Data Current as of March 2005
Page 1 of 2

<u>TOWNSHIP, RANGE AND SECTION</u>	<u>ELEMENT NAME</u>	<u>STATE STATUS</u>	<u>FEDERAL STATUS</u>
T28N R23E S23 S26 SEofNW	<i>Schizachyrium scoparium</i> var. <i>scoparium</i> (little bluestem)	T	
T28N R23E S35 SEofNW	<i>Spiranthes diluvialis</i> (Ute ladies' tresses)	E	LT
T28N R23E S35 T27N R23E S02	<i>Sisyrinchium montanum</i> (strict blue-eyed grass)	T	
T29N R23E S10 SEofNW	<i>Carex sychnocephala</i> (many-headed sedge)	S	
T29N R24E S07 W2ofSW S18 W2	PURSHIA TRIDENTATA / PSEUDOROEGERIA SPICATA SHRUB HERBACEOUS VEGETATION		
T29N R23E S01 S2 S12 E2 S13 E2ofE2	(BITTERBRUSH / BLUEBUNCH WHEATGRASS)		
T29N R23E S01 SWofSE S12 NWofNE	RHUS GLABRA / PSEUDOROEGERIA SPICATA SHRUB HERBACEOUS VEGETATION (SMOOTH SUMAC / BLUEBUNCH WHEATGRASS)		
T29N R24E S07 SW S18 NWofNW	PURSHIA TRIDENTATA / PSEUDOROEGERIA SPICATA SHRUB HERBACEOUS VEGETATION (BITTERBRUSH / BLUEBUNCH WHEATGRASS)		
T32N R25E S04 SWofSW	ARTEMISIA TRIDENTATA SSP. WYOMINGENSIS / PSEUDOROEGERIA SPICATA SHRUB HERBACEOUS VEGETATION (WYOMING BIG SAGEBRUSH / BLUEBUNCH WHEATGRASS)		
T32N R24E S25 SWofNE	PINUS PONDEROSA / PURSHIA TRIDENTATA WOODLAND (PONDEROSA PINE / BITTERBRUSH)		
T32N R24E S25 NWofSW	ARTEMISIA TRIPARTITA / FESTUCA IDAHOENSIS SHRUB HERBACEOUS VEGETATION (THREETIP SAGEBRUSH / IDAHO FESCUE)		
T32N R24E S26 E2 S25 SWofNE	PURSHIA TRIDENTATA / PSEUDOROEGERIA SPICATA SHRUB HERBACEOUS VEGETATION (BITTERBRUSH / BLUEBUNCH WHEATGRASS)		

WASHINGTON NATURAL HERITAGE INFORMATION SYSTEM
 ENDANGERED, THREATENED AND SENSITIVE PLANT SPECIES &
 HIGH QUALITY WETLAND ECOSYSTEMS AND HIGH QUALITY TERRESTRIAL ECOSYSTEMS
 IN THE VICINITY OF WELLS HYDROELECTRIC PROJECT, DOUGLAS COUNTY
 REQUESTED BY EDAS INC

Data Current as of March 2005
 Page 2 of 2

<u>TOWNSHIP, RANGE AND SECTION</u>	<u>ELEMENT NAME</u>	<u>STATE STATUS</u>	<u>FEDERAL STATUS</u>
T32N R24E S26 E2	PURSHIA TRIDENTATA / FESTUCA		
S25 SWofNE	IDAHOENSIS SHRUB HERBACEOUS VEGETATION		
S36 NW	(BITTERBRUSH / IDAHO FESCUE)		
T32N R24E S25 SWofNE	ARTEMISIA TRIDENTATA SSP. WYOMINGENSIS		
	/ STIPA COMATA SHRUBLAND		
	(WYOMING BIG SAGEBRUSH /		
	NEEDLE-AND-THREAD)		

WASHINGTON NATURAL HERITAGE INFORMATION SYSTEM
Rare Plant Species

FEDERAL STATUS DEFINITIONS- (Note: Federally listed plant species are subject to the US Endangered Species Act.)

LE = Listed Endangered: Any taxon that is in danger of extinction throughout all or a significant portion of its range and that has been formally listed as such in the Federal Register under the Federal Endangered Species Act.

LT = Listed Threatened: Any taxon that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range and that has been formally listed as such in the Federal Register under the Federal Endangered Species Act.

PE = Proposed Endangered: Any taxon that is in danger of extinction throughout all or a significant portion of its range and that has been proposed for listing as such in the Federal Register under the Federal Endangered Species Act.

PT = Proposed Threatened: Any taxon that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range and that has been proposed for listing as such in the Federal Register under the Federal Endangered Species Act.

C = Candidate species: Taxa for which current information indicates the probable appropriateness of listing as Endangered or Threatened and that has been published in the Federal Register as a candidate for listing under the Federal Endangered Species Act.

SC = Species of Concern: Species whose conservation standing is of concern but for which status information is still needed. Species of concern lists are not published in the Federal Register.

STATE STATUS DEFINITIONS- (Note: The state ESA does not include provisions to list or protect rare plant species – the state rare plant list is advisory only.)

E = Endangered: Any taxon in danger of becoming extinct or extirpated from Washington within the foreseeable future if factors contributing to its decline continue. Populations of these taxa are at critically low levels or their habitats have been degraded or depleted to a significant degree.

T = Threatened: Any taxon likely to become Endangered in Washington within the foreseeable future if factors contributing to its population decline or habitat degradation or loss continue.

S = Sensitive: Any taxon that is vulnerable or declining and could become Endangered or Threatened in the state without active management or removal of threats.

X = Possibly Extinct or Extirpated from Washington: Based on recent field searches, a number of plant taxa are considered to be possibly extinct or extirpated from Washington. Taxa in this group are all high priorities for field investigations. If found, they will be assigned one of the above status categories.

R = Review: Taxa of potential concern, but for which no status has yet been assigned.
Group 1 = Taxa in need of additional field work before a status can be assigned.
Group 2 = Taxa with unresolved taxonomic questions.

W = Watch: Taxa more abundant and/or less threatened in Washington than previously assumed.

Non-Vascular Plant:

P = Priority: At this time, there is insufficient information to assign a statewide status to the non-vascular taxa. For now, the lichen and macrofungi lists have been divided into two priority groups based on criteria of occurrence pattern, vulnerability, threats, degree of protection, and taxonomy.

WASHINGTON NATURAL HERITAGE PROGRAM

CRITERIA FOR HIGH-QUALITY WETLAND ECOSYSTEMS

The WNHP does not maintain a comprehensive inventory of all wetlands in the state. The database includes information only on those areas that have been surveyed by the program scientists and found to be relatively undisturbed high-quality wetlands. For wetlands included in the database, the physical characteristics, biota, ecosystem functions, processes and settings are essentially natural. For example, to be included in the WNHP database, a freshwater wetland site must meet these six criteria:

1. A native wetland ecosystem type (element) considered important for preservation within the state.
2. Little or no human-caused changes to wetland topography or soils.
3. No human caused changes to hydrology of the wetland, or the wetland appears to have recovered from any changes.
4. Few or no exotic plant species.
5. Little human-caused disturbance of native vegetation, or vegetation has recovered from past disturbance.
6. No major water quality problems.

Criteria 2-6 are weighted based on the amount of disturbance present in all known examples of a given wetland type. Thus a disturbed wetland may be included in the WNHP Information System if it has one of the highest quality examples remaining of a particular wetland type. On the other hand, an equally disturbed site may not be included in the WNHP Information System if it contains a wetland type which has many other undisturbed examples. A severe degree of disturbance would exclude a site from being entered into the WNHP Information System, even if no better examples of that wetland type exist.

CRITERIA FOR HIGH-QUALITY TERRESTRIAL ECOSYSTEMS

Occurrences of terrestrial ecosystem types are determined by the characteristics of each individual ecosystem type. Ecological quality refers to both the ecological condition and the ecological viability of a particular community.

Condition is determined by relative importance of native versus non-native species, extent and nature of human-caused disturbance, and how well the occurrence represents the ecosystem type definition. Viability is determined by size of the area and landscape setting.

Minimum criteria for an occurrence of a terrestrial ecosystem:

1. Native plants dominate the site: tree layers composed of only native species, at least 80 percent of the shrub and herbaceous layers are composed of native plants. Non-native plants are generally insignificant.
2. Little or insignificant disturbance to vegetation by logging, conversion to agriculture, heavy grazing, residential development, or other recent human extractive activities that alter the ecosystem processes.
3. Large enough for minimal viability and ecological function: at least 100 acres for forests in the montane provinces and at least four average tree heights wide at its narrowest width, at least 20 acres for forest in the Puget Lowlands, and at least 10 acres for native grasslands.

The degree to which these criteria are applied to a site depends on characteristics of the particular ecosystem types present. Some ecosystem types are found almost exclusively as small patches, perhaps in areas smaller than in criterion 3. In this case, meeting criteria 1 and 2 would be sufficient. Large but moderately disturbed ecosystems representative of types that have been altered throughout their range because of various land uses may need only meet criteria 1 and 3.

COPY

STATE OF WASHINGTON
DEPARTMENT OF NATURAL RESOURCES
FED ID: 91-6012771

* INVOICE *

Agreement Id: 89 004149
Invoice No : IB30052

Page 1
Invoice Date: 03/30/05
Due Date : 04/29/05

EDAW INC
815 WESTERN AVE SUITE 300
SEATTLE WA 98104

LINE	QUANTITY	UOM	UNIT PRICE	VALUE
001	NATURAL HERITAGE DATA RETRIEVAL			
	1.0000	\$	30.00000	\$ 30.00
	WELLS HYDROELECTRIC PROJECT, DOUGLAS COUNTY REQUESTED BY RICHARD DWERLKOTTE			

TOTAL - PLEASE PAY THIS AMOUNT \$ 30.00
THE DEPARTMENT ASSESSES INTEREST ON PAST DUE ACCOUNTS

If you have any questions, call SANDY MOODY (360) 902-1667
Keep this portion for your records

Agreement Id: 89 004149
Invoice No : IB30052
Customer Id : DNR 000 025 090
NAME: EDAW INC

Acct Mgr: FR
Group : NHDS
Due Date: 04/29/05

REMIT CHECKS TO:
DEPARTMENT OF NATURAL RESOURCES
FINANCIAL MGMT DIVISION
PO BOX 47041
OLYMPIA, WA 98504-7041

TOTAL - Please pay this amount
\$ 30.00

RETURN THIS PORTION FOR PROPER CREDIT TO YOUR ACCOUNT.

Appendix B

RTE Plant Maps

(CONFIDENTIAL)

AVAILABLE UPON REQUEST

Appendix C

Washington State Noxious Weed Control Board Class A and B Noxious Weeds

Washington State Noxious Weed Control Board's Class A and B Noxious Weeds¹.

Class A noxious weeds in Washington		
Scientific Name	Common Name	Designated for Control
<i>Abutilon theophrasti</i>	Velvetleaf	Statewide
<i>Alliaria petiolata</i>	Garlic mustard	Statewide
<i>Carduus pycnocephalus</i>	Italian thistle	Statewide
<i>Carduus tenuiflorus</i>	Slenderflower thistle	Statewide
<i>Centaurea calcitrapa</i>	Purple starthistle	Statewide
<i>Centaurea macrocephala</i>	Bighead knapweed	Statewide
<i>Centaurea nigrescens</i>	Vochin knapweed	Statewide
<i>Crupina vulgaris</i>	Common crupina	Statewide
<i>Euphorbia oblongata</i>	Eggleaf spurge	Statewide
<i>Galega officinalis</i>	Goatsrue	Statewide
<i>Helianthus ciliaris</i>	Texas blueweed	Statewide
<i>Heracleum mantegazzianum</i>	Giant hogweed	Statewide
<i>Hieracium floribundum</i>	Yellow devil hawkweed	Statewide
<i>Hydrilla verticillata</i>	Hydrilla	Statewide
<i>Isatis tinctoria</i>	Dyers woad	Statewide
<i>Mirabilis nyctaginea</i>	Wild four o' clock	Statewide
<i>Pueraria montana</i> var. <i>lobata</i>	Kudzu	Statewide
<i>Salvia aethiopsis</i>	Mediterranean sage	Statewide
<i>Salvia pratensis</i>	Meadow clary	Statewide
<i>Salvia sclarea</i>	Clary sage	Statewide
<i>Silybum marianum</i>	Milk thistle	Statewide
<i>Solanum elaeagnifolium</i>	Silverleaf nightshade	Statewide
<i>Solanum rostratum</i>	Buffalobur	Statewide
<i>Soliva sessilis</i>	Lawnweed	Statewide
<i>Sorghum halepense</i>	Johnsongrass	Statewide
<i>Spartina densiflora</i>	Denseflower cordgrass	Statewide
<i>Spartina patens</i>	Salt meadow cordgrass	Statewide
<i>Spartium junceum</i>	Spanish broom	Statewide
<i>Thymelaea passerina</i>	Spurge flax	Statewide
<i>Zygophyllum fabago</i>	Syrian bean-caper	Statewide
Class B noxious weeds designated for control in Region 3, Washington²		
Scientific Name	Common Name	Designated for Control
<i>Alhagi maurorum</i>	Camelthorn	All
<i>Alopecurus myosuroides</i>	Blackgrass	All
<i>Amorpha fruticosa</i>	Indigobush	All
<i>Anchusa arvensis</i>	Annual bugloss	All
<i>Anchusa officinalis</i>	Common bugloss	All
<i>Anthriscus sylvestris</i>	Wild chervil	All
<i>Berteroa incana</i>	Hoary alyssum	Except for portions of Okanogan County
<i>Bryonia alba</i>	White bryony	All
<i>Cabomba caroliniana</i>	Fanwort	All
<i>Carduus acanthoides</i>	Plumeless thistle	All

Washington State Noxious Weed Control Board's Class A and B Noxious Weeds¹.

<i>Carduus natans</i>	Musk thistle	All
<i>Cenchrus longispinus</i>	Longspine sandbur	All
<i>Centaurea biebersteinii</i>	Spotted knapweed	All
<i>Centaurea jacea</i>	Brown knapweed	All
<i>Centaurea jacea x nigra</i>	Meadow knapweed	All
<i>Centaurea nigra</i>	Black knapweed	All
<i>Centaurea solstitialis</i>	Yellow starthistle	All
<i>Chondrilla juncea</i>	Rush skeletonweed	All
<i>Cyperus esculentus</i>	Yellow nutsedge	All
<i>Cytisus scoparius</i>	Scotch broom	All
<i>Daucus carota</i>	Wild carrot	Except where intentionally cultivated
<i>Echium vulgare</i>	Blueweed	All
<i>Egeria densa</i>	Brazilian elodea	All
<i>Euphorbia esula</i>	Leafy spurge	All
<i>Geranium robertianum</i>	Herb-Robert	All
<i>Hieracium atratum</i>	Polar hawkweed	All
<i>Hieracium aurantiacum</i>	Orange hawkweed	All
<i>Hieracium caespitosum</i>	Yellow hawkweed	All
<i>Hieracium glomeratum</i>	Queendevil hawkweed	All
<i>Hieracium laevigatum</i>	Smooth hawkweed	All
<i>Hieracium pilosella</i>	Mouseeear hawkweed	All
<i>Hypochaeris radicata</i>	Common catsear	All
<i>Impatiens glandulifera</i>	Policeman's helmet	All
<i>Lepidim latifolium</i>	Perennial pepperweed	All
<i>Leprodiclis holosteoides</i>	Lepyrodiclis	All
<i>Linaria dalmatica ssp. dalmatica</i>	Dalmatian toadflax	Portions of Douglas & Okanogan Counties
<i>Ludwigia hexapetala</i>	Water primrose	All
<i>Lysimachia vulgaris</i>	Garden loosestrife	All
<i>Lythrum salicaria</i>	Purple loosestrife	Except within 100 ft of the Okanogan River From the Canadian boarder south of Riverside
<i>Lythrum virgatum</i>	Wand loosestrife	Except within 100 ft of the Okanogan River From the Canadian boarder south of Riverside
<i>Myriophyllum aquaticum</i>	Parrotfeather	All
<i>Nymphoides peltata</i>	Yellow floating heart	All
<i>Onopordum acanthium</i>	Scotch thistle	All
<i>Picris hieracioides</i>	Hawkweed oxtongue	All
<i>Polygonum cuspidatum</i>	Japanese knotweed	Chelan County only
<i>Potentilla recta</i>	Sulfur cinquefoil	All
<i>Rorippa austriaca</i>	Austrian fieldcress	All
<i>Senecio jacobaea</i>	Tansy ragwort	All
<i>Sonchus arvensis spp. arvensis</i>	Perennial sowthistle	All
<i>Spartina alterniflora</i>	Smooth cordgrass	All

Washington State Noxious Weed Control Board's Class A and B Noxious Weeds¹.

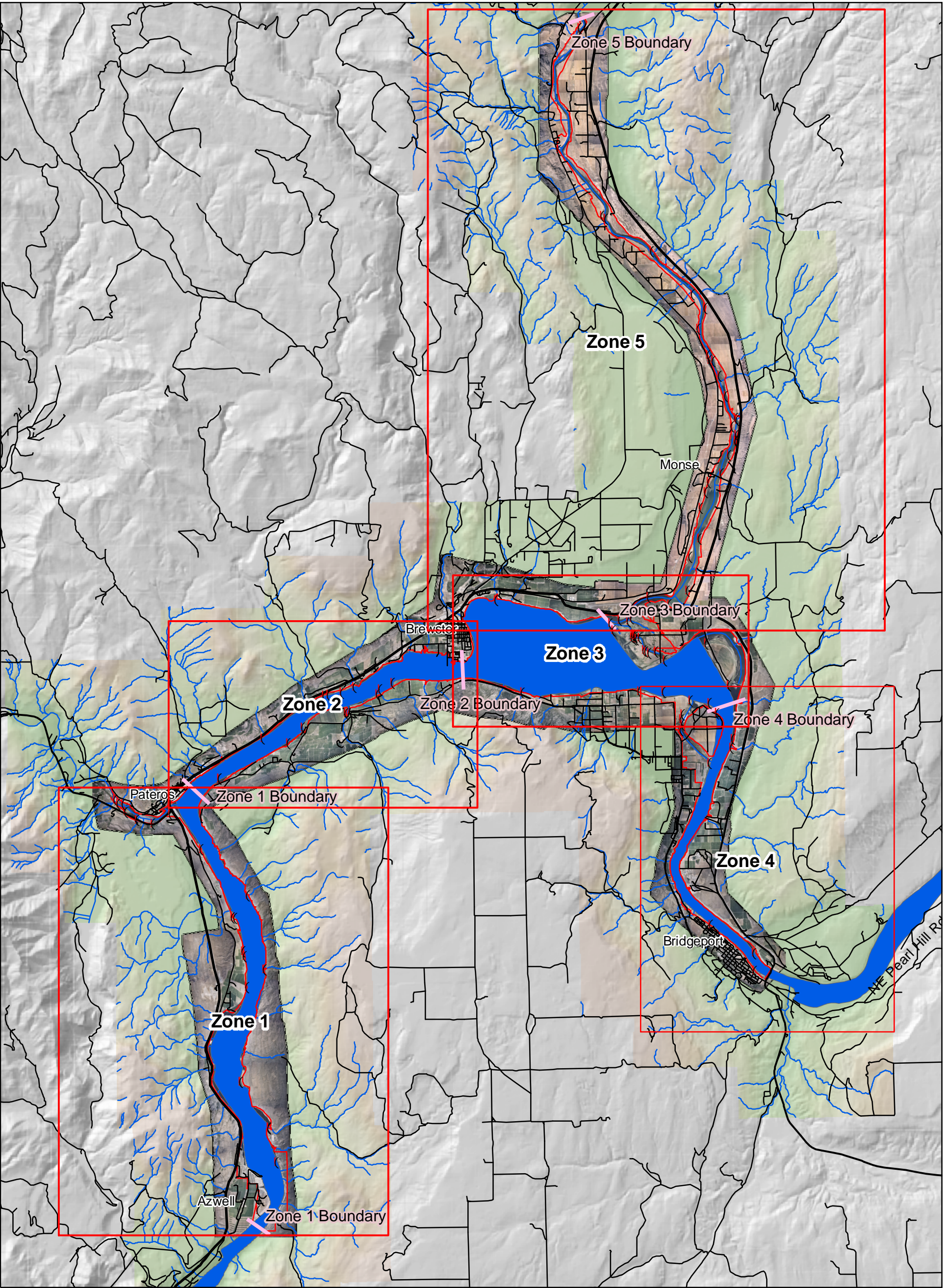
<i>Spartina anglica</i>	Common cordgrass	All
<i>Sphaerophysa salsula</i>	Swainsonpea	All
<i>Tamarix ramosissima</i>	Saltcedar	All
<i>Torilis arvensis</i>	Hedgeparsley	All
<i>Ulex europaeus</i>	Gorse	All

¹ Class A weeds are non-native species with a limited distribution in the state; eradication of all Class A weeds is required by state law. Treatment of Class B weeds varies between regions of the state. In regions where a Class B is unrecorded or of limited distribution, prevention of seed production is required; in these areas, the weed is a "Class B designate," meaning it is designated for control by state law.








² Region 3 includes all lands within Douglas, Okanogan, and Chelan Counties.

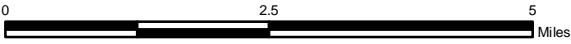
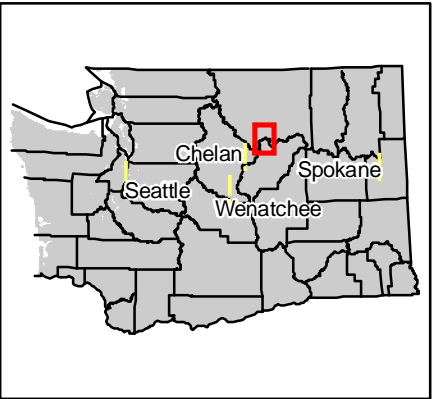
Appendix D

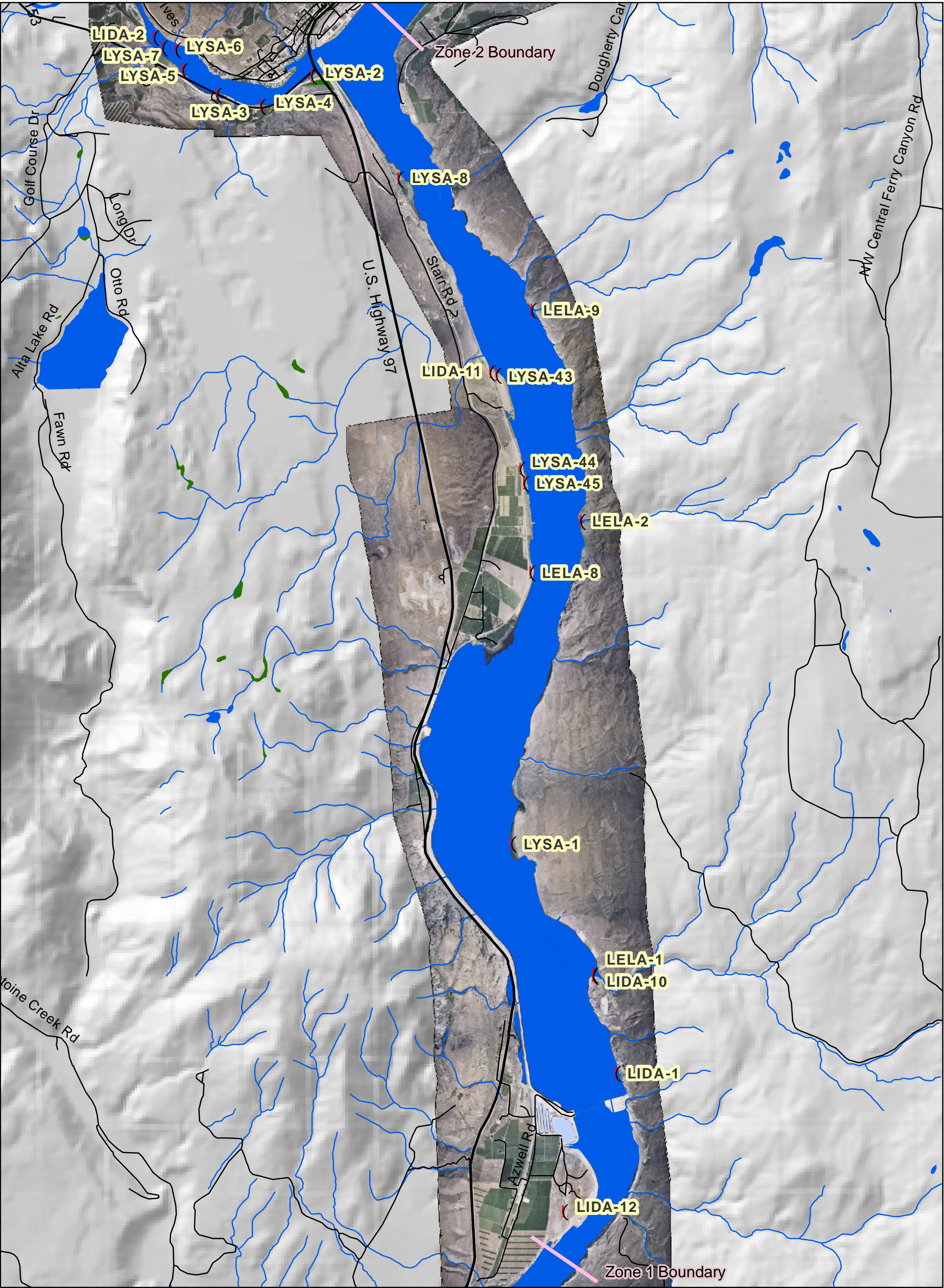
Invasive Plant Species Maps



Appendix D. Noxious weed infestations observed in the Wells Hydroelectric Project relicensing study area in 2005.

- | | |
|--|---|
|  U.S. Highway |  FERC Project Boundary |
|  State Highway/Route |  Weed Observation Points |
|  Local Road | EUES = <i>Euphorbia esula</i> , Leafy Spurge |
|  Project Area Zone Boundary | LELA = <i>Lepidium latifolium</i> , Perennial pepperweed |
|  Stream | LIDA = <i>Linaria dalmatica</i> , Dalmation toadflax |
| | LYSA = <i>Lythrum salicaria</i> , Purple loosestrife |





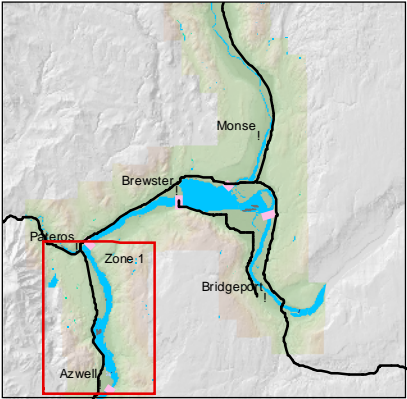
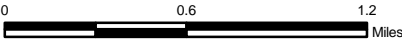
Appendix D. Noxious weed infestations observed in the Wells Hydroelectric Project relicensing study area in 2005.

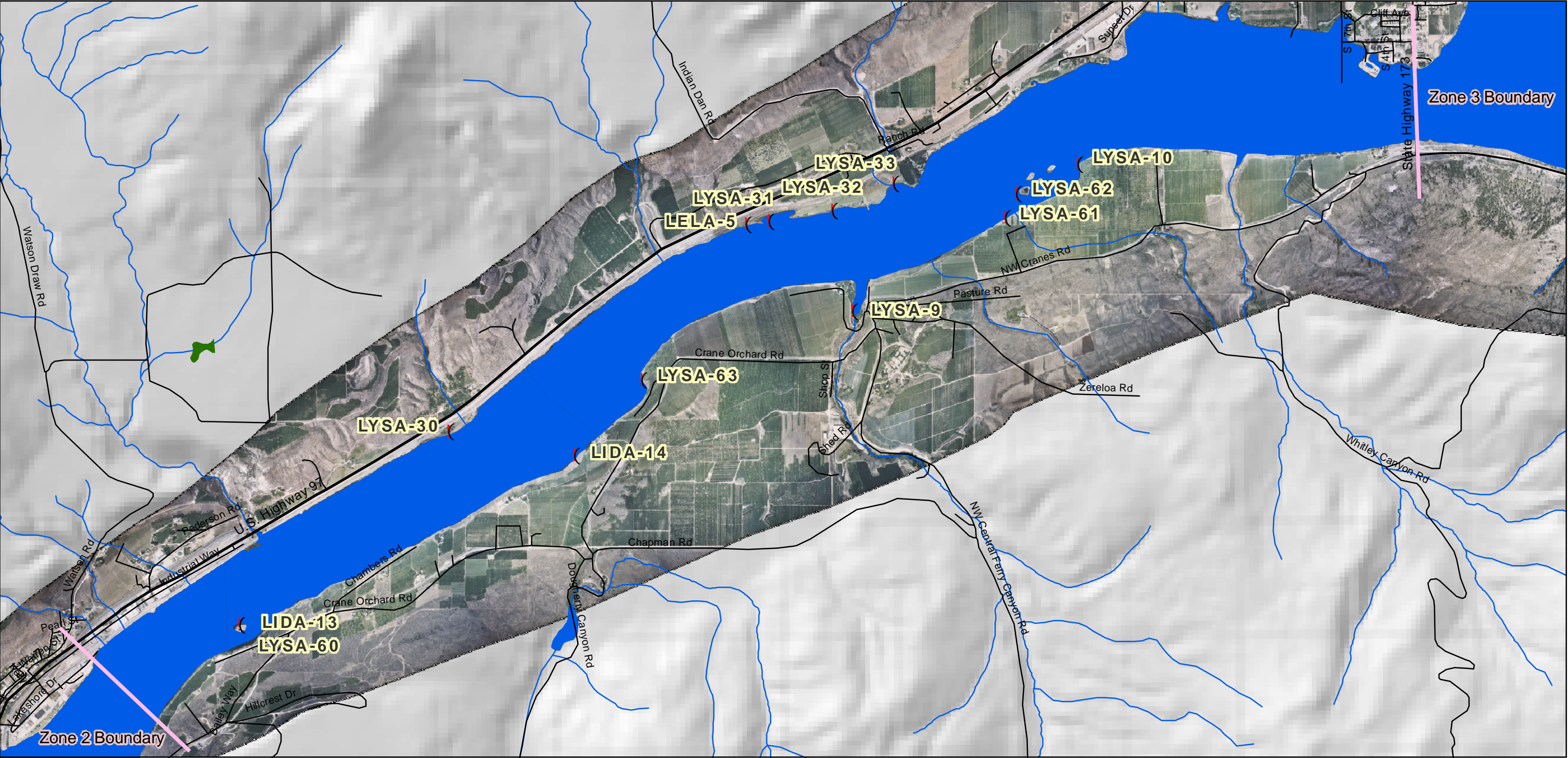
- U.S. Highway
- State Highway/Route
- Local Road
- Project Area Zone Boundary
- Stream

- Weed Observation Points
 - EUES = *Euphorbia esula*, Leafy Spurge
 - LELA = *Lepidium latifolium*, Perennial pepperweed
 - LIDA = *Linaria dalmatica*, Dalmation toadflax
 - LYSA = *Lythrum salicaria*, Purple loosestrife









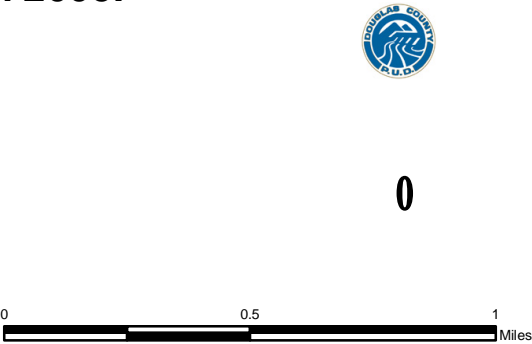
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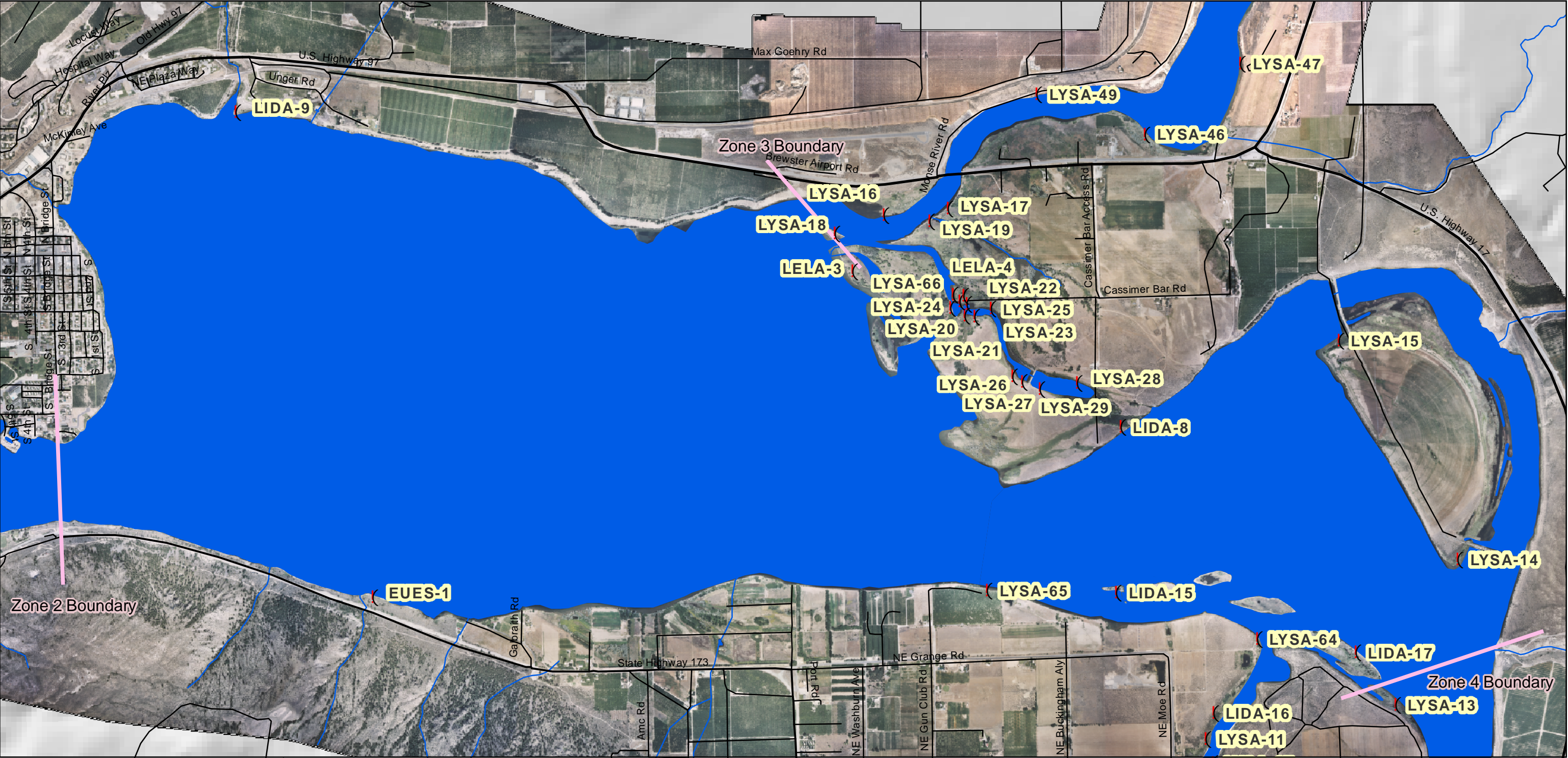




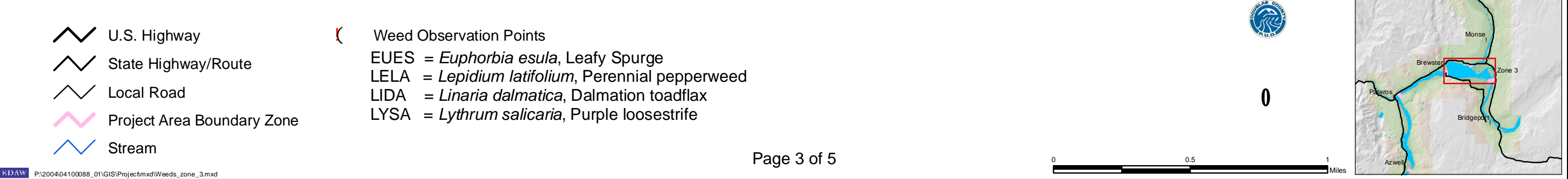
Appendix D. Noxious weed infestations observed in the Wells Hydroelectric Project relicensing study area in 2005.

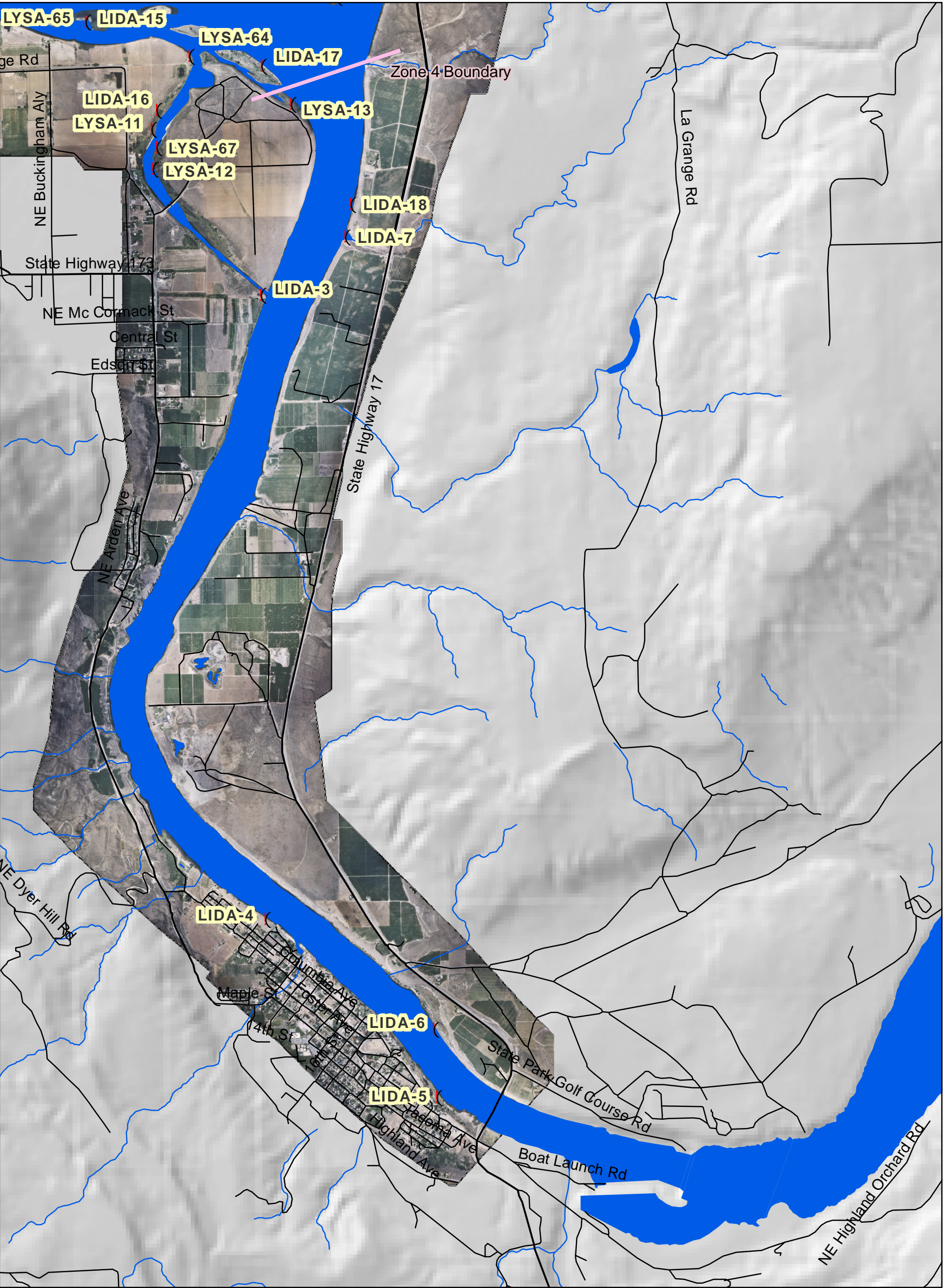
- | | |
|--|---|
|  U.S. Highway |  Weed Observation Points |
|  State Highway/Route | EUES = <i>Euphorbia esula</i> , Leafy Spurge |
|  Local Road | LELA = <i>Lepidium latifolium</i> , Perennial pepperweed |
|  Project Area Boundary Zone | LIDA = <i>Linaria dalmatica</i> , Dalmation toadflax |
|  Stream | LYSA = <i>Lythrum salicaria</i> , Purple loosestrife |





Appendix D. Noxious weed infestations observed in the Wells Hydroelectric Project relicensing study area in 2005.

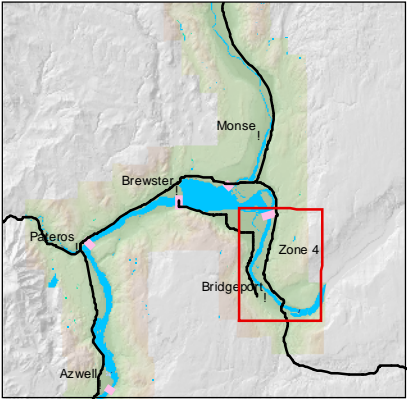
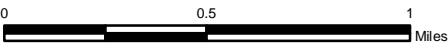




Appendix D. Noxious weed infestations observed in the Wells Hydroelectric Project relicensing study area in 2005.

- U.S. Highway
- State Highway/Route
- Local Road
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- Stream

- Weed Observation Points
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 - LIDA = *Linaria dalmatica*, Dalmation toadflax
 - LYSA = *Lythrum salicaria*, Purple loosestrife



Appendix E

Cover Type Maps

AVAILABLE UPON REQUEST

Appendix F

Plant Species List

Appendix F. Plant Species List by Cover Type Compiled During Botanical Surveys Conducted in 2005 at the Well Hydroelectric Project Study Area.

Status ¹	Family Name	Scientific Name	Common Name	Tree Dominated Conifer, Conifer Shrub	Upland Vegetation		Herb/Grass dominated Weedy Cover Types	Upland Rock		Riparian and Wetland Vegetation				Littoral Zone - Wash			Bare-Disturbed- Eroded		
					Shrub Dominated Steppe	Shrub Sand		Rock Talus	Rock Outcrop	Mud Flats	Emergent Wetland	Riparian Shrub	Riparian Deciduous Tree	Open Water	Wash	Gravel Bar	Rocky Shore	Eroded Bank	Disturbed
			Douglas maple/Rocky																
		Aceraceae	<i>Acer glabrum</i>						X										
		Aceraceae	<i>Acer negundo</i>										X	X					
x		Aceraceae	<i>Acer platanoides</i>											X					
x		Aceraceae	<i>Acer tridentata</i>											X					
		Anacardiaceae	<i>Rhus glabra</i>					X	X				X						
		Anacardiaceae	<i>Rhus radicans</i>		X			X	X				X	X			X		
		Apiaceae	<i>Berula erecta</i>										X						
		Apiaceae	<i>Cicuta douglasii</i>								X		X						
		Apiaceae	<i>Cymopterus terebinthinus</i>		X	X		X											
		Apiaceae	<i>Lomatium ambiguum</i>		X														
		Apiaceae	<i>Lomatium grayi</i>		X	X													
		Apiaceae	<i>Lomatium macrocarpum</i>		X														
		Apiaceae	<i>Lomatium triternatum</i>		X														
		Apiaceae	<i>Perideridia gairdneri</i>									X	X						
		Apocynaceae	<i>Apocynum cannabinum</i>									X	X	X					
		Asclepiaceae	<i>Asclepias speciosa</i>		X	X					X	X	X		X		X		
		Asteraceae	<i>Achillea millefolium</i>		X	X	X		X			X	X	X		X		X	X
		Asteraceae	<i>Agoseris heterophylla</i>		X														
x		Asteraceae	<i>Anaphalis margaritacea</i>				X												
		Asteraceae	<i>Antennaria dimorpha</i>		X														
			<i>Artemisia campestris</i> var.																
		Asteraceae	<i>scouleriana</i>									X	X	X		X			
		Asteraceae	<i>Artemisia douglasiana</i>									X	X			X		X	
		Asteraceae	<i>Artemisia dracunculus</i>		X	X						X	X	X		X		X	
		Asteraceae	<i>Artemisia ludoviciana</i>									X	X	X		X		X	
		Asteraceae	<i>Artemisia tridentata</i>		X														
		Asteraceae	<i>Artemisia tripartita</i>		X	X													
		Asteraceae	<i>Balsamorhiza sagittata</i>	X	X														
		Asteraceae	<i>Bidens cernua</i>									X				X			
B		Asteraceae	<i>Centaurea diffusa</i>	X	X	X	X	X	X			X	X	X		X	X	X	X
B		Asteraceae	<i>Centaurea repens</i>		X							X	X	X					
		Asteraceae	<i>Chaenactis douglasii</i>		X	X						X	X	X					
			<i>Chrysanthemum</i>																
B		Asteraceae	<i>leucanthemum</i>									X	X	X			X		
			<i>Chrysopsis villosa</i> var.																
		Asteraceae	<i>villosa</i>													X			
		Asteraceae	<i>Chrysothamnus nauseosus</i>	X	X	X							X						
		Asteraceae	<i>Chrysothamnus viscidiflorus</i>			X							X						
C		Asteraceae	<i>Cirsium arvense</i>									X	X	X					
		Asteraceae	<i>Cirsium undulatum</i>													X			
C		Asteraceae	<i>Cirsium vulgare</i>	X	X							X	X	X					
		Asteraceae	<i>Conyza canadensis</i>				X	X											
		Asteraceae	<i>Coreopsis atkinsoniana</i>									X							
		Asteraceae	<i>Crepis atrabarba</i>		X														
		Asteraceae	<i>Crepis barbigera</i>	X	X														

Appendix F. Plant Species List by Cover Type Compiled During Botanical Surveys Conducted in 2005 at the Well Hydroelectric Project Study Area.

Status ¹	Family Name	Scientific Name	Common Name	Tree Dominated Conifer, Conifer Shrub	Upland Vegetation			Upland Rock		Riparian and Wetland Vegetation					Littoral Zone - Wash			Bare-Disturbed- Eroded		
					Shrub Dominated		Herb/Grass dominated	Rock Talus	Rock Outcrop	Mud Flats	Emergent Wetland	Riparian Shrub	Riparian Deciduous Tree	Open Water	Wash	Gravel Bar	Rocky Shore	Eroded Bank	Disturbed	
					Shrub Steppe	Shrub Sand	Herb Grass													Weedy Cover Types
	Asteraceae	<i>Crepis intermedia</i>	Limestone hawkbeard		X															
	Asteraceae	<i>Erigeron corymbosus</i>	Longleaf fleabane		X										X					
	Asteraceae	<i>Erigeron divergens</i>	Spreading fleabane		X														X	
	Asteraceae	<i>Erigeron filifolius</i>	Threadleaf fleabane		X	X									X					
	Asteraceae	<i>Erigeron linearis</i>	Desert yellow fleabane		X						X									
	Asteraceae	<i>Erigeron philadelphicus</i>	Philadelphia fleabane		X						X	X	X							
	Asteraceae	<i>Erigeron pumilus</i>	Shaggy fleabane									X								
	Asteraceae	<i>Eriophyllum lanatum</i>	Common wooly sunflower	X	X															
	Asteraceae	<i>Gaillardia aristida</i>	Common gaillardia									X					X			
	Asteraceae	<i>Geum macrophyllum</i>	Largeleaf avens								X									
	Asteraceae	<i>Helenium autumnale</i>	Common sneezeweed								X									
	Asteraceae	<i>Helianthus annuus</i>	Common sunflower													X				
	Asteraceae	<i>Lactuca pulchella</i>	Blue lettuce													X				
	Asteraceae	<i>Machaeranthera canescens</i>	Hoary tansyaster		X	X							X			X				
	Asteraceae	<i>Microseris troximoides</i>	Weevil prairie-dandelion		X	X														
	Asteraceae	<i>Solidago "young"</i>	Goldenrod								X	X	X		X		X			
	Asteraceae	<i>Solidago canadensis</i>	Canada goldenrod								X	X	X							
	Asteraceae	<i>Solidago occidentalis</i>	Western goldentop								X	X	X							
	Asteraceae	<i>Stephanomeria tenuifolia</i>	Narrowleaf wirelettuce		X	X														
C	Asteraceae	<i>Tanacetum vulgare</i>	Common tansy								X	X	X				X			
x	Asteraceae	<i>Taraxacum officinale</i>	Common dandelion		X	X	X	X			X	X	X		X		X			
x	Asteraceae	<i>Tragopogon dubius</i>	Yellow salsify		X	X	X		X		X	X	X		X		X			
C	Asteraceae	<i>Xanthium strumarium</i>	Rough cocklebur								X	X			X		X			
	Balsaminaceae	<i>Impatiens ecalcarata</i>	Spurless touch-me-not								X									
	Berberidaceae	<i>Berberis aquifolium</i>	Hollyleaved barberry			X					X									
	Betulaceae	<i>Alnus incana</i>	Gray alder									X								
	Betulaceae	<i>Alnus sinuata</i>	Sitka alder								X	X	X		X		X			
	Betulaceae	<i>Betula occidentalis</i> var. <i>o.</i>	Water birch								X	X	X		X					
	Boraginaceae	<i>Amsinckia lycopsoides</i>	Tarweed fiddleneck		X	X									X					
	Boraginaceae	<i>Cryptantha ambigua</i>	Basin cryptantha		X	X														
	Boraginaceae	<i>Cryptantha celosioides</i>	Buttecandle		X															
	Boraginaceae	<i>Cryptantha circumcissa</i>	Cushion cryptantha			X									X					
	Boraginaceae	<i>Cryptantha pterocarya</i>	Wingnut cryptantha			X														
	Boraginaceae	<i>Hackelia arida</i>	Sagebrush stickseed		X															
	Boraginaceae	<i>Hackelia ciliata</i>	Okanogan stickseed		X															
	Boraginaceae	<i>Hackelia diffusa</i> v. <i>cottonii</i>	Cotton's stickseed												X	X				
x	Boraginaceae	<i>Lithospermum arvense</i>	Corn gromwell		X	X														
	Boraginaceae	<i>Myosotis laxa</i>	Bay forget-me-not							X	X	X	X							
	Boraginaceae	<i>Plagiobothrys scouleri</i>	Scouler's popcornflower							X										
	Boraginaceae	<i>Plagiobothrys tenellus</i>	Pacific popcornflower							X					X					
	Brassicaceae	<i>Arabis holboellii</i>	Holboell's rockcress		X															
	Brassicaceae	<i>Cardamine oligosperma</i>	Little western bittercress																	
x	Brassicaceae	<i>Cardaria chalapensis</i>	Lenspod whitetop																X	
C	Brassicaceae	<i>Cardaria pubescens</i>	Hairy whitetop																	
	Brassicaceae	<i>Descurainia pinnata</i>	Western tansymustard		X															

Appendix F. Plant Species List by Cover Type Compiled During Botanical Surveys Conducted in 2005 at the Well Hydroelectric Project Study Area.

				Tree Dominated Conifer, Conifer Shrub	Upland Vegetation			Weedy Cover Types	Upland Rock		Riparian and Wetland Vegetation				Littoral Zone - Wash			Bare-Disturbed- Eroded		
					Shrub Dominated		Herb/Grass dominated		Rock Talus	Rock Outcrop	Mud Flats	Emergent Wetland	Riparian Shrub	Riparian Deciduous Tree	Open Water	Wash	Gravel Bar	Rocky Shore	Eroded Bank	Disturbed
					Shrub Steppe	Shrub Sand	Herb Grass													
Status ¹	Family Name	Scientific Name	Common Name																	
B-des	Brassicaceae	<i>Draba verna</i>	Spring draba		X															
	Brassicaceae	<i>Erysimum asperum</i>	Sanddune wallflower		X															
	Brassicaceae	<i>Lepidium latifolium</i>	Broadleaved pepperweed								X	X	X		X					
	Brassicaceae	<i>Lepidium perfoliatum</i>	Clasping pepperweed					X												
	Brassicaceae	<i>Rorippa obtusa</i>	Bluntleaf yellowcress								X									
x	Brassicaceae	<i>Sisymbrium altissimum</i>	Tall tumbledustard		X			X												
x	Brassicaceae	<i>Thlaspi arvense</i>	Field pennycress					X												
R1	Cactaceae	<i>Opuntia fragilis</i>	Brittle pricklypear		X	X							X	X			X	X		
x	Caprifoliaceae	<i>Lonicera (common shrub)</i>	Honeysuckle	X	X							X	X				X	X		
	Caprifoliaceae	<i>Sambucus caerulea</i>	Blue elderberry					X								X				
	Caprifoliaceae	<i>Symphoricarpos albus</i>	Common snowberry	X	X															
		<i>Arenaria congest ssp.</i>																		
	Caryophyllaceae	<i>prolifera</i>	Ballhead sandwort	X																
x	Caryophyllaceae	<i>Arenaria serpyllifolia</i>	Thymeleaf sandwort					X												
C	Caryophyllaceae	<i>Gypsophila paniculata</i>	Babysbreath gypsophila	X	X	X	X	X	X							X			X	
x	Caryophyllaceae	<i>Saponaria officinalis</i>	Bouncingbet									X					X			
x	Caryophyllaceae	<i>Silene cserei</i>	Balkan catchfly														X			
	Caryophyllaceae	<i>Silene douglasii var. d..</i>	Seabluff catchfly		X															
x	Caryophyllaceae	<i>Silene noctiflora</i>	Nightflowering silene													X	X			
x	Caryophyllaceae	<i>Spergularia rubra</i>	Red sandspurry					X												
	Ceratophyllaceae	<i>Ceratophyllum demersum</i>	Coon's tail												X					
	Chenopodiaceae	<i>Ambrosia acanthicarpa</i>	Flatspine burr ragweed					X								X				
	Chenopodiaceae	<i>Chenopodium leptophyllums</i>	Narrowleaf goosefoot					X												
B	Chenopodiaceae	<i>Kochia scoparia</i>	Mexican-fireweed					X												
x	Chenopodiaceae	<i>Salsola kali</i>	Russian thistle					X												
C	Clusiaceae	<i>Hypericum perforatum</i>	Common St. Johnswort		X	X	X	X	X			X	X	X		X				
x	Convolvulaceae	<i>Convolvulus arvensis</i>	Field bindweed		X			X								X				
	Crassulaceae	<i>Crassula aquatica</i>	Water pygmyweed								X									
	Cupressaceae	<i>Juniperus scopulorum</i>	Rocky Mountain juniper		X								X	X						
	Cyperaceae	<i>Carex cf. amplifolia</i>	Bigleaf sedge									X								
	Cyperaceae	<i>Carex atherodes</i>	Wheat sedge									X								
	Cyperaceae	<i>Carex athrostachya</i>	Slenderbeak sedge									X	X					X		
	Cyperaceae	<i>Carex bebbii</i>	Bebb's sedge									X								
	Cyperaceae	<i>Carex brevior</i>	Shortbeak sedge									X								
	Cyperaceae	<i>Carex douglasii</i>	Douglas' sedge		X															
W	Cyperaceae	<i>Carex hystericina</i>	Bottlebrush sedge									X								
	Cyperaceae	<i>Carex interior</i>	Inland sedge									X								
	Cyperaceae	<i>Carex lanuginosa</i>	Wooly sedge									X	X					X		
	Cyperaceae	<i>Carex lenticularis</i>	Lakeshore sedge									X						X		
	Cyperaceae	<i>Carex microptera</i>	Smallwing sedge									X								
	Cyperaceae	<i>Carex nebrascensis</i>	Nebraska sedge									X								
	Cyperaceae	<i>Carex oederi</i>	Little green sedge									X								
	Cyperaceae	<i>Carex praegracilis</i>	Clustered field sedge									X	X							
	Cyperaceae	<i>Carex retrorsa</i>	Knotsheath sedge									X						X		
	Cyperaceae	<i>Carex vesicaria</i>	Blister sedge									X								
	Cyperaceae	<i>Carex vulpinoidea</i>	Fox sedge									X						X		

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				Tree Dominated Conifer, Conifer Shrub	Upland Vegetation			Upland Rock Rock Talus	Upland Rock Rock Outcrop	Riparian and Wetland Vegetation				Littoral Zone - Wash			Bare-Disturbed- Eroded			
					Shrub Dominated		Herb/Grass dominated													
					Shrub Steppe	Shrub Sand	Herb Grass			Weedy Cover Types	Mud Flats	Emergent Wetland	Riparian Shrub	Riparian Deciduous Tree	Open Water	Wash	Gravel Bar	Rocky Shore	Eroded Bank	Disturbed
Status ¹	Family Name	Scientific Name	Common Name																	
W	Cyperaceae	<i>Cyperus aristatus</i>	Bearded flatsedge								X									
	Cyperaceae	<i>Cyperus bipartitus</i>	Slender flatsedge								X									
	Cyperaceae	<i>Eleocharis acicularis</i>	Needle spikerush								X	X								
	Cyperaceae	<i>Eleocharis ovata</i>	Ovate spikerush								X									
	Cyperaceae	<i>Eleocharis palustris</i>	Common spikerush								X	X			X	X				
	Cyperaceae	<i>Scirpus maritimus</i>	Cosmopolitan bulrush												X					
	Cyperaceae	<i>Scirpus acutus</i>	Hardstem bulrush									X								
	Cyperaceae	<i>Scirpus americanus</i>	Chairmaker's bulrush									X								
	Cyperaceae	<i>Scirpus microcarpus</i>	Panicled bulrush									X								
	Dryopteridaceae	<i>Athyrium filix-femina</i>	Common ladyfern		X															
x	Dryopteridaceae	<i>Woodsia oregana</i>	Oregon cliff fern						X			X								
	Elaeagnaceae	<i>Elaeagnus angustifolia</i>	Russian olive									X	X							
	Equisetaceae	<i>Equisetum arvense</i>	Field horsetail									X								
	Equisetaceae	<i>Equisetum hyemale</i>	Scouringrush horsetail									X								
B-des	Euphorbiaceae	<i>Euphorbia esula</i>	Leafy spurge				X													
	Fabaceae	<i>Astragalus purshii</i>	Woolypod milkvetch		X										X					
	Fabaceae	<i>Lotus corniculatus</i>	Birdfoot deervetch									X								
x	Fabaceae	<i>Lupinus sericeus</i> var. <i>serieus</i>	Silky lupine		X															
	Fabaceae	<i>Medicago sativa</i>	Alfalfa				X													
	Fabaceae	<i>Medicago</i> sp.	Alfalfa				X					X								
	Fabaceae	<i>Melilotus alba</i>	White sweetclover									X	X		X	X	X			
	Fabaceae	<i>Robinia pseudo-acacia</i>	Black locust										X							
	Fabaceae	<i>Trifolium dubium</i>	Suckling clover				X													
	Fabaceae	<i>Trifolium pratense</i>	Red clover				X													
	Fabaceae	<i>Trifolium repens</i>	White clover				X													
	Fabaceae	<i>Veronica peregrina</i> var. <i>xalapense</i>	Hairy purslane speedwell								X									
	Fabaceae	<i>Vicia americana</i>	American vetch				X													
x	Fabaceae	<i>Vicia villosa</i>	Winter vetch	X	X		X	X												
B	Gentianaceae	<i>Centaurium</i> cf. <i>umbellatum</i>	European centaury					X												
	Grossulariaceae	<i>Ribes cereum</i>	Wax currant	X	X															
	Haloragaeae	<i>Myriophyllum spicatum</i>	Spike watermilfoil											X						
	Hydrangaceae	<i>Philadelphus lewisii</i>	Lewis' mock orange		X				X	X										
	Hydrocharitaceae	<i>Elodea canadensis</i>	Canadian waterweed											X						
	Hydrophyllaceae	<i>Phacelia hastata</i>	Silverleaf phacelia		X			X		X										
	Hydrophyllaceae	<i>Phacelia linearis</i>	Threadleaf phacelia		X	X														
C	Iridaceae	<i>Iris pseudacorus</i>	Yellow flag								X	X	X	X						
	Juncaceae	<i>Juncus articulatus</i>	Jointleaf rush								X	X								
	Juncaceae	<i>Juncus balticus</i> var. <i>balticus</i>	Baltic rush									X	X	X						
	Juncaceae	<i>Juncus bufonius</i>	Toad rush									X								
	Juncaceae	<i>Juncus effusus</i>	Common rush									X								
	Juncaceae	<i>Juncus nodosus</i>	Knotted rush								X	X								
	Juncaceae	<i>Juncus tenuis</i>	Poverty rush									X								
	Juncaceae	<i>Juncus torreyi</i>	Torrey's rush									X								

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				Tree Dominated Conifer, Conifer Shrub	Upland Vegetation			Upland Rock		Riparian and Wetland Vegetation				Littoral Zone - Wash			Bare-Disturbed- Eroded			
					Shrub Dominated		Herb/Grass dominated													
					Shrub Steppe	Shrub Sand	Herb Grass	Weedy Cover Types	Rock Talus	Rock Outcrop	Mud Flats	Emergent Wetland	Riparian Shrub	Riparian Deciduous Tree	Open Water	Wash	Gravel Bar	Rocky Shore	Eroded Bank	Disturbed
Status ¹	Family Name	Scientific Name	Common Name																	
x	Lamiaceae	<i>Lycopus americanus</i>	American water horehound									X								
	Lamiaceae	<i>Lycopus asper</i>	Rough bugleweed									X								
	Lamiaceae	<i>Mentha arvensis</i>	Wild mint									X								
	Lamiaceae	<i>Mentha piperita</i>	Water mint									X								
	Lamiaceae	<i>Monardella odoratissima</i>	Mountain monardella		X	X														
	Lamiaceae	<i>Nepeta cataria</i>	Catnip				X													
	Lamiaceae	<i>Prunella vulgaris</i>	Common Selfheal									X					X			
	Lamiaceae	<i>Salvia dorrii</i>	Purple Sage	X	X															
	Lamiaceae	<i>Scutellaria angustifolia</i>	Narrowleaf skullcap		X				X	X										
	Lamiaceae	<i>Scutellaria galericulata</i>	Marsh skullcap		X							X	X							
x	Liliaceae	<i>Allium acuminatum</i>	Tapertip onion		X															
	Liliaceae	<i>Allium schoenoprasum</i>	Wild chives									X	X							
	Liliaceae	<i>Asparagus officinalis</i>	Garden asparagus				X	X				X	X	X		X				
	Liliaceae	<i>Brodiaea douglasii</i>	Largeflower triteleia		X		X													
	Liliaceae	<i>Fritillaria pudica</i>	Yellow fritillary		X															
B-des	Liliaceae	<i>Maianthemum stellatum</i>	Starry false lily of the valley										X							
	Liliaceae	<i>Platanthera sp.</i>	Fringed orchid										X							
	Liliaceae	<i>Platanthera hyperborea</i>	Northern green orchid										X							
	Liliaceae	<i>Zigadenus venenosus</i>	Meadow deathcamas		X								X							
	Lythraceae	<i>Lythrum salicaria</i>	Purple Loosestrife									X	X					X		
	Mentzeliaceae	<i>Mentzelia albicaulis</i>	Whitestem blazingstar		X	X										X				
	Mentzeliaceae	<i>Mentzelia laevicaulis</i>	Smoothstem blazingstar													X				
	Oleaceae	<i>Fraxinus latifolia</i>	Oregon ash										X							
	Onagraceae	<i>Epilobium angustifolium</i>	Fireweed					X												
	Onagraceae	<i>Epilobium ciliatum</i>	Fringed willowherb									X								
S	Onagraceae	<i>Oenothera pallida</i>	Pale evening-primrose			X														
	Orchidaceae	<i>Epipactis gigantea</i>	Stream orchid									X								
	Pinaceae	<i>Pinus ponderosa</i>	Ponderosa pine	X																
	Plantaginaceae	<i>Plantago lanceolata</i>	Narrowleaf plantain					X				X	X	X						
	Plantaginaceae	<i>Plantago major</i>	Common plantain									X	X	X						
	Poaceae	<i>Agropyron dasystachyum</i>	Streambank wheatgrass									X	X							
	Poaceae	<i>Agrostis alba</i>	Redtop									X	X	X						
	Poaceae	<i>Agrostis tenuis</i>	Colonial bentgrass					X				X	X	X						
	Poaceae	<i>Aristida longiseta</i>	Fendler threeawn		X		X													
	Poaceae	<i>Bromus carinatus</i>	California brome	X																
x	Poaceae	<i>Bromus hordeaceus</i>	Soft brome		X		X													
	Poaceae	<i>Bromus inermis var. inermis</i>	Smooth brome		X		X	X				X	X	X						
	Poaceae	<i>Bromus japonicus</i>	Japanese brome	X	X	X	X	X												
	Poaceae	<i>Bromus tectorum</i>	Cheatgrass	X	X	X	X	X	X	X			X			X	X	X		
	Poaceae	<i>Dactylis glomerata</i>	Orchardgrass				X	X				X	X	X				X	X	
	Poaceae	<i>Danthonia unispicata</i>	Onespike danthonia		X		X													
	Poaceae	<i>Deschampsia danthonioides</i>	Annual hairgrass		X														X	
	Poaceae	<i>Elymus canadensis</i>	Canada wildrye				X					X	X	X					X	
Poaceae	<i>Elymus cinereus</i>	Basin wildrye				X						X	X		X					

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				Upland Vegetation					Upland Rock		Riparian and Wetland Vegetation					Littoral Zone - Wash			Bare-Disturbed-Eroded	
Status ¹	Family Name	Scientific Name	Common Name	Tree Dominated	Shrub Dominated		Herb/Grass dominated	Weedy Cover Types	Rock Talus	Rock Outcrop	Mud Flats	Emergent Wetland	Riparian Shrub	Riparian Deciduous Tree	Open Water	Wash	Gravel Bar	Rocky Shore	Eroded Bank Disturbed	
				Conifer, Shrub	Steppe	Shrub Sand	Grass													
R1	Poaceae	<i>Elymus elymoides</i>	Squirreltail	X	X															
	Poaceae	<i>Elymus glaucus</i>	Blue wildrye									X								
	Poaceae	<i>Festuca arundinacea</i>	Tall fescue									X				X				
	Poaceae	<i>Festuca idahoensis</i>	Idaho fescue	X	X															
	Poaceae	<i>Festuca pratensis</i>	Meadow ryegrass				X	X												
	Poaceae	<i>Festuca rubra</i>	Red fescue									X	X							
	Poaceae	<i>Glyceria elata</i>	Fowl mannagrass									X								
	Poaceae	<i>Glyceria striata</i>	Fowl mannagrass									X								
	Poaceae	<i>Hierochloa odorata</i>	Vanilla grass									X								
	Poaceae	<i>Hordeum jubatum</i>	Foxtail barley									X?								
	Poaceae	<i>Koeleria cristata</i>	Prairie junegrass		X															
	Poaceae	<i>Leersia oryzoides</i>	Rice cutgrass									X								
	Poaceae	<i>Muhlenbergia asperifolia</i>	Scratchgrass									X				X				
	Poaceae	<i>Oryzopsis hymenoides</i>	Indian ricegrass	X	X	X														
	Poaceae	<i>Panicum occidentale</i>	Western panicgrass									X	X							
	Poaceae	<i>Panicum scribnerianum</i>	Scribner's rosette grass									X	X							
	Poaceae	<i>Phalaris arundinacea</i>	Reed canarygrass									X	X	X			X	X		
	Cx	Poaceae	<i>Phleum pratense</i>									X								
ST	Poaceae	<i>Poa bulbosa</i>	Bulbous bluegrass													X	X			
	Poaceae	<i>Poa compressa</i>	Canada bluegrass									X	X	X			X			
	Poaceae	<i>Poa cusickii</i>	Cusick's bluegrass		X															
	Poaceae	<i>Poa juncifolia</i>	Sandberg bluegrass		X		X					X	X	X						
	Poaceae	<i>Poa pratensis</i>	Kentucky bluegrass		X							X	X	X				X		
	Poaceae	<i>Poa secunda</i>	Sandberg bluegrass	X	X	X				X										
	Poaceae	<i>Pseudoroegneria spicata</i>	Bluebunch wheatgrass		X	X				X						X				
	Poaceae	<i>Schizachyrium scoparium</i>	Little bluestem				X													
	Poaceae	<i>Sporobolus cryptandrus</i>	Sand dropseed		X	X	X													
	Poaceae	<i>Stipa comata</i>	Needle and thread		X	X	X													
	Poaceae	<i>Stipa occidentalis</i>	Western needlegrass		X	X				X										
	Poaceae	<i>Stipa thurberiana</i>	Thurber's needlegrass		X															
	Poaceae	<i>Vulpia microstachys</i>	Small fescue							X						X				
	Poaceae	<i>Vulpia sp.</i>	Fescue				X	X												
	Polemoniaceae	<i>Collomia grandiflora</i>	Grand collomia		X															
	Polemoniaceae	<i>Collomia linearis</i>	Tiny trumpet		X		X	X												
	Polemoniaceae	<i>Gilia aggregata</i>	Scarlet gilia					X		X										
	Polemoniaceae	<i>Gilia sinuata</i>	Rosy gilia													X				
B	Polemoniaceae	<i>Leptodactylon pungens</i>	Granite prickly phlox		X	X														
	Polemoniaceae	<i>Phlox longifolia</i>	Longleaf phlox		X															
	Polygonaceae	<i>Eriogonum cf. compositum</i>	Arrowleaf buckwheat		X	X														
	Polygonaceae	<i>Eriogonum heracleoides</i>	Parsnipflower buckwheat		X	X			X											
	Polygonaceae	<i>Eriogonum niveum</i>	Snow buckwheat		X	X	X	X		X						X	X	X		
	Polygonaceae	<i>Polygonum amphibium</i>	Water knotweed									X			X					
	Polygonaceae	<i>Polygonum aviculare</i>	Prostrate knotweed					X												
	Polygonaceae	<i>Polygonum cuspidatum</i>	Japanese knotweed					X												
	Polygonaceae	<i>Polygonum douglasii</i>	Douglas' knotweed					X												
	Polygonaceae	<i>Rumex acetosella</i>	Common sheep sorrel					X												
x	Polygonaceae	<i>Rumex crispus</i>	Curly dock									X								

Appendix F. Plant Species List by Cover Type Compiled During Botanical Surveys Conducted in 2005 at the Well Hydroelectric Project Study Area.

Status ¹	Family Name	Scientific Name	Common Name	Tree Dominated Conifer, Conifer Shrub	Upland Vegetation		Herb/Grass dominated Weedy Cover Types	Upland Rock		Riparian and Wetland Vegetation				Littoral Zone - Wash			Bare-Disturbed- Eroded			
					Shrub Dominated Steppe	Shrub Sand		Rock Talus	Rock Outcrop	Mud Flats	Emergent Wetland	Riparian Shrub	Riparian Deciduous Tree	Open Water	Wash	Gravel Bar	Rocky Shore	Eroded Bank	Disturbed	
R1	Polygonaceae	<i>Rumex venosus</i>	Veiny dock																	X
	Potamogetonaceae	<i>Potamogeton crispus</i>	Curly pondweed												X					
	Primulaceae	<i>Centunculus minimus</i>	Chaffweed							X										
	Primulaceae	<i>Dodecatheon cusickii</i>	Cusick's shootingstar		X															
	Primulaceae	<i>Lysimachia ciliata</i>	Fringed loosestrife									X								
	Primulaceae	<i>Lysimachia thyrsoiflora</i>	Tufted loosestrife									X								
	Ranunculaceae	<i>Clematis ligusticifolia</i>	Western white clematis		X			X												
	Ranunculaceae	<i>Delphinium nuttallianum</i>	Twolobe larkspur	X																
	Ranunculaceae	<i>Ranunculus cymbalaria</i>	Alkali buttercup										X							
	Ranunculaceae	<i>Ranunculus repens</i>	Creeping buttercup										X							
x	Rosaceae	<i>Amelanchier alnifolia</i>	Saskatoon serviceberry	X									X	X						
	Rosaceae	<i>Crataegus columbiana</i>	Black hawthorn										X							
	Rosaceae	<i>Crataegus douglasii</i>	Black hawthorn										X							
	Rosaceae	<i>Morus alba</i>	White mulberry					X					X	X						
	Rosaceae	<i>Potentilla anserina</i>	Silverweed cinquefoil								X		X	X		X	X			
	Rosaceae	<i>Prunus virginiana</i>	Chokecherry						X				X							
	Rosaceae	<i>Purshia tridentata</i>	Antelope bitterbrush	X	X															
	Rosaceae	<i>Rosa multiflora</i>	Multiflora rose										X	X						
	Rosaceae	<i>Rosa nutkana</i>	Nootka rose										X							
	Rosaceae	<i>Rosa woodsii</i>	Woods' rose					X				X	X	X						
x	Rosaceae	<i>Rubus discolor</i>	Himalayan blackberry																	
	Rosaceae	<i>Rubus leucodermis</i>	Whitebark raspberry																	
x	Rubiaceae	<i>Galium aparine</i>	Stickywilly	X																
	Rubiaceae	<i>Galium sp.</i>	Bedstraw																	
	Salicaceae	<i>Populus alba</i>	White poplar				X							X						X
		<i>Populus balsamifera ssp.</i>																		
	Salicaceae	<i>trichocarpa</i>	Black cottonwood										X	X						
	Salicaceae	<i>Populus deltoides</i>	Eastern cottonwood											X						
	Salicaceae	<i>Populus tremuloides</i>	Quaking aspen											X						
	Salicaceae	<i>Salix babylonica</i>	Weeping willow											X						
	Salicaceae	<i>Salix bebbiana</i>	Bebb willow										X	X						
	Salicaceae	<i>Salix exigua</i>	Narrowleaf willow										X	X			X	X		
W	Salicaceae	<i>Salix lucida ssp. lasiandra</i>	Pacific willow										X							
	Santalaceae	<i>Comandra umbellata</i>	Bastard toadflax		X	X														
	Saxifragaceae	<i>Heuchera cylindrica</i>	Roundleaf alumroot		X															
	Saxifragaceae	<i>Lithophragma parviflora</i>	Smallflower woodland-star	X	X															
	Saxifragaceae	<i>Saxifraga integrifolia</i>	Wholeleaf saxifrage		X															
	Scrophulariaceae	<i>Castilleja thompsonii</i>	Thompson's Indian paintbrush		X															
	Scrophulariaceae	<i>Collinsia parviflora</i>	Maiden blue eyed Mary	X	X															
	Scrophulariaceae	<i>Gratiola neglecta</i>	Clammy hedgehyssop							X										
	Scrophulariaceae	<i>Limosella acaulis</i>	Owyhee mudwort							X	X									
	Scrophulariaceae	<i>Limosella aquatica</i>	Water mudwort							X										
B-des	Scrophulariaceae	<i>Linaria dalmatica</i>	Dalmatian toadflax		X	X	X	X								X	X			
	Scrophulariaceae	<i>Mimulus guttatus</i>	Seep monkeyflower									X								
	Scrophulariaceae	<i>Orobanche fasciculata</i>	Clustered broomrape		X	X														
	Scrophulariaceae	<i>Penstemon deustus var. d.</i>	Scabland penstemon						X	X										

Appendix F. Plant Species List by Cover Type Compiled During Botanical Surveys Conducted in 2005 at the Well Hydroelectric Project Study Area.

Status ¹	Family Name	Scientific Name	Common Name	Upland Vegetation					Upland Rock		Riparian and Wetland Vegetation				Littoral Zone - Wash			Bare-Disturbed-Eroded		
				Tree Dominated Conifer, Conifer Shrub	Shrub Dominated		Herb/Grass dominated		Rock Talus	Rock Outcrop	Mud Flats	Emergent Wetland	Riparian Shrub	Riparian Deciduous Tree	Open Water	Wash	Gravel Bar	Rocky Shore	Eroded Bank	Disturbed
					Shrub Steppe	Shrub Sand	Herb Grass	Weedy Cover Types												
		<i>Penstemon glandulosus</i> v.																		
	Scrophulariaceae	<i>chelanensis</i>	Stickystem penstemon					X	X											
	Scrophulariaceae	<i>Penstemon richardsonii</i>	Cutleaf beardtongue						X											
x	Scrophulariaceae	<i>Verbascum thapsus</i>	Common mullein		X										X	X	X		X	
x	Simaroubaceae	<i>Ailanthus altissima</i>	Tree of heaven										X							
	Solanaceae	<i>Solanum dulcamara</i>	Climbing nightshade										X							
	Typhaceae	<i>Typha latifolia</i>	Broadleaf cattail							X		X	X							
x	Ulmaceae	<i>Ulmus pumila</i>	Siberian elm									X	X		X					
	Urticaceae	<i>Urtica dioica</i>	Stinging nettle									X	X							
	Verbenaceae	<i>Verbena bracteata</i>	Bigbract verbena				X													
	Verbenaceae	<i>Verbena hastata</i>	Swamp verbena				X					X	X							
	Violaceae	<i>Viola nephrophylla</i>	Northern bog violet									X								
	Vitaceae	<i>Parthenocissus quinquefolia</i>	Virginia creeper				X					X	X							
	Vitaceae	<i>Vitis vinifera</i>	Wine grape				X													

1. x = non-native species; Washington State Noxious Weeds: B or B-des = Class B or Class B designated, C = Class C; Washinton Natural Heritage Program: W = watch list, R1 = review 1 list, ST = state threatened