Henry M. Jackson Hydroelectric Project

(FERC No. 2157)

Amphibian Survey

Final Technical Report
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LIST OF ACRONYMS

District ..... Public Utility District No. 1 of Snohomish County
F ..... Fahrenheit
FC ..... Federal candidate (species)
FCo ..... Federal species of concern
FERC ..... Federal Energy Regulatory Commission
FSS ..... Forest Service sensitive species
ft ..... foot, feet
GIS ..... Geographic Information System
GPS ..... Global Positioning System
mi ..... mile, miles
O&M ..... Operation and maintenance
PHS ..... Washington State Priority Habitat and Species
Project ..... Jackson Hydroelectric Project
R ..... River
RM ..... River Mile
SE ..... Washington State endangered (species)
SF ..... South Fork
SM ..... Washington State monitor (species)
SVL ..... Snout-vent length
TPH ..... Total Person Hours
USGS ..... United States Geological Survey
WDFW ..... Washington Department of Fish and Wildlife
WDG ..... Washington Department of Game
WDOE ..... Washington Department of Ecology
WHMP ..... Wildlife Habitat Management Plan

Amphibian Life Stages

A ..... adult
E ..... egg mass
J ..... juvenile
L ..... larval stage
H ..... heard (frog vocalization)
PA ..... paedomorphic adult (mature form that retains larval characteristics)

Species

BF ..... Bullfrog
CGS ..... Coastal giant salamander
CTF ..... Coastal tailed frog
NRLF ..... Northern red-legged frog
NWS ..... Northwestern salamander
PTF ..... Pacific treefrog
RSN ..... Rough-skinned newt

WT ..... Western toad

Survey Sites

Out.....Outside of formal study area
SL.....Spada Lake fluctuation zone
SR..... Sultan River downstream of Culmback Dam
WC..... WHMP Lake Chaplain Tract
WL .....WHMP Lost Lake Tract
WP..... WHMP Project Facility Lands Tract
WS.....WHMP Spada Lake Tract
WW..... WHMP Williamson Creek Tract

EXECUTIVE SUMMARY

Potential habitats for special status amphibians in areas closely associated with the Jackson Hydroelectric Project (Project) were identified, mapped, described, and surveyed in 2007 and 2008 per the requirements of Revised Study Plan 10 of the Project relicensing effort. The study area encompassed lands within the Project boundary and wetlands and riparian habitats within the Wildlife Habitat Management Plan (WHMP) lands, focusing on areas within or adjacent to the fluctuation zone of Spada Lake. It also included suitable amphibian habitat within the riparian corridor and wetlands along the Sultan River downstream of Culmback Dam, with emphasis on habitats where potential Project operation effects are most plausible. This study assessed the Project nexus based on amphibian use of habitats within the operational fluctuation zone of Spada Lake, flow-affected habitats along the Sultan River riparian corridor, and on WHMP lands where maintenance activities or Project-related recreation occurs.

Surveys were conducted on the following dates in 2007: April 3-4, 10-13, and 24; June 5-8; July 24-27; August 15-16; and September 11-13. In 2008 surveys were conducted on June 25-26, July 24, July 30-31, and August 22. A total of eight amphibian species were documented by the surveys, including six "pond-breeding" species (northwestern salamander, rough-skinned newt, western toad, Pacific treefrog, northern red-legged frog, and bullfrog) and two stream-associated species (coastal giant salamander and coastal tailed frog).

Northwestern salamander was documented at the greatest number of sites, followed by Pacific treefrog and northern red-legged frog. These three species were associated with wetlands of various size and complexity, including small, isolated pools, whereas rough-skinned newts were found only at several larger wetland complexes. Bullfrogs were found at two sites within the WHMP tracts, Lost Lake and Chaplain Creek Marsh, and at two sites in the Sultan River riparian corridor (old oxbow channel wetlands in the City of Sultan); these sites were also occupied by other pond-breeding species. Pond-breeding species did not occur in flowing water reaches within the Sultan River, but utilized adjacent pools, some of which are presumably recharged by the river during seasonal high flow periods.

Surveys revealed very few amphibian egg masses of two species (northwestern salamander and northern red-legged frog) in the Spada Lake fluctuation zone. Egg masses of these two species were found at only two sites in the fluctuation zone (only in 2007), and in numbers much smaller than observed at sites outside of the fluctuation zone. All of these egg masses were subsequently exposed by lowered reservoir water levels; this was followed by a long period of higher water, during which time no amphibians were found using the reservoir. The results suggest that breeding in the Spada Lake fluctuation zone is uncommon and unlikely to represent a substantial loss of reproductive effort for amphibian populations.

Coastal tailed frog, a special status species (WDFW monitored), was found at most of the surveyed perennial streams flowing into Spada Lake, and was also found at one site

(River Mile [RM] 14.4) in the Sultan River downstream of Culmback Dam, and in a tributary (RM 15.7) of the Sultan River. Occurrence of coastal tailed frog in the Sultan River may be constrained by the intermittent distribution of suitable habitats. Another special status species, western toad (WDFW monitored), was found on one occasion on the WHMP lands and at one site on WDNR land east of the Spada Lake Tract, although breeding was not documented at either site.

1.0 STUDY OBJECTIVES AND DESCRIPTION

This technical report presents the results of *Revised Study Plan 10: Amphibian Survey* filed with the Federal Energy Regulatory Commission (FERC) by the Public Utility District No. 1 of Snohomish County (District) on September 12, 2006, and approved by FERC on October 12, 2006. The report addresses the distribution and abundance of special-status amphibian species and suitable habitat associated with the Jackson Hydroelectric Project (Project) reservoir (Spada Lake), the Wildlife Habitat Management Plan (WHMP) lands, and the Project-affected reach of the lower Sultan River, and identifies possible Project operational effects on amphibians and their habitats.

The objectives of this study are to:

- Identify special status amphibians (i.e., federal or state listed species, species of concern, or candidate species) that could occur in the Project vicinity, based on their known or suspected ranges, habitat requirements, and documented occurrences.

- Map potential habitat for special status amphibians within the Project area, including the riparian corridor along the mainstem Sultan River between Culmback Dam and its confluence with the Skykomish River, the fluctuation zone of Spada Lake, and wetlands and riparian areas managed as part of the WHMP.

- Conduct field surveys to ascertain the presence, relative abundance, life history timing and distribution of amphibian species, targeting those with special status but documenting the occurrence of all amphibians observed.

- Develop a GIS database of amphibian occurrence, abundance, and habitat use.

2.0 BACKGROUND INFORMATION

This study, requested by Washington Department of Fish and Wildlife (WDFW) and Washington Department of Ecology (WDOE) to supplement information contained in the Pre-Application Document, was developed in consultation with tribes and agencies and is designed to provide current information on the distribution and abundance of amphibians and to identify any potential Project effects on these species. Project operation and maintenance (O&M) could have a measurable adverse direct or indirect effect on amphibians in any of three geographic areas:

1. Spada Lake operational fluctuation zone – If amphibians attempt to breed below or above the normal high water level of Spada Lake, egg masses or larvae could be exposed or deeply inundated by subsequent water level fluctuations;

2. Sultan River downstream of Culmback Dam – Amphibians utilizing instream habitats or wetlands adjacent to the river could be habitat limited by the existing flow regime; and

3. Other Project-associated lands – On WHMP lands and pipeline right-of-way, amphibians could potentially be affected where maintenance activities or Project-related recreation occurs.

Table 2-1 identifies amphibian species that have previously been reported from the study area and the sources documenting their occurrence, lists other potentially-occurring species, and summarizes general habitat associations. Much of the area addressed in this study was previously surveyed in 1979-1980 as part of the Fish and Wildlife Resource Studies conducted by Washington Department of Game (WDG) in preparation of Stage II of the Project (WDG and Eicher Associates 1982). Those surveys included wetland sites and streams around Spada Lake, and wetlands associated with Chaplain Creek and Marsh Creek. No other amphibian surveys are known to have been conducted, although District biologists periodically note incidental observations of amphibians at Project-associated wetlands and downstream of Culmback Dam.

No amphibian species federally listed as endangered or threatened or proposed for listing potentially occurs in the study area; however, four species monitored by the Washington State Priority Habitat and Species (PHS) database are addressed herein (Table 2-1). An information request of the database did not reveal any records of these species in the study area. One of the tracked species, Oregon spotted frog (*Rana pretiosa*) is state listed as endangered and is a federal candidate species. Historically, this species occurred throughout the Puget Sound lowlands and into the Cascade foothills. Currently, the only known extant populations are in Thurston and Klickitat counties (WDFW 1997).

Table 2-1. Species addressed in the Amphibian Survey.

Species and Status[1]	Habitat Associations	Study Area Occurrences
Coastal giant salamander *Dicamptodon tenebrosus*	Larvae and paedomorphic adults are aquatic in streams and mountain lakes; metamorphosed, terrestrial form is forest-dwelling.	Documented[2,3]
Northwestern salamander *Ambystoma gracile*	Larvae and paedomorphic adults occur in slow moving perennial streams, permanently or semi-permanently flooded wetlands, and lakes. Terrestrial form widespread in forest habitats.	Documented[2,3]
Long-toed salamander *Ambystoma macrodactylum*	Aquatic forms occur in slow moving streams, seasonal to permanently flooded wetlands, and lakes. Terrestrial form widespread in forest habitats and other areas.	No documented occurrences in study area
Rough-skinned newt *Taricha granulosa*	Breeds in slow moving streams, ponds, and lakes. Adults are terrestrial in forests and often diurnally active.	Documented[2,3]
Western red-backed salamander *Plethodon vehiculum*	Terrestrial species often associated with large woody debris, rocks, and other cover objects. No free-living larval form.	Documented[2]

Species and Status[1]	Habitat Associations	Study Area Occurrences
Ensatina *Ensatina eschscholtzii*	Terrestrial species often associated with large woody debris and other cover objects. No free-living larval form.	Documented[2,3]
Coastal tailed frog[FCo, SM] *Ascaphus truei*	Larval forms entirely aquatic in perennial, clear, rocky, cool-water streams; adults under rocks or wood on stream edges, foraging at night in streamside areas and in adjacent moist forests.	Documented[2]
Western toad[FCo, SM] *Anaxyrus boreas*	Breeds in marshes, small lakes, and ponds; toads may travel long distances from breeding sites and use a variety of terrestrial habitats.	Documented[2]
Pacific treefrog *Pseudacris regilla*	Breeds in marshes, ponds, pools, stream backwaters, and shallow lake edges; frogs can be found far from breeding sites.	Documented[2,3]
Northern red-legged frog *Rana aurora*	Breeds in marshes, ponds, bogs, and slow moving streams, usually at lower elevations; frogs often occur in moist woodlands adjacent to streams.	Documented[2,3]
Cascades frog[FCo, SM] *Rana cascadae*	Breeds in pools, ponds, bogs, small lakes, and marshy stream edges, generally at moderate (about 2,000 ft) to higher elevations. Usually remains close to water.	No documented occurrences in study area
Oregon spotted frog[FC, SE, FSS] *Rana pretiosa*	Highly aquatic, associated with large wetland complexes. Breeds in open, shallow, seasonally flooded, emergent wetlands. Often over-winters in permanently flooded areas.	No documented occurrences in study area
Bullfrog *Lithobates catesbeianus*	Highly aquatic, associated with permanently flooded ponds, lakes, reservoirs, deep marshes, and sluggish streams, particularly with at least some warm water areas and emergent or submerged vegetation.	Documented[3]

[1]Status: FCo = Federal species of concern, FC = Federal candidate, SM = Washington state monitor, SE = Washington state endangered, FSS = Forest Service sensitive species.
[2]Occurrences documented by WDG and Eicher (1982).
[3]Documented by District biologists or City of Everett Watershed Patrol.

3.0 METHODS

3.1 Habitat Mapping and Selection of Survey Sites

The study area encompasses the riparian corridor along the mainstem Sultan River between Culmback Dam and its confluence with the Skykomish River, the fluctuation zone of Spada Lake, wetlands and riparian areas managed as part of the WHMP, and wetlands associated with the buried power pipeline right-of-way. Potential habitats for the target species were preliminarily identified from the following sources of existing information: aerial geo-rectified color photographs (2006, National Agriculture Imagery Program; 2003, Sultan Orthophotos provided by District), aerial videography of the Sultan River (2003, Sultan River Aerial Video), US Geological Survey (USGS) topographic maps, National Wetland Inventory maps, wetland mapping and characterization of wetlands being conducted by the District on the WHMP lands under *Study Plan 9: Wetland Surveys*, and associated District field photographs. The first year results of *Study Plan 18: Riverine, Riparian and Wetland Habitat Assessment in the Sultan River below Culmback Dam* were also examined for additional wetland areas that might merit surveys; however, no additional wetland areas were identified. Given the broad extent of potential terrestrial habitats for amphibians, only wetland and stream-associated habitats were mapped. Amphibian habitat mapping was further refined after field reconnaissance of the study area in April 2007. Survey sites in amphibian habitat areas were selected based on the following criteria:

- apparent suitability to support the target species; that is, lentic (still-water or wetland) habitats suitable for western toad, Cascades frog, or Oregon spotted frog; or streams suitable for coastal tailed frog;

- sites that illustrate representative conditions for amphibians in the study area, as well as sites of unusually high quality; and

- thorough coverage of areas with the highest potential for Project effects.

3.2 Field Surveys

The amphibian survey was based on the "toolbox approach" described by Olson and Leonard (1997). Under this approach the site specific application of search methods during each survey period is designed to be most appropriate to the types of habitats, species, and life stages that potentially occur, as well as the specific objectives at that time and location. Numerous survey methods have been successfully applied to documenting the presence, distribution, relative abundance, and life history timing of lentic-breeding and lotic (i.e., flowing water) amphibian species in the Pacific Northwest. These include a variety of active search (e.g., "visual encounter," net capture, and searches under cover objects) and passive search (e.g., aquatic funnel traps) techniques, and sampling protocols (e.g., area-constrained sampling).

The survey approach emphasized sampling of representative habitats following reconnaissance-level characterization of habitats (Fellers 1997). Depending on the extent of suitable habitats, entire or partial-area surveys were conducted. Field surveys were conducted in appropriate seasons for the target species and under suitable temperature and moisture conditions. Multiple survey visits, including visits in 2007 and 2008, were performed to account for seasonal differences in detection for certain species and to describe timing of major life history events. However, these objectives did not require repeated visits to all sites during all survey periods. In addition, because the distribution of suitable habitats within a site often changed as water levels receded or rose, it would have been impractical and ineffective to repeat searches of a set transect or plot.

Visual encounter surveys were conducted following procedures generally described by Heyer et al. (1994), and specifically applied to Northwestern habitats and species by Olson et al. (1997). Surveys in April 2007 emphasized searches for egg masses of early breeding species, larvae of species that over-winter, and adult or juvenile life stages. During surveys in June and July of both years it was anticipated that larvae of most species would be detectable, with later surveys more likely to document metamorphosed individuals.

Because amphibian larvae are often under-detected by visual searches in dark, clouded, or vegetation-filled water, surveys for larvae usually included rigorous dip-netting or deployment of aquatic funnel traps. Collapsible aquatic funnel traps ("minnow traps") were an adjunct to active searches and increased the number of sites that could be surveyed. Trapping sometimes also reveals species or life stages (e.g., large larvae) that may escape detection by other means (Willson and Dorcas 2003). Traps were typically deployed in the afternoon or early evening, situated in a variety of suitable microhabitats, and were secured to vegetation or sticks as needed to maintain an air pocket in the trap (a precaution to prevent mortality, although amphibians rarely drown in funnel traps even if completely submerged). After a night in place, traps were pulled and the contents, including invertebrates and fish, were tabulated and released.

Stream surveys for aquatic amphibian species generally followed sampling procedures described in Bury and Corn (1991) and Hawkins and Crisafulli (1994). Within small streams, rocks were carefully lifted and set aside while one or more nets were held immediately downstream to capture any amphibians swept downstream. In many instances, exposed amphibians remained more-or-less in place and were tallied without being captured. Larvae of one of the target species for instream searches, coastal tailed frog, adhere to rocks with an oral disc, but typically detach as rocks are moved. Stream surveys were conducted in rocky, perennial tributaries of Spada Lake, at locations in the lower Sultan River, and in suitable tributaries of the Sultan River. Instream surveys were conducted in 2007 between August 15 and September 13, when flows were likely to be lowest. Surveys were not repeated in 2008 because basic questions of presence and distribution of species were adequately addressed in the 2007 effort. The Hawkins and Crisafulli method differs from the basic instream search method in that a seine is secured at the lower end of the habitat unit before the substrates are removed in a band across the stream upstream of the seine. The method assumes that larvae will be swept into the seine where they can be identified and tallied.

Survey site conditions were documented by photographs during each survey visit. Geographic coordinates representing the extent of areas surveyed (including placement of aquatic funnel traps) and other findings were determined by a hand-held GPS unit (Thales MobileMapper CE or Garmin GPSMAP 60CSx) and entered into a GIS database. At each survey site the start and end time was recorded to quantify search effort; Total Person Hours (TPH) represented the total time of the search multiplied by the number of persons searching independently. The number of aquatic funnel traps deployed at a site was also recorded, as well as the number of dip-net sweeps (ideally, a sweep ascribes a swirling horizontal figure-eight through the water column). Survey results were tallied by the total number of each life stage of each species observed. Weather conditions, including air and water temperature, were also recorded during surveys. Data were compiled and added to a geodatabase provided by the District to document species occurrence and develop species-habitat associations within the Project area. Survey area locations and survey results were defined in the database.

Prior to initiating field surveys, the lead investigator obtained a Washington State Scientific Collection Permit, which also listed other survey participants, and all of the surveyors adhered to the guidelines stipulated in the permit. All specimens were released alive at collection sites immediately after data collection. Species were identified in the field based on information contained in Corkran and Thoms (1996), Jones et al. (2006), Altig et al. (2006), and Altig et al. (undated), as well as personal experience of the lead investigator. Larval specimens were measured with a ruler or visually estimated for snout-vent length (SVL), the distance from the tip of the snout to the anterior margin of the vent (cloacal opening). Representative and unusual specimens (e.g., atypically large larvae) were photographed. Scientific and common names of amphibians discussed in this report are consistent with Jones et al. (2005) and more recent revisions presented in Frost et al. (2006) and Recuero (2006).

4.0 RESULTS

4.1 Overview

Results are organized below according to the following geographic areas. Sites in the Spada Lake fluctuation zone (approximately the area at or below 1,445 feet msl, the normal full pool surface elevation) are designated with the prefix "SL." WHMP Lands are divided by the five management units ("Tracts"): Spada Lake Tract ("WS"), Williamson Creek Tract ("WW"), Lake Chaplain Tract ("WC"), Lost Lake Tract ("WL"), and Project Facility Lands ("WP"). Spada Lake Tract wetlands outside of the Spada Lake fluctuation zone are addressed separately from Spada Lake tributaries that did not contain lentic wetlands. Instream and off-channel habitats along the Sultan River riparian corridor downstream of Culmback Dam are designated "SR." Sites SR-1 to SR-4 represent stream reaches with sub-sites representing instream sampling points and identified off-channel habitats in the riparian corridor (e.g., SR-1A). A site on WDNR land just east of the Spada Lake Tract was also investigated because of amphibian sightings of interest reported by the City of Everett Watershed Patrol; this site was designated as "Out-1."

Detailed maps of all sites and sub-sites, depicting the extent of areas surveyed, locations of aquatic funnel traps ("traplines"), areas determined to be suitable amphibian habitats, and species found at each site, are presented in Appendix A. Because many of the sites are also addressed in the technical report for Revised Study Plan 9 ("Wetland Surveys"), a cross-reference for site designations in the two studies is included in Appendix A. Photographs illustrating site conditions and examples of the species found are presented in Appendix B.

4.2 Spada Lake Fluctuation Zone

Surveys were conducted at seven sites in the Spada Lake fluctuation zone in 2007 (Figure 4-1, Table 4-1). Sites corresponded to areas mapped as wetlands by the District and other smaller, field-identified areas that appeared at least marginally suitable for lentic-breeding amphibians. Only two sites (SL-2 and SL-3) had evidence of amphibian use (Table 4-2), both early in the survey period when a small number of egg masses of two species (northwestern salamander [*Ambystoma gracile*] and northern red-legged frog [*Rana aurora*]) were found. No amphibians of any life stage were documented in the Spada Lake fluctuation zone after initial surveys in April.

During the 2007 survey period, Spada Lake surface water elevation fluctuated by 30.2 vertical feet (see Figure 4-2). This fluctuation was evident at site SL-2 where egg masses were progressively exposed by declining water levels in April soon after deposition. By April 24 all observed egg masses had been exposed. Water levels then rose to a peak in June and were too deep to permit meaningful surveys at most of the survey sites. The lake level gradually dropped during the remainder of the survey period, permitting surveys at some sites in July and September, when the target species was western toad (*Anaxyrus boreas*), a relatively late breeding species. Aquatic funnel trapping was

conducted at one site (SL-2) in July; the only vertebrates observed or trapped at the site were brown bullhead (*Ameiurus nebulosus*) fry, which were present in dense schools at this site.

Lake water levels were too deep for amphibian surveys in the fluctuation zone in 2008. Spada Lake was at 1,409 ft elevation on May 1 and rose to 1,449 by the end of May (Figure 4-3), after which water levels remained too high for the amphibian survey. It was possible and would not have been meaningful to replicate the amphibian survey schedule in 2008 because winter conditions in 2008 included a deep and persistent snow pack that delayed amphibian breeding and access for surveys (see Section 4.3.1.1).

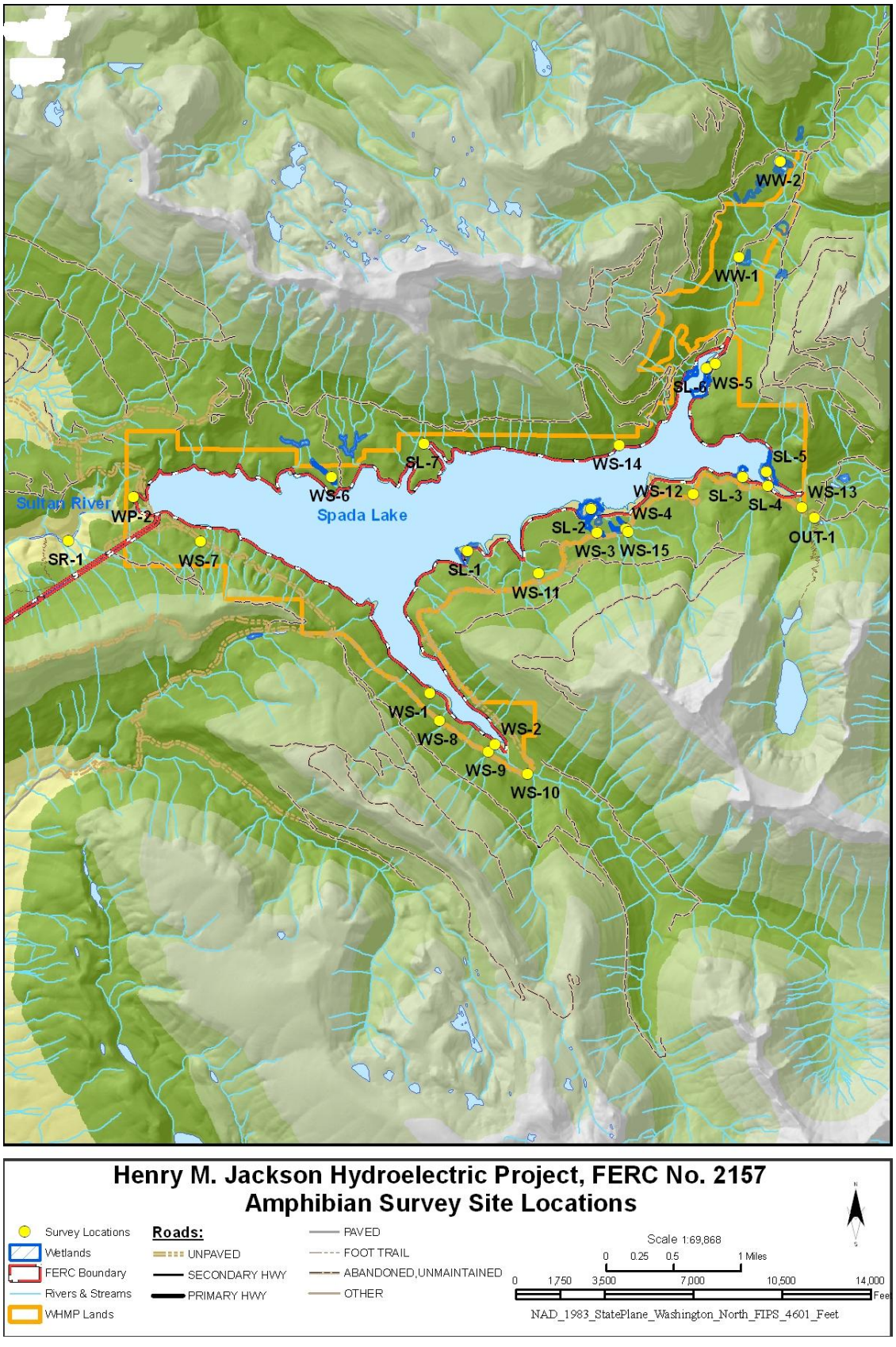

Figure 4-1 Amphibian survey site locations. (Page 1).

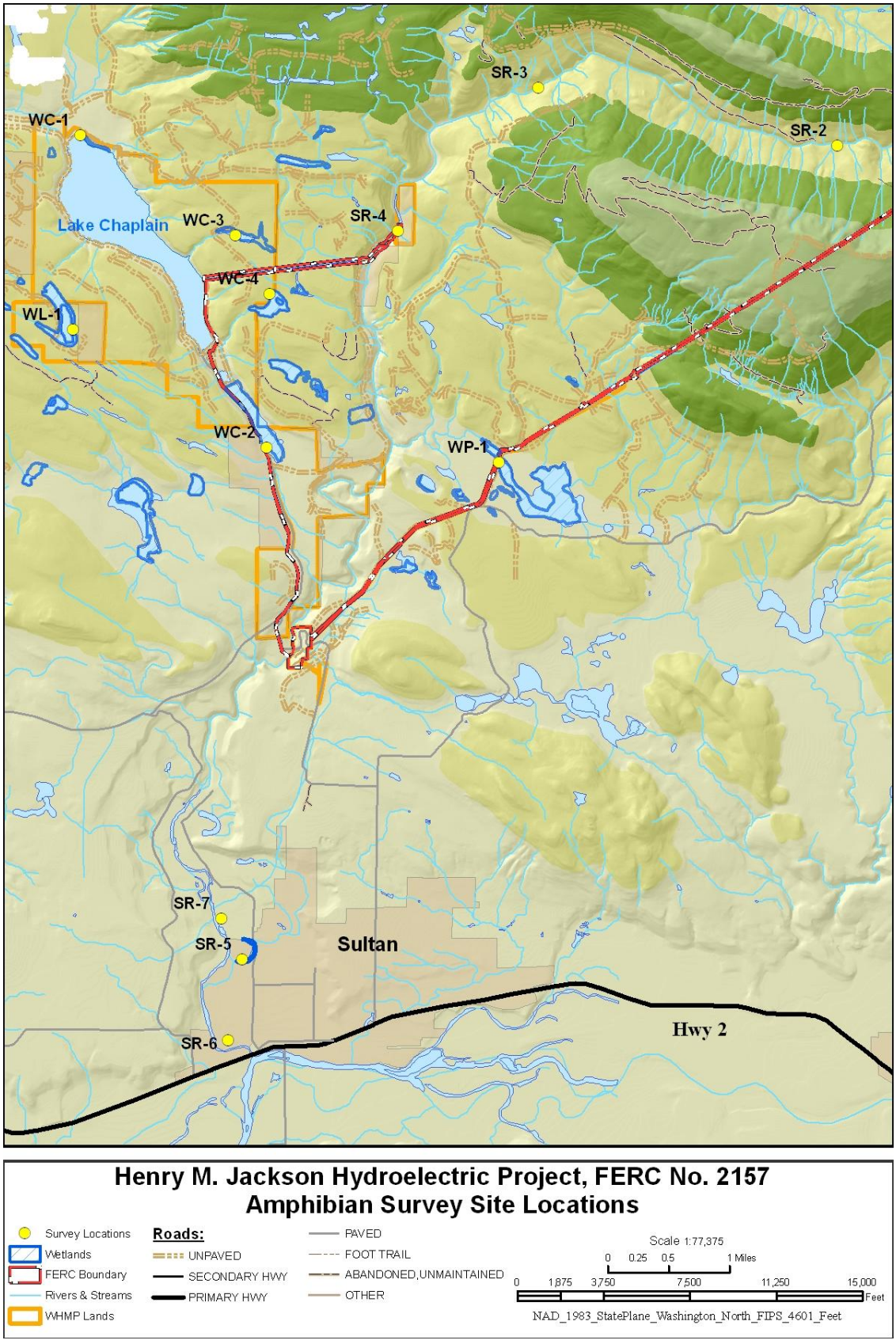

Figure 4-1. Amphibian survey site locations. (Page 2).

Table 4-1. Amphibian Survey Sites Within Spada Lake Fluctuation Zone

Site	Site Description
SL-1	Emergent wetland between 2 south shore coves. Water mostly less than 2 ft deep when examined and ground surface relatively hard, suggesting site is not flooded for prolonged periods.
SL-2	Lacustrine fringe emergent wetland west of South Shore (Recreation Site 3) boat launch. Much of the site is gently sloping. No perched pools; the only areas that retain water when lake level recedes are associated with the channel and mouth of a small drainage.
SL-3	Lacustrine fringe shrub-scrub and emergent wetland on south shore. No evident depressions and not associated with any significant drainage.
SL-4	Lacustrine fringe (area small and not mapped as a wetland) with emergent and limited scrub-shrub elements. Emergent area estimated to be about 1441.0-1442.0 ft elevation.
SL-5	Lacustrine fringe emergent and shrub-scrub wetland on North Fork Arm. Includes areas of deep water, but no perched pools.
SL-6	Lacustrine fringe emergent and shrub-scrub wetland on Williamson Creek Arm. Estimated elevation mostly above 1440 ft. No perched pools.
SL-7	Cove on north shore terminating at a small drainage. Beaver dam on the drainage forms a deep pool; no significant associated emergent vegetation.

Table 4-2. Results of Amphibian Surveys in Spada Lake Fluctuation Zone

Site	Date	Elevation[1]	Effort[2]	Survey Results[3]
SL-1	6/05/07	1446.3	0.67 TPH 20 sweeps	No amphibians. Found few invertebrates.
SL-2	4/13/07	1439.3	1.75 TPH	Egg masses: 6 NWS, 4 exposed out of water, 2 in shallow water; 2 NRLF less than 12 inches below surface.
	4/24/07	1434.6	1.00 TPH	The same 2 NRLF masses and one other found exposed. No other eggs found.
	6/05/07	1446.3	NA	Water too deep to perform search.
	7/24/07	1444.5	0.67 TPH 20 sweeps	No amphibians. Found few invertebrates. Observed many schooling brown bullhead fry.
	7/25/07	1444.2	20 traps	No amphibians. Captured hundreds of brown bullhead fry and 3 sub-adult brown bullheads.
	9/11/07	1418.4	0.67 TPH	No amphibians.
	6/25/08	1446.2	NA	Water too deep to perform search.
	7/24/08	1443.9	NA	Water too deep to perform search.
SL-3	4/11/07	1441.0	0.50 TPH	Egg masses: 3 NWS in a small freshet above reservoir water surface.
	6/05/07	1446.3	NA	Water too deep to perform search.
	7/25/07	1444.2	1.00 TPH 40 sweeps	No amphibians. Found few invertebrates.
SL-4	4/11/07	1441.0	0.17 TPH	No amphibians.
SL-5	4/11/07	1441.0	0.50 TPH	No amphibians.

Site	Date	Elevation[1]	Effort[2]	Survey Results[3]
SL-6	4/11/07	1441.0	0.40 TPH	No amphibians.
SL-7	4/11/07	1441.0	0.25 TPH	No amphibians.
	6/05/07	1446.3	0.12 TPH	No amphibians. Beaver dam inundated.

[1]Reservoir water surface elevation in feet.
[2]TPH = "Total Person Hours" (total search time multiplied by number of surveyors searching independently), sweeps = number of dip net sweeps, traps = number of aquatic funnel traps.
[3]NWS =Northwestern salamander, NRLF = Northern red-legged frog.

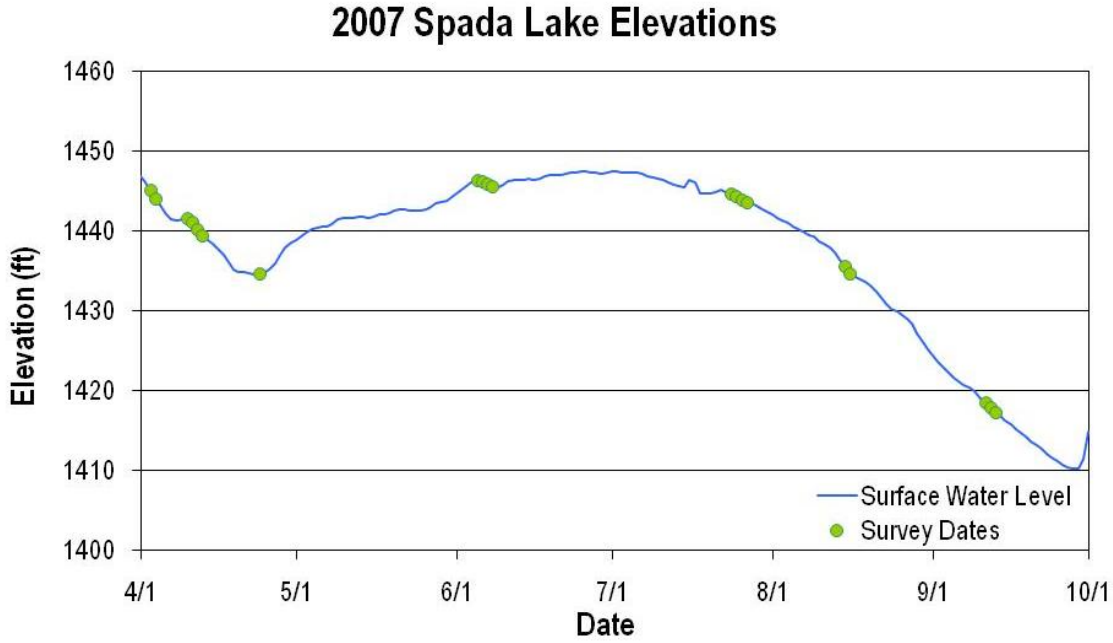

Figure 4-2. Water surface elevations at Spada Lake in 2007

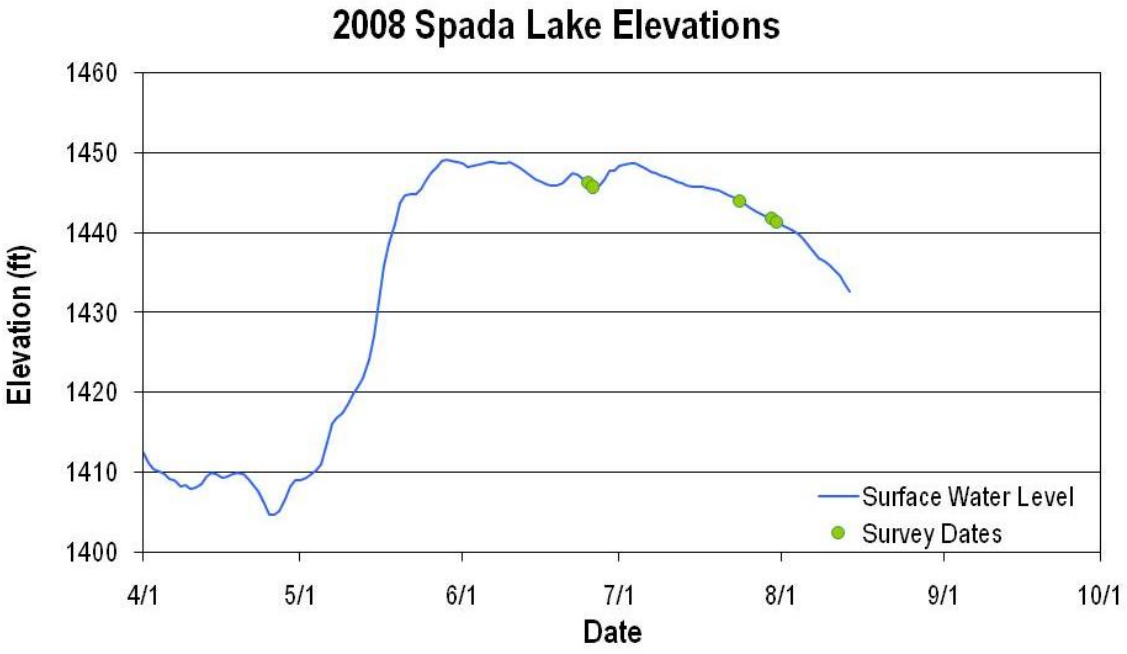

Figure 4-3. Water surface elevations at Spada Lake in 2008

4.3 WHMP Lands

4.3.1 Spada Lake and Williamson Creek Tracts

4.3.1.1 Spada Lake Tract Wetlands

On the WMHP lands of the Spada Lake Tract outside of the Spada Lake fluctuation zone, six sites (designated with the prefix "WS") were identified as potential amphibian habitats (Figure 4-1, Table 4-3). All of the sites were associated with small perennial streams where flows were impounded by beaver dams or an abandoned logging road. One site (apparent recent impoundment) was not evidently used by amphibians (Table 4-4). Surveys in multiple seasons were conducted at most of the sites to determine timing of major life history events, with the greatest number of surveys at site WS-3. Aquatic funnel traps were deployed at sites WS-3 and WS-4. Because site WS-6 is remote, not subject to possible Project O&M related effects, and is unlikely to be affected by Project-related recreation, survey efforts were limited to two visits.

Two sites with limited habitat were each used for breeding by a single species: one site by northwestern salamander and the other by northern red-legged frog (Table 4-4). In contrast, the three largest wetland complexes were each used by four species: northwestern salamander, rough-skinned newt (*Taricha granulosa*), Pacific treefrog (*Pseudacris regilla*), and northern red-legged frog. An adult western toad (*Anaxyrus boreas*) was detected at WS-4 on June 25, 2008; however, no eggs or larvae were found on that date or subsequently.

A reconnaissance-level examination of site WS-4 on April 3, 2007 revealed freshly deposited egg masses of northwestern salamander and northern red-legged frog, whereas newly laid Pacific treefrog eggs were found on April 10. It is not known exactly when rough-skinned newts bred at WS-4 or other wetlands on the Spada Lake Tract (rough-skinned newt eggs are laid individually and are difficult to find), but may have bred as late as July at WS-3 and WS-4, based on the small size of larvae found in September. It is possible that larvae of this species over-winter before metamorphosing in this area (large rough-skinned newt larvae were found on July 25 at WS-6, including one larva beginning metamorphosis). Northwestern salamander larvae at WS-3, WS-4, and WS-6 exhibited a bi-modal distribution indicative of over-wintering. No definitively paedomorphic (adults retaining gills and other larval features) salamanders were found in 2007; however, the largest individuals on September 12 were probably in their third year, which suggests paedomorphic development. Most northern red-legged frog and Pacific treefrog larvae evidently metamorphosed prior to the September 2007 survey period.

Surveys on the Spada Lake Tract in 2008 (Table 4-4) were limited to two sites (WS-3 and WS-4) and began later because of prolonged snow cover on South Shore Road. Based on the developmental stages of egg masses observed on the first survey (June 25), the breeding period for northwestern salamanders and northern red-legged frogs probably began no earlier than late May in 2008 and likely extended into early June. Northern red-legged frog egg masses on June 25 had mostly already hatched, although many hatchlings still clung to the decomposing masses. Northwestern salamander eggs were generally in

middle stages of development (by July 24 the last eggs were hatching). Other observations on June 25 were a freshly laid Pacific treefrog egg mass, several adult rough-skinned newts in breeding condition, and a single larval rough-skinned newt at WS-4 (13 mm SVL), confirming that larvae of this species over-winter here. The 2008 survey also conclusively documented the presence of both the paedomorphic and terrestrial form of northwestern salamander at WS-4. The population at WS-3 is probably also comprised of these two forms: two size classes of larvae were found on July 31 (13 larvae 33-49 mm SVL and two large larvae, 70-74 mm SVL), suggesting second and third year larvae respectively, and two larvae in the smaller size class had reduced gills (i.e., were undergoing metamorphosis).

Table 4-3. Amphibian Survey Sites on WHMP Lands (Spada Lake Tract)

Site	Site Description
WS-1	Beaver impoundment on west shore of SF Sultan R arm of Spada Lake. Site shows signs that one or more beaver dams failed earlier. Two small pools present, with scant emergent vegetation.
WS-2	Beaver impoundments on west shore of SF Sultan R arm of Spada Lake, forming several pools. Evidently recently constructed.
WS-3	Beaver impoundments in wetland that crosses Recreation Site 3 Access Rd and extends nearly to Spada Lake fluctuation zone. Large and small pools, permanently flooded, but much reduced in late summer. Emergent and scrub-shrub areas around meandering channel.
WS-4	Series of beaver impoundments along small stream that crosses South Shore Rd east of Recreation Site #3 and associated emergent and scrub-shrub wetlands; permanently flooded, but much reduced in late summer. Includes ditch on south side of road.
WS-5	Small pool formed where old logging road partially impedes flow of small stream. Almost no associated emergent vegetation (under forest canopy).
WS-6	Series of beaver impoundments along small stream north of Spada Lake and associated emergent and scrub-shrub wetlands.

Table 4-4. Results of Amphibian Survey Sites on WHMP Lands (Spada Lake Tract)

Site	Date	Effort[1]	NWS[2,3]	RSN[2,3]	PTF[2,3]	NRLF[2,3]	WT
WS-1	6/05/07	0.33 TPH				L: present	
	7/25/07	0.33 TPH 10 sweeps				L:15	
WS-2	7/25/07	0.25 TPH 12 sweeps					
WS-3	4/10/07	Recon.	E:1			E:8	
	6/08/07	12 traps	L:7 2nd year, 2 3rd year	A:2		L:1	
	9/12/07	10 traps	L:21 (at least 15 are 1st year and at least 1 older)	L:1 (1st year)			
	6/26/08	15 Traps 0.5 TPH	E:52, L:23 (mostly 2nd year, one or more 3rd year)	A:1		E:21 (all hatched), L:3, A:1	
	7/31/08	11 traps	L:13 2nd year, 2 3rd year				

Site	Date	Effort[1]	NWS[2,3]	RSN[2,3]	PTF[2,3]	NRLF[2,3]	WT
WS-4	4/03/07	Recon.	E: 4			E:6	
	4/10/07	1.93 TPH	E:12	A:1	E:9, A: heard	E:40	
	6/08/07	7 traps	L:7 (mostly 2nd year, at least one 3rd year)	A:1		L:2	
	7/24/07	0.90 TPH 31 sweeps	L:1 (1st year)		L:12, A:1	L:24, A:5	
	9/11/07	0.50 TPH 25 sweeps		L:6 (1st .year)	L:9	L:1, J:3	
	9/12/07	10 traps					
	9/12/07	0.25 TPH 8 sweeps			L:1	L:1, J:1	
	6/25/08	2.0 TPH	E:41, L:6 (2nd year)		E:1	L: many 100s, J:6	A: 1 (female)
	6/26/08	16 traps	L:13 (2nd year)	A:5 (in breeding condition) L:1 (2nd year)		L: 13	
	7/24/08	2.25 TPH 30 sweeps	L:3 (2nd year)	A:3	L:3	A:1,J:7, L:	
	7/31/08	16 traps 10 sweeps	L:3 (2nd year), 4 (1st year), PA:1	A:3	L:1	L:35	
WS-5	4/11/07	0.10 TPH	E:3				
	6/05/07	0.08 TPH	E:6 (5 of those stranded)				
WS-6	4/11/07	1.53 TPH	E:33		E:7, A:3	E:34	
	7/25/07	2.50 TPH 55 sweeps	E:5, L:10 1st year, 3 2nd year	L:5 (2nd year)	L:22, A:1	L:8	

[1]TPH = "Total Person Hours" (total search time multiplied by number of surveyors searching independently), sweeps = number of dip net sweeps, traps = number of aquatic funnel traps.
[2]NWS = Northwestern salamander, RSN = Rough-skinned newt, PTF = Pacific treefrog, NRLF = Northern red-legged frog, WT = Western toad.
[3]E = egg mass, L = larval stage, J = juvenile (post-larval, but not sexually mature), A = adult, PA = paedomorphic adult

4.3.1.2 Tributaries to Spada Lake

Three large perennial streams (North Fork Sultan River, South Fork Sultan River, and Williamson Creek) and numerous smaller, perennial and seasonally intermittent streams flow into Spada Lake. Some of these streams follow a low to moderate gradient and are partially impounded by beaver dams (see Section 4.3.1.1). Of the remaining streams, at least eleven are apparently perennial (as determined in September 2007) and seven of these were surveyed for stream-dwelling amphibians in August or September, 2007

(Figure 4-1, Table 4-5). The North Fork Sultan River was not sampled because the substrate is predominately sand and gravel, not suitable for coastal tailed frog. One site (South Fork Sultan River) was sampled on July 24, 2007, primarily to test methods, and an additional site on the north shore of Spada Lake (Gilbert Creek) was briefly examined on July 25 while flows were still relatively high. Another perennial stream (WS-15) is free-flowing south of South Shore Road (outside of the WHMP boundary), but impounded by a series of beaver dams north of the road (site WS-4); this stream was briefly investigated on July 24, 2008.

Coastal tailed frog (*Ascaphus truei*) larvae were documented in six of the surveyed tributaries, with numerous detections at three of these sites (WS-5, WS-6 [Bear Creek], and WS-7 [Greider Creek]). One unoccupied site (WS-1) was the smallest surveyed stream; although perennial, flows at this site appear to be insufficient to clear accumulated silt. Gilbert Creek, not formally surveyed in 2007, is evidently suitable for coastal tailed frog and almost certainly also occupied. The stream at WS-15, which was only examined in a relatively low gradient section, might be inhabited by coastal tailed frog further upstream. The small number of detections at WS-2 probably reflects marginal conditions associated with a recent mass wasting event (see Appendix B, Photo 27). Larval coastal tailed frogs ranged in size from about 12 to 17 mm snout-vent length (SVL); all were evidently two or three years old and several had hind limbs (Gosner stage 37, Gosner 1960).

Coastal giant salamanders (*Dicamptodon tenebrosus*) were found in all of the surveyed tributary sites (not found at WS-8, where only a brief reconnaissance occurred), with detections most numerous in WS-1 and WS-6. Specimens were all larvae, ranging in size from about 25 to 78 mm SVL. Because instream surveys were generally concentrated in microhabitats most suitable for coastal tailed frog, survey results undoubtedly under-represent the abundance of coastal giant salamanders. Coastal tailed frog larvae were typically found in different microhabitats than coastal giant salamanders: frogs were commonly observed under medium- to large-sized flat rocks in rapidly flowing water, whereas salamanders frequently occurred in pools of slower moving water.

Table 4-5. Amphibian Survey Sites on WHMP Lands – Tributaries to Spada Lake

Site	Site Description
WS-7	Perennial stream crossing Culmback Dam Road. Low water flow, with pocket pools and a deeper pool before culvert. Substrate: angular cobbles and gravel; moderately silty. Stream width: 4-6 ft. Searched 117 ft reach. Water temp. = 53°F (9/13/07).
WS-8	Perennial stream crossing South Shore Road. Intermittent surface flow. Recent mass wasting event removed riparian zone vegetation and much substrate from the bed. Substrate: cobble and gravel. Stream width: 8-10 ft. Searched 60 ft upstream from road. Water temp. = 55°F (8/15/07).
WS-9	Perennial stream crossing South Shore Road. Swift flowing water with medium gradient steps and small pools. Substrate: boulder. Stream width: 8-10 ft. Searched 15 ft reach. Water temp. = 55°F (9/11/07).

Site	Site Description
WS-10	South Fork Sultan River crossing under South Shore Road bridge. Moderate flow with low gradient. Substrate: boulder and cobble mix. Stream width: 25-50 ft. Searched 102 ft reach. Water temp. = 55°F (8/15/07).
WS-11	Perennial stream crossing South Shore Road. Multiple smaller streams converge into a moderate flow, medium gradient channel with erosion and confinement. Substrate: cobbles and small boulders; somewhat silty. Invertebrates abundant, unidentified salmonids present. Stream width: 4-12 ft. Searched two reaches: 65 ft and 82 ft. Water temp. = 49°F (9/13/07).
WS-12	Bear Creek: perennial stream with culvert. Low water flow upstream of culvert, swift water flow downstream. Substrate: small boulders and cobble; slightly silty. Unidentified salmonids present. Stream width: 10-12 ft. Searched two reaches: 119ft and 50ft. Water temp. = 51°F (9/13/07).
WS-13	Greider Creek: perennial stream with low water flow. Substrate: small to large boulders and cobble; slightly silty. Stream width: 15-20 ft. Searched 50 ft reach. Water temp. = 55°F (9/11/07).
WS-14	Gilbert Creek. Moderate to steep gradient with strong flow; step pools. Habitat appears to be high quality. Conducted brief reconnaissance only. Large stoneflies and unidentified salmonids present. Stream width: 15-18 ft. Water temp. = 53°F (7/25/07).
WS-15	Perennial stream that flows into WS-4. Relatively low gradient where examined, with cobble and gravels. Large stoneflies common. Stream width: 6-10 ft. Searched 15 ft reach. Water temp. = 50°F (7/24/08).

Table 4-6. Results of Amphibian Surveys on WHMP Lands - Tributaries to Spada Lake

Site	Date	Effort[1]	CGS[2, 3]	CTF[2, 3]	Comments
WS-7	8/15/07	0.07 TPH	L:3		Reconnaissance-level site examination.
	9/13/07	0.90 TPH	L:6		
WS-8	8/15/07	0.58 TPH		L:2	
WS-9	9/11/07	0.16 TPH	L:2	L:2	
WS-10	7/24/07	3.33 TPH	L:2		
	8/15/07	1.40 TPH		L:3	
WS-11	9/13/07	1.87 TPH	L:3	L:7	
WS-12	7/24/07	1.00 TPH		L:4	
	9/13/07	2.00 TPH	L:9	L:7	
WS-13	9/11/07	1.16 TPH	L:2	L:8	One CGS was found opportunistically.
WS-14	7/25/07	0.42 TPH			Brief reconnaissance only.
WS-15	7/24/08	0.25 TPH	L:1		Brief reconnaissance only.

[1]TPH = "Total Person Hours" (total search time multiplied by number of surveyors searching independently).
[2]CGS = Coastal giant salamander, CTF = Coastal tailed frog.
[3]L = larval stage.

4.3.1.3 Williamson Creek Tract

Because the Williamson Creek Tract is remote, is not subject to possible Project O&M effects outside of the Spada Lake fluctuation zone, and is unlikely to be affected by Project-related recreation, survey efforts were limited to a single visit on June 5 in 2007. Two sites were examined as potential amphibian habitat (Figure 4-1, Table 4-7). At WW-1 two species were documented (Table 4-8). Habitat conditions at this site may be inadequate to support at least one of these species: most of the northwestern salamander egg masses observed at this site were stranded out of water having not yet hatched and the one pool was already much reduced.

The second site (WW-2) (Figure 4-1), located on District land just outside of the WHMP boundaries, was also surveyed on June 5. This high quality emergent wetland supports at least three species: northwestern salamander, Pacific treefrog, and northern red-legged frog (Table 4-8). Identification of the latter species was based on brief examination of a single larva with a relatively short tail and high tail fin (consistent with northern red-legged frog, not Cascades frog) and one juvenile frog; as discussed in Section 5.1, this identification is tentative.

Table 4-7. Amphibian Survey Sites on WHMP Lands (Williamson Creek Tract)

Site	Site Description
WW-1	Emergent wetland intersected by old logging road; surrounded by larger scrub-shrub wetland. Probably seasonally flooded and dry by July.
WW-2	Large emergent and scrub-shrub wetland associated with beaver impoundment. Located on District land, but outside of WHMP lands north of the Williamson Creek Tract.

Table 4-8. Results of Amphibian Survey Sites on WHMP Lands (Williamson Creek Tract)

Site	Date	Effort[1]	NWS[2,3]	RSN[2,3]	PTF[2,3]	NRLF[2,3]	WT
WW-1	6/05/07	0.50 TPH 20 sweeps	E:9 (7 of those stranded)		E:1, L: 6, A: heard		
WW-2	6/05/07	1.50 TPH 60 sweeps	E:6 (hatched), L:2 1st year,1 2nd year		L:77	L:1, J:1	

[1]TPH = "Total Person Hours" (total search time multiplied by number of surveyors searching independently), sweeps = number of dip net sweeps, traps = number of aquatic funnel traps.
[2]NWS = Northwestern salamander, RSN = Rough-skinned newt, PTF = Pacific treefrog, NRLF = Northern red-legged frog.
[3]E = egg mass, L = larval stage, J = juvenile (post-larval, but not sexually mature), A = adult

4.3.3 Lake Chaplain Tract

Four wetlands on the Lake Chaplain Tract were surveyed (Figure 4-1, Table 4-9). No amphibians were found at WC-1 (Lake Chaplain), a narrow shrub-scrub and emergent wetland on the north shore of Lake Chaplain. This wetland does not contain any perched pools or potential larval habitats separate from the lake and the adjacent shallow littoral

zone, which is largely devoid of vegetation, has minimal potential for amphibian breeding or larval rearing, even for western toad.

Surveys at WC-2 (Chaplain Creek Marsh) documented the presence of five species of amphibians, more than at any other site (Table 4-10). This was only one of two sites where bullfrog (*Lithobates catesbeianus*) was found. Chaplain Creek Marsh is formed by a series of beaver dams along a low gradient segment of Chaplain Creek and is the largest wetland in the study area. Surveys were conducted in two general areas, designated as the upper and lower marsh, respectively. The upper marsh is relatively deep (extensive areas probably more than 4-5 deep), permanently flooded, and dominated by aquatic beds and emergent vegetation; this area was surveyed only along the west shore on April 4, 2007, and by boat on June 6 and July 27, 2007. The deep water and thick vegetation limited the effectiveness of visual encounter and dip-netting; however, four of the five species were found in the upper marsh. Survey results included observations of juvenile bullfrogs and detections of vocalizing adult bullfrogs during surveys in July.

The lower marsh is characterized by a deep meandering stream channel, flanked by extensive emergent wetlands. Large areas of seasonally shallow water occur, and these areas supported concentrations of northern red-legged frog egg masses, many of which had already hatched on April 4, 2007. Rough-skinned newts in breeding condition were found on April 13. Aquatic funnel traps were deployed on three dates in 2007 in the lower marsh area and on one date in 2008; these efforts along with rigorous dip-netting documented no bullfrog larvae in the lower marsh. Water levels during the surveys in 2008 (July 30-31) were notably higher compared to conditions in 2007, which had the effect of greatly expanding available habitat for amphibians and probably reducing the efficacy of aquatic funnel trap and dip-net surveys; nonetheless, metamorphosing northern red-legged frogs were observed to be abundant in the lower marsh. Fish occur in both the upper and lower marsh, and four species were documented during the surveys: three-spine stickleback (*Gasterosteus aculeatus*), red-sided shiner (*Richardsonius balteatus*), Salish sucker (*Catostomus* sp.), and unidentified trout.

Site WC-3 and WC-4 are beaver-impoundments adjacent to Swamp Road (east of Lake Chaplain). These sites are both relatively remote in a public-access restricted area, with limited potential for Project effects. Site WC-4 straddles the eastern boundary of the Lake Chaplain Tract and most of the wetland is on WDNR lands. Surveys at WC-3 were conducted during the June and July 2007 survey period; two species were documented (northwestern salamander and Pacific treefrog). The survey of WC-4 on July 30, 2008 documented northwestern salamander, rough-skinned newt, and Pacific treefrog. Northern red-legged frog was not detected here, but could occur, as suggested by observation of an adult of this species approximately 0.25 mi southwest of the site.

Table 4-9. Amphibian Survey Sites on WHMP Lands (Lake Chaplain Tract)

Site[1]	Site Description
WC-1	Lake Chaplain: Shrub-scrub and emergent class wetland with no perched pools; limited habitat in shallow littoral zone.
WC-2	Chaplain Creek Marsh: open water with aquatic beds and emergent vegetation. Fish present.
WC-3	Near Swamp Road: Emergent wetland with boggy areas and scrub-shrub surrounding. Fish not observed.
WC-4	East of Swamp Road (site mostly on WDNR land): Emergent wetland and scrub-shrub wetland associated with beaver impoundment of a small stream. Fish not observed.

[1]WC: Lake Chaplain.

Table 4-10. Results of Amphibian Surveys on WHMP Lands (Lake Chaplain Tract)

Site	Date	Effort[1]	NWS[2,3]	RSN[2, 3]	PTF[2,3]	NRLF[2,3]	BF[2,3]
WC-1	4/12/07	0.25 TPH					
WC-2	4/04/07[4]	2.50 TPH 20 sweeps	E:26 (7 stranded), L:1 (2nd year))		A: heard	E:21	
	4/13/07[6]	20 traps	L: 5 2nd year, 2 presumed 3rd year or older	A:8	E:10+	L:5	
	6/06/07[4]	1.00 TPH			L:7	L:8	
	6/07/07[6]	30 traps	L: 5 2nd year, 3 possibly older	A:1	L:2, A:1	L:32	
	7/26/07[4]	3.00 TPH 60 sweeps	L:13 (1st year)		L:7	L:7, J:1	J:1, A: heard
	7/26/07[4] night	0.95 TPH					A: heard
	7/27/07[4]	30 traps	L:1 (2nd year)	L:1 (1st year)	L:2	L:6	J:3, A: heard
	9/13/07[6]	1.33 TPH 96 sweeps	L:1 (1st year)	L:1 (1st year)	A: heard	L:1, J:1	
	7/30/08[6]	0.5 TPH 20 sweeps	L:3 (1st year)	L:1 (1st year)	L:15	L:4, J:18	
	7/31/08[6]	12 traps 35 sweeps	L:8 (1st year)	L:5 (1st year)	L:4	L:11, J:9	

Site	Date	Effort[1]	NWS[2,3]	RSN[2, 3]	PTF[2,3]	NRLF[2,3]	BF[2,3]
WC-3	6/06/07	0.75 TPH 70 sweeps	E:15, L:4 (2nd year)		L:9		
	7/26/07	2.12 TPH 55 sweeps	L:9 (1st year)		L:4		
	7/27/07	20 traps	L:10 (2nd year)		L:1		
WC-4	7/30/08	0.75 TPH 22 sweeps	L:1 (1st year)	L:1 (1st year)	L:63		

[1]TPH = "Total Person Hours" (total search time multiplied by number of surveyors searching independently), sweeps = number of dip net sweeps, traps = number of aquatic funnel traps.
[2]NWS = Northwestern salamander, RSN = Rough-skinned newt, PTF = Pacific treefrog, NRLF = Northern red-legged frog, BF = Bullfrog.
[3]E = egg mass, L = larval stage, J = juvenile (post-larval, but not sexually mature), A = adult.
[4]Upper and lower Chaplain Creek Marsh.
[5]Upper marsh only.
[6]Lower marsh only.

4.3.4 Lost Lake Tract

Lost Lake (Figure 4-1, Table 4-11) is a permanent pond with areas of open water and aquatic beds, and evidently exhibits a stable water level. Open water areas are surrounded by floating bog mats. Lost Lake is open to low-impact recreational use (e.g., wildlife viewing, fishing and hiking). This site was briefly examined on April 3, 2007, and surveyed by boat on April 12 and June 6, 2007 (Table 4-12). Because of the sensitivity of the bog areas to disturbance, most of the survey effort was boat-based visual encounter (water was generally too deep for dip-netting), which was not efficacious for surveying larvae (rainfall also impeded visibility on June 6). An associated shallower wetland north of the pond was also examined. Four species were documented: northwestern salamander, Pacific treefrog, northern red-legged frog, and bullfrog (Table 4-12).

Table 4-11. Amphibian Survey Sites on WHMP Lands (Lost Lake and Project Facility Lands Tracts)

Site[1]	Site Description
WL-1	Lost Lake, deep water and floating bog. Water comparatively warm.
WP-1	Marsh Creek: emergent wetland with thick scrub-shrub surrounding.
WP-2	Concrete ditch on north side of Culmback Dam, with water 3-4 inches deep.

[1]WL: Lost Lake, WP: Project Facility Lands.

Table 4-12. Results of Amphibian Surveys on WHMP Lands (Lost Lake and Project Facility Lands Tracts)

Site	Date	Effort[1]	NWS[2,3]	RSN[2, 3]	PTF[2,3]	NRLF[2,3]	BF[2,3]
WL-1	4/04/07	Recon.	E: 4				
	4/12/07	1.87 TPH	E:49		E:4	E:20	
	6/06/07	1.67 TPH 25 sweeps	E:29, L:4		L:30, A: heard		E:3
WP-1	4/04/07	1.00 TPH	E:7			E:2	
	6/08/07	10 traps				L:1	
WP-2	6/26/08	0.5 TPH			L: >200		

[1]TPH = "Total Person Hours" (total search time multiplied by number of surveyors searching independently), sweeps = number of dip net sweeps, traps = number of aquatic funnel traps.
[2]NWS = Northwestern salamander, RSN = Rough-skinned newt, PTF = Pacific treefrog, NRLF = Northern red-legged frog, BF = Bullfrog.
[3]E = egg mass, L = larval stage, J = juvenile (post-larval, but not sexually mature), A = adult.

4.4 Project Facility Lands Tract

The buried power pipeline right-of-way (part of the Project Facility Lands Tract) intersects a single wetland associated with Marsh Creek (Table 4-11, Figure 4-1). This is an extensive wetland stretching more than 4,000 feet southeast of the Project crossing. However, because of the limited extent of the Project footprint and low potential for Project effects, only the area proximate to the Project area was surveyed for amphibians on April 4 and June 8, 2007. Three species were documented (northwestern salamander, northern red-legged frog, and Pacific treefrog), each in small numbers (Table 4-12).

Pacific treefrog larvae were also observed in a concrete ditch on the north side of Culmback Dam (Table 4-11, Figure 4-1) by biologists performing *Revised Study Plan 11: Marbled Murrelets Surveys* in 2007. Examination of this site in 2008 indicated the site was again used by Pacific treefrogs (Table 4-12). This was the only ditch on the dam with standing water.

4.5 Sultan River Riparian Corridor

4.5.1 Sultan River Instream Habitats

Instream surveys were conducted on four segments of the Sultan River downstream of Culmback Dam in 2007 (Table 4-13), with a total of 8 sample points (Figure 4-1, Table 4-14). These segments were selected based on accessibility via established trails. Within the segments, sample locations represented the best available habitats for coastal tailed frog. Few suitable sampling locations were observed. Suitability was variously limited by conditions not conducive to the survey procedures (i.e., areas with excessive flow velocities, flowing water more than about three feet deep, and deep pools); preponderance of sandy or immovable, coarse substrates lacking in interstices (boulders or partially imbedded, rounded cobbles); and by substrates covered with moss, filamentous algae, or growths other than the diatoms required by coastal tailed frog larvae.

Table 4-13. Amphibian Survey Sites Along Sultan River – Instream Surveys

Site	Location[1]	Reach Description
SR-1	RM 15.5	0.8 mi downstream of Culmback Dam. Series of riffles with intermittent long, pools. Riffles that were sampled were characterized by cobbles and small boulders; most substrates exhibited a thick foliose growth (possibly algae). Water temp. = 55°F (8/15/07).
SR-2	RM 14.5	Vicinity of old Stringer Bridge. Riffles, runs, and pools, including long, deep pools at the upstream and downstream ends of the reach. Water temp. = 47°F (8/16/07).
SR-3	RM 11.5	Near Big Four Creek confluence. Riffles and pools. Thick foliose growth (possibly algae) present on rocks in slower moving water. Rocks embedded, substrate covered in silt. Temp = 48°F (9/12/07).
SR-4	RM 9.6	Vicinity of Diversion Dam. Riffles and runs below dam and long pool above dam. Below dam mostly too deep and fast flowing to conduct instream searches. Riffles characterized by small and large boulders.

[1]RM = River mile.

Table 4-14. Results of Amphibian Surveys Along Sultan River – Instream Surveys

Site	Date	Effort[1]	Sub-site Results
SR-1	8/15/07	0.85 TPH 400 ft^2	SR-1A: 2 CGS larvae (found opportunistically adjacent to formal search area).
		0.45 TPH 250 ft^2	SR-1B: No amphibians.
SR-2	8/16/07	1.00 TPH 700 ft^2	SR-2A: 2 CTF larvae.
		0.83 TPH 400 ft^2	SR-2B: 1 possible CTF larva (something briefly observed dropping from lifted rock).

Site	Date	Effort[1]	Sub-site Results
SR-3	9/12/07	0.33 TPH 200 ft^2	SR-3A: No amphibians.
		0.63 TPH 150 ft^2	SR-3B: No amphibians.
SR-4	8/16/07	0.50 TPH 75 ft^2	SR-4A: No amphibians.
		0.60 TPH 75 ft^2	SR-4B: No amphibians.

[1]TPH = "Total Person Hours" (total search time multiplied by number of surveyors searching independently).
[2]CGS = Coastal giant salamander, CTF = Coastal tailed frog.

Two species were documented by the instream survey methods on the Sultan River: coastal tailed frog and coastal giant salamander (Table 4-14). Coastal giant salamander was only detected by opportunistic search adjacent to site SR-1. Other relicensing consultants encountered six larval or paedomorphic coastal giant salamanders during an electrofishing survey at RM 10.3 just upstream of the Diversion Dam, and two terrestrial stage salamanders were above the bank of the river at RM 11.5 and RM 12 (C. Karchesky, Normandeau Consulting, personal communication, August 27, 2007). A local miner also reported observing a large salamander in a pool at site SR-1 on August 15, 2007. Coastal tailed frog larvae were found at only one site during the surveys.

Amphibians characteristic of lentic habitats (Pacific treefrog and northern red-legged frog) were found at three locations within the Sultan River channel during the surveys, all associated with shallow pools (Table 4-15). These occurrences were less numerous than use of off-channel habitats (See Section 4.5.2).

Table 4-15. Amphibian Survey Sites Along Sultan River – Pool Habitats

Site	Location[1]	Description	Observed
SR-1C	RM 15.5	0.8 mi downstream of Culmback Dam. Shallow margin (1,050 ft^2) of deep pool, warmer water.	3 PTF larvae in metamorphosis (4 legs, tail not reduced). (8/15/07)
SR-3C	RM 11.5	Near Big Four Creek confluence. Impounded pool (10 ft^2) isolated from river.	3 PTF larvae, 2 NRLF juveniles. (9/12/07)
SR-4C	RM 9.6	Upstream of Diversion Dam. Small pool on alluvial bar.	20+ PTF larvae. (8/16/07)

[1]RM = River mile.

4.5.2 Off-Channel Habitats

Thirteen off-channel sites or sub-sites (including one stream) within the riparian corridor of the Sultan River downstream of Culmback Dam were identified as amphibian habitats (Figure 4-1, Table 4-16). With the exception of a few areas evident on the aerial videography and one mapped wetland discernible on the aerial photographs, these

habitats were discovered opportunistically as stream segments were explored. As such, it is reasonable to assume that other habitats occur in areas that were not surveyed.

Off-channel habitats were associated with a variety of settings including flow-impeded tributaries or seeps, small pools on bedrock presumably filled by rainwater, and relict oxbow channels. The latter (represented by SR-5, SR-6, and SR-7) were restricted to the lowermost 2.8 river miles of the Sultan River which is characterized by a wider floodplain and historical channel meanders. Some of the sites or sub-sites (e.g., SR-1D and F) may regularly receive water from the river during seasonal high flow periods, but most probably do not.

Pacific treefrog and northern red-legged frog were found at the greatest number of off-channel locations, ranging from the smallest pools to the large wetland at site SR-6. The latter site, which is part of a wetland occupying about 4.3 acres, supports five species of amphibians and was the only off-channel site where rough-skinned newt was documented. Sites SR-5 and SR-7 were not extensively searched (SR-7 was also examined relatively late in the year after larvae of some species would have metamorphosed) and likely support additional species. A juvenile northern red-legged frog was found in the forest within easy dispersal distance from SR-5, and this wetland is suitable for rough-skinned newt. Two frogs were heard jumping into the water at SR-7 (the frogs did not make the vocalization characteristic of juvenile bullfrogs, and could have been northern red-legged frogs).

Table 4-16. Amphibian Survey Sites Along Sultan River – Tributaries and Off-Channel Habitats

Site	Location[1]	Site Description
SR-1	RM 15.5	D) Approximately 0.8 mi downstream of Culmback Dam. Small, shallow emergent wetland (15 ft^2) perched slightly above Sultan River. Water temp. = 60°F (8/15/07).
		E) Approximately 0.8 mi downstream of Culmback Dam. Small tributary to river (5-7 ft wide), cobble and boulder substrate, over-hanging forest cover. Water temp. = 55°F (8/15/07).
		F) Approximately 0.8 mi downstream of Culmback Dam. Small, shallow emergent and scrub-shrub wetland (40 ft^2), perched slightly above Sultan River. Water temp. = 59°F (8/15/07).
		G) Approximately 0.85 mi downstream of Culmback Dam. Seepage-fed pool (1,875 ft^2, 1 ft deep), with minimal emergent vegetation. Water temp. = 55°F (8/15/07).
SR-2	RM 14.5	C) Approximately 0.075 mi upstream of Stringer Bridge. 12 small pothole pools on bedrock high above river. Water temp. = 61°F (8/16/07).
		D) Approximately 0.075 mi upstream of Stringer Bridge. Pool 3,000 ft^2, 1.5 ft deep, with emergent vegetation, surrounded by wooded vegetation. Water temp = 59°F (8/16/07).
		E) Approximately 0.075 mi upstream of Stringer Bridge. Series of small shallow pools, sandy substrate, some emergent vegetation. Water temp. = 59°F (8/16/07).
		F) Approximately 0.075 mi upstream of Stringer Bridge. Very small pool fed by drainage.

Site	Location[1]	Site Description
SR-3	RM 11.5	D) Near Big Four Creek confluence. 4 small pothole pools on bedrock high above river. Water temp. = 60°F (9/12/07).
SR-5	RM 1.3	Osprey Park – Depressional, permanently and semi permanently flooded, emergent wetland in relict oxbow channel with beaver dam at outlet. Drains into Sultan River, but not otherwise evidently associated with Sultan River hydrology.
SR-6	RM 0.25	Near Skykomish confluence, DNR land. During a reconnaissance-level examination, amphibian habitats were identified in a permanently flooded, emergent wetland associated with relict oxbow channel and in puddles on trails.
SR-7	RM 1.5	Relict oxbow channel with beaver impoundment; also scattered, seasonally wet depressions. During a reconnaissance-level examination, the beaver impoundment was observed to be deep in places, emergent vegetation was scant, and the outlet was draining into the Sultan River. The depressions harbored fingernail clams (Sphaeridae).

[1]RM=River mile.

Table 4-17. Results of Amphibian Surveys Along Sultan River In Tributaries

Site	Date	Effort[1]	CGS[2]	CTF[2]	Comments
SR-2E	8/15/07	2.07 TPH	10	3	Two of the CTF were feeding on top of rocks.

[1]TPH = "Total Person Hours" (total search time multiplied by number of surveyors searching independently), sweeps = number of dip net sweeps, traps = number of aquatic funnel traps.
[2]CGS = Coastal giant salamander (larvae), CTF = Coastal tailed frog (larvae).

Table 4-18. Results of Amphibian Surveys Along Sultan River In Off-Channel Habitats

Site		Date	Effort[1]	NWS[2,3]	RSN[2,3]	PTF[2,3]	NRLF[2,3]	BF[2,3]
SR-1	D	8/15/07	0.07 TPH			L:10+		
	F	8/15/07	1.00 TPH			L: 20+	L: 200+	
	G	8/15/07	0.25 TPH			L: 20+	L: 20+	
SR-2	C	8/16/07	0.15 TPH			L: 50+		
	D	8/16/07	0.60 TPH	L: 6 (1st year)		L: 20+	L: 50+	
	E	8/16/07	0.15 TPH			L: 200+		
	F	8/16/07	0.10 TPH			L: 50		
SR-3		9/12/07	0.30 TPH, 7 sweeps			L:3	J:2, A:1	

Site	Date	Effort[1]	NWS[2,3]	RSN[2,3]	PTF[2,3]	NRLF[2,3]	BF[2,3]
SR-5	4/12/07	0.83 TPH	E:29, L1 1st year, 1 2nd year,	L:3	J:1	E:1, J:3	
	4/13/07	9 traps	L: 5 2nd year, 1 3rd year or older	L:3			
	6/7/07	15 traps	L: 2 2nd year, 1 3rd year 3			L:4	L:1
	7/23/07 night	20 TPH					A:H
	7/26/07	15 traps					
SR-6	7/26/07	Recon.	L:8 (1st year)		L:40+		
	8/22/08	Recon.	L:2 (1st year)				
SR-7	8/22/08	Recon.					

[1]TPH = "Total Person Hours" (total search time multiplied by number of surveyors searching independently), sweeps = number of dip net sweeps, traps = number of aquatic funnel traps, Recon. = reconnaissance-level examination with spot dip-netting.
[2]NWS = Northwestern salamander, RSN = Rough-skinned newt, PTF = Pacific treefrog, NRLF = Northern red-legged frog, BF = Bullfrog.
[3]E = egg mass, L = larval stage, J = juvenile (post-larval, but not sexually mature), A = adult. H = heard.

4.6 Other Areas Investigated

Prompted by a sighting of two western toads on Elk Road near a beaver pond on WDNR land just outside of the Spada Lake Tract (Figure 4-1) (reported by the Everett Watershed Patrol on August 30, 2007), this pond (designated "Out-1") was investigated on September 11, 2007 (no amphibians observed), June 25, 2008 (two adult male western toads, two sub-adult northern red-legged frogs, and one northwestern salamander observed), and July 24, 2008 (no amphibians observed). Brown bullhead catfish were present. The site appears to be suitable breeding habitat for western toad, but no eggs or larvae were found.

5.0 DISCUSSION AND CONCLUSIONS

5.1 Occurrence of Special Status Species

Neither Oregon spotted frog nor Cascades frog (*Rana cascadae*) were documented during the survey. The apparent absence of Oregon spotted frog is consistent with the known pattern of occurrence of this species in Washington. McAllister and Leonard (1997) report no currently known and only one historically documented populations of this species in Snohomish County (in 1939 near City of Monroe), although populations once were found in the Puget Sound lowlands and at sites in the Washington Cascades foothills. The few known remaining populations in Washington are associated with wetland complexes that afford breeding and larval rearing habitats (typically, seasonal emergent wetlands), and permanently flooded areas for post-breeding and over-wintering habitats. In contrast, most of the wetlands in the study area are relatively small and were created by beaver impoundments of small streams.

Cascades frog was also not anticipated in the study area, because this species is typically found at higher elevations (Csuti et al. 1997; Dvornich et al. 1997). However, biologists engaged in *Revised Study Plan 11: Marbled Murrelets Surveys* in 2007 observed a ranid frog on the Williamson Tract which appeared to show yellowish thigh coloration when it jumped, a feature possessed by Cascades frog, in contrast to the reddish thigh color diagnostic of northern red-legged frog. However, the frog could not be captured for examination or photographed. In July 2008, the marbled murrelet crew observed two juvenile frogs (young-of-the-year from 2007) and photographed them (see Appendix B, Photo 104) at the same site. These frogs also lacked red or pale pink coloration, but this is not unusual for juvenile northern red-legged frog (Jones et al., 2005). Nonetheless, it was considered prudent to examine and photograph presumed northern red-legged frogs from WS-4 for comparative purposes to confirm identification (identification of frogs from lower elevation sites such as Chaplain Creek Marsh is not at issue because these sites are well outside of the possible elevation range for Cascades frog).

Juvenile ranid frogs from WS-4 were difficult to assign to species: only one of five juvenile frogs examined from this site had a slightly pink coloration under the thighs, and none had the complex, colorful groin mottling characteristic of adult northern red-legged frogs (see Appendix B, Photos 103 and 106). However, they were not distinctly different from juvenile northern red-legged frogs found at Chaplain Creek Marsh (Appendix B, Photo 105). Curiously, an adult frog found at WS-4 (July 24, 2008) was white and pale yellow under the thighs and had almost no groin mottling, but lacked the inky black dorsal spots typical for Cascades frog (Appendix B, Photo 107).

Larval ranids from WS-4 were consistent with expected characteristics of northern red-legged frog for general morphology (a relatively short tail and higher tail fin than Cascades frog), oral disc (submarginal papillae well developed, but lacking in Cascades frog), and dentition (the first tooth row of the posterior labium has a median gap, which Cascades frog does not) (see Appendix B, Photo 100) (Altig 1970, Altig et al., undated). Other features that point to northern red-legged frog are general behavior (a well

developed escape response in contrast to the more sluggish response characteristic of Cascades frog), adults presumably much more terrestrial (very few adults were observed at wetland sites even where the number of egg masses indicate large populations compared to the more aquatic Cascades frog, and greater number of eggs/egg mass (more than 700 compared to the 300-500 reported for Cascades frog). Based on all this information, despite somewhat aberrant coloration of an adult frog, ranid frogs on the Spada Lake Tract can be assigned to *Rana aurora* with a high degree of confidence. The identity of the frogs reported from the Williamson Creek Tract is less certain with the available information.

Western toad was found during these surveys only once in the study area and also occurred at a site adjacent to the Spada Lake Tract (site "Out-1," see Section 4.6) in 2007 and 2008, although breeding was not documented. Possibly, western toad bred at site Out-1, a beaver pond with extensive shallow areas presumably suitable for breeding, but egg masses or larvae were subsequently stranded when the water level dropped. Although it is unlikely that eggs or larvae were present, but were undetected at this site when it was thoroughly surveyed in 2008, western toad might have escaped detection elsewhere. This species breeds later than most other western Washington amphibians (Jones et al. 2005) and tends to use different habitats, including shallow littoral areas and spring- or rainwater-filled puddles and ditches. Larvae of this species also tend to exhibit clumped distribution as a result of aggregative behavior, which may reduce the efficacy of visual encounter surveys that did not encompass all suitable habitat. Western toad larvae were documented in lake inlets and in a wetland north of lake during the Stage II surveys (WDG and Eicher Associates 1982); most of these areas were inundated by the Stage II development and are no longer suitable habitat. Severe decline of this species has been documented in the Rocky Mountains; however, Washington populations have not shown the same decline.

Coastal tailed frog was documented in most of the perennial streams that flow into Spada Lake, and probably exhibits a similar distribution along the Sultan River downstream of Culmback Dam, provided that water is suitably cold (Welsh and Hodgson 2008 determined that the thermal niche of coastal tailed frog larvae was concentrated between 49.6-56.5 ^{o} F), coarse substrates predominate, and other prerequisites exist. Use of the Sultan River appears to be more limited, although the effectiveness of sampling at some sites was questionable (see Section 5.3). Occurrence of coastal tailed frog in the Sultan River may be constrained by the intermittent distribution of suitable habitats. In particular, stream segments with long, deep pools may act as barriers to larval dispersal. Pools were characterized by sandy substrates unsuitable for larval feeding and without interstitial shelter from predators. Other areas with evidently suitable coarse substrates lacked preferred larval foods (a smooth sheen of diatoms over which larvae can graze while adhered to the substrate) and were instead covered by foliose growths (other types of algae or moss) over which larvae cannot feed.

5.2 Amphibian Use of Spada Lake

The extent of amphibian breeding in Spada Lake is limited by habitat conditions: most areas are either overly steep, too deeply inundated, or lacking in emergent vegetation that

might attract amphibian breeding. Breeding may also be deterred by wave action, short-term fluctuations in water level, or the presence of predatory fish. These deterrents may ensure that few amphibians attempt to breed in the Spada Lake fluctuation zone and that this area is unlikely to be a 'sink' habitat (i.e., a place where reproductive output is wasted because conditions are attractive but unsuitable).

The first two species to breed in the Spada Lake area (northwestern salamander and northern red-legged frog) tend to spawn within a relatively brief period (estimated at approximately April 1 to April 15 in 2007). The 2007 survey results suggest that if conditions are suitable on the margin of Spada Lake in this early breeding period, a small number of egg masses may be deposited in the fluctuation zone, where they are unlikely to survive. Opportunistic selection of inappropriate breeding sites was also documented at other sites outside of the Spada Lake fluctuation and egg mass stranding occurred even at high quality depressional wetland sites (e.g., WS-3 and WS-4).

In context, the number of egg masses found in the fluctuation zone was much smaller than occurred in wetlands outside of the fluctuation zone. Two of the northwestern salamander egg masses in the fluctuation zone at SL-2 were also unusually small (each fewer than 20 eggs), possibly suggesting small, inexperienced salamanders or interrupted egg laying. Later breeding species (Pacific treefrog, rough-skinned newt, or western toad) may use the lake similarly, although there was no evidence that any of these species did so in 2007.

Amphibians are unlikely to have bred in Spada Lake in 2008. Based on the development of northwestern salamander and northern red-legged frog eggs at two Spada Tract wetlands (WS-3 and WS-4, see Section 4.3.1.1) investigated on June 25 2008, lake water levels would have been either steadily rising or the lake already full at the onset of the amphibian breeding season in 2008, which was delayed by prolonged winter conditions. Deep water in the Spada Lake fluctuation zone would probably have deterred amphibian breeding in this area.

Northwestern salamander populations at wetlands in the vicinity of Spada Lake (WS-3 and WS-4) contain some individuals that are paedomorphic. Although not detected during surveys (including the use of aquatic funnel traps), the occurrence of paedomorphic northwestern salamanders in Spada Lake is possible. The presence of the paedomorphic form, which remains aquatic after maturity, is not unusual for this species, particularly at moderate to high altitude sites (Snyder 1956, MacCracken 2008). Efford and Mathias (1969) found that larvae and paedomorphic adults of this species were rarely observed by day, but nocturnally active on the muddy bottom and concentrated in shallow areas of a small, fish-inhabited lake where they regularly fell prey to rainbow trout. Richter and Kerr (2001) reported that paedomorphic and metamorphic northwestern salamanders at their study site bred at the same time, but that the paedomorphic individuals deposited egg masses very slightly (5 cm) deeper than did their metamorphic counterparts. Because Spada Lake is oligotrophic, relatively cool and deep, and supports rainbow trout and brown bullhead, the lake is probably not inherently good habitat for paedomorphic northwestern salamander.

5.3 Amphibian Use of Sultan River

The survey documented use of Sultan River instream habitats by coastal giant salamander and coastal tailed frog, but the results are insufficient to characterize the distribution or abundance of these species. Instream sampling methods following the Hawkins and Crisafulli protocol were generally ill-suited for conditions on the Sultan River because of strong flows. The only coastal tailed frog larvae documented on the Sultan River were found when use of the seine was abandoned and rocks were selectively lifted while a dip-net or kick-net was held immediately downstream. However, even under this methodology, detection rates were lower than in the smaller streams sampled, which may be better habitat for coastal tailed frog because of lower flow velocities. Coastal giant salamanders, which were not the primary target of surveys, are undoubtedly more numerous than the results indicate, particularly in pools and margins that were not sampled.

Water released from the outlet of Culmback Dam is necessarily drawn from deep water areas that remain cold even in summer. Cold water conditions are acceptable to coastal tailed frog or coastal giant salamander (e.g., coastal tailed frog larvae usually occur in water less than 63^{o} F; deVlaming and Bury 1970, Nussbaum et al. 1983), but growth and developmental rates are likely to be slower than under a warmer temperature regime. In each surveyed reach, amphibians characteristic of still water habitats were found associated with various off-channel habitats, including small, isolated pools. Current Project operations appear to be consistent with the continued existence of off-channel amphibian habitats within in the Sultan River riparian corridor.

5.4 Amphibian Use of WHMP Lands

One or more amphibian species are associated with most of the wetlands on the WHMP lands outside of the Spada Lake fluctuation zone. These wetlands are not affected by Project O&M and most are relatively remote. Sites WS-3 and WS-4 both straddle roads used for recreational access and could be subject to vehicle-mediated weed dispersal. However, only a portion of site WS-4 was weed infested (Canada thistle [*Cirsium arvense*] was locally common only in saturated or infrequently inundated areas near the South Shore Road). Recreational activities such as canoeing and Nature-watching occur at Lost Lake and presumably at Chaplain Creek Marsh, but these activities are unlikely to adversely affect amphibians. Overall, wetlands on the WHMP were in good condition, with few signs of recreational use or disturbance that could affect amphibians.

5.5 Possible Protection or Enhancement Measures

Results of this study do not suggest the need for additional special measures to protect or enhance amphibian habitats. The presence of two WDFW monitor species, coastal tailed frog and western toad, on the Spada Lake Tract and possible occurrence of Cascades frog on the Williamson Creek Tract should not require any change in land management. The WHMP provides for wetland and riparian forest habitat protection that will benefit amphibians through the year 2060. Under the WHMP, wetlands associated with the

Project are protected, along with buffer zones of 200 feet around most wetlands and 500 feet around the Lost Lake wetlands. Wetland management primary involves avoidance of land disturbing or other activities which might alter hydrologic or vegetative characteristics. This includes allowing existing or new beaver activity except in drainages flowing into Lake Chaplain, or if the impoundment would threaten an existing functioning road or structure. The District also manages wetland sites by controlling invasive plant species. Stream habitat for coastal tailed frog is protected on WHMP lands by no-harvest riparian buffers 100-feet wide on all fish-bearing streams and 50-feet wide on all other streams, as well as by extended timber harvest rotations and decreased harvest unit sizes in adjacent uplands. Large woody debris is retained in forest management units, which provides hiding cover for terrestrial amphibians.

If flows in the Sultan River are changed to benefit fish, recreation, or other resources, amphibians may also be affected. Current base-flows within the Sultan River bypass reach appear to be fully sufficient and perhaps higher than optimum to provide habitat for stream-dwelling amphibians (i.e., coastal giant salamander and coastal tailed frog). Higher base flows might expand the area of usable habitat in some locations, but would not be beneficial at locations where flow velocities are already higher than optimum.

Possible effects of different flow scenarios on amphibians that utilize disjunct pools and wetlands along the Sultan River corridor are difficult to predict. These areas were generally too small to be detected on aerial photographs (thus, most are not depicted in GIS data resulting from RSP-18, *Riverine, Riparian and Wetland Habitat Assessment*) and were found opportunistically during field surveys. Very high resolution topographic data would be required to accurately predict changes in the extent or quality of such small wetland areas for amphibians under different flow scenarios, including flows for recreation. Higher base flows would probably inundate some existing wetlands to the detriment of amphibians (e.g., allowing access by predaceous fish or converting still water habitats to flowing water habitats), but might also create other habitats where amphibians could breed. From an amphibian perspective, flows that recharge floodplain wetlands in winter or early spring are more likely to simulate natural river dynamics and be beneficial to amphibians than higher flows in summer.

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APPENDIX A
MAPS

List of Acronyms

FERC.....Federal Energy Regulatory Commission
GIS.....Geographic Information System
WHMP.....Wildlife Habitat Management Plan

BF.....Bullfrog
CGS.....Coastal giant salamander
CTF.....Coastal tailed frog
NRLF.....Northern red-legged frog
NWS.....Northwestern salamander
PTF.....Pacific treefrog
RSN.....Rough-skinned newt
WT.....Western toad

Out.....Outside of formal study area
SL.....Spada Lake fluctuation zone
SR.....Sultan River downstream of Culmback Dam
WC.....WHMP Lake Chaplain Tract
WL.....WHMP Lost Lake Tract
WP.....WHMP Project Facility Lands Tract
WS.....WHMP Spada Lake Tract
WW.....WHMP Williamson Creek Tract

Cross-reference for Site Designations Between Amphibian Survey and Wetlands Survey

	Site Designation	
General Location	**Amphibian Survey (RSP 10)**	**Wetlands Survey (RSP 9)**
Spada Lake fluctuation zone	SL-1	16
Spada Lake fluctuation zone	SL-2	1
Spada Lake fluctuation zone	SL-3	11
Spada Lake fluctuation zone	SL-4	n/a
Spada Lake fluctuation zone	SL-5	8
Spada Lake fluctuation zone	SL-6	7
WHMP Spada Lake Tract	WS-1	14
WHMP Spada Lake Tract	WS-2	n/a
WHMP Spada Lake Tract	WS-3	9
WHMP Spada Lake Tract	WS-4	4
WHMP Spada Lake Tract	WS-5	n/a
WHMP Spada Lake Tract	WS-6	10
WHMP Spada Lake Tract (stream)	WS-7	n/a
WHMP Spada Lake Tract (stream)	WS-8	n/a
WHMP Spada Lake Tract (stream)	WS-9	n/a
WHMP Spada Lake Tract (stream)	WS-10	n/a
WHMP Spada Lake Tract (stream)	WS-11	n/a
WHMP Spada Lake Tract (stream)	WS-12	n/a
WHMP Spada Lake Tract (stream)	WS-13	n/a
WHMP Spada Lake Tract (stream)	WS-14	n/a
WHMP Spada Lake Tract (stream)	WS-15	n/a
WMHP Williamson Creek Tract	WW-1	6
WMHP Williamson Creek Tract	WW-2	n/a
WHMP Lake Chaplain Tract	WC-1	n/a
WHMP Lake Chaplain Tract	WC-2	5
WHMP Lake Chaplain Tract	WC-3	n/a
WHMP Lake Chaplain Tract	WC-4	n/a
WHMP Lost Lake Tract	WL-1	2, 12
WHMP Lost Lake Tract	n/a	3
WHMP Project Facility Lands Tract	WP-1	18
WHMP Project Facility Lands Tract	WP-2	n/a
Sultan River downstream of Culmback Dam	SR-1	21
Sultan River downstream of Culmback Dam	SR-2	n/a
Sultan River downstream of Culmback Dam	SR-3	n/a
Sultan River downstream of Culmback Dam	SR-4	n/a
Sultan River downstream of Culmback Dam	SR-5	17
Sultan River downstream of Culmback Dam	SR-6	n/a
Sultan River downstream of Culmback Dam	SR-7	19

n/a = Site not included in study

Figure 1, Sheet 1. Suitable Amphibian Habitat and Survey Site Locations. Notes: "Rivers & streams" represents an existing GIS data layer and may not precisely depict locations of these features. The full extent of suitable habitat associated with SR-6 is not depicted here (existing GIS data layers do not show wetlands for this area, which is under a forest canopy).

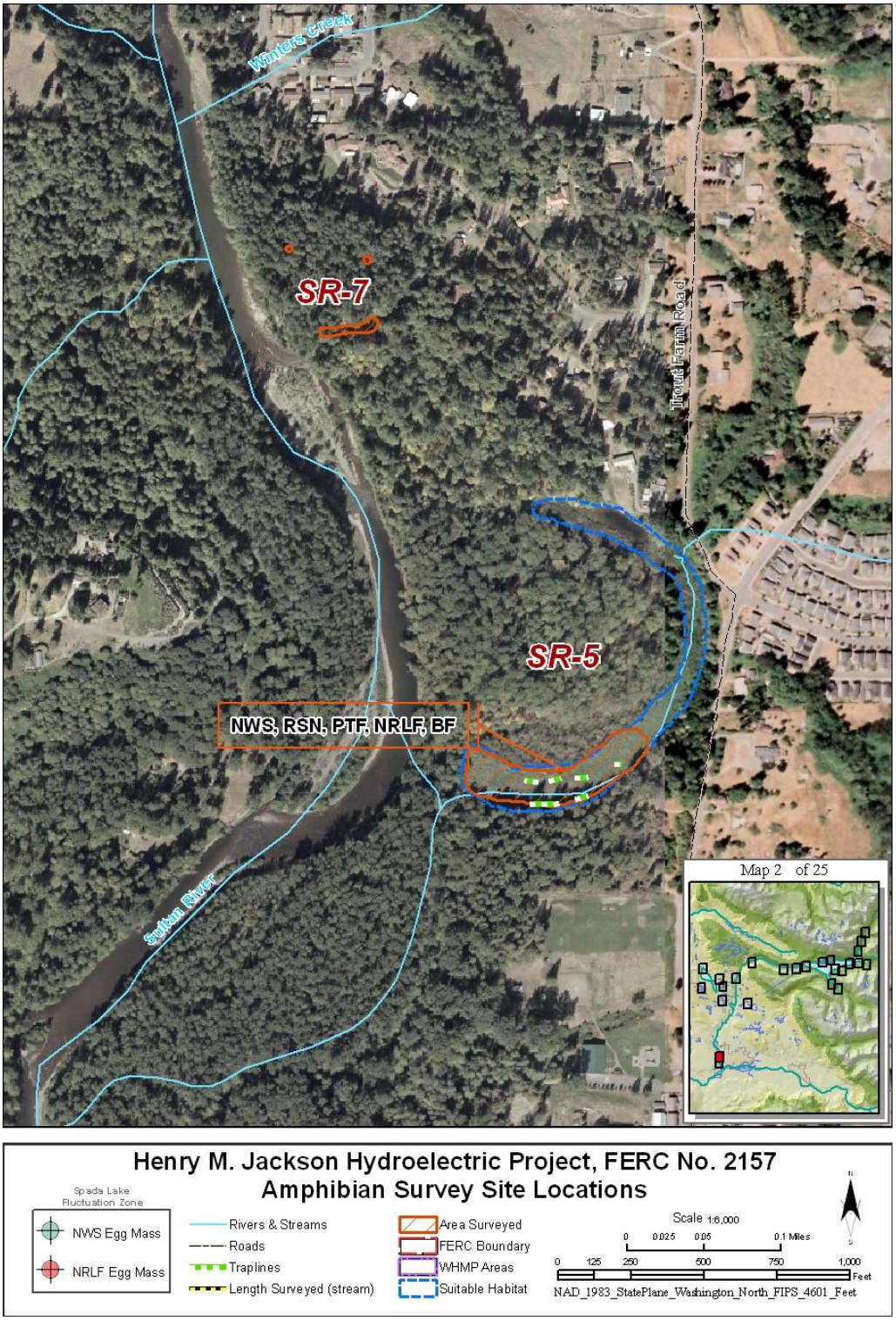

Figure 1, Sheet 2. Suitable Amphibian Habitat and Survey Site Locations. Note: "Rivers & streams" represents an existing GIS data layer and may not precisely depict locations of these features. The full extent of suitable habitat associated with SR-5 is not depicted here (existing GIS data layers do not show wetlands for this area, which is under a forest canopy).

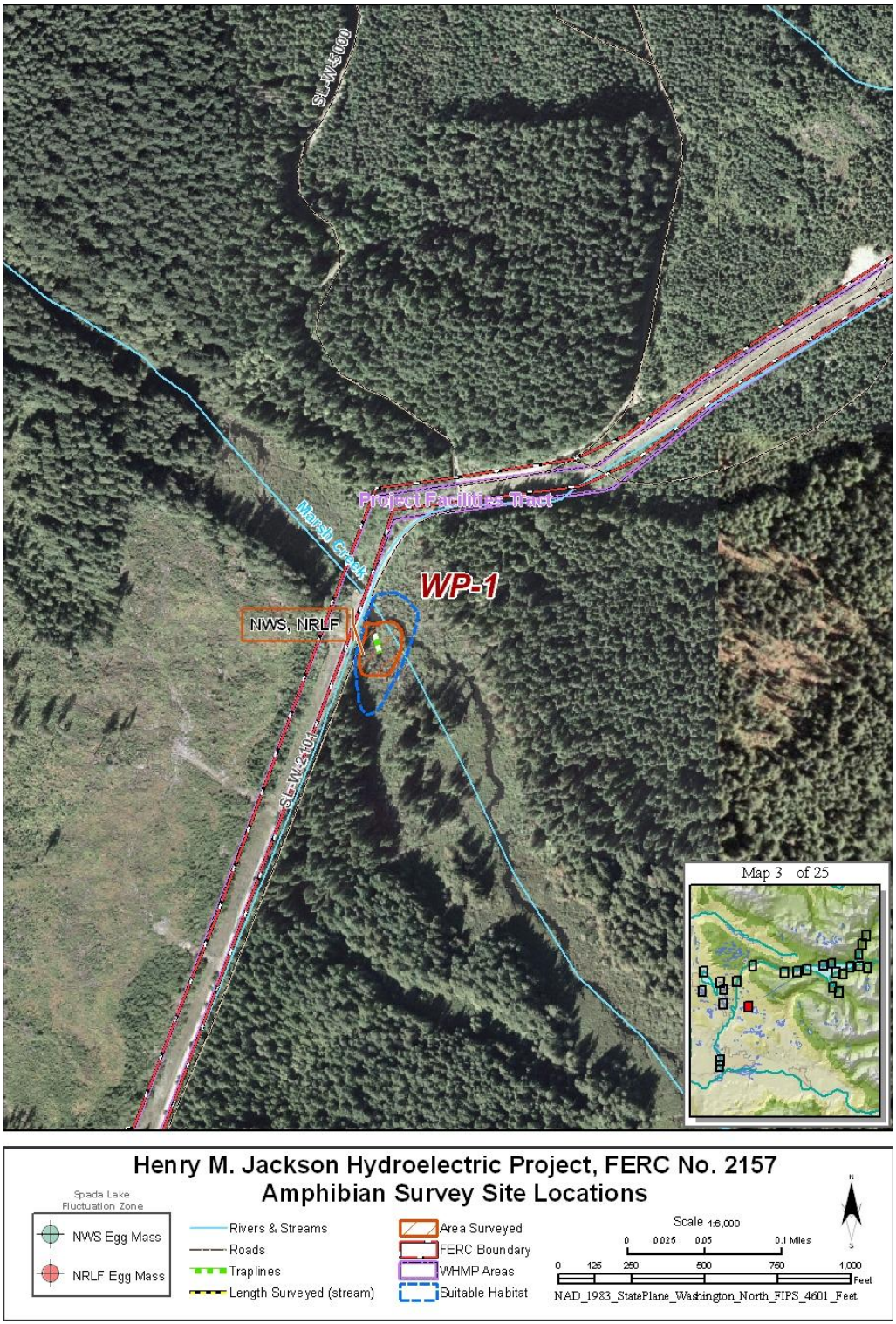

Figure 1, Sheet 3. Suitable Amphibian Habitat and Survey Site Locations. Notes: "Rivers & streams" represents an existing GIS data layers and may not precisely depict locations of these features. Field surveys and habitat mapping associated with Site WP-1 were limited to an area within about 200 feet of the Project boundary.

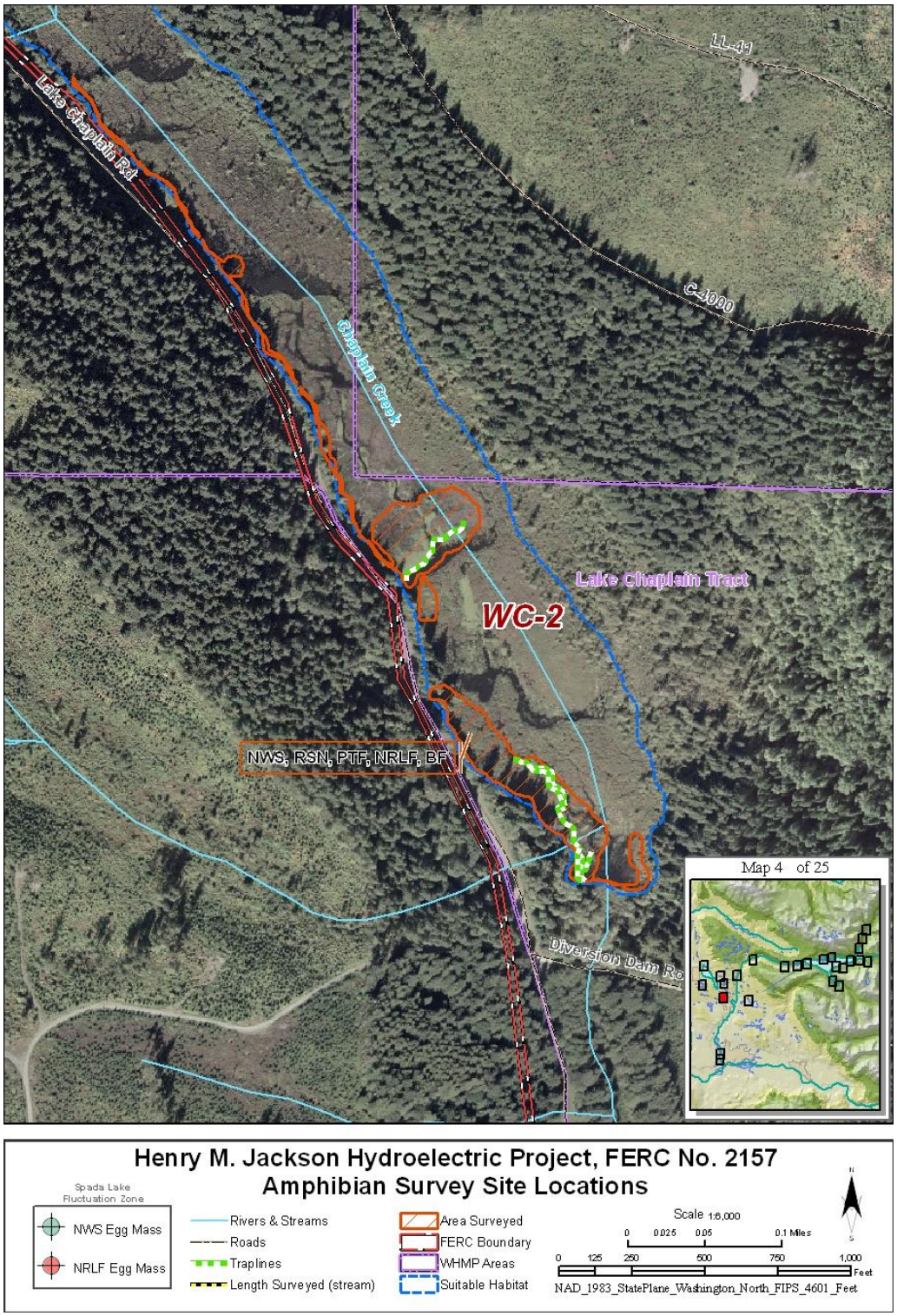

Figure 1, Sheet 4. Suitable Amphibian Habitat and Survey Site Locations. Note: "Rivers & streams" represents an existing GIS data layer and may not precisely depict locations of these features.

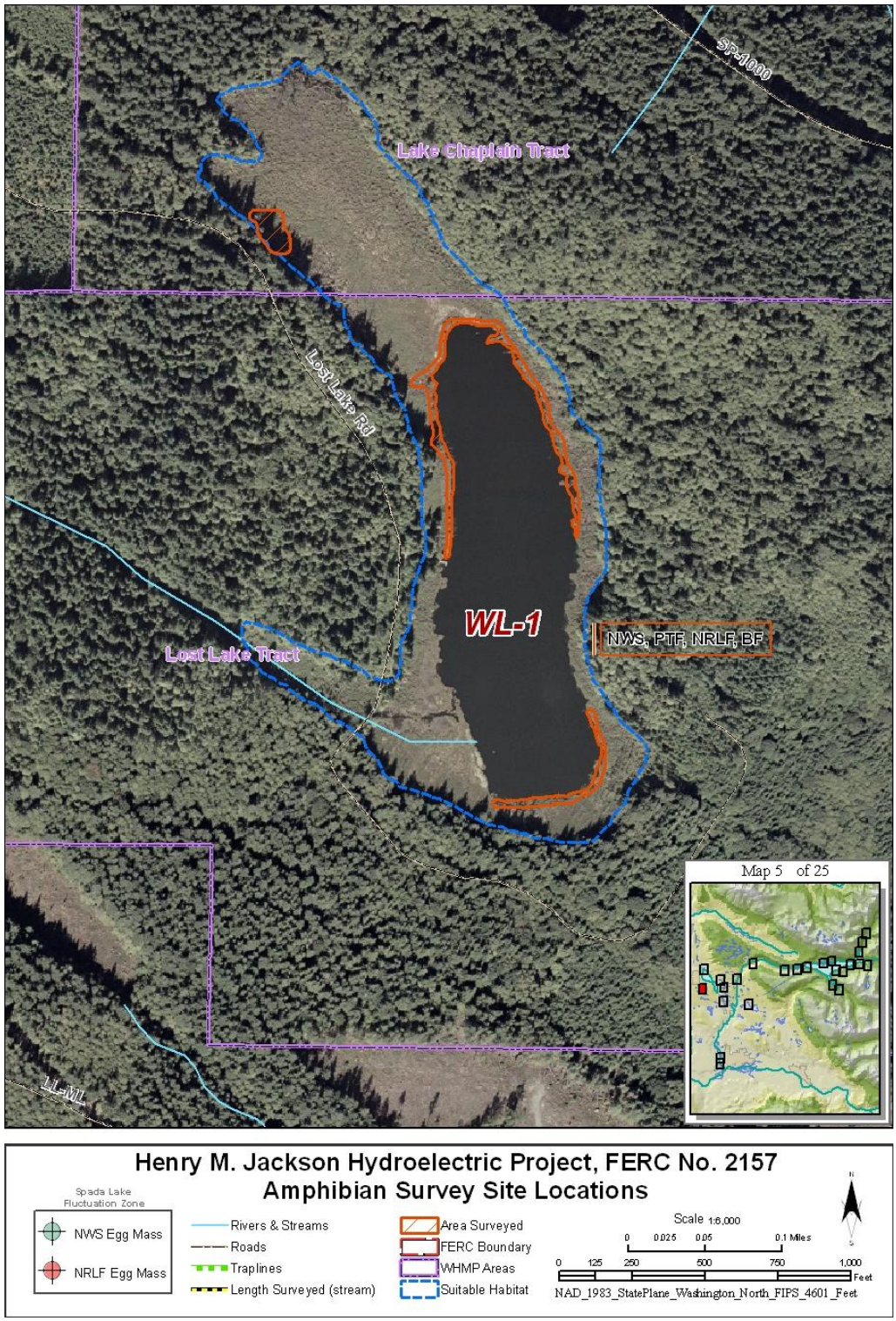

Figure 1, Sheet 5. Suitable Amphibian Habitat and Survey Site Locations. Note: "Rivers & streams" represents an existing GIS data layer and may not precisely depict locations of these features.

Figure 1, Sheet 6. Suitable Amphibian Habitat and Survey Site Locations. Note: "Rivers & streams" represents an existing GIS data layer and may not precisely depict locations of these features.

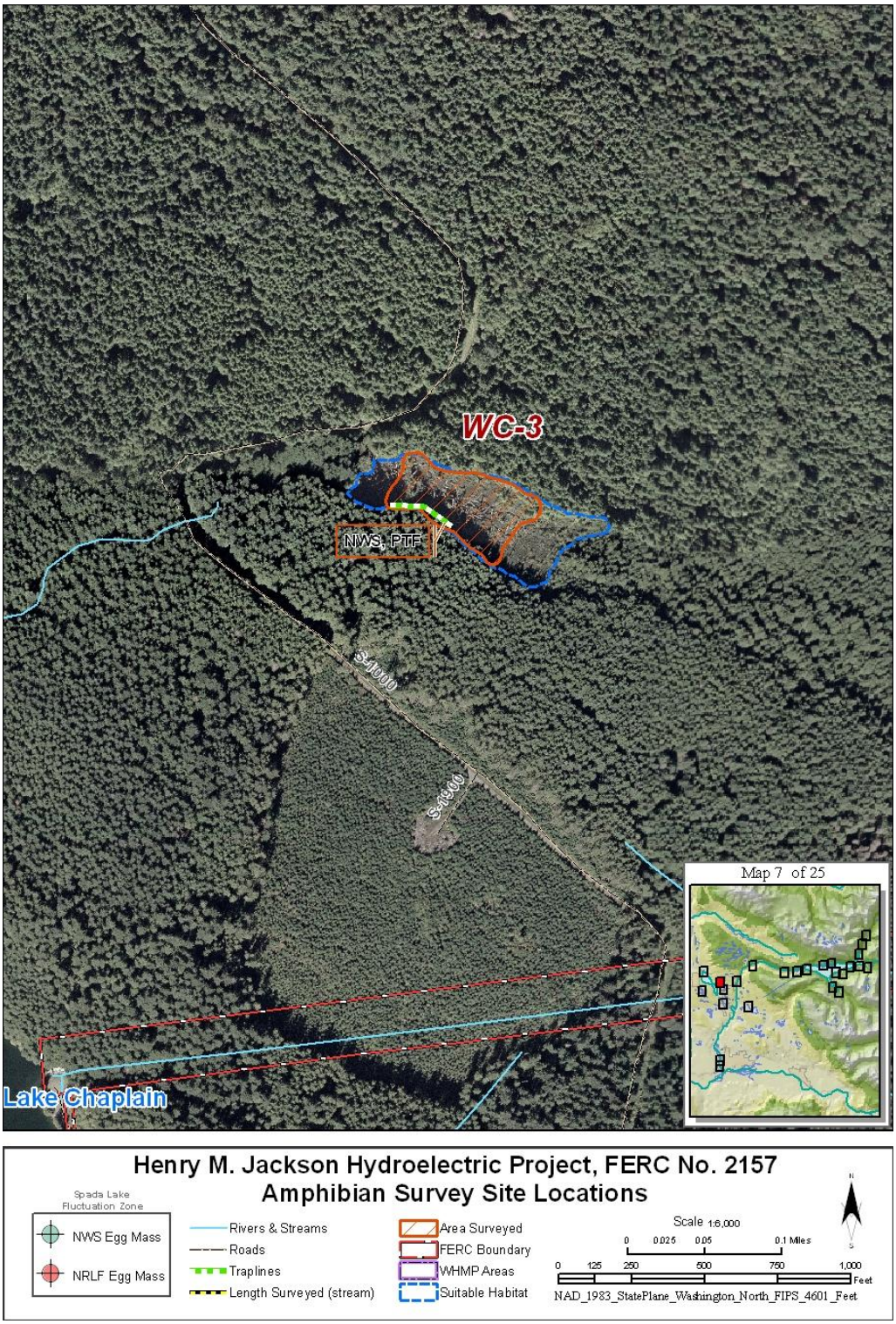

Figure 1, Sheet 7. Suitable Amphibian Habitat and Survey Site Locations. Note: "Rivers & streams" represents an existing GIS data layer and may not precisely depict locations of these features.

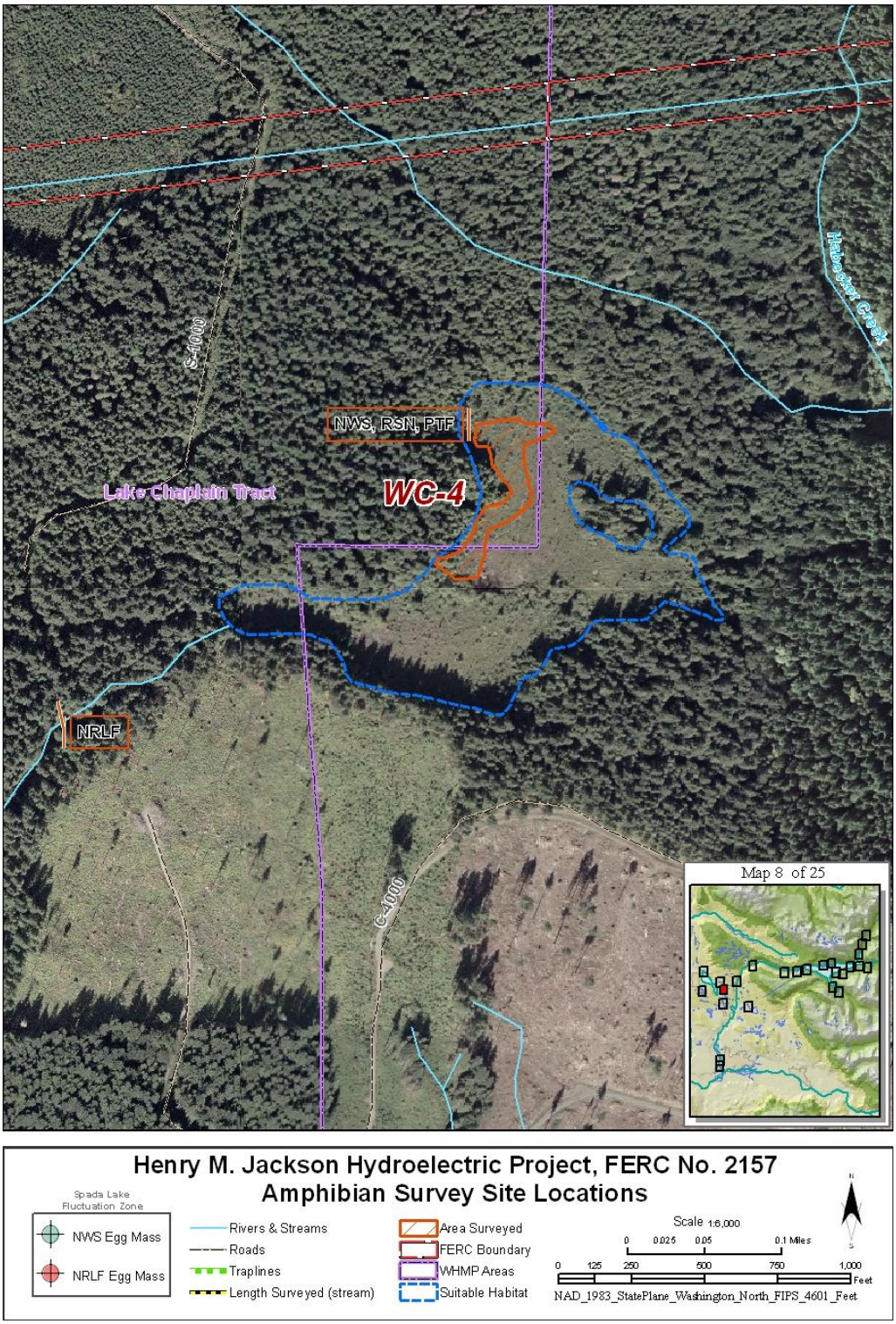

Figure 1, Sheet 8. Suitable Amphibian Habitat and Survey Site Locations. Note: "Rivers & streams" represents an existing GIS data layer and may not precisely depict locations of these features.

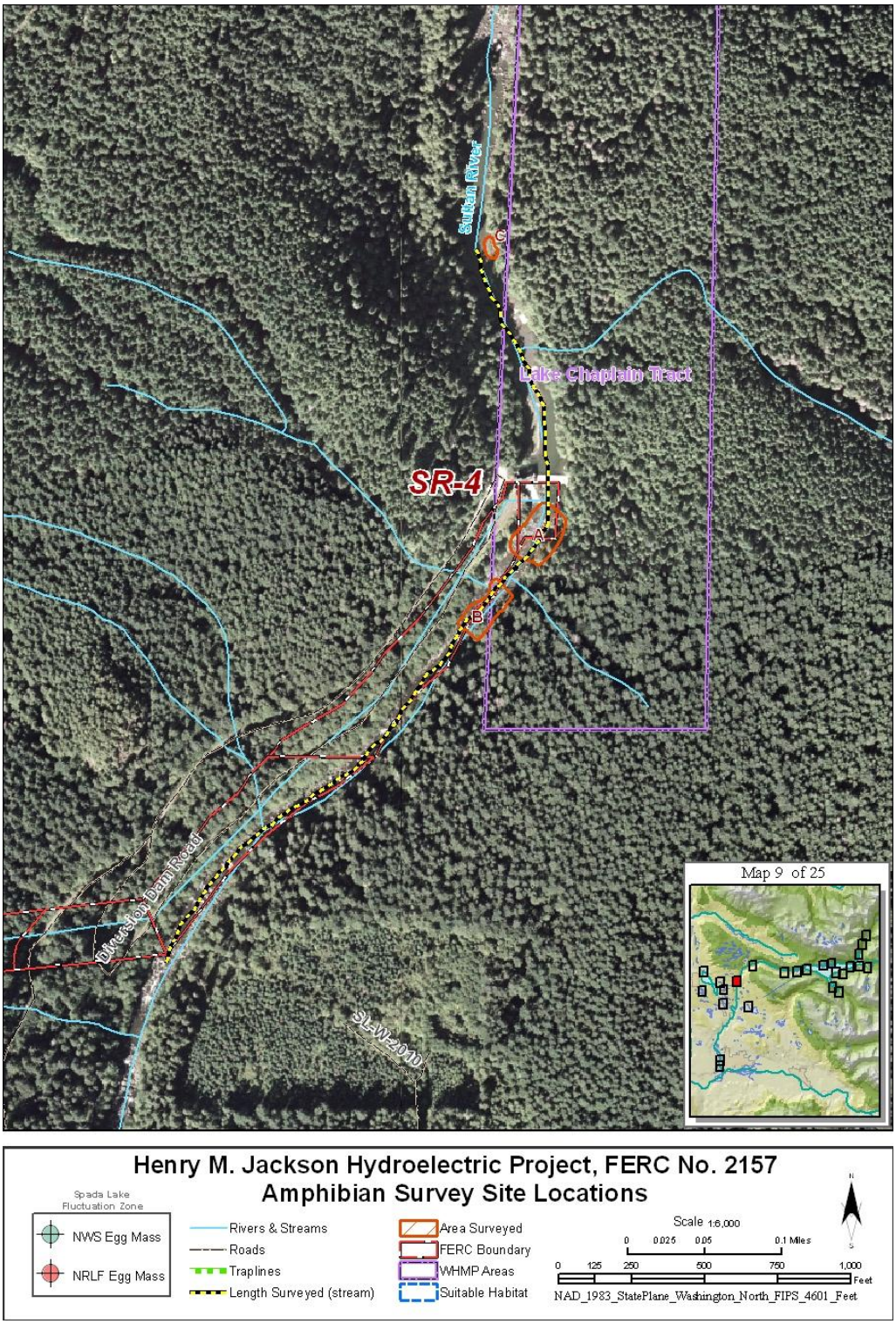

Figure 1, Sheet 9. Suitable Amphibian Habitat and Survey Site Locations. Note: "Rivers & streams" represents an existing GIS data layer and may not precisely depict locations of these features.

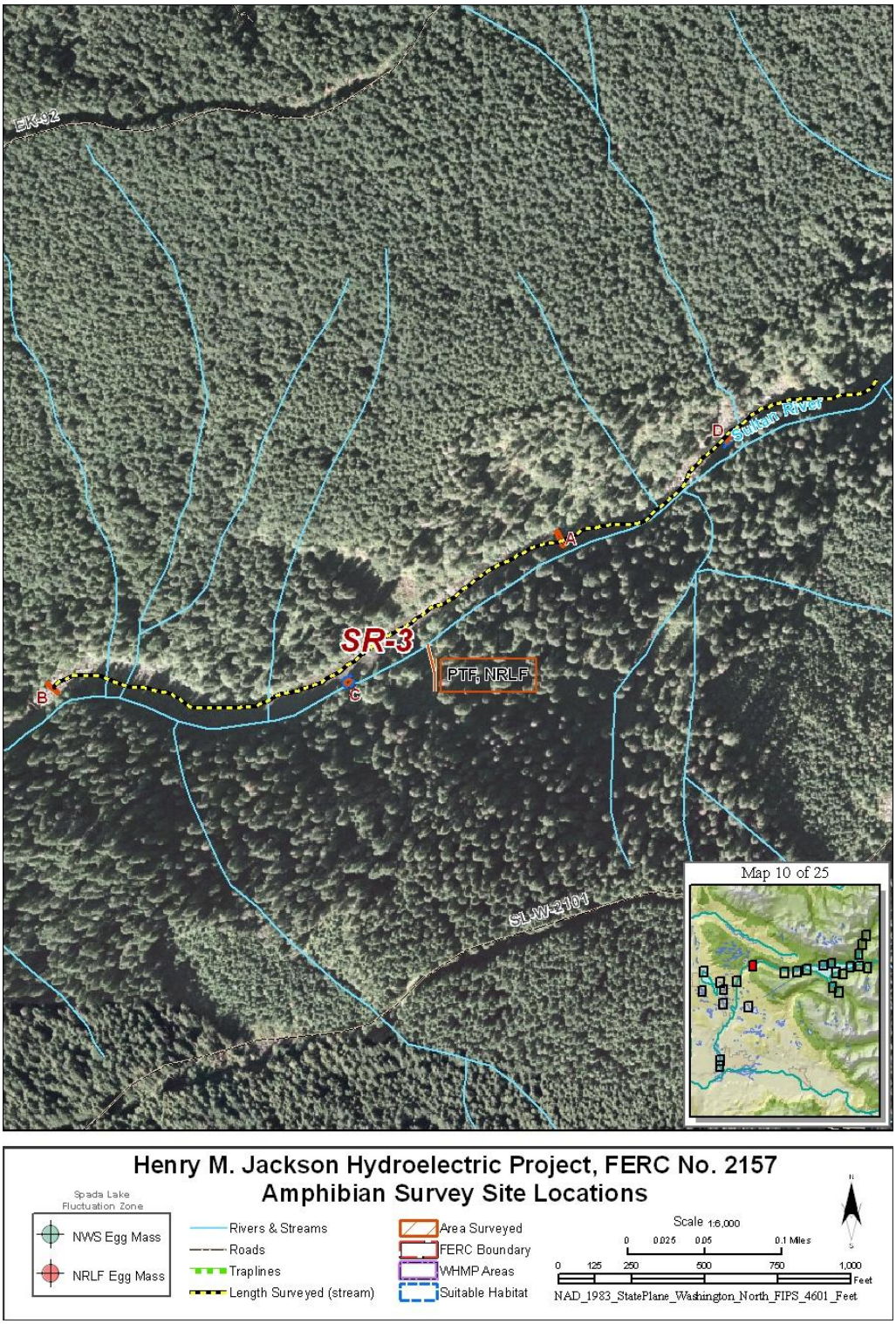

Figure 1, Sheet 10. Suitable Amphibian Habitat and Survey Site Locations. Note: "Rivers & streams" represents an existing GIS data layer and may not precisely depict locations of these features.

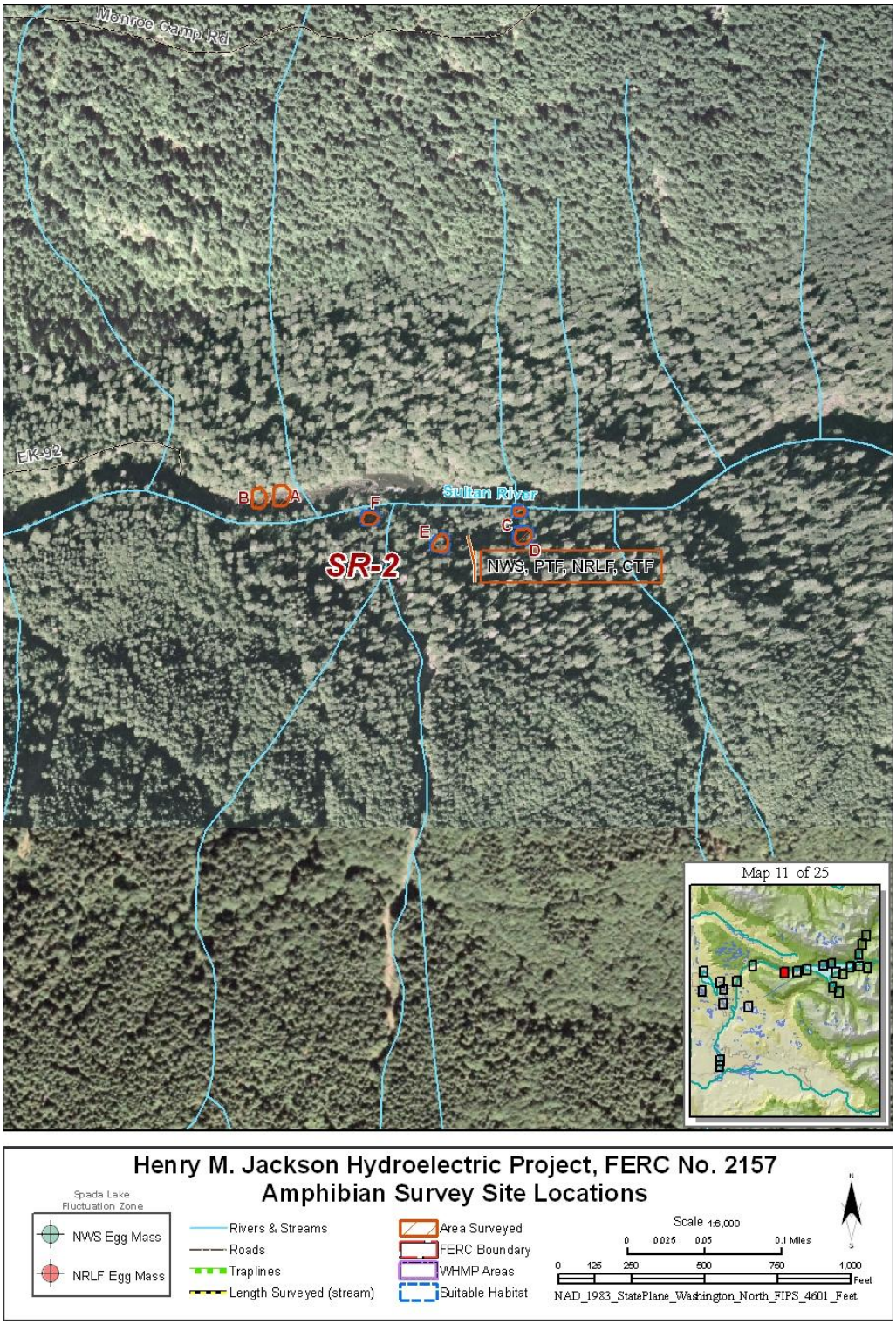

Figure 1, Sheet 11. Suitable Amphibian Habitat and Survey Site Locations. Note: "Rivers & streams" represents an existing GIS data layer and may not precisely depict locations of these features.

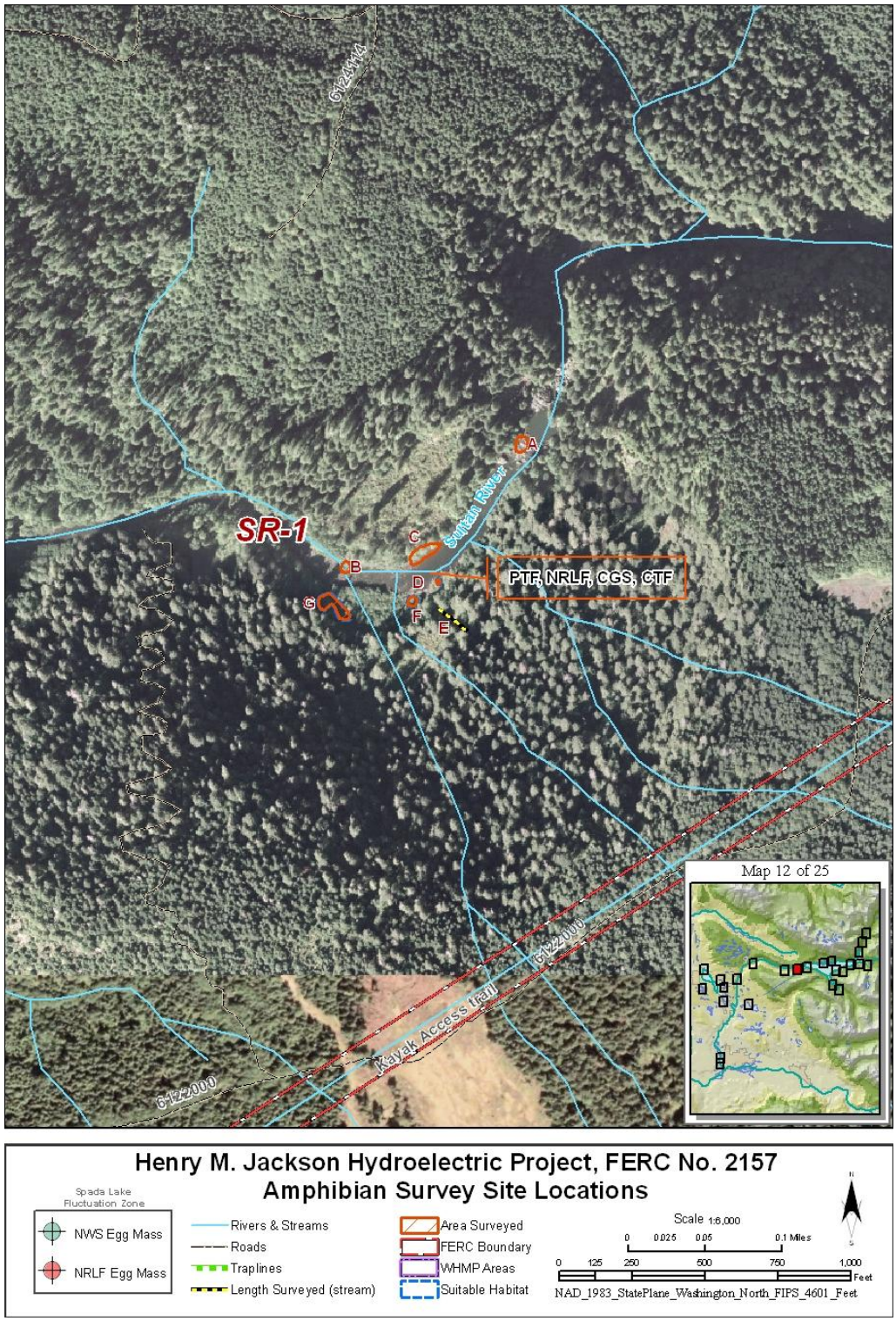

Figure 1, Sheet 12. Suitable Amphibian Habitat and Survey Site Locations. Note: "Rivers & streams" represents an existing GIS data layer and may not precisely depict locations of these features.

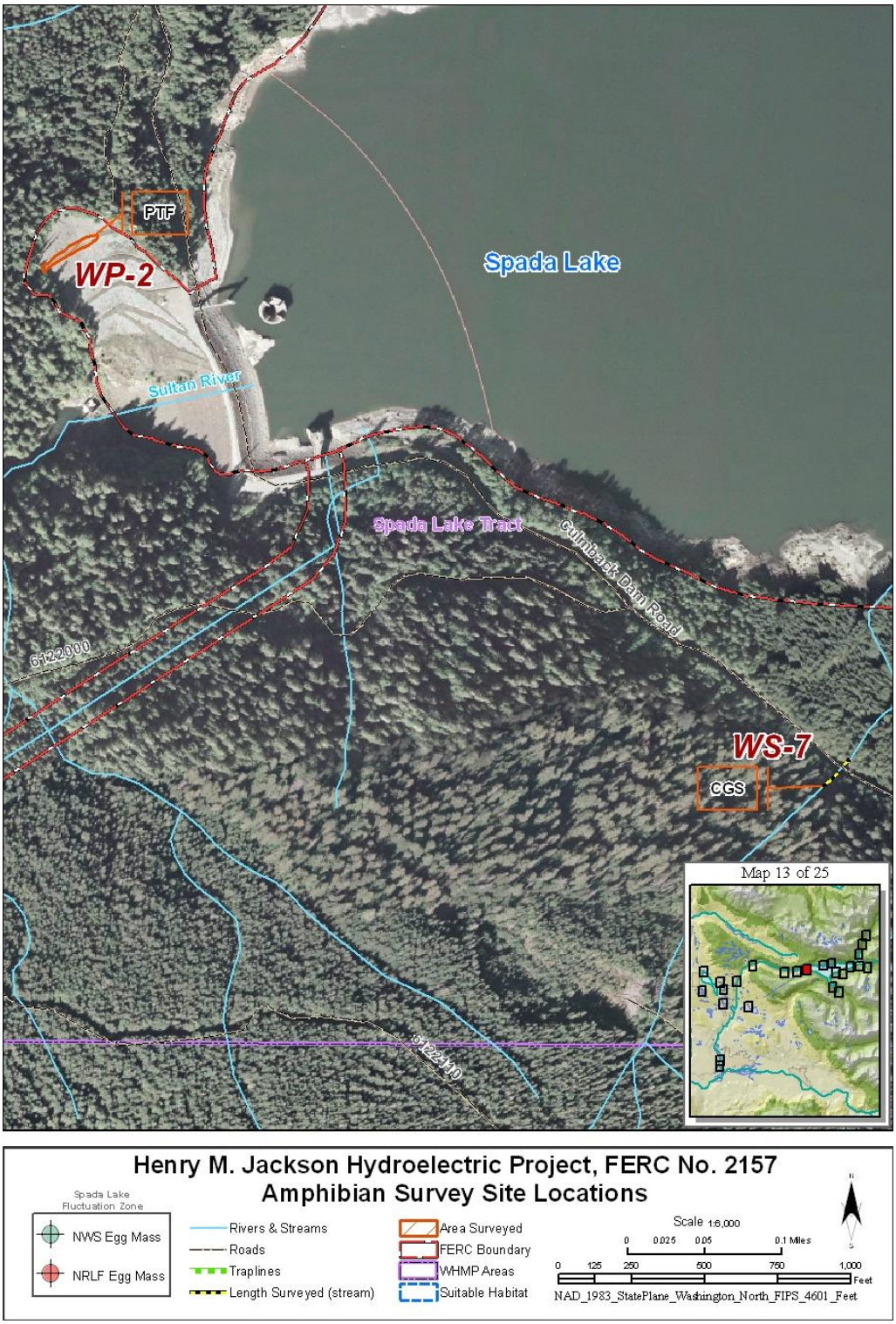

Figure 1, Sheet 13. Suitable Amphibian Habitat and Survey Site Locations. Note: "Rivers & streams" represents an existing GIS data layer and may not precisely depict locations of these features.

Figure 1, Sheet 14. Suitable Amphibian Habitat and Survey Site Locations. Note: "Rivers & streams" represents an existing GIS data layer and may not precisely depict locations of these features.

Figure 1, Sheet 15. Suitable Amphibian Habitat and Survey Site Locations. Note: "Rivers & streams" represents an existing GIS data layer and may not precisely depict locations of these features.

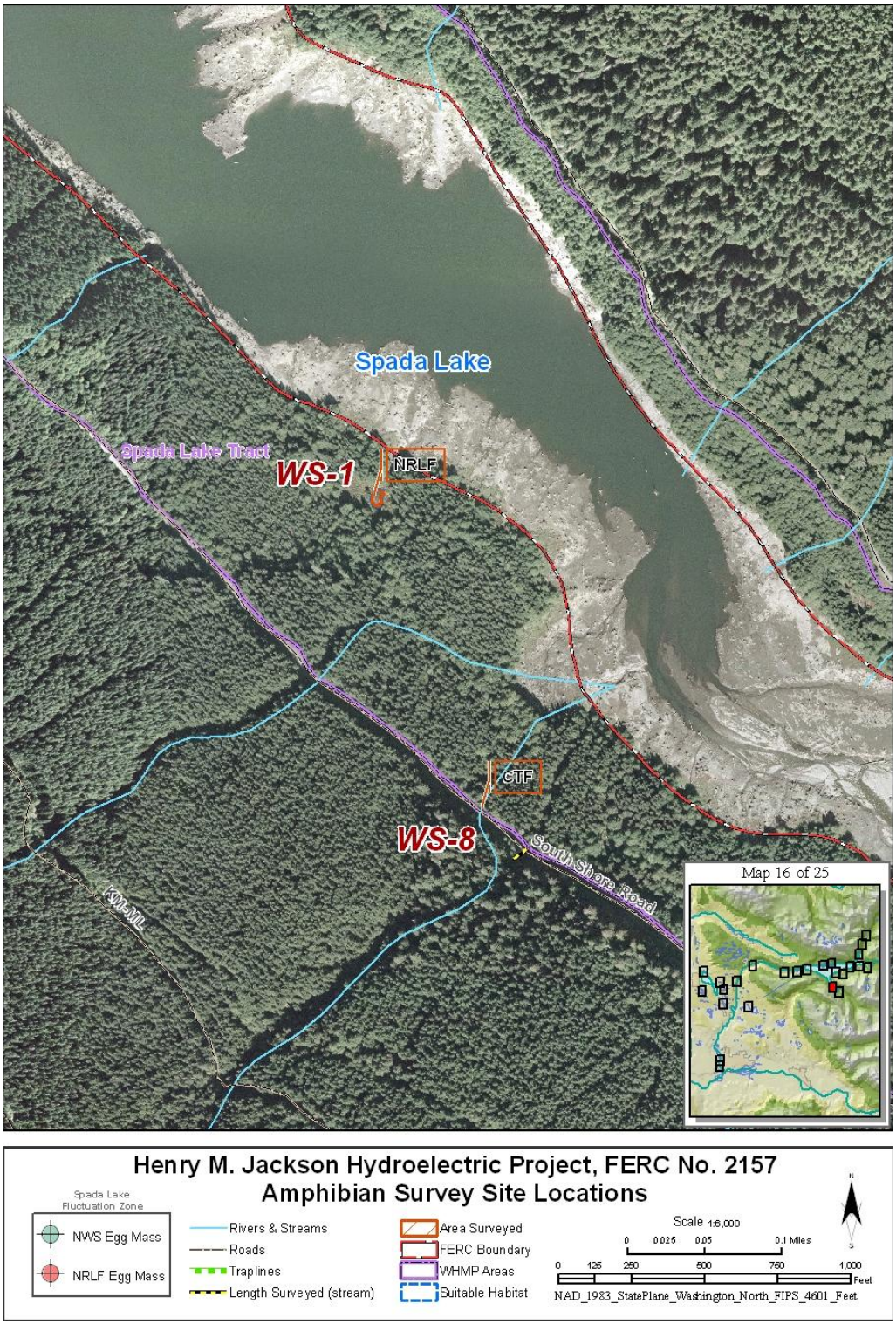

Figure 1, Sheet 16. Suitable Amphibian Habitat and Survey Site Locations. Note: "Rivers & streams" represents an existing GIS data layer and may not precisely depict locations of these features.

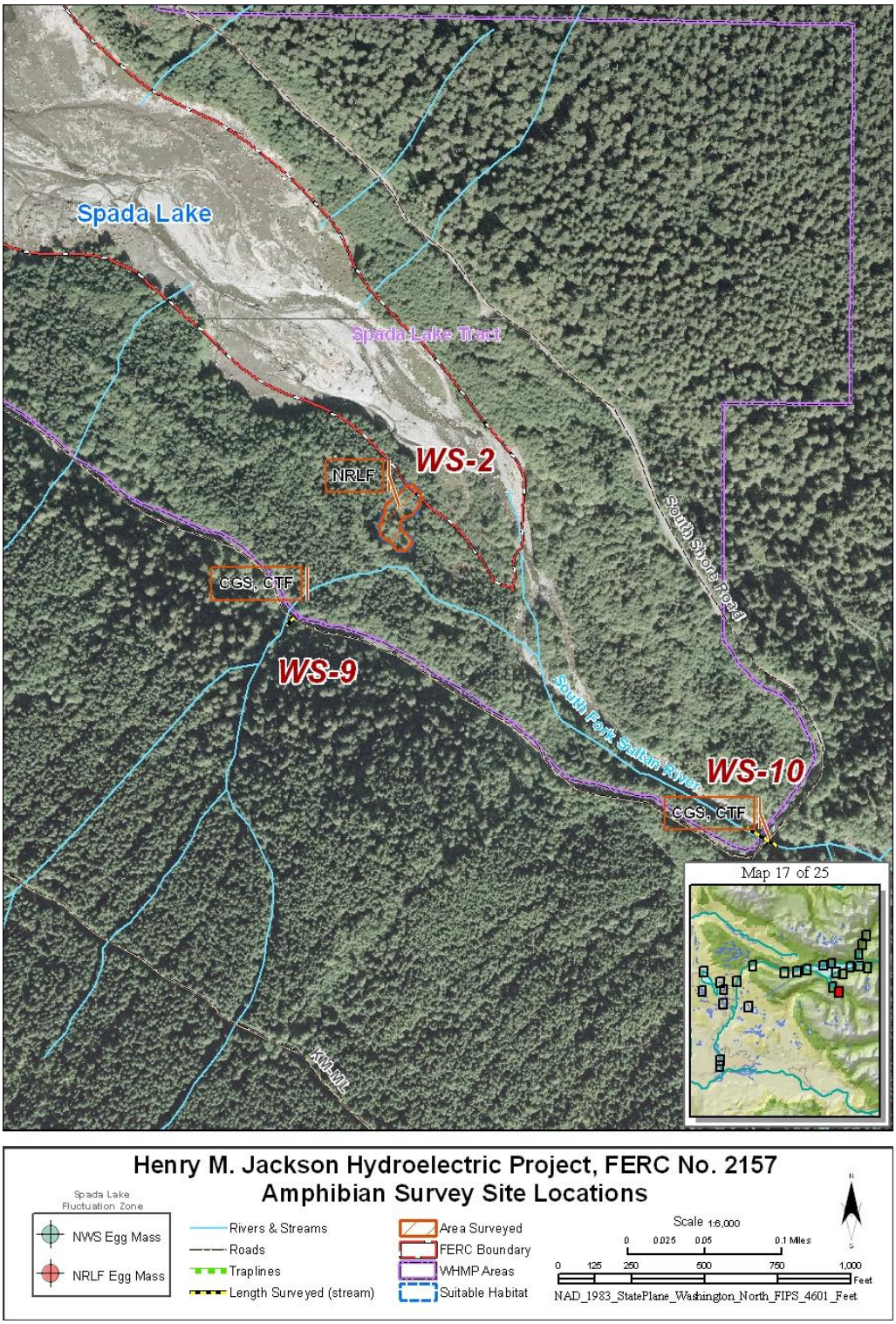

Figure 1, Sheet 17. Suitable Amphibian Habitat and Survey Site Locations. Note: "Rivers & streams" represents an existing GIS data layer and may not precisely depict locations of these features.

Figure 1, Sheet 18. Suitable Amphibian Habitat and Survey Site Locations. Notes: "Rivers & streams" represents an existing GIS data layer and may not precisely depict locations of these features. Within the Spada Lake fluctuation zone, "suitable habitat" is a relative term. No habitats suitable for successful completion of entire aquatic life phases were identified in this zone during the study.

Figure 1, Sheet 19. Suitable Amphibian Habitat and Survey Site Locations. Note: "Rivers & streams" represents an existing GIS data layer and may not precisely depict locations of these features.

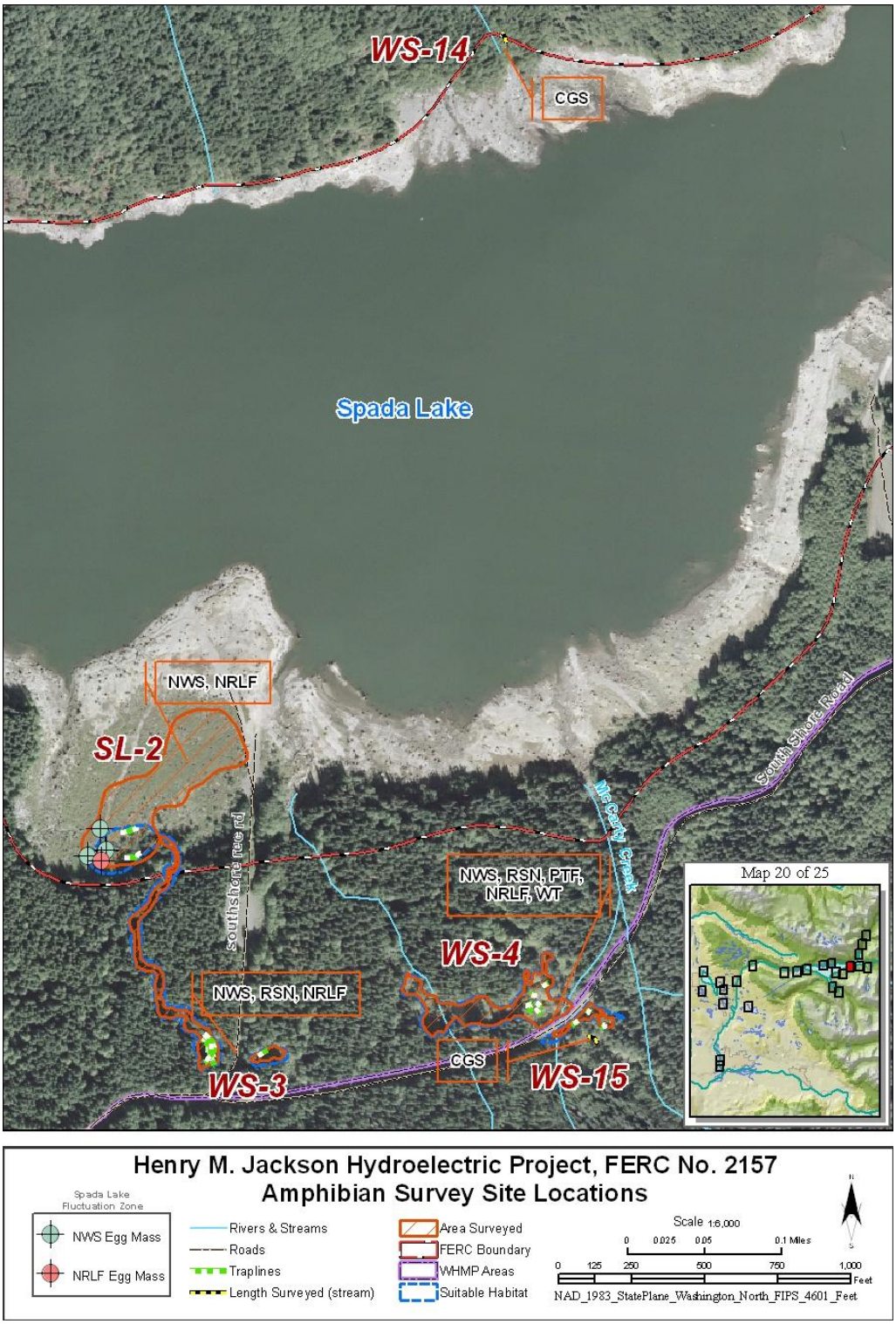

Figure 1, Sheet 20. Suitable Amphibian Habitat and Survey Site Locations. Notes: "Rivers & streams" represents an existing GIS data layer and may not precisely depict locations of these features. Within the Spada Lake fluctuation zone, "suitable habitat" is a relative term. No habitats suitable for successful completion of entire aquatic life phases were identified in this zone during the study.

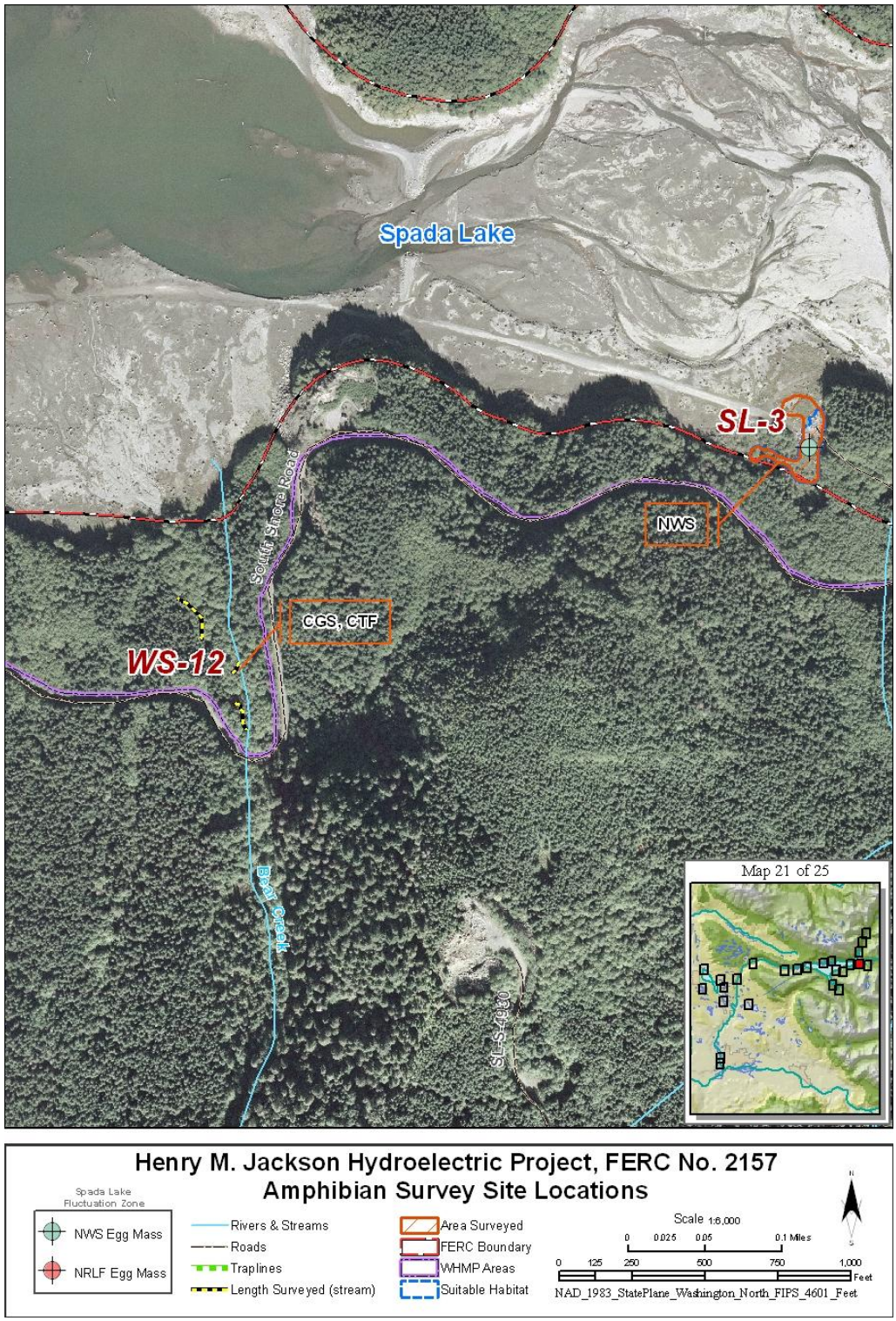

Figure 1, Sheet 21. Suitable Amphibian Habitat and Survey Site Locations. Notes: "Rivers & streams" represents an existing GIS data layer and may not precisely depict locations of these features. Within the Spada Lake fluctuation zone, "suitable habitat" is a relative term. No habitats suitable for successful completion of entire aquatic life phases were identified in this zone during the study.

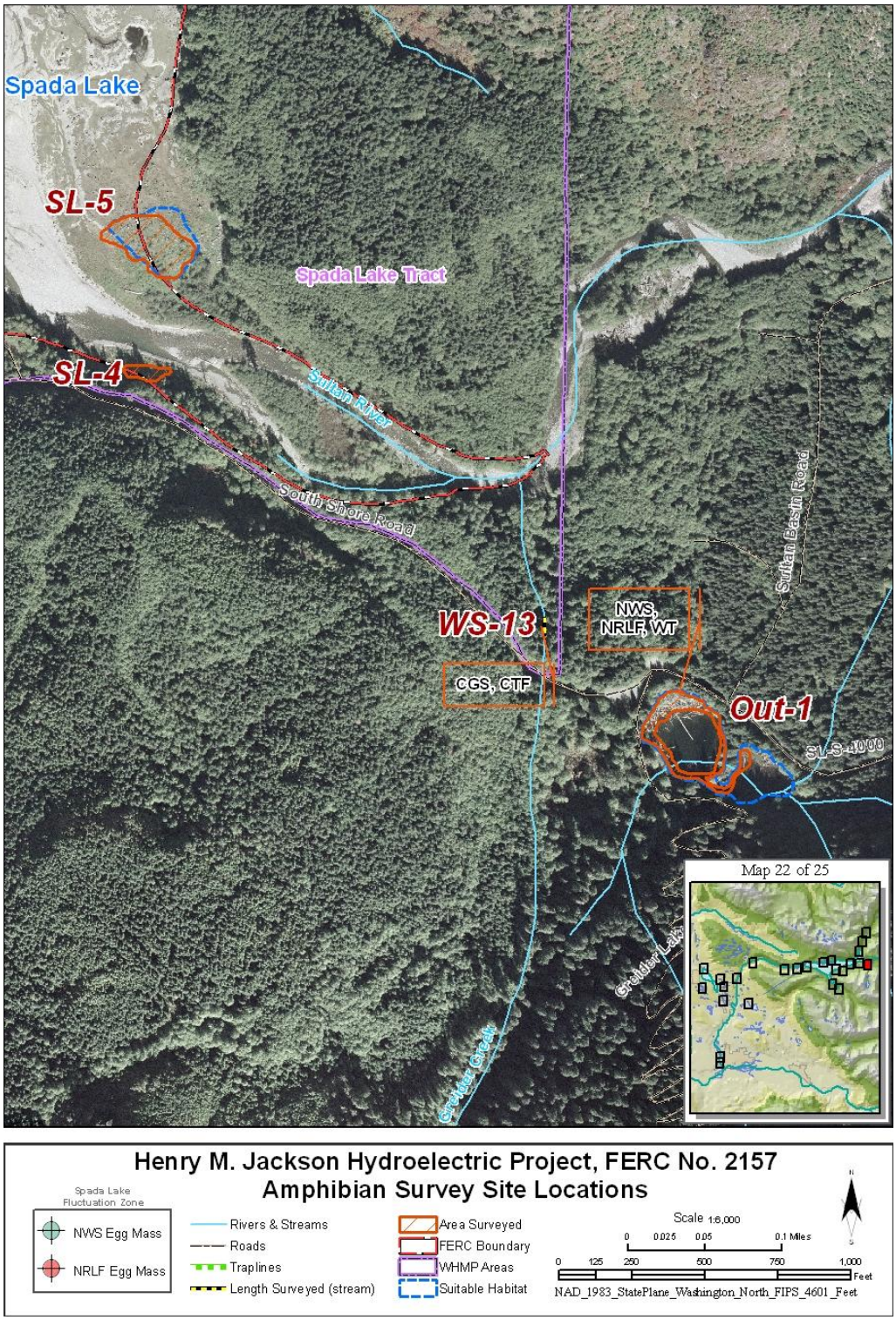

Figure 1, Sheet 22. Suitable Amphibian Habitat and Survey Site Locations. Notes: "Rivers & streams" represents an existing GIS data layer and may not precisely depict locations of these features. Within the Spada Lake fluctuation zone, "suitable habitat" is a relative term. No habitats suitable for successful completion of entire aquatic life phases were identified in this zone during the study.

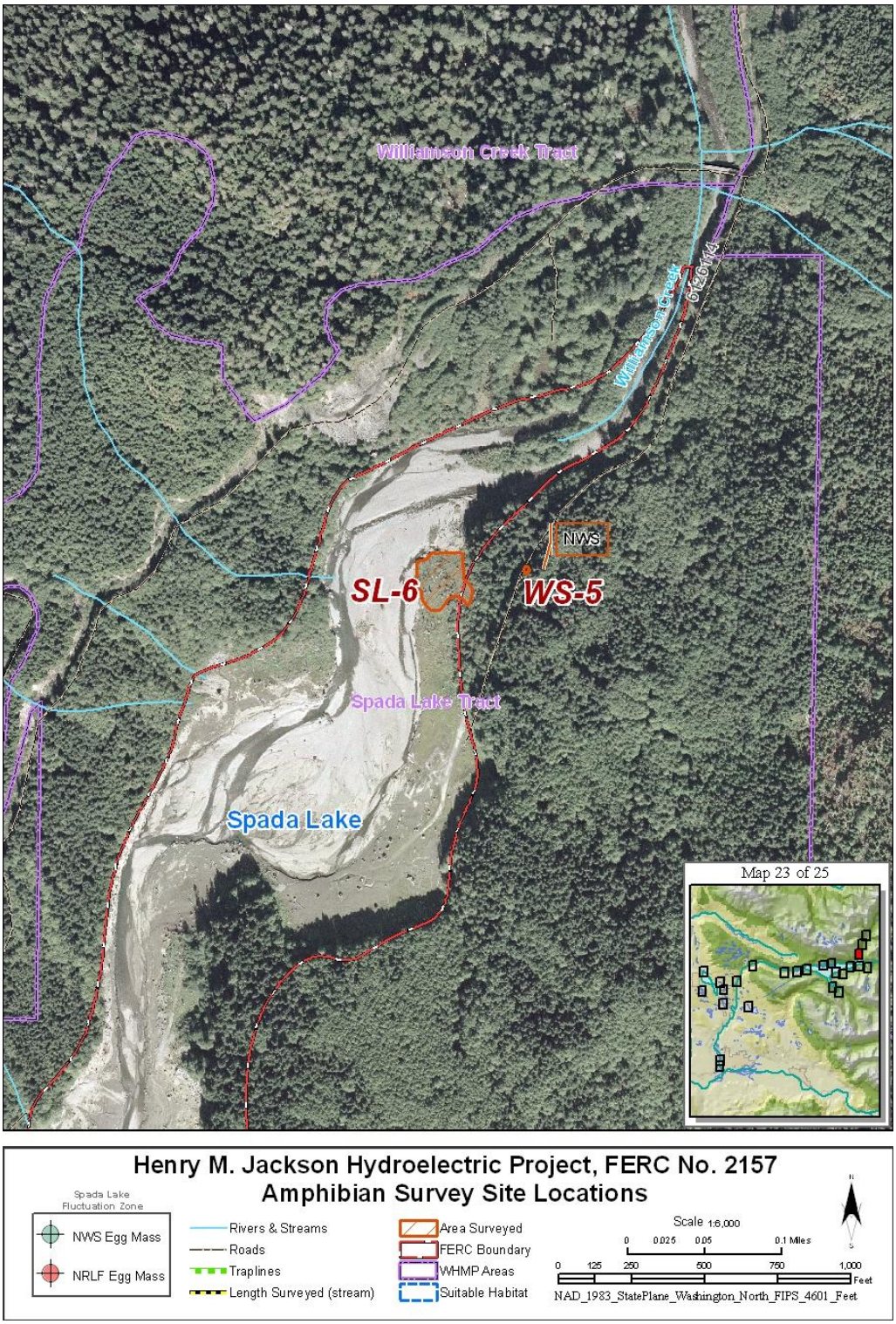

Figure 1, Sheet 23. Suitable Amphibian Habitat and Survey Site Locations. Notes: "Rivers & streams" represents an existing GIS data layer and may not precisely depict locations of these features. Within the Spada Lake fluctuation zone, "suitable habitat" is a relative term. No habitats suitable for successful completion of entire aquatic life phases were identified in this zone during the study.

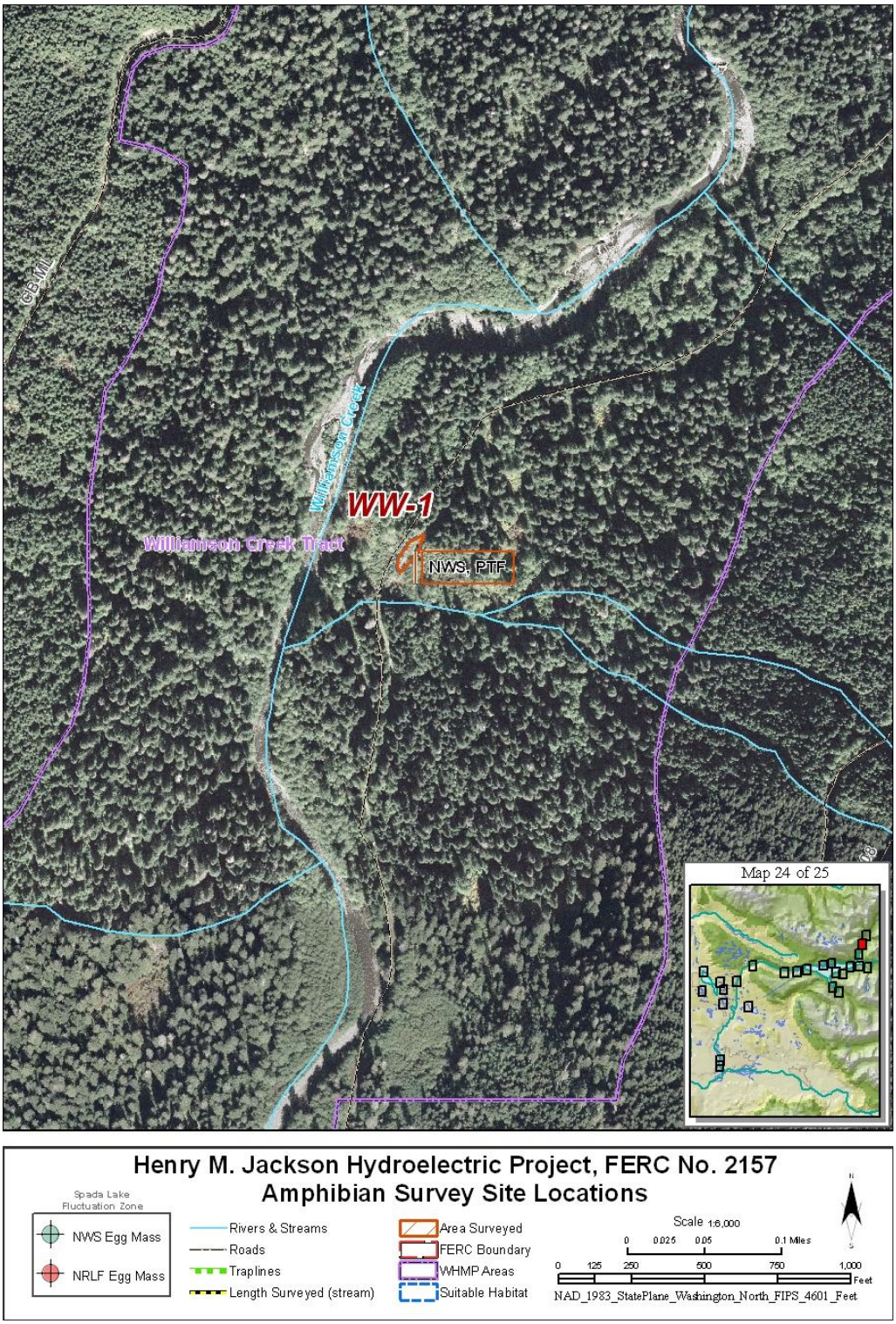

Figure 1, Sheet 24. Suitable Amphibian Habitat and Survey Site Locations. Note: "Rivers & streams" represents an existing GIS data layer and may not precisely depict locations of these features.

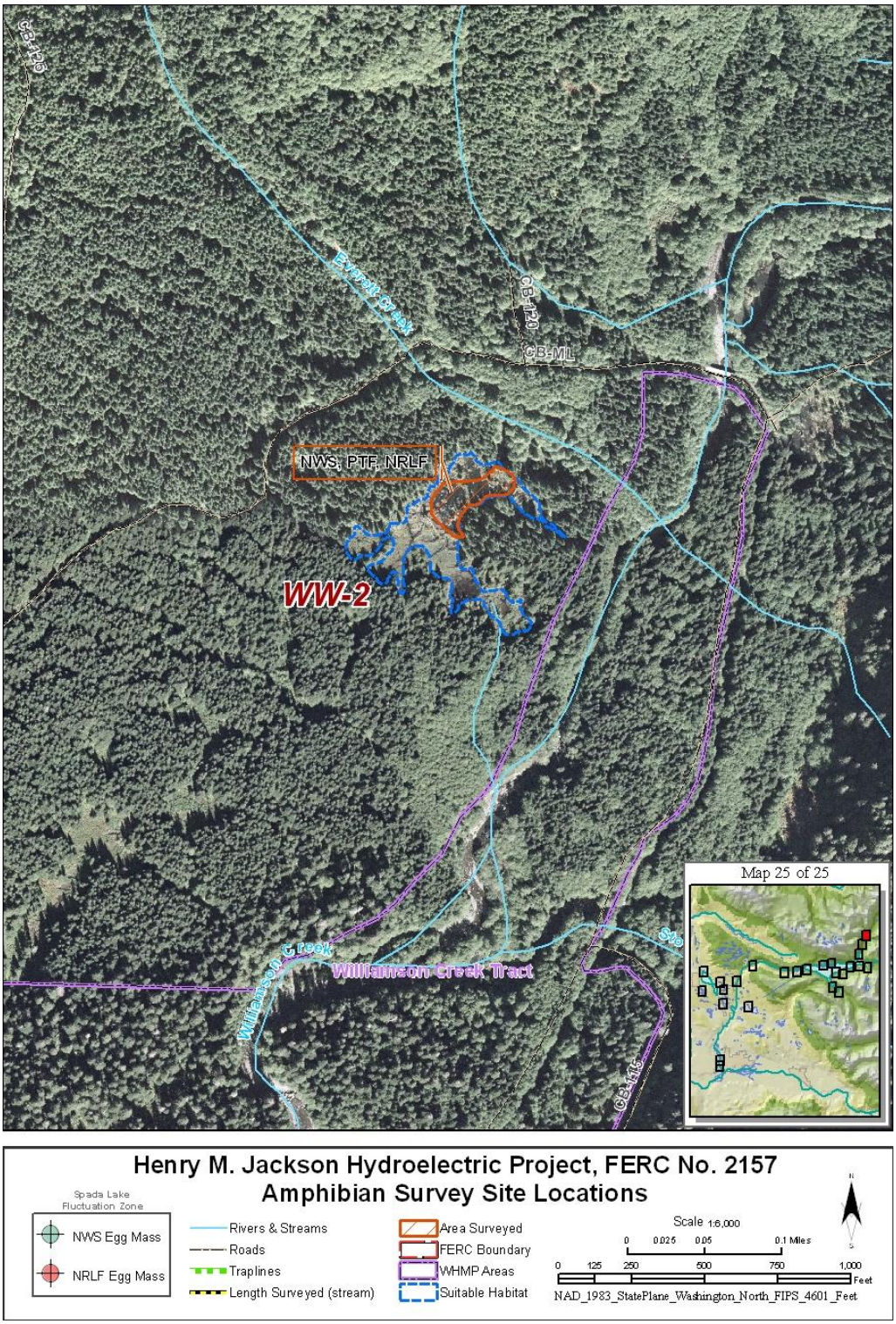

Figure 1, Sheet 25. Suitable Amphibian Habitat and Survey Site Locations. Note: "Rivers & streams" represents an existing GIS data layer and may not precisely depict locations of these features.

APPENDIX B
PHOTOGRAPHS

SPADA LAKE FLUCTUATION ZONE

Photo 1: Site SL-1 (June 7, 2007). Emergent and shrub wetland in fluctuation zone. Firm substrate suggests that period of inundation is not long. No amphibians found. (Map location: Appendix A, Fig. 1, Sheet 18).

Photo 2: Site SL-2 (April 13, 2007). Emergent wetland partially exposed. Beaver dams on small drainage appear to be just above normal reservoir high water level. (Map location: Appendix A, Fig. 1, Sheet 20).

Photo 3: Site SL-2 (April 13, 2007). Two northern red-legged frog egg masses (one shown here) were found at the site on this date, both in relatively shallow water in a cove filled with woody debris.

Photo 4: Site SL-2 (April 13, 2007). A total of six northwestern salamander egg masses were found at the site on this date, four of which were stranded out of the water. Two of these masses were unusually small (there are fewer than ten eggs in this mass compared to typical egg mass content of 50-200 eggs).

Photo 5: Site SL-2 (April 13, 2007). Northwestern salamander egg mass stranded out of water. Eggs of this species can survive periods of stranding, but under prolonged exposure are likely to become desiccated and die, or succumb to predation by raccoons, birds, etc.

Photo 6: Site SL-2 (April 24, 2007). Reservoir water surface 4.7 feet lower than on April 13.

Photo 7: Site SL-2 (April 24, 2007). This view is looking down from the uppermost beaver dam toward the reservoir fluctuation zone wetland. The beaver impoundments contain almost no emergent vegetation and are not yet particularly good amphibian habitat.

Photo 8: Site SL-2 (April 24, 2007). The two northern red-legged frog egg masses observed on April 13 (and another mass found on this date) were stranded out of water. Egg masses of this species are not tolerant of stranding and will quickly desiccate.

Photo 9: Site SL-2 (July 24, 2007). Reservoir water surface 5.2 feet higher than on April 13. No amphibians found.

Photo 10: Site SL-2 (September 11, 2007). Most of the wetland exposed. No amphibians found.

Photo 11: Site SL-2 (June 25, 2008). In 2008 amphibian activity was greatly delayed by unusually prolonged winter conditions. High water levels in Spada Lake precluded amphibian surveys in the fluctuation zone; however, deep water over submerged vegetation during amphibian breeding periods probably created conditions unattractive to amphibians in 2008.

Photo 12: Site SL-3 (April 11, 2007). Emergent and shrub wetland partially exposed. Evidence of amphibian use was limited to an exposed area through which a small seasonal drainage flowed (drainage indicated by arrow). (Map location: Appendix A, Fig. 1, Sheet 21).

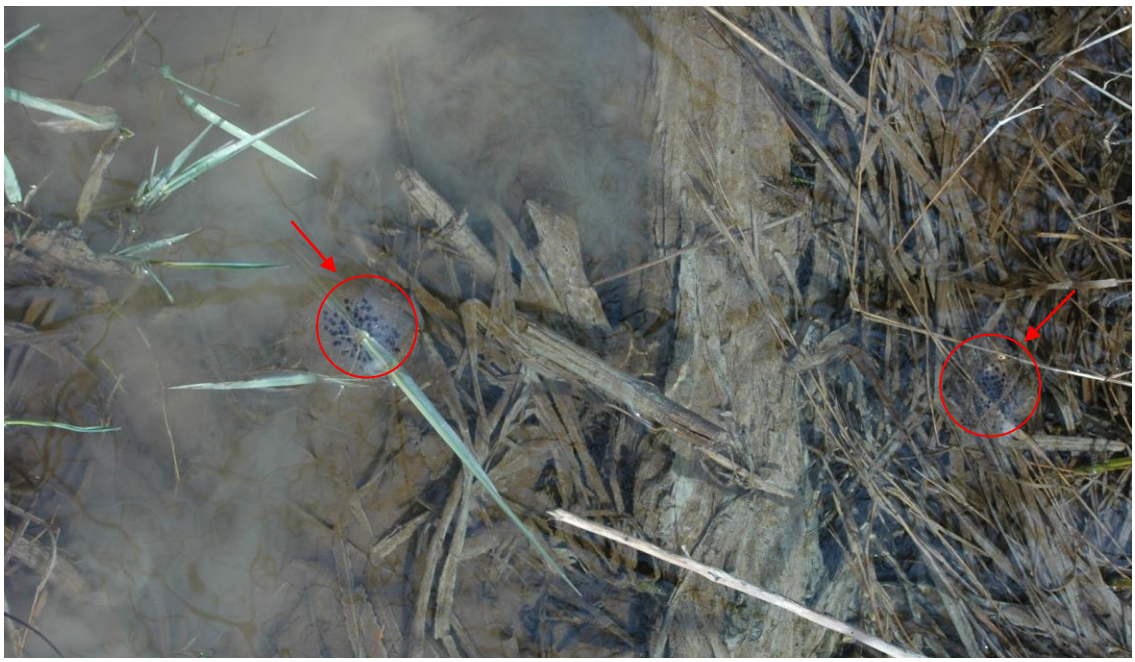

Photo 13: Site SL-3 (April 11, 2007). A total of three northwestern salamander egg masses were found at this site (two are indicated here) in a small drainage. Possibly, the eggs survived the subsequent period of lower reservoir water level, but the site was later under deep water.

Photo 14: Site SL-4 (June 7, 2007). An area of emergent vegetation and shrubs was partially exposed on April 11, but under deep water subsequently. No amphibians found. (Map location: Appendix A, Fig. 1, Sheet 22).

Photo 15: Site SL-5 (April 11, 2007). Water at this site was mostly deep. No amphibians found. (Map location: Appendix A, Fig. 1, Sheet 22).

Photo 16: Site SL-6 (April 11, 2007). Emergent wetland with only small areas of shallow water. No amphibians found. (Map location: Appendix A, Fig. 1, Sheet 23).

Photo 17: Site SL-7 (June 7, 2007). A beaver dam at the head of this cove forms a small, deep pool. The dam was above the reservoir level on April 11, but under water on this date. No amphibians found. (Map location: Appendix A, Fig. 1, Sheet 15).

WHMP LANDS – SPADA LAKE TRACT

Photo 18: Site WS-1 (June 7, 2007). Beaver dam on small stream was in disrepair and large amount of alluvium apparently washed into pool. Northern red-legged frog larvae in this pool and in another pool below the dam were smaller than at other sites, possibly because of colder water. (Map location: Appendix A, Fig. 1, Sheet 16).

Photo 19: Site WS-2 (July 25, 2007). Beaver dams appear to be relatively recent. No amphibians found. (Map location: Appendix A, Fig. 1, Sheet 17).

Photo 20: Site WS-3 (June 25, 2008). Permanently flooded wetland formed by beaver dams along small stream. Three aquatic funnel traps are along near shoreline. Northwestern salamanders are abundant at this site; rough-skinned newt and northern red-legged frog also documented. (View looking south; arrow indicates western skunk cabbage identified as reference point in Photo 21.) (Map location: Appendix A, Fig. 1, Sheet 20).

Photo 21: Site WS-3 (July 31, 2008). Seasonal changes in water level at this and other beaver impoundments on the Spada Tract are a normal occurrence, often causing amphibian (particularly northwestern salamander) egg masses to be stranded. (View looking north; arrow indicates western skunk cabbage identified as reference point in Photo 20.)

Photo 22: Site WS-4 (April 10, 2007). Site straddles South Shore Road. This wetland is formed by a series of beaver dams on small stream. On this date, northwestern salamander and northern red-legged frog egg masses were mostly at least several days to a week old (the breeding period probably over), whereas Pacific treefrog egg masses were probably only 1-2 days old (breeding period continuing). (View looking north from South Shore Road.) (Map location: Appendix A, Fig. 1, Sheet 20).

Photo 23: Site WS-4 (June 7, 2007). Water was noticeably lower than in April. Northwestern salamander larvae trapped on this date were all large (i.e., in their second year as larvae).

Photo 24: Site WS-4 (July 31, 2008). This site contains numerous connected or separate pools of different depths and permanence, and different patterns of species use. Northern red-legged frog and Pacific treefrog larvae tended to be most numerous in shallow, disjunct pools, where water may be warmer and predation by rough-skinned newts and northwestern salamander larvae less severe.

Photo 25: Site WS-4 (June 8, 2007). This ditch on the south side of South Shore Road was warmer than other areas in the wetland in 2007 and contained larger northern red-legged frog larvae than elsewhere at the site.

Photo 26: Site WS-5 (April 11, 2007). This site is a very small pool (circled in photograph) formed where a stream flows over an abandoned logging road. A total of six northwestern salamander egg masses were found at this site despite marginal conditions (five of the masses were found stranded in June, not having yet hatched because of cold water). (Map location: Appendix A, Fig. 1, Sheet 23).

Photo 27: Site WS-6 (July 25, 2007). This site is comprised of pools and channels impounded by beaver dams along a small drainage north of Spada Lake. Four species of amphibians were found in this high quality wetland: northwestern salamander, rough-skinned newt, Pacific treefrog, and northern red-legged frog. (Map location: Appendix A, Fig. 1, Sheet 14).

WHMP LANDS – SPADA LAKE TRACT
TRIBUTARIES TO SPADA LAKE

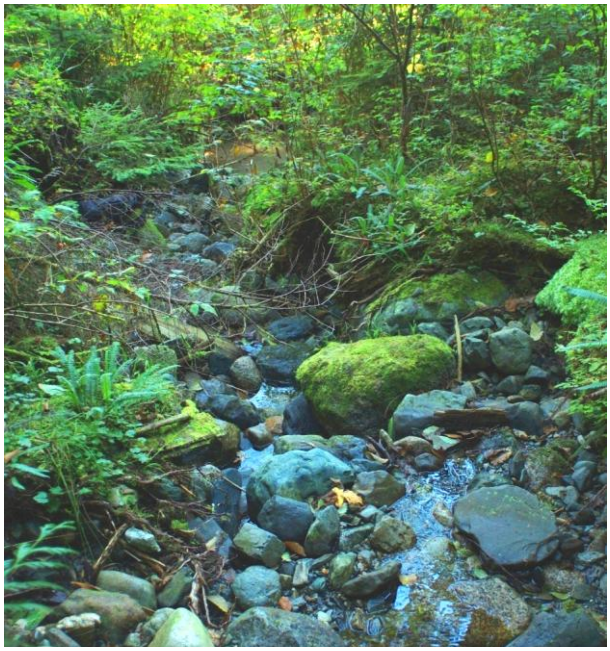

Photo 28: Site WS-7 (September 13, 2007). This is a small, perennial stream with relatively silty conditions. Coastal giant salamander larvae documented; coastal tailed frog unlikely to occur. (Map location: Appendix A, Fig. 1, Sheet 13).

Photo 29: Site WS-8 (August 15, 2007). This perennial stream has been adversely affected by a mass wasting event originating outside of the WHMP boundary. The photo view is looking upstream of South Shore Road where two coastal tailed frog larvae were found. The larvae may not have survived subsequent drying of parts of the stream observed on September 11. (Map location: Appendix A, Fig. 1, Sheet 16).

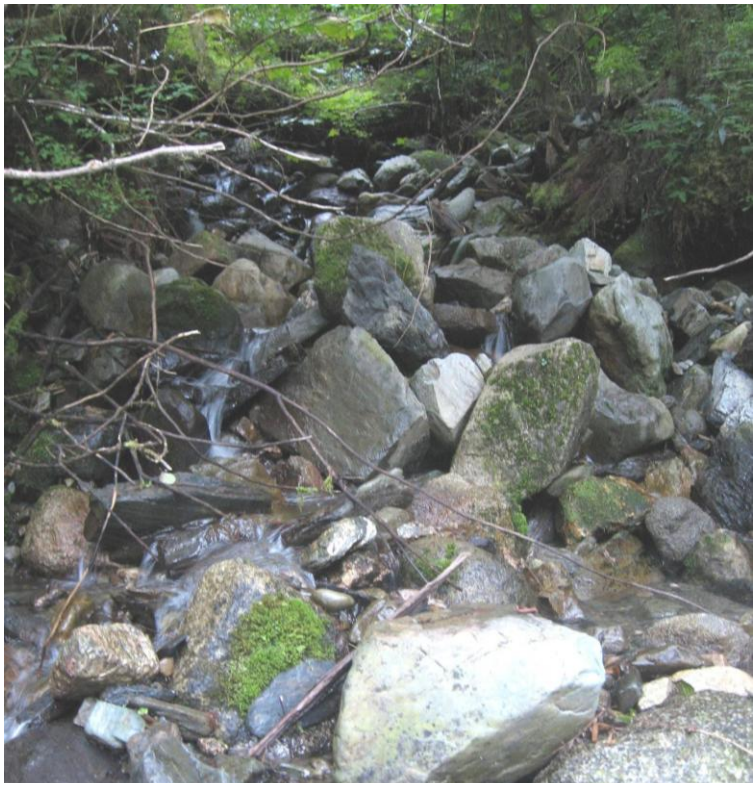

Photo 30: Site WS-9 (September 11, 2007). This perennial stream has a coarse substrate, cold water, and minimal silt. Coastal tailed frog and coastal giant salamander larvae were found. (Map location: Appendix A, Fig. 1, Sheet 17).

Photo 31: Site WS-10 (August 15, 2007). South Fork Sultan River, divided channel just upstream of South Shore Road crossing. Coastal tailed frog and coastal giant salamander larvae were found. (Map location: Appendix A, Fig. 1, Sheet 17).

Photo 32: Site WS-12 (September 13, 2007). Parts of this stream were somewhat silty and the channel intersects a stratum of clay, but overall habitat condition is good. Coastal tailed frog and coastal giant salamander larvae were found. (Map location: Appendix A, Fig. 1, Sheet 21).

Photo 33: Site WS-12 (September 13, 2007). The lower reach of this stream is seasonal and was dry when examined.

WHMP LANDS – WILLIAMSON CREEK TRACT

Photo 34: Site WW-1 (June 5, 2007). Amphibian habitat appears to be limited to this small pool, which was already much reduced (most of the wetland is vegetated by shrubs and was not flooded). Pacific treefrog larvae and nine northwestern salamander egg masses were found (all but two of these egg masses were stranded out of water). (Map location: Appendix A, Fig. 1, Sheet 24).

Photo 35: Site WW-1 (July 30, 2004). Seasonal drying is evident in this photo of District biologists documenting wetland conditions in 2004.

Photo 36: Site WW-2 (June 5, 2007). This site is located on District land, but outside of the WHMP boundary west of Williamson Creek. It was examined because of high quality wetland conditions and to see whether special status amphibian species were present. Northwestern salamander, Pacific treefrog, and northern red-legged frog were documented. (Map location: Appendix A, Fig. 1, Sheet 25).

Photo 37: Site WW-2 (June 5, 2007).

WHMP LANDS – LAKE CHAPLAIN TRACT

Photo 38: Site WC-1 (April 12, 2007). Lake Chaplain. A narrow emergent and shrub wetland has been mapped adjacent to the lake. Based on observations in 2007, the wetland does not represent potential amphibian breeding habitat, but the shallow edge of the like might be suitable for western toad. No amphibians were found. (Map location: Appendix A, Fig. 1, Sheet 6).

Photo 39: Site WC-2 (June 7, 2007). Chaplain Creek Marsh, the largest wetland on the WHMP lands, is formed by a series of beaver dams on Chaplain Creek. The "lower marsh" was surveyed in April, June, July, and September in 2007, and in July 2008. Five species were documented: northwestern salamander, rough-skinned newt, Pacific treefrog, northern red-legged frog, and bullfrog. The latter species was heard but not observed in the lower marsh. (Map location: Appendix A, Fig. 1, Sheet 4).

Photo 40: Site WC-2 (June 7, 2007). This extensive shallow area of the lower marsh contained numerous northern red-legged frog egg masses on April 4, many of which had already hatched in the warm water.

Photo 41: Site WC-2 (July 31, 2008). Higher water levels at this site in 2008 greatly expanded the area of habitat for amphibian larvae. Large numbers of metamorphosing northern red-legged frogs were observed on this date.

Photo 42: Site WC-2 (June 7, 2007). The "upper marsh" contains an extensive deep marsh with cattail and aquatic beds, and required use of a boat for surveying. Dip-netting was effective only by "trolling" with the net through aquatic beds favored by northern red-legged frog larvae. Aquatic funnel traps were more effective. Other documented species were northwestern salamander, Pacific treefrog, and bullfrog (juveniles trapped on July 27).

Photo 43: Site WC-3 (June 7, 2007). This beaver impoundment on Swamp Road contains boggy conditions in places. Northwestern salamander and Pacific treefrog were documented. (Map location: Appendix A, Fig. 1, Sheet 7).

Photo 44: Site WC-4 (July 30, 2008). This large beaver impoundment east of Swamp Road is partially located on WHMP lands and partially on WDNR land. Northwestern salamander, rough-skinned newt, and Pacific treefrog were documented. An adult northern red-legged frog was also found approximately 0.25 mi southwest from the site, suggesting that this species may also breed here.

Photo 45: Site WC-4 (July 30, 2008). Much of this wetland was dry at the time of the survey.

WHMP LANDS – LOST LAKE TRACT

Photo 46: Site WL-1 (April 12, 2007). Lost Lake is a deep, permanently flooded pond surrounded by a floating bog. Conditions here require use of a boat for surveying. Northwestern salamander, northern red-legged frog, and Pacific treefrog egg masses were observed on this date; bullfrogs began breeding around June 6. (Map location: Appendix A, Fig. 1, Sheet 5).

Photo 47: Site WL-1 (June 6, 2007). Northwest of the open water and floating bogs of Lost Lake, there is an extensive shallow, flooded area where northwestern salamander and Pacific treefrog larvae were found on this date.

WHMP LANDS – PROJECT FACILITY LANDS TRACT

Photo 48: Site WP-1 (April 4, 2007). Marsh Creek wetland. Because of the narrow footprint of the pipeline right-of-way, amphibian surveys were limited in geographic scope to an area within about 200 feet of the right-of-way. Suitable amphibian habitat was found on the east side of the bridge crossing, shown here. Three species were documented: northwestern salamander (eggs), Pacific treefrog (heard only), and northern red-legged frog (eggs). (Map location: Appendix A, Fig. 1, Sheet 3).

Photo 49: Site WP-1 (June 7, 2007). Aquatic funnel traps set on this date captured only one northern red-legged frog larva.

Photo 50: Site WP-2 (June 26, 2008). This concrete lined ditch on the north side of Culmback Dam contained hundreds of Pacific treefrog larvae. (Map location: Appendix A, Fig. 1, Sheet 13).

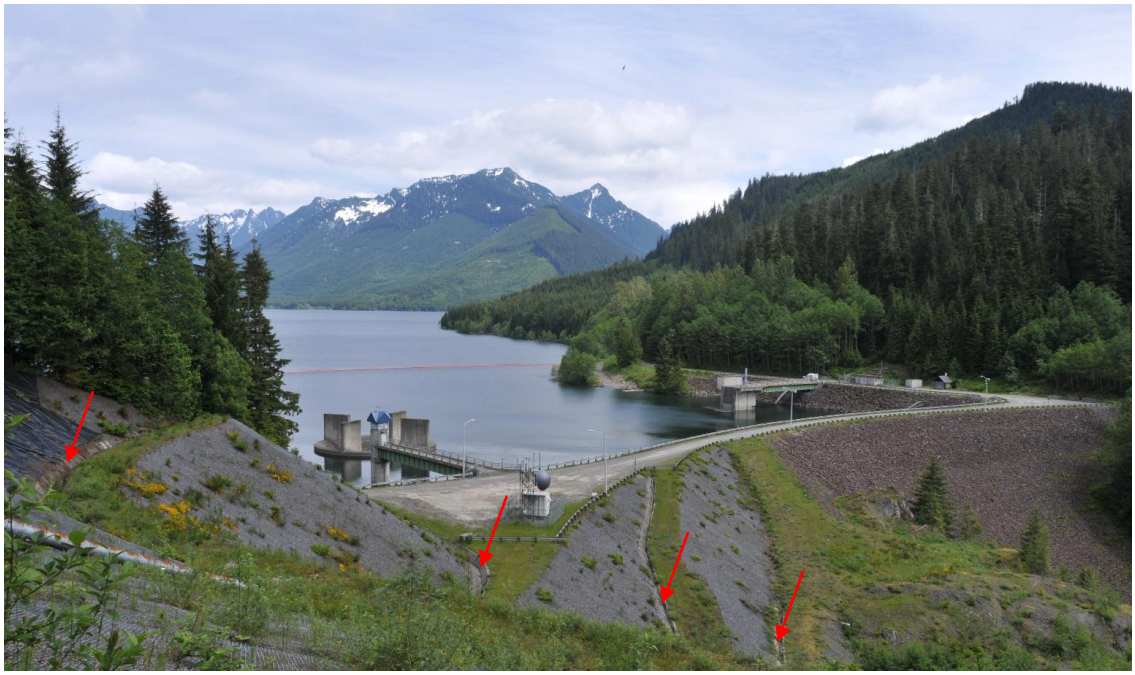

Photo 51: Site WP-2 (June 26, 2008). Other ditches on the dam (indicated by arrows) were dry and not used by amphibians.

SULTAN RIVER DOWNSTREAM OF CULMBACK DAM

Photo 52: Site SR-1B (August 15, 2007). The instream survey method described in RSP-10 includes use of a seine in a fixed position just downstream of the area searched. This method was unsuited for flow conditions in the Sultan River. No amphibians were found at this location. (Map location: Appendix A, Fig. 1, Sheet 12).

Photo 53: Site SR-1C (August 15, 2007). The shallow margins of an instream pool were inhabited by three Pacific treefrog larvae in late stage of metamorphosis. (Map location: Appendix A, Fig. 1, Sheet 12).

Photo 54: Site SR-2A (August 16, 2007). Two coastal tailed frog larvae were found at this instream survey location. (Map location: Appendix A, Fig. 1, Sheet 11).

Photo 55: Site SR-2B (August 16, 2007). There was one possible coastal tailed frog sighting at this instream survey location. (Map location: Appendix A, Fig. 1, Sheet 11).

Photo 56: Site SR-3A (September 12, 2007). Many of the cobbles and small boulders here were immovable. No amphibians were found at this instream survey location. (Map location: Appendix A, Fig. 1, Sheet 10).

Photo 57: Site SR-3 (September 12, 2007). No amphibians were found at this instream survey location. (Map location: Appendix A, Fig. 1, Sheet 10).

Photo 58: Site SR-3C (September 12, 2007). Three Pacific treefrog larvae and two juvenile northern red-legged frogs were found at this tiny pool on a lateral sand bar. (Map location: Appendix A, Fig. 1, Sheet 10).

Photo 59: Site SR-4A (September 12, 2007). No amphibians were found at this instream survey location just below the Diversion Dam. (Map location: Appendix A, Fig. 1, Sheet 9).

Photo 60: Site SR-4-C (August 16, 2007). The pool on the left (indicated by arrow) is located on a lateral bar upstream of the Diversion Dam. Pacific treefrog larvae were found here. (Map location: Appendix A, Fig. 1, Sheet 9).

Photo 61: Site SR-4C. Aerial view of site in 2003.

SULTAN RIVER RIPARIAN CORRIDOR TRIBUTARIES

Photo 62: Site SR-1E (August 15, 2007). Perennial tributary with step pool structure. Coastal giant salamander and coastal tailed frog larvae were found. (Map location: Appendix A, Fig. 1, Sheet 12).

SULTAN RIVER RIPARIAN CORRIDOR OFF-CHANNEL HABITATS

Photo 63: Site SR-1D (August 15, 2007). Emergent wetland area adjacent to Sultan River fed by seepage and perched slightly above river level. Pacific treefrog larvae were numerous here. (Map location: Appendix A, Fig. 1, Sheet 12).

Photo 64: Site SR-1F (August 15, 2007). Emergent wetland area adjacent to Sultan River fed by seepage and perched slightly above river level. Pacific treefrog and northern red-legged frog larvae and recently metamorphosed frogs of both species were numerous. (Map location: Appendix A, Fig. 1, Sheet 12).

Photo 65: Site SR-1G (August 15, 2007). This pool (approximately 75 feet long) is evidently fed by seasonal seepage (no inflow when examined) and is separated from the Sultan River by alluvium. Pacific treefrog and northern red-legged frog larvae were found. (Map location: Appendix A, Fig. 1, Sheet 12).

Photo 66: Site SR-2D (August 16, 2007). This silty-pool with scattered emergent vegetation may be fed by a seasonal stream. Northern red-legged frog larvae were particularly numerous, with fewer northwestern salamander and Pacific treefrog larvae. (Map location: Appendix A, Fig. 1, Sheet 11).

Photo 67: Site SR-2E (August 16, 2007). These are shallow pools on sand-silt substrate. Pacific treefrog larvae were numerous. (Map location: Appendix A, Fig. 1, Sheet 11).

Photo 68: Site SR-2F (August 16, 2007). This site illustrates the opportunistic nature of breeding site selection by some amphibians. A pool (indicated by arrow) less than 2 ft^2 in size was formed by surface drainage on landslide debris adjacent to the river and contained more than 30 Pacific treefrog larvae. (Map location: Appendix A, Fig. 1, Sheet 11).

Photo 69: Site SR-2C (August 16, 2007). Some of the dozen rainwater-filled pools at this site on a bedrock escarpment above the Sultan River were inhabited by Pacific treefrog larvae. (Map location: Appendix A, Fig. 1, Sheet 11).

Photo 70: Site SR-2C. Aerial view of site in 2003 (pools shown in Photo 62 are indicated).

Photo 71: Site SR-3D (September 12, 2007). There were a total of four water-filled potholes at this site. In addition to Pacific treefrog larvae, the presence of two juvenile and one adult northern red-legged frog suggests that species also breeds here. (Map location: Appendix A, Fig. 1, Sheet 10).

Photo 72: Site SR-3D (September 12, 2007). Site is located adjacent to, but high above a deep pool of the Sultan River.

Photo 73: Site SR-5 (June 7, 2007). Osprey Park in Sultan. This relict oxbow channel wetland has a beaver dam at its outlet to the Sultan River and it is not evidently affected by river flows. Five species were documented here in 2007: northwestern salamander, rough-skinned newt, Pacific treefrog, northern red-legged frog, and bullfrog. (Map location: Appendix A, Fig. 1, Sheet 2).

Photo 74: Site SR-5 (June 7, 2007). Aquatic funnel traps (trap indicated by circle) were deployed at this site in April, June, and July.

Photo 75: Site SR-6 (July 26, 2007). A reconnaissance-level survey was conducted here on this date. Rainwater-filled pools occurred on the trails and Pacific treefrog larvae were present. (Map location: Appendix A, Fig. 1, Sheet 1).

Photo 76: Site SR-6 (July 26, 2007). A reconnaissance-level survey was conducted here on this date. Northwestern salamander and Pacific treefrog larvae were found in this relict oxbow channel wetland.

Photo 77: Site SR-7 (August 22, 2008). A reconnaissance-level survey was conducted at this relict oxbow channel with beaver impoundments. Emergent vegetation and partly submerged shrubs were limited in extent. Two unidentified frogs were noted.

Photo 78: Site SR-7 (August 22, 2008). Much of this beaver impoundment was devoid of emergent vegetation. No amphibians were observed.

Photo 79: Site SR-7 (August 22, 2008). Two small flooded depressions were found in this area.

OTHER AREAS INVESTIGATED

Photo 80: Site Out-1 (June 25, 2008). This beaver pond on WDNR land contains bullhead catfish. Two adult male western toads were observed on logs at the edge of the pond and there were additional sightings by Everett Watershed Patrol on August 30, 2007 (two toads on the adjacent road) and July 18. The only other amphibian observations were two sub-adult northern red-legged frogs and one northwestern salamander egg mass. (Map location: Appendix A, Fig. 1, Sheet 22).

Photo 81: Site Out-1 (July 24, 2008). Water levels had dropped by this date (logs that had been floating were almost all on dry land now) and no amphibians were found.

AMPHIBIAN SPECIES

Photo 82: Coastal giant salamander (*Dicamptodon tenebrosus*) larva in tributary to Sultan River (August 15, 2007).

Photo 83: Two northwestern salamander (*Ambystoma gracile*) egg masses flanked by several recently hatched northern red-legged frog (*Rana aurora*) egg masses at WS-3 (June 25, 2008).

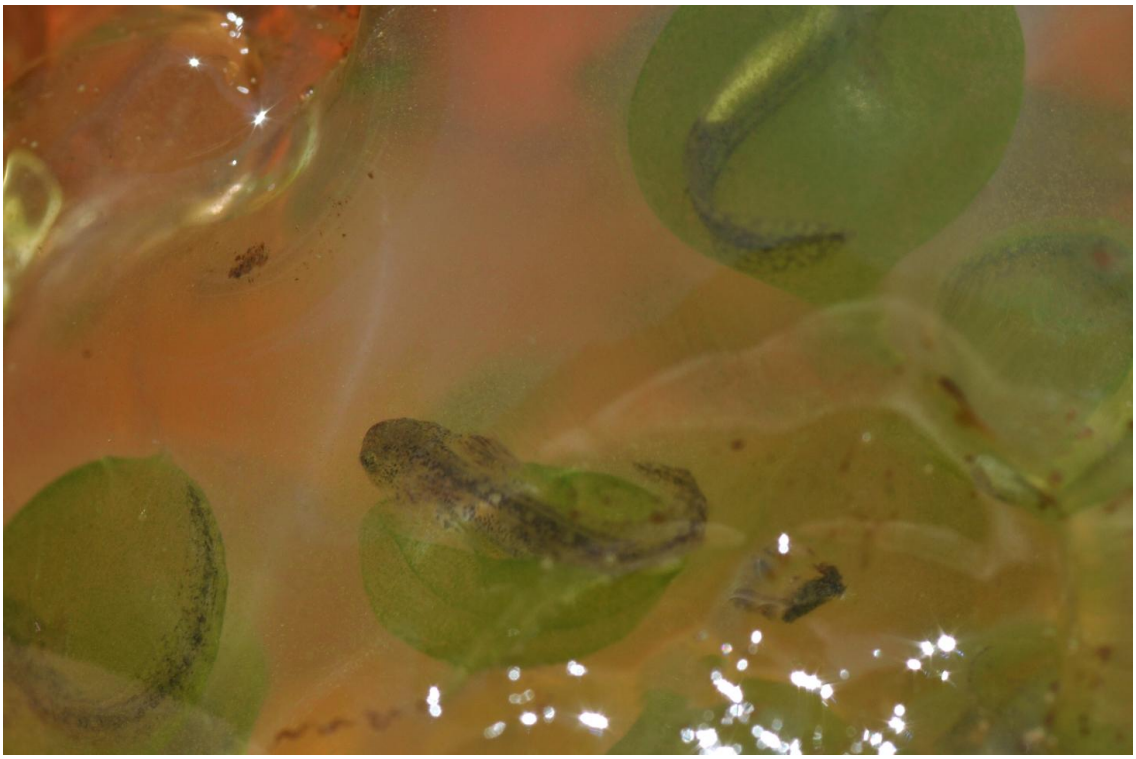

Photo 84: Hatching northwestern salamander eggs (July 24, 2008).

Photo 85: Northwestern salamander and Pacific treefrog (*Pseudacris regilla*) larvae at WC-2 (July 31, 2008).

Photo 86: Northwestern salamander larva, in at least second year of larval phase (September 12, 2007).

Photo 87: Northwestern salamander larva at WS-4 in late metamorphosis and about to enter terrestrial phase (July 31, 2008).

Photo 88: Adult paedomorphic (i.e., a form that retains gills and other larval characteristics and remains aquatic when mature) northwestern salamander at WS-4 (July 31, 2008).

Photo 89: Adult rough-skinned newt (*Taricha granulosa*) in breeding condition at WC-2 (June 7, 2007).

Photo 90: Rough-skinned newt larva (snout-vent length about 11 mm) at WC-2 (July 31, 2008).

Photo 91: Rough-skinned newt larva, probably in second year of larval phase, at WS-6 (July 25, 2007).

Photo 92: Coastal tailed frog (*Ascaphus truei*) larva, probably in third year of larval phase (September 11, 2007).

Photo 93: Coastal tailed frog larva showing ventral view. The oral disc functions like a sucker, allowing larvae to adhere to rocks while they scrape-off diatoms with their rasp-like teeth.

Photo 94: Western toad (*Anaxyrus boreas*) at WS-4. This individual (a female) was the only toad found in the formal study area (June 25, 2008).

Photo 95: Two adult western toads (both males) were found at Site Out-1, a beaver pond on WDNR land just east of the Spada Lake Tract. No egg masses or larvae were subsequently found; however, this site appears to be suitable breeding habitat (possibly toads bred here in 2008 but eggs were stranded when the water level dropped). Two toads were previously observed by the City of Everett Watershed Patrol on the road adjacent to this site on August 30, 2007 and toads were also observed at the pond by the Patrol on July 18, 2008.

Photo 96: Pacific treefrog egg mass, freshly laid at WS-4 (April 10, 2007).

Photo 97: Pacific treefrog larva in metamorphosis; found on the margin of a pool in Sultan River (August 15, 2007).

Photo 98: Northern red-legged frog (*Rana aurora*) larva at WS-4 (June 25, 2008).

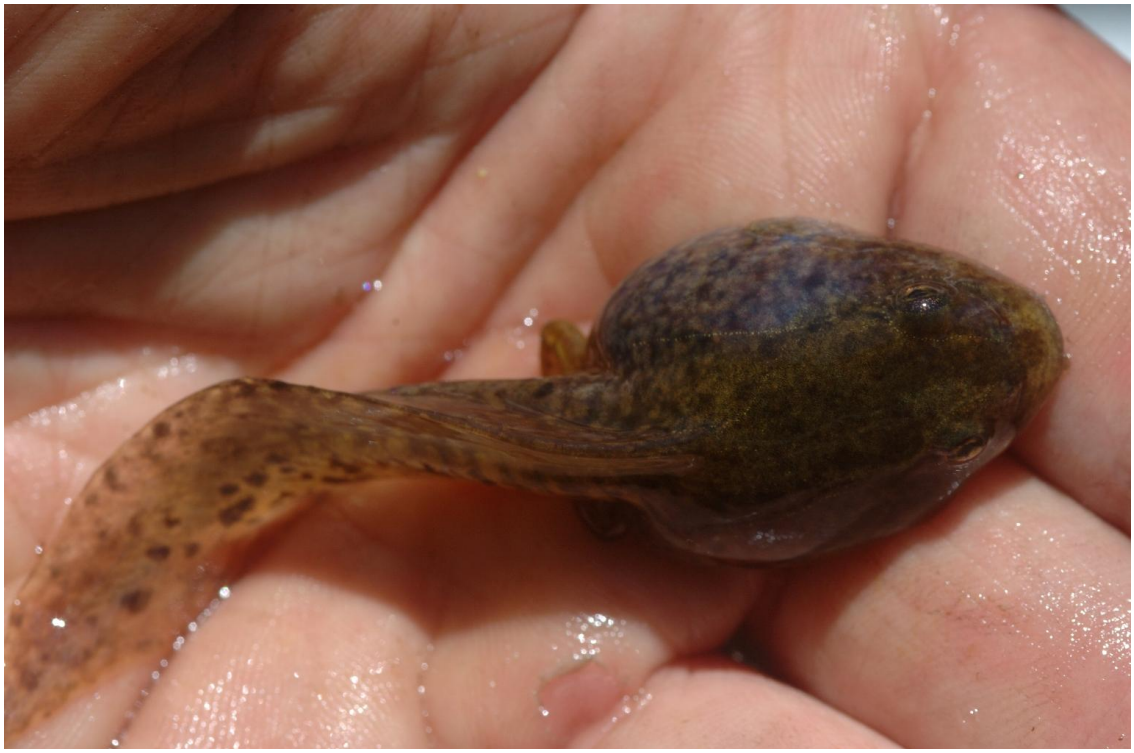

Photo 99: Northern red-legged frog larva at WS-6 (July 25, 2007).

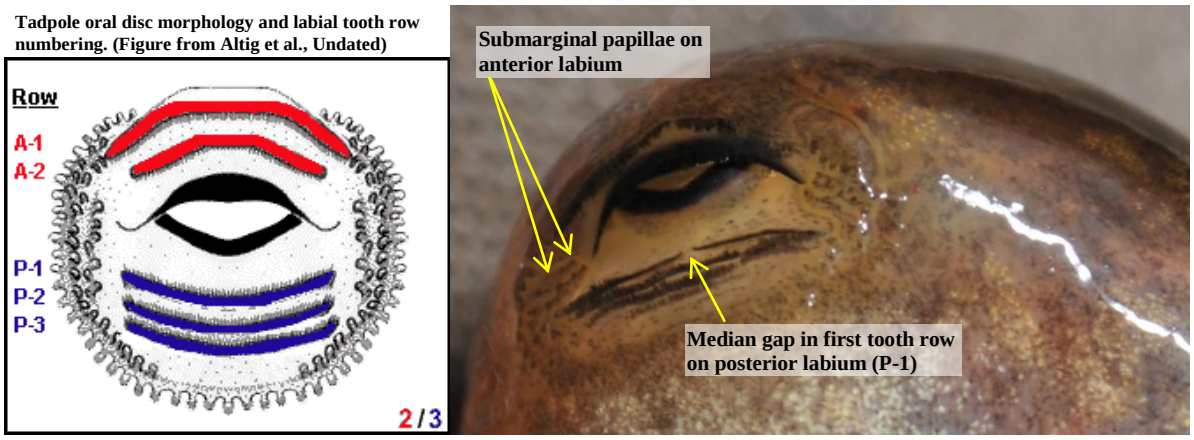

Photo 100: On the right above is a ventral view of the mouth parts of a typical northern red-legged frog larva found during this study, with diagnostic characteristics of this species noted. The "anterior labium" is associated with the anterior (upper) jaw and the "posterior labium" is associated with the posterior (lower) jaw, as illustrated in the figure above left.

Photo 101: Adult northern red-legged frog found southwest of WC-4, exhibiting typical groin coloration (July 30, 2008).

Photo 102: Juvenile northern red-legged frog from SR-3 by Sultan River (September 12, 2007). Undersides of thighs were slightly pink.

Photo 103: Juvenile northern red-legged frog from WS-4 (July 24, 2008). Underside of thighs were honey colored.

Photo 104: Juvenile northern red-legged frog (tentative identification) from Williamson Creek Tract showing yellowish pigment on underside of thighs (photographed by Pacific Biota Environmental Services) (July 18, 2008).

Photo 105: Juvenile northern red-legged frog from WC-2 (July 31, 2008). Juveniles at this site exhibited very light pink or yellowish color on underside of thighs.

Photo 106: Juvenile northern red-legged frog from WS-4 with light yellow on underside of thighs (July 31, 2008).

Photo 107: Adult northern red-legged frog from WS-4. This individual lacked reddish color under legs and colorful groin mottling, but in every other way was identifiable as a northern red-legged frog (July 24, 2008).

Photo 108: Bullfrog (*Lithobates catesbeianus*) larva in second year of larval phase from SR-5 (June 7, 2007).

APPENDIX C
RESPONSES TO DRAFT REPORT COMMENTS

Presler, Dawn

From: Rich Johnson [JOHNSRJ@DFW.WA.GOV]
Sent: Friday, January 04, 2008 1:30 PM
To: Presler, Dawn
Subject: Re: Jackson Project (FERC No. 2157) - SP10 Amphibians - Drafttech rpt for your review

Hi Dawn,
This study is well documented and explained. The photos are very helpful. Since western toads are apparently present within the general study area, perhaps more focus should be put finding and documenting them this next season.

Rich Johnson / Habitat Biologist
Washington Department of Fish and Wildlife

>>> "Presler, Dawn" <DJPresler@SNOPUD.com> 12/06/2007 9:01 AM >>>
Dear Terrestrial Resources Group:

Please see attached RSP10: Amphibian Survey cover letter and draft technical report representing 2007 field season data. Appendix A
(maps)
and Appendix B (photos) are too large to send via email; they may be accessed on the relicensing web site at:
http://www.snopud.com/water/relicensing/relicensingdocs/studyrpts/drafts

.ashx?p=3699 (or go to www.snopud.com, select Water Resources, then Relicensing, Relicensing - Documents, Study Reports, Drafts).

Comments on the draft report can be emailed or mailed to me by Monday January 7, 2008 (email and mailing addresses are identified in the cover letter).

Dawn Presler
Relicensing Specialist
Jackson Hydroelectric Project (P-2157)
Snohomish County PUD
Phone: 425-783-1709
Fax: 425-267-6369

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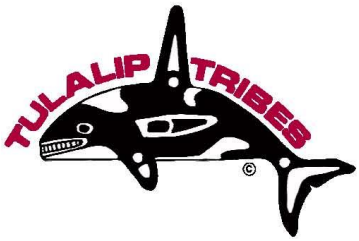

TULALIP TRIBES' COMMENTS ON THE JACKSON HYDROELECTRIC PROJECT (FERC NO. 2157) –
STUDY PLAN 10: AMPHIBIAN SURVEY DRAFT FINAL TECHNICAL REPORT
STUDY PLAN 11: MARBLED MURRELET SURVEYS FINAL TECHNICAL REPORT
STUDY PLAN 12: NORTHERN SPOTTED OWL SURVEYS FINAL TECHNICAL REPORT

SEPTEMBER 23, 2008

This memorandum summarizes the Tulalip Tribes' review of Study Plan 10: Amphibian Survey DRAFT Final Technical Report, Study Plan 11: Marbled Murrelet Surveys Final Technical Report, and Study Plan 12: Northern Spotted Owl Surveys Final Technical Report. Thank you for the opportunity to comment.

Study Plan 10: Amphibian Survey DRAFT Final Technical Report

General Comments and Questions:

Because there are so many study documents associated with the Jackson Hydroelectric Relicensing process, more summary-type information and decision histories would be desirable in the "Background Information" section of the survey report so that the reader does not have to sift through the various documentation to understand why the study is being conducted in a certain manner or why there may be variations from what was described in the study plan.

The dates and seasons of sampling from year-to-year vary dramatically. In some cases entire sites weren't sampled. Why is this? Perhaps the objectives of the study need to be clarified further, and the methods should clarify why certain dates were or were not important for sampling. For instance, how can change or impacts be measured if the sampling time frames don't correlate from year-to-year?

Survey times in the report did not match up with what was included in the study plan. For instance, surveys were supposed to be conducted in the early spring and autumn for all sites. Also, there was inconsistency with the timing and season of the surveys between 2007 and 2008. What was the rationalization for this? A summary of any decisions that were made regarding this change in timing should be noted in the "Background Information" section.

The report stated that the "objectives did not require repeated visits to all sites during all survey periods." How do we know that a species is absent, ensure that all target species had appropriate detection probabilities, or achieve a good estimate on relative abundance if we've only surveyed the site once? It seems that this does not consider variations in the species activities due to seasonal variations or varying moisture regimes. For instance, how can we conclude whether western toads are declining if the species is primarily

terrestrial and would only be present during the breeding season in the areas being surveyed? A table with rationalizations summarizing this information would be helpful.

Grammatical/style comments:

- Page 3 – Should be Washington Department of **Fish and** Wildlife
- Page 3, bullet 1 – should be "above or below" rather than "below"
- The use of the superscript "2" representing studies by WDG and Eicher should be used either to represent the column, "Study Area Occurrences" or to represent the row for each species. It is redundant to include in both and confusing when the denotation is *not* included for a particular species.
- Page 32, second paragraph should read "Occurrence of cascades frog was also not anticipated in the study area because the study area is lower in elevation than is typical for this species."

More information for "Background Information" required

- Need figures that display the project regionally (vicinity map); a map displaying the Project site locations in relation to each other and the dam; and any other items referred to throughout the document (streams, dams, rivers, roads, etc.). A map of the fluctuation zone and other potential impacts, or areas of influence, would be helpful.
- Generally list the impacts (recreation, varying water levels, increased wave action etc.).
- Generally, what is the history of the site (when did the hydroelectric project constructed, tie to initial surveys). What is the WHMP and it's objective?
- An additional column in Table 2-1 such as "reason for inclusion" or "potential of occurrence" in substitution or addition to the "Study Area Occurrence" column in order to clarify the first statement in the first paragraph on page 4. For instance, indicating that "habitat is present, within species distribution" or "listed in PHS" would clarify why the long-toed salamander is being addressed even though there are "no documented occurrences in study area".
- What is the general habitat for each of the larger survey locations?

Questions/comments on the "methods" section:

- What was the rationale for using a particular search strategy per survey site (i.e., trapping verses visual encounter survey)? Appropriate methods for surveying depends on the species, was that considered and how? A table of each survey area, the type of survey method utilized, and the reasoning for the survey method choice would be a good addition to the methods section.
- A general description of the methodology of each survey method would be a good addition to the document. How was each site surveyed – belt transects, line transects, area searches, timed searches –a table would help clarify.

Questions/comments on the "results" section:

- Page 20 discusses the results of survey sites WS 1 through WS-6; these are listed as being part of the Spada Lake Wetlands according to Tables 4-3 and 4-4, not Spada lake tributaries. Likewise, Table 4-12 is labeled as Lake Chaplain, but includes Facility Land and Lost Lake information as well; either rename the table or have a separate table for each of the tracts. A separate table for each tract is more consistent with the rest of the document.
- Why were the Sultan River Instream sampling locations based on coastal tailed frog habitat? Doesn't that rule out the possibility of detecting other special status species?
- A summary table of the numbers of individuals per species identified for each survey site/location would be beneficial to the reader, in addition to a sum of total person hours spent surveying.

Questions/Comments on the Discussion Section

The document could use more discussion of relative abundance since that was an objective of the study; i.e., how do the results relate to species abundance vs. impacts from project operations?

Conclusions:

Only one western toad was found during two years of surveying the study area, it seems that more intense management efforts and perhaps further terrestrial surveys (audio) for this species is warranted.

Study Plan 11: Marbled Murrelet Surveys Final Technical Report

- Page 5, first sentence – "Survey areas were delineated in a manner consistent with the..."
- Section 3.3, last bullet – "birds calling from a stationary location within a survey area"
- Is there critical habitat in the project area?
- A regional (project vicinity) map would be a good figure to include, as well as a map that shows all tracts in relation to each other.
- Although the final paragraph is fitting, it should be noted in the paragraph prior that the potential future construction of a recreational trail in the Culmback West area could impact marbled murrelet nesting activities due to construction noise (if during the nesting season) and future use of the trail. Wildlife habitat enhancement activities at Williamson Creek could impact marbled murrelet nesting activities due to construction noise if during the nesting season.
- The figures only include maps of suitable habitat that was surveyable. The objectives were to map all suitable habitat. Are there additional maps that illustrate suitable habitat?

Study Plan 12: Northern Spotted Owl Surveys Final Technical Report

- May want to double check the recent revised designation of critical habitat and include a more recent document reference than 2005.
- The figures only include maps of surveyable suitable habitat. The objectives were to map suitable habitat. Are there maps additional to this document that illustrate suitable habitat?

STAKEHOLDER COMMENT	LICENSEE RESPONSE
Rich Johnson – WDFW – Email dated 01/04/2008	
This study is well documented and explained. The photos are very helpful.	Thank you, comment noted.
Since western toads are apparently present within the general study area, perhaps more focus should be put finding and documenting them this next season.	Agreed. Surveys to obtain more information on western toad occurrence were conducted in 2008 at a site on WDNR land adjacent to the Spada Lake Tract, although breeding was not documented.
Dustin Hinson – Tulalip Tribes – Email memo dated 9/23/2008	
Because there are so many study documents associated with the Jackson Hydroelectric Relicensing process, more summary-type information and decision histories would be desirable in the "Background Information" section of the survey report so that the reader does not have to sift through the various documentation to understand why the study is being conducted in a certain manner or why there may be variations from what was described in the study plan.	The Background Information section largely repeats the same information that was accepted in Revised Study Plan 10. We do not believe that additional information as described in the comment is necessary. Variances to the study plan are documented in the ISR and USR.
The dates and seasons of sampling from year-to-year vary dramatically. In some cases entire sites weren't sampled. Why is this? Perhaps the objectives of the study need to be clarified further, and the methods should clarify why certain dates were or were not important for sampling. For instance, how can change or impacts be measured if the sampling time frames don't correlate from year-to-year?	As indicated in the results, it was not possible and would not have been meaningful to conduct surveys in 2008 on the same schedule as in 2007 because prolonged winter conditions in 2008 greatly delayed amphibian breeding, initial access for surveys, and affected subsequent larval development periods. Amphibian life history timing is affected by temperature and precipitation; thus, the timing of amphibian surveys often requires adjustment based on actual conditions. Survey timing had no bearing on the ability to assess Project effects. (Survey timing considerations are addressed further in response to the next comment.) Surveys in 2007 were generally sufficient to document species occurrence and assess possible project effects. Surveys were not repeated in 2008 in areas where the project nexus was minimal or nil, except to portray life history timing.

Survey times in the report did not match up with what was included in the study plan. For instance, surveys were supposed to be conducted in the early spring and autumn for all sites. Also, there was inconsistency with the timing and season of the surveys between 2007 and 2008. What was the rationalization for this? A summary of any decisions that were made regarding this change in timing should be noted in the "Background Information" section.	As indicated above, the report explains why survey timing differed between 2007 and 2008. Regarding early spring and autumn surveys, agencies and stakeholders were advised of proposed changes to the 2007 survey schedule and the reason for these changes on April 30, 2007. Comments on the proposed changes were requested at that time. No objections to the changes were received. The reasons for these modifications are also repeated in the ISR, which states: "*In order to meet the objectives of the study, modification has been required to the field survey schedule defined in the plan for this study, as presented in the September 12, 2006, Revised Study Plans approved by FERC on October 12, 2006. The study plan specified survey periods as February to early April (Spring); July to mid-August (Summer); and October to early November (Fall). The prescribed Spring survey period was too early for the high elevation sites (amphibians in the Spada Lake area were just beginning to breed the first week in April) and the Fall survey period was scheduled later than most amphibians are likely to be active or detectable. In addition, the interval between the Spring and Summer survey periods was excessively long. Without supplemental surveys, this schedule could have missed some important information regarding species presence, life history timing, distribution, or relative abundance. To address these issues, the Spring survey period was extended, a late spring field effort was added, and the timing of the Fall survey adjusted. The changes to the schedule have met the intended objectives."*

The report stated that the "objectives did not require repeated visits to all sites during all survey periods." How do we know that a species is absent, ensure that all target species had appropriate detection probabilities, or achieve a good estimate on relative abundance if we've only surveyed the site once? It seems that this does not consider variations in the species activities due to seasonal variations or varying moisture regimes. For instance, how can we conclude whether western toads are declining if the species is primarily terrestrial and would only be present during the breeding season in the areas being surveyed? A table with rationalizations summarizing this information would be helpful.	The commenter may be misunderstanding several aspects of this study. (1) The study provides information on species presence not absence. Because species absence is inherently difficult to prove, we have made probabilistic statements regarding the presence of undocumented species. (2) An effort was made to survey as many sites as possible, even though the project nexus was minimal at most sites, in order to provide maximum information on species occurrence to the Licensee. A single stream survey was generally sufficient to determine the presence of coastal tailed frog. In contrast, most wetland sites were surveyed more than once and the more significant sites, including the Spada Lake fluctuation zone, were surveyed repeatedly. Surveys at different times provided opportunities to detect different life stages and increased the likelihood of detecting a species present in small numbers. (3) "Relative abundance" is not a population estimate, but rather merely quantifies survey results by unit effort. (4) It is understood that comparing survey results from different survey periods is problematic; consistent with this understanding, we endeavored not to make such comparisons. (5) This study was not designed to document species trends and does not do so. The purpose of the study is to document existing conditions. The status of western toad in the study area is uncertain and the report so states. The report also accurately notes that decline of the species in Washington comparable to the species' decline in the Rocky Mountains has not been documented. Regardless, the Project has no conceivable effect on the site where western toads were documented in 2007 and 2008. (6) The focus on aquatic habitats in this study is consistent with the survey approach described in the Revised Study Plan. Although adult western toads may only be present at a breeding site for a limited period, surveys of potential breeding sites provide a more prolonged opportunity to detect other life stages (egg masses, larvae, or post-metamorphic young-of-the-year). However, as stated, this species may have been overlooked at some sites.
Page 3- Should be Washington Department of **Fish and** Wildlife	Change made.
Page 3, bullet 1- should be "above or below" rather than "below".	Change made.
The use of the subscript "2" representing studies by WDG and Eicher should be used either to represent the column, "Study Area Occurrences" or to represent the row for each species. It is redundant to include in both and confusing when the denotation is *not* included for a particular species.	Change made.

Page 32, second paragraph should read "Occurrence of cascades frog was also not anticipated in the study area because the study area is lower in elevation than is typical for this species."	The text has been revised.
Need figures that display the project regionally (vicinity map); a map displaying the Project site locations in relation to each other and the dam; and any other items referred to throughout the document (streams, dams, rivers, roads, etc). A map of the fluctuation zone and other potential impacts, or areas of influence, would be helpful.	The regional location of the Project is well known and a vicinity map is not necessary in each individual technical study report. Maps showing locations of study sites, streams, roads, etc. are already included in the report (see Figure 4-1 and Appendix A). The FERC Project Boundary, which approximates the upper limit of the fluctuation zone, is depicted on maps of Spada Lake in Appendix A. We do not believe that other "areas of influence" (recreation?) could be meaningfully depicted.
Generally list the impacts (recreation, varying water levels, increased wave action etc.).	Potential project effects and their geographic nexus are listed in Section 2.0.
Generally, what is the history of the site (when did the hydroelectric project constructed, tie to initial surveys). What is the WHMP and its objective?	This information is fully presented in the Pre-Application Document. The WHMP is also well described in the report for RSP-6 ("*Habitat Management Methods Literature Review and Evaluation*").
An additional column in Table 2-1 such as "reason for inclusion" or "potential of occurrence" in substitution or addition to the "Study Area Occurrence" column in order to clarify the first statement in the first paragraph on page 4. For instance, indicating that "habitat is present, within species distribution" or "listed in PHS" would clarify why the long-toed salamander is being addressed even though there are "no documented occurrences in the study area".	We do not agree that revision to the table is necessary. As stated in the text, "*Table 2-1 identifies amphibian species that have previously been reported from the study area and the sources documenting their occurrence, [and]* ***lists other potentially occurring species*** *[emphasis added]*." Long-toed salamander is a potentially occurring species.
What is the general habitat for each of the larger survey locations?	All of the survey locations are described in the results text and tables, and are depicted with representative photographs in Appendix B.
What was the rationale for using a particular search strategy per survey site (i.e., trapping verses visual encounter survey)? Appropriate methods for surveying depends on the species, was that considered and how? A table of each survey area, the type of survey method utilized and the reasoning for the survey method choice would be a good addition to the methods section.	As stated in Section 3.2, the "toolbox approach" applies various search methods as most appropriate "to the types of habitats, species, and life stages that potentially occur, as well as the specific objectives at that time and location." The application of these techniques to different conditions and the use of aquatic funnel trapping as a survey supplement is described on page 7. Most sites were subject to multiple survey techniques (often consecutively) as clearly indicated in the results tables. We do not believe that a site by site explanation for the survey approach is necessary. Decisions regarding the allocation of survey effort were made by the principal investigator based on 30 years of experience designing and implementing amphibian studies.
A general description of the methodology of each survey method would be a good addition to the document. How was each site surveyed- belt transects, line transects, area searches, timed searches – a table would help clarify.	Search areas are indicated on maps in Appendix A. Depending on the extent of suitable habitats, entire or partial-area surveys were conducted (text added to Methods section).

Page 20 discusses the results of survey sites WS 1 through WS-6; these are listed as being part of the Spada Lake Wetlands according to Tables 4-3 and 4-4, not Spada lake tributaries. Likewise, table 4-12 is labeled as Lake Chaplain, but includes Facility Land and Lost Lake information as well; either rename the table or have a separate table for each of the tracts. A separate table for each tract is more consistent with the rest of the document.	Sites WS-1 through WS-6 are correctly identified in Section 4.3.1.1 as "wetlands on the Spada Lake Tract;" some of these sites are associated with tributaries, but differ from Sites WS-7 through WS-17, which are unimpounded tributaries (i.e., lotic habitats) addressed in Section 4.3.1.2. No change is needed. The last three sites in Table 4-10 (Sites WL-1, WP-1, and WP-2) were inadvertently retained when Tables 4-11 and 4-12 were created; these lines have been removed. The comment regarding Table 4-12 is incorrect: this table does not address Lake Chaplain Tract sites and is not labeled as such.
Why were the Sultan River Instream sampling based on coastal tailed frog habitat? Doesn't that rule out the possibility of detecting other special status species?	The survey approach for instream habitats is consistent with that described in the Revised Study Plan. As indicated in the report, coastal tailed frog is the only potentially occurring special-status species associated with lotic habitats; thus, the sampling methods for instream habitats were designed with this species in mind. Lentic habitats adjacent to the Sultan River were surveyed using appropriate techniques for lentic habitats.
A summary table of the numbers of individuals per species identified for each survey site/location would be beneficial to the reader, in addition to a sum of total person hours spent surveying.	We do not agree that such a summary table is necessary or would be meaningful. Combining the number of detections/species from different dates ignores differences in search time or search area, would combine detections of different life stages, and ignores the possibility that individuals might have been detected on more than one occasion. Readers interested in comparing total search effort per site can easily do so, but such a comparison is not particularly meaningful given the great range in size of sites.
The document could use more discussion of relative abundance since that was an objective of the study; i.e., how do the results relate to species abundance vs. impacts from project operations?	As explained above, relative abundance quantifies survey results by unit effort, but should not be construed as a population estimate. The report clearly compares detections of amphibians in areas where there was an identified project nexus to adjacent areas where project effects were minimal or nil. The report concludes that there is probably limited use of Spada Lake by amphibians compared to adjacent areas that represent better habitat for amphibians; and that use of the Sultan River downstream of Culmback Dam by coastal tailed frog is probably lower than in tributary streams.

Conclusions: Only one western toad was found during two years of surveying the study area, it seems that more intense management efforts and perhaps further terrestrial surveys (audio) for this species is warranted.	It is unclear what type of management for western toad would be warranted or appropriate. A variety of factors, including disease, increased UVB radiation, water pollution, and habitat changes, have been suggested to explain extirpation and decline of western toad in the southern Rocky Mountains. Auditory detection surveys are not likely to be efficacious for western toad. This species does not produce a strong vocalization (the call is a soft chirping sound), although in some large populations males will form choruses that can be heard at a distance.