

AQUATIC INVASIVE SPECIES MANAGEMENT AND CONTROL PLAN



ENLOE HYDROELECTRIC PROJECT (FERC PROJECT NO. 12569)

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ACRONYMS AND ABBREVIATIONS

AIS	Aquatic Invasive Species
ANS	Aquatic Nuisance Species
APHIS	Animal and Plant Health Inspection Service
District	Public Utility District Number One of Okanogan County
Ecology	Washington Department of Ecology
EO	Executive Order
ESSB	Engrossed Substitute Senate Bill
FERC	Federal Energy Regulatory Commission
FLA	Final License Application
NMFS	National Marine Fisheries Service
NISA	National Invasive Species Act
NISC	National Invasive Species Council
Project	Enloe Hydroelectric Project
RCW	Revised Code of Washington
TRG	Technical Review Group
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
WDFW	Washington Department of Fish and Wildlife
WSDA	Washington Department of Agriculture

1.0 INTRODUCTION

This Enloe Aquatic Invasive Species (AIS) Monitoring and Control Plan (Monitoring Plan) is developed for compliance with the requirements of the Washington Department of Ecology Section 401 of the Clean Water Act (401 Certification). The AIS Monitoring Plan is provided in relation to the Enloe Hydroelectric Project (Project), FERC No. 12569, for Public Utility District No. 1 of Okanogan County (District).

Invasive species have been a serious problem in the United States, which extends to the state of Washington. An invasive species is defined by Executive Order 13112 as “an alien whose introduction does or is likely to cause economic or environmental harm or harm to human health”. AIS are described as any prohibited, regulated, unregulated, or unlisted aquatic animal or plant species (RCW 77.08.010), any aquatic weed on the state noxious weed control list (RCW 17.10.080), and any nonnative aquatic plant or animal species that threatens the diversity or abundance of native species, the ecological stability of infested waters, or commercial, agricultural, or recreational activities dependent on such waters (RCW 77.60.130(1)).

1.1 GOAL AND OBJECTIVES

The goal of the AIS Monitoring Plan is to limit or prevent the introduction and spread of invasive species potentially associated with Project-related operations and activities.. To achieve this goal, and to meet the requirements of the 401 Certification, the AIS Monitoring Plan has several objectives, including:

- Identify potential plant and animal AIS concerns in the Project Area, or within the broader vicinity (e.g., Okanogan Valley, Palmer Lake, Osoyoos Lake).
- Identify potential pathways for AIS introduction in the Project Area.
- Monitor the Project Area for AIS to identify newly introduced species, map and track the movement of newly found and/or existing AIS, and provide information for control, eradication and/or restoration efforts.
- Education outreach to increase public awareness of the dangers of spreading AIS, and how to reduce and/or prevent its spread.
- Provide adaptive management that addresses the need for prevention, control, and eradication of AIS, or the restoration of impacted habitat.

1.2 FEDERAL AND STATE LAWS RELATED TO INVASIVE SPECIES

As the threat of invasive plants and animals became more apparent, the federal government initiated programs to address these issues. Under the auspices of federal legislation, state and local efforts play a large role in controlling the spread of invasive species. Invasive species populations span federal and local jurisdictions, which is why cooperation across governmental entities is crucial. While federal law preempts state law, the states have the power to define which species are imported and/or released (Meacham 2001). The sections below describe relevant federal laws, followed by the relevant Washington State laws.

1.2.1 The Lacey Act

The Lacey Act was signed into law in 1900, making it the oldest national wildlife protection statute in the United States. It has been amended several times since, the latest occurring with the Food, Conservation, and Energy Act of 2008. The Lacey Act criminalizes the import, export, transport, purchase, or selling of fish, wildlife, and plants taken or possessed in violation of federal, state, or tribal law. For example, the newest amendments (1981 and 2008) require packages containing fish or wildlife to be plainly marked and requires import declarations for certain plants and plant products. This Act is administered by the Departments of the Interior, Commerce, and Agriculture through their respective agencies, which include the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and Animal and Plant Health Inspection Service (APHIS) (16 USC 3371-3378).

1.2.2 The National Invasive Species Act

The National Invasive Species Act (NISA) is a federal law passed in 1996, which amended the Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990. The 1990 Act responded to the invasion of zebra mussels and other species to the Great Lakes, with ships' ballast water targeted as the vector. Pathways for potential spread of aquatic invasive species by commercial marine vessels are primarily regulated by the provisions of this law. The Act also established the Aquatic Nuisance Species (ANS) Task Force to organize and promote regional and state efforts in implementing their own aquatic invasive species management plans. The ANS Task Force approves state and regional management plans so that they may receive support from federal funding (Meacham 2001).

1.2.3 Executive Order 13112

In 1999, Executive Order (EO) 13112 established the National Invasive Species Council (NISC) as a high-level interdepartmental organization, which was to provide coordination for the federal invasive species programs. Secretaries and administrators

of the 13 federal government departments and agencies serve as its members. EO 13112 also required the Secretary of the Interior to establish the Invasive Species Advisory Committee, which is composed of nonfederal representatives and stakeholders who provide input and advice to the NISC (Clinton 1999).

The EO called for the NISC to develop and issue the first National Invasive Species Management Plan, which was completed in 2001. This document served as a template for future federal action on invasive species and for states and regional authorities in developing management plans of their own. The 2008-2012 National Invasive Species Management Plan is the first revision of the 2001 Plan (NISC 2008). The Enloe AIS Monitoring Plan adopts its structure from the national plan.

1.2.4 Engrossed Substitute Senate Bill 5699

Effective in 2006, Engrossed Substitute Senate Bill (ESSB) 5699 created the Washington Invasive Species Council in the Interagency for Outdoor Recreation and established the Washington AIS Prevention and Enforcement Programs. The Council was charged with providing policy direction, planning, and coordination for combating and preventing invasive species in Washington State. In 2007, ESSB 5923 was passed to clarify funding allocation for the programs and named Washington Department of Fish and Wildlife (WDFW) as the primary agency in charge of enforcement of state AIS laws (Pleus et al. 2010). WDFW coordinated the drafting of the Washington Aquatic Nuisance Species Management Plan, which was finalized in 1998 and updated in 2001 (Meacham 2001).

1.2.5 Other Washington State Programs and Regulations

Below is a brief listing of agencies involved in setting policy for and determining which species are considered to be invasive in Washington as described in the 2001 Washington State Aquatic Nuisance Species Management Plan (Meacham 2001).

- **Wildlife Code of the State of Washington** – WDFW administers and enforces the wildlife code and possesses regulatory authority including the classification of “deleterious exotic wildlife” and warmwater fish.
- **Washington Department of Agriculture (WSDA) Quarantine List** – implements state policy and decides which plants belong on the state noxious weed list. There are also county weed control boards.
- ***Spartina* and Purple Loosestrife Eradication Program** – WSDA is the designated lead agency for the eradication of *Spartina* cordgrass and control of purple loosestrife.
- **Washington Department of Ecology (Ecology) Aquatic Plant Management Program** – a herbicide-permitting program for the management of native and invasive aquatic plants.

- **USFWS** – works with the Aquatic Nuisance Species Task Force in the implementation of funding management plans.

1.3 BACKGROUND CONDITIONS

Limited aquatic vegetation was found during habitat surveys conducted in the Project area. A small amount of vegetation was found in surveys in the reservoir, including a few patches of submerged grasses. Riparian vegetation communities exist in wetland areas throughout the Project area and are described below (District 2008). Detailed lists of riparian species within the Project area can be found in Appendix E.3.5 to the FLA (District 2008).

1.3.1 Riparian Shrub

The riparian shrub community consists of woody vegetation that is less than 12 feet tall. This community occupies approximately 7.4 acres in the Project Area and is found primarily along the east bank of reservoir where the slope is gentle. It also occurs as a narrow fringe elsewhere along the reservoir. Willow stands, varying in size from bands of seedlings or small shrubs to large dense thickets, provide over 75 percent of the total shrub canopy cover. The dominant willow species are Bebb willow (*Salix bebbiana*) and yellow willow (*Salix rigida*). Other species in this community include red-osier dogwood, chokecherry, clematis, smooth sumac, and young black cottonwoods.

1.3.2 Herbaceous Wetland

The herbaceous wetland community is found on wet or seasonally flooded areas. This community occupies approximately 3.5 acres in the Project Area and occurs in scattered patches on low-elevation terraces immediately adjacent to the reservoir. Dominant species are perennial grasses, including reed canary grass (*Phalaris arundinacea*) and bluegrass. Other species include cattail (*Typha* spp.), horsetail, milkweed (*Asclepias* spp.), and knapweed. Woody species found in these areas include Wood's rose, red-osier dogwood, black hawthorn and willow, but provide less than 5 percent of the cover in this community.

2.0 NONNATIVE AND EXOTIC SPECIES ASSOCIATED WITH THE PROJECT AREA

This section includes a description of the known aquatic nonnative (that did not naturally occur in Washington State) and exotic species found in the general Project Area. In some cases, but not all, these species are also considered to be invasive. Although the scope of species identified includes a wider range than the habitat directly affected by the Project (e.g., Okanogan Valley, Palmer Lake, Osoyoos Lake), these were included because of the potential for species to migrate or be introduced to new areas.

2.1 AQUATIC ANIMAL SPECIES

The USGS website (<http://nas.er.usgs.gov>) and field studies presented in the Final License Application (FLA) (District 2008) were consulted for the presence of nonnative aquatic animal species documented in the vicinity of the Project. No listings of nonnative crustaceans, mollusks, or aquatic mammals resulted from this search. Aquatic nonnative and exotic fish found in the general Project Area are provided in Table 1.

Introduced warm-water species found in Enloe Reservoir, such as bass, yellow perch and common carp, are likely transported to the reservoir from upstream sources such as Palmer Lake (District 2008). Many introduced fish species are the basis of recreational fisheries that provide substantial economic benefits to local economies (e.g., sport fisheries), while at the same time adversely affecting native fish species by way of predation, the introduction of disease, competition for resources, and hybridization.

Table 1. Nonnative and Exotic Aquatic Fish in the Vicinity of the Enloe Dam Project.							
Species		Documented Locations					
Common Name	Scientific Name	Palmer Lake	Palmer Creek	Above Enloe Dam	Below Similk. Falls	Osoyoos Lake	oxbow lakes
Centrarchidae (sunfish and bass)							
Pumpkinseed	<i>Lepomis gibbosus</i>	X		X			
Bluegill	<i>Lepomis macrochirus</i>	X		X			
Smallmouth bass	<i>Micropterus dolomieu</i>	X		X	X	X	
Largemouth bass	<i>Micropterus salmoides</i>	X	X		X	X	X
Black crappie	<i>Pomoxis nigromaculatus</i>	X			X	X	

Table 1. Nonnative and Exotic Aquatic Fish in the Vicinity of the Enloe Dam Project.

Species		Documented Locations					
Common Name	Scientific Name	Palmer Lake	Palmer Creek	Above Enloe Dam	Below Similk. Falls	Osoyoos Lake	oxbow lakes
Cyprinidae							
Common carp	<i>Cyprinus carpio</i>	X	X	X	X	X	X
Redside shiner	<i>Richardsonius balteatus</i>	X		X	X		
Unidentified	Cyprinidae spp.			X	X		
Percidae (perch)							
Yellow perch	<i>Perca flavescens</i>		X	X			X
Salmonidae (salmon and trout)							
Brook trout	<i>Salvelinus fontinalis</i>	X				X	

Sources: District 2008; USGS 2010; Christoph pers. com. 2011

2.2 AQUATIC PLANT SPECIES

Six nonnative aquatic plants have been found in the Project vicinity (Table 2). Two of the nine species (Eurasian watermilfoil and purple loosestrife) are considered priority species in Washington, according to the Washington Invasive Species Council Management Priority Species List (2010) and fall under management Class 2. Activities associated with species in this class “focus on mitigating the impact, controlling population size, and preventing dispersal to other water bodies of nonnative plant or animal species that are present and established in Washington.” These two species are also considered Class B weeds, according to the Washington State Noxious Weed List (2010), which means that these plants should be controlled in areas where populations are not widespread and further spread should be prevented. Although Eurasian watermilfoil and purple loosestrife have been found in the Project vicinity, they are not listed by Okanogan County’s Noxious Weed Control Board (<http://www.okanogancounty.org/nw/list.html>) as requiring control.

All of the aquatic plants listed in Table 2 are currently monitored by Ecology as part of their Environmental Assessment Program and were found in the Project vicinity. Some of the weeds listed were only identified to the genus level during the surveys, however, since it is possible the plants identified are those classified as a priority species or otherwise, they are included. .

Two of these plants, Eurasian watermilfoil and purple loosestrife, fall under the WSDA Washington Plant Quarantine List (2009) as prohibited plant species, meaning it is prohibited “to transport, buy, sell, offer for sale, or distribute plants or plant parts of the regulated species within the state of Washington.”

Table 2. Nonnative and Exotic Aquatic Plants Identified in the Vicinity of the Enloe Dam Project and their State Status as Invasive Species.

Species			Priority Species ¹	Noxious Weed ²	WSDA Status ³	Location(s) Found
Family Name	Common Name	Scientific Name				
Haloragaceae	Eurasian watermilfoil	<i>Myriophyllum spicatum</i>	Yes	Class B	Prohibited	Palmer Lake, Osoyoos Lake
Iridaceae	yellow iris	<i>Iris pseudacorus</i>	No	Class C	Not applicable	Osoyoos Lake
Lythraceae	purple loosestrife	<i>Lythrum salicaria</i>	Yes	Class B	Prohibited	Osoyoos Lake, Okanogan Valley
Nymphaeaceae	fragrant waterlily	<i>Nymphae odorata</i>	No	Not listed	Not listed	Osoyoos Lake
Poaceae	reed canarygrass	<i>Phalaris arundinacea</i>	No	Class C	Not listed	Osoyoos Lake
Potamogetonaceae	curly pondweed	<i>Potamogeton crispus</i>	No	Class C	Not applicable	Osoyoos Lake

¹ Washington Invasive Species Council Management Priority Species (2010)

² Washington State Noxious Weed List (2010)

³ Washington Summaries of Exterior Quarantines (2009)

Source: Ecology 2009, USGS 2010

3.0 PATHWAYS FOR AIS INTRODUCTION

Introduction of AIS can occur through several different pathways. The most likely pathways associated with the Project are listed below. As a monitoring strategy, the District will continue to research potential new pathways not identified in this AIS Monitoring Plan, which will be addressed in annual updates. The team will rely on communication with the Technical Review Group, and results of fisheries habitat monitoring presented in the Enloe Fish Management Plan (EFMP).

3.1 RECREATION

Recreation is commonly cited as a primary pathway of AIS introduction through transport on fishing gear and boating vessels. For example, the New Zealand mudsnail can become attached to fisherman's boots and waders, and if the gear is not dried out or cleaned before entering a new system, the species can be introduced to the new waterbody. Because introductions are so common through recreational use of waterbodies, the most common method for preventing introductions is through public education, as discussed below.

Recreational access to the Project area is described in the FLA (District 2008). At present, all recreational access and resources within the Project Area are informal, and have been developed through use, over time. The following features are used by visitors:

- Upstream and downstream access roads, leading from the Loomis-Oroville Road to the Project Area. Neither access road is maintained for passenger vehicles. The upstream access road (Oroville-Tonasket Irrigation District Road) is impassable in spring and early summer. It is inundated during the spring runoff and remains muddy for some time after the peak flow period. Heavy brush impedes clearance. The road is heavily rutted and steep in places. It is a single-lane road with poor visibility in places. The downstream access road (Enloe Dam Road) is very steep with exposed embankments, heavily rutted, and heavily eroded in places; it is also a single-lane road
- Informal/unimproved reservoir access ramps located just upstream from the safety barrier
- Old powerhouse eastbank access road, providing foot access to the shoreline area below the dam for boaters, miners, and fishers
- Informal/unimproved parking area near the top of the dam

- Informal/unimproved user trails providing access to the reservoir above the dam
- Informal/unimproved user trails providing access to the river below the dam
- Informal/unimproved camping areas on the east bank of the reservoir

While the reservoir behind Enloe Dam is relatively accessible from the east bank, terrain limits access from the west bank. Terrain also limits access to the portion of the Project Area downstream of the dam. Below the Dam and falls, the Similkameen River is confined between nearly sheer rock walls until the canyon opens just below the railroad trestle (the downstream limit of the Study Area, approximately two miles downstream from Enloe Dam). This downstream canyon area is accessible only on foot from the east bank, via game and user trails. From the west bank, access crosses private land and occurs via game and user trails leading to the river from the rail grade which sits nearly 100 feet, in places, above the river. The only other means of access is by boat. Steep terrain makes access to the reservoir difficult from the west bank, as well.

Existing recreation use is about 6 visitors on a typical day, whether weekday or weekend, rising to 14 per day during holidays. Recreational use drops to near zero during the winter.

Miner's Flat is a large bench on BLM land about three miles upstream of Enloe Dam. In response to measures described in the FERC EA for the Project (FERC 2011), minor upgrades to the access road and an informal boater take-out has been proposed at this location, located at the end of Miner's Flat Road shown in Figure 1.

3.2 UPSTREAM INTRODUCTION

AIS can also be introduced from upstream locations, such as Palmer Lake. Upstream sources can also include flows from tributaries and irrigation return flows. An example of a wide-spread introduction from upstream sources is Eurasian watermilfoil. This aquatic plant was first observed in Washington in 1974 when it moved downstream from the Canadian Okanogan lake chain into Lake Osoyoos (Ecology 2010a). It appears to be primarily spread from waterbody to waterbody through recreational boating, although anglers have been known to deliberately plant this species in lakes (Ecology 2010a). For upstream introductions, AIS monitoring and control activities that provide early detection will be the most efficient way of addressing potential introductions from upstream.

3.3 PLANTING OF ORNAMENTAL AQUATIC PLANTS AND DUMPING OF UNWANTED PETS AND PLANTS

Intentional planting of ornamental plants, dumping of unwanted pets (e.g., goldfish, carp), or the unintentional release of plants and animals into waterways is another

pathway of AIS introduction. Many organisms released through this pathway are likely to die, but in many cases they are able to survive and become established. The most efficient ways of addressing these types of introductions are early detection and public education.

4.0 AIS MONITORING AND CONTROL PLAN

This AIS Monitoring Plan is focused on four main lines of defense against invasive species: (1) prevention, (2) monitoring, (3) control and management, and (4) restoration (NISC 2008). Prevention is the first line of defense against the invasion of harmful species of plants and animals. Early detection includes the identification of invasives and, when coupled with rapid response, becomes a critical second defense. Control and management serve to reduce the spread of populations once they have been identified, and restoration actions help meet natural resource conservation goals in the face of invasive species.

The only species that will be addressed in this AIS Monitoring Plan under control and management and restoration include Eurasian watermilfoil and purple loosestrife, which are state priority species for controlling and preventing dispersal. Although nonnative fish species, such as largemouth bass, yellow perch, and black crappie, occur in the Enloe Reservoir and downstream of the Project in the Similkameen River, these populations are well-established in the basin as a result of introductions for the purpose of providing a sport fisheries in the Similkameen River and lakes. Their distribution is not associated with Project activities, and so their control is not a concern for the District. Further, because warm-water fish offer recreational opportunities, they are not considered by the state to be invasive species that require control or restoration (WDFW 2005).

4.1 PREVENTION

Preventing the introduction and establishment of invasive species is the most fiscally responsible approach to take, if the option is available. Once a harmful plant or animal species establishes a population, it can become much more costly in terms of the environmental damage caused and the amount of effort it can take to combat its spread. For example, smooth cordgrass was allowed to extend its range past controllable levels in Willapa Bay and other areas before the threat was recognized due to a lack of monitoring and identification. However, the European green crab has been kept to acceptable levels due to early implementation and consistency of monitoring and control effort in infested bays in Washington (Meacham 2001).

4.1.1 Educational Outreach

One component of prevention in the AIS Monitoring Plan is providing educational opportunities for the public about the risks involved with AIS. The Project's Recreation Management Plan includes interpretive materials to be provided at recreation sites (PM&Es REC-06, REC-11, REC-12; District 2008). Educational outreach will occur through posting flyers at the local kiosk operated by the PUD. Educational materials will consist of pamphlets and signs that increase public awareness of how to prevent the spread of AIS, including prevention of the recreational transfer of organisms from one waterbody to another. Educational materials will include examples of how AIS species

can impact ecosystems, recreation, and economies. Recreational information materials will be provided by WDFW and/or USFWS and installed by the PUD. Information related to the dumping of unwanted aquatic pets and plants can be obtained through the website <http://habittitude.net/>.

4.1.1 Additional Prevention Measures

The prevention measures, schedule, and potential adaptive management measures for invasive aquatic species associated with the Project are presented in Table 3.

Table 3. Prevention Measures, Schedule and Adaptive Management for Invasive Aquatic Species associated with the Enloe Dam Project.			
Species	Prevention Measures	Schedule	Potential Adaptive Management Measures
Fish (general)	<ul style="list-style-type: none"> Due to concerns about the introduction of disease to fisheries by the Canadian First Nations and the Colville Confederated Tribes, fish passage upstream of Enloe Dam will not be provided. Passage has been opposed Prevent unauthorized introductions of fish into waters associated with the Project. 	NA	<ul style="list-style-type: none"> NA Report any unauthorized introductions to WDFW.
Plants and Animals (general)	<ul style="list-style-type: none"> WDFW and other Agency Poster signs and pamphlets on how to prevent transfer of plant species from different water bodies from fishing gear and boats. Education signs and pamphlets will also include information geared specifically toward decontamination of fishing gear to prevent transporting AIS species at the information board. 	The year following Ecology and FERC approval of AIS plan and maintained as needed.	<ul style="list-style-type: none"> Place at recreational access provided for the reservoir, and maintain and update as needed. Coordinate efforts with WDFW.

4.2 MONITORING

Monitoring includes the identification of the species and its boundaries of infestation. Area monitoring, taxonomic identification and species surveys are actions related to this component (NISC 2008). The goal of AIS monitoring will be to identify newly introduced AIS plants and animals into the Project area, as well as map and track the movement of newly found and/or existing AIS. Monitoring will then lead into the rapid assessment and response associated with control and eradication efforts.

The District will monitor nonnative plants known to occur in the Project vicinity (Table 2 above), as well as the WDFW Management Class listing of nonnative species that are known or thought to present a risk of becoming invasive and the listed aquatic weeds that are monitored by Ecology (Table 4). The WDFW Classes are rated from 1 to 4 based on the level of management that should be addressed. Class 1 includes species that are not currently present in the state, or have limited populations in state waters. Class 2 includes species that are present and established in Washington. Class 3 includes species that are established in the state, but for which there are no available or appropriate management techniques. Class 4 includes species that are not present in the state, and for which there is a lack of adequate information to understand their potential to be invasive.

The Washington State Weed Control Board classes are A, B, and C. Class A weeds are non-native species whose distribution in Washington is still limited. Eradication of Class A weeds is required by law. Class B weeds are limited to portions of the State, and are designated for control in regions where they are not yet widespread. Class C weeds are already widespread in the State or are of special interest to the State's agricultural industry. Counties may enforce control if locally desired.

Although only the Eurasian watermilfoil and purple loosestrife are found in the vicinity of the Project, monitoring efforts should be made to verify that any of the other management species have not been introduced and are not becoming an issue within the Project area.

Table 4. AIS Plants and Animals to be Monitored for the Enloe Project by Management Class.				
Management Class	Species	Schedule	Species Type	
	Common Name	Scientific Name	Animal	Plant
1	Mitten crab	<i>Eriocheir</i> spp	X	
1	Zebra mussel	<i>Dreissena</i> spp	X	
1	Spiny water flea	<i>Bythotrephes cederstroemi</i>	X	
1	Round goby	<i>Neogobius melanostomus</i>	X	
1	Eurasian ruffe	<i>Gymnocephalus cernuus</i>	X	
A	Floating primrose-willows	<i>Ludwigia peploides</i>		X
A	Flowering rush	<i>Butomus umbellatus</i>		X
1, A	Hydrilla	<i>Hydrilla verticillata</i>		X
A	Reed sweetgrass	<i>Glyceria maxim</i>		X
A	Ricefield bulrush	<i>Schoenolectus mucronatus</i>		X
A	Variable-leaf milfoil	<i>Myriophyllum heterophyllum</i>		X

Table 4. AIS Plants and Animals to be Monitored for the Enloe Project by Management Class.				
Management Class	Species	Schedule	Species Type	
	Common Name	Scientific Name	Animal	Plant
1	Water chestnut	<i>Trapa natans</i>		X
1	Water Hyacinth	<i>Eichornia crassipes</i>		X
2	New Zealand mud snail	<i>Potamopyrgus antipodarium</i>	X	
2	Louisiana red swamp crayfish	<i>Procambarus clarkia</i>	X	
2, B	Brazilian elodea	<i>Egeria densa</i>		X
2, B	Common reed	<i>Phragmites australis</i>		X
2, B	Eurasian watermilfoil	<i>Myriophyllum spicatum</i>		X
B	Fanwort	<i>Cabomba caroliniana</i>		X
B	Garden loosestrife	<i>Lysimachia vulgaris</i>		X
B	Hairy willowherb	<i>Epilobium hirsutum</i>		X
2, B	Parrotfeather	<i>Myriophyllum aquaticum</i>		X
2, B	Purple loosestrife	<i>Lythrum salicaria</i>		X
2, B	Saltcedar	<i>Tamarix ramosissima</i>		X
B	Water primrose	<i>Ludwigia hexapetala</i>		X
B	Yellow floatingheart	<i>Nymphoides peltata</i>		X
3	Asian clam	<i>Corbicula fluminea</i>	X	
C	Curly leaf pondweed	<i>Potamogeton crispus</i>		X
C	Fragrant waterlily	<i>Nymphae ororata</i>		X
C	Reed canarygrass	<i>Phalaris arundinacea</i>		X
C	Yellowflag iris	<i>Iris pseudacorus</i>		X
4	Giant Salvinia	<i>Salvinia molesta</i>		X

Source: Meacham 2001, Ecology 2011, NWCB 2011

Also listed under Management Class 3 are nonnative fish, amphibians, and other vertebrates that have been introduced intentionally and unintentionally (Meacham 2001). These include the warmwater species found in Enloe Reservoir and below Similkameen Falls, and other nonnative species found in the Project vicinity (Table 1 above). Although WDFW is not expecting that any eradication or control plan be employed for these species, it is expected that in areas where they do not occur management should be directed at limiting their spread. The District will monitor the abundance and spread of nonnative fish and report through the EFMP. Frequency of these evaluations will be approximately every ten years or as determined in coordination with the Technical Review Group (TRG), who will review and recommend changes for the Enloe Fish Management Plan.

4.2.1 Monitoring Methods

- Monthly, when onsite for other routine monitoring work during the high use period of May to October, the District or contractors will conduct voluntary inspection of rafts, boats, or any floatation device that could be used by an AIS species as a vector.
- During construction, watercraft and equipment used by the District or contractors will be visually inspected prior to the first time it is used onsite if it has been used in another state. Decontamination procedures will be used if necessary.
- The District will conduct a walking survey of the perimeter of the project boundary to inspect the shoreline and adjacent shallow water areas for all AIS presence, annually.
- **Aquatic Plants:** Monitoring of aquatic plants would occur along the Similkameen River corridor portion of the Project and along the Enloe Reservoir shoreline within the Project Area. Monitoring efforts would consist of visually identifying plants and animals and inspecting for AIS from a boat along the shoreline of the Project Area. Additionally, more detailed surveys will be conducted by walking approximately 10 meters upstream and downstream of the boat launch site. In areas where macrophytes cannot be seen, a sampling rake will be used to pull them up for visual identification. (Macrophytes will also be identified and inspected for invertebrates, including zebra mussels, quagga mussels, New Zealand mudsnails, and crayfish.) Digital photographs will be taken and sent to WDFW and/or Ecology AIS personnel for identification assistance, as necessary. A map of sample areas will be created using GPS data. Once a baseline map and GPS database is established, the same sites will be re-visited during future sampling efforts.
- **Aquatic Animals:** No listing of aquatic invertebrates or mammals was identified in the Project vicinity. In the event that any of the species identified in Table 4 are found during standard EFMP monitoring, the annual walking survey, and/or voluntary inspection of rafts, boats, and floatation devices, then additional

monitoring efforts will be provided to identify the distribution and abundance of these species.

4.2.2 Monitoring Schedule

- **Aquatic Plants:** Monitoring for AIS would occur monthly when onsite for other routine monitoring work during the high use period of May through October. This would be in coordination with any fish monitoring efforts established in the EFMP.
- **Aquatic Animals:** The District will conduct an annual walking survey of the project boundary to inspect the shoreline and adjacent shallow water for AIS presence, including zebra mussels, quagga mussels, New Zealand mudsnails, and crayfish.

4.3 CONTROL AND MANAGEMENT

Once an invasive species becomes established, financial and human resources can become the limiting factors in controlling and managing the population. To lessen the negative effects, efforts must be made to understand the ecological, social, and economic impacts the species may have so that the appropriate actions may be taken to combat them (NISC 2008). Sometimes, however, eradication of a species is not feasible. In these cases, such as with introduced warmwater fishes in Washington, limiting their spread into waters where they do not already occur may be the best approach (Meacham 2001).

The only species that may require control and management are the Eurasian watermilfoil and purple loosestrife. However, although these species are found in the Project vicinity, they are not known to occur in the immediate Project area. Until it is documented in the Project area, the only control and management measures necessary are public education and monitoring to limit the spread of potential introductions. Additional potential measures that could be taken in the event of introduction for these species are discussed below. Any newly identified AIS species found during the monitoring efforts will be discussed with the TRG and the County Noxious Weed Coordinator, and potential control and management measures will be determined, as necessary. For example, if yellowflag iris (*iris pseudacorus*) is found in the project area, it will be considered for control in coordination with the TRG, the landowner, and the County Noxious Weed Office Manager. These activities will be included in the pertinent EFMP report.

4.3.1 Eurasian Watermilfoil

Eurasian watermilfoil is an invasive nonnative plant found submersed in freshwater. The plant is often identified by leaf shape, however, because it resembles its native

relative (*Myriophyllum sibiricum*), even milfoil experts must rely on pigment or DNA analysis (Ecology 2010a). Eurasian watermilfoil forms dense canopies that can shade out native vegetation. It also provides poor habitat for waterfowl, fish, and wildlife. Dense mats can alter water quality by raising pH, decreasing oxygen, and increasing temperature (Ecology 2010a). Eurasian watermilfoil is a common problem in Washington State freshwater systems, and can cost dam operators thousands of dollars each year because of the build-up in trashrack systems (Meacham 2001). Therefore, it is in the District's best interest to control and manage the spread of this aquatic invasive if it is found in the immediate Project area.

Methods that have been used to control Eurasian watermilfoil include the herbicides triclopyr, 2,4-D, or fluridone (Sonar) with follow-up diver surveys and hand pulling. Herbicide treatment varies with species but typically occurs for 10 to 12 weeks. Non-herbicide methods include covering the sediment with an opaque fabric, and introduction of the milfoil weevil (*Euhyrchiopsis lecontei*), which is a milfoil specialist. Studies are currently being conducted to understand the efficacy of biological introduction of the milfoil weevil (Ecology 2010a). However, each of these methods would need further evaluation based on monitoring results, potential impacts to other aquatic species, habitat, recreation, and consultation with the TRG to obtain a statewide water quality permit through Ecology to allow control treatments.

4.3.2 Purple Loosestrife

Purple loosestrife is an invasive nonnative plant that grows in freshwater to brackish wetlands. It can quickly adapt to environmental changes and expand its range to replace native plants used for ground cover, food or nesting materials (Ecology 2010b).

Methods that have been used to control purple loosestrife include the herbicides triclopyr (Renovate) and glyphosate (Rodeo) in the early summer to early fall for a few years (during blooming). Non-herbicide methods include the introduction of insects such as a flower feeding weevil (*Nanophyes* sp.), a root boring weevil (*Hylobius* sp.), and a leaf feeding beetle (*Hylobius* sp.) (Ecology 2010b). However, each of these methods would need further evaluation based on monitoring results, potential impacts to other aquatic species, habitat, recreation, and consultation with the TRG, and BLM to obtain a statewide water quality permit through Ecology to allow control treatments.

4.4 RESTORATION

Restoration treatments are considered to be part of control and management efforts to avoid future re-infestations and spread of the invasive species and re-establish native communities that were impacted from the introduction of the invasive species. A typical restoration plan will start with an assessment of the ecosystem's desired future condition and restoration potential across a range of spatial scales (NISC 2008). This strategy allows for lower control costs, increased effectiveness, and improved chances for ecosystem restoration success.

In the event that invasive aquatic species are identified in the area, restoration options will be discussed with the TRG.

5.0 RESPONSE AND COORDINATION

In the event of positive identification of new AIS within the Project area, the District will conduct the following response activities:

- Immediate notification to Ecology (plants) and WDFW (animals) of positive or suspected AIS species identified during monitoring activities. Digital photographs will be taken and sent to the agencies for assistance in identification, as needed. Table 5 provides contact information for AIS personnel in the event of a new AIS identification.
- If the AIS is a highly invasive species, such as zebra mussel, or quagga mussel, the District will also notify dam operators on the Columbia River (Douglas County PUD, International Osoyoos Lake Board of Control). The District will then formulate a rapid response implementation, as defined through the adaptive management process.
- The District will assist in the coordination of agency site visits as necessary to assist in confirming the presence and extent of AIS infestation and determination of immediate or long-term control/eradication needs.

Table 5. Contact List for AIS Response				
Agency	*Name	Position	Phone Number	E-Mail Address
Ecology	Jeff Lewis	Shorelands & Environmental Assistance	509-574-3992	jlew461@ecy.wa.gov
	Tom Tebb	Central Regional Office Director	509-574-3989	gteb461@ecy.wa.gov
	Charlie McKinney	Water Quality	509-457-7107	cmck461@ecy.wa.gov
	Mark Schuppe	Water Resources	509-454-4238	msch461@ecy.wa.gov
WDFW	General		888-WDFW-AIS	
	Allen Pleus	ANS Coordinator	360-902-2724	Allen.Pleus@dfw.wa.gov
	Dennis Beich	North Central Regional Director	509-754-4624	TeamEphrata@dfw.wa.gov
Washington State Recreation and Conservation Office	General	Washington Invasive Species Council	877-9-INFEST	invasivespecies@rco.wa.gov
	Wendy Brown	Executive Coordinator	360-902-3088	
Okanogan County	Anna Lyon	Weed Office Manager	509-422-7168	alyon@co.okanogan.wa.us

**Specific individuals may change; contacts will defer to the position noted above.*

5.1 ADAPTIVE MANAGEMENT

Adaptive management is a strategy defined in the 401 Certification. Similar to the TRG for fishery resources (see the EFMP), the adaptive management process will be used to protect and control the development of invasive species in the Project area. The cycle of adaptive management occurs in four stages (UCSRB 2007):

1. **Hypothesis Statement**: identification of information needs;
2. **Monitoring**: information acquisition and assessment;
3. **Evaluation**: interpret information gathered from monitoring and research, assess deviations from goals and objectives or anticipated results; and
4. **Responding**: continued or revised implementation of management actions.

The adaptive management process uses monitoring activities to update implementation schedules, monitoring methods, educational methods, new AIS threats, and potential control and management procedures. Additional aspects of the adaptive management process will be review of reports and data by the TRG as in conjunction with the EFMP, and subsequent recommendations for adaptive management and control of AIS related to the Project area, as necessary.

5.1.1 Technical Review Group

The TRG may coordinate this plan and work with the Aquatic Nuisance Committee formed by 2000 Washington Legislation (Meacham 2001), as necessary. This would ensure coordination with the Confederated Colville Tribes, WDFW, USFWS, NMFS and Ecology when addressing control and restoration options. The purpose of the TRG will be to identify feasible, cost effective management practices to be implemented in partnership with tribes, private, and public interests for the prevention and control of invasive species.

5.1.2 Reporting

The District will provide a report to the TRG on monitoring events that identify the presence of and planned management activities for invasive species. This report will be incorporated into the current EFMP report and considered in the annual budget for the protection and sustainability of aquatic species associated with the Project. If there are concerns that require more frequent monitoring, the TRG can recommend more frequent monitoring. The report will be included in the EFMP report submitted to Ecology for review and approval, and will include a summary of monitoring and educational activities conducted each year.

6.0 REFERENCES

Chelan County PUD (Public Utility District No. 1 of Chelan County). 2010. 2010 aquatic invasive species monitoring and control plan, final. Rocky Reach Hydroelectric Project FERC Project No. 2145. Wenatchee, Washington. 43 pp.

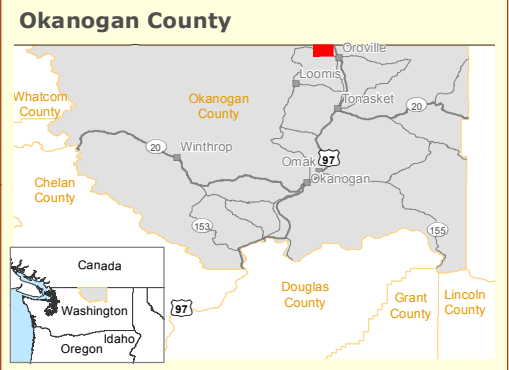
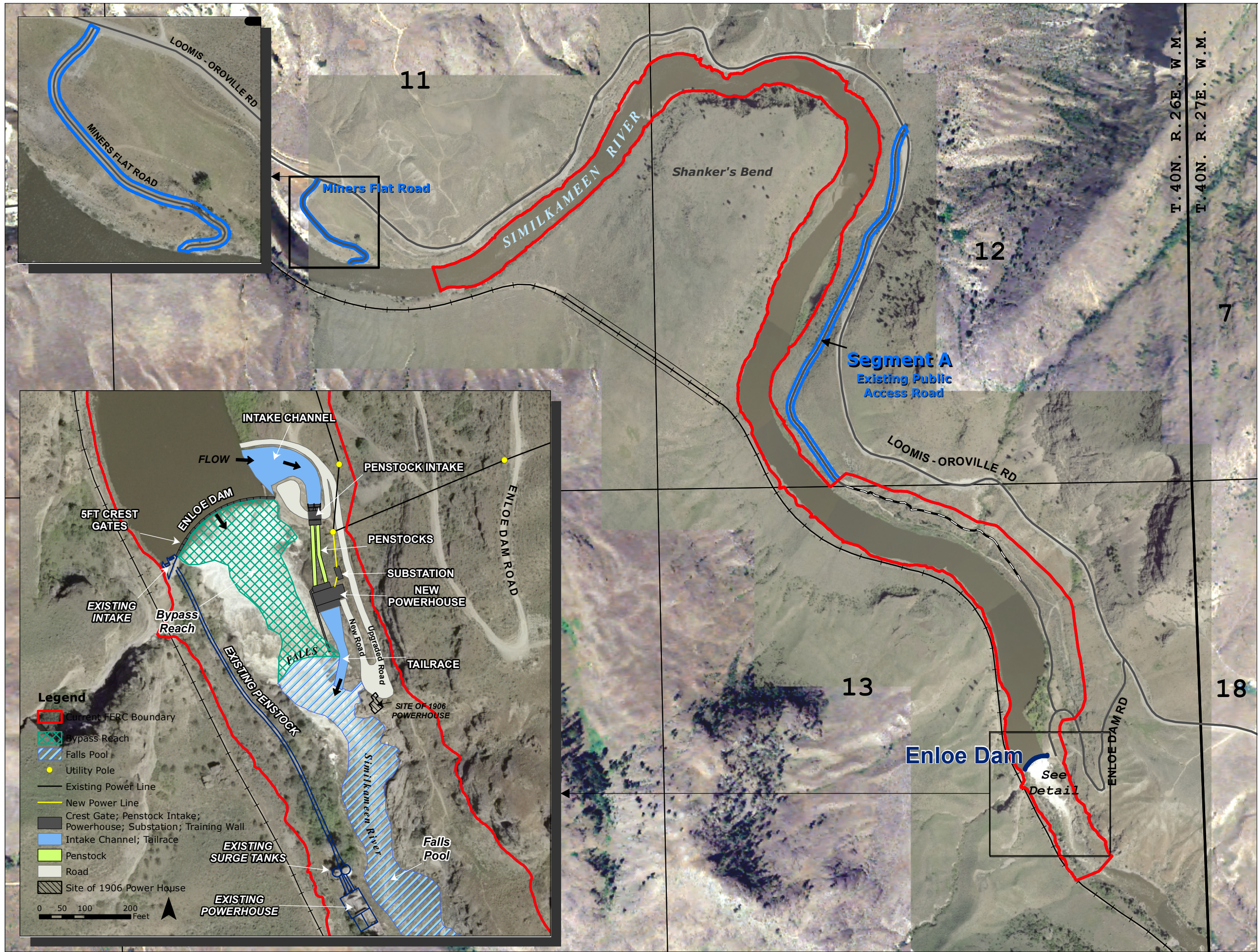
Christoph, N. 2011. Pers. com. Okanogan County Public Utility District. Okanogan, WA.

District 2008. District (Public Utility District No. 1 of Okanogan County). 2008. Enloe Hydroelectric Project (FERC Project No. 12569), Final license application. Before the Federal Energy Regulatory Commission. August 2008.

Ecology (Washington Department of Ecology). 2009. Aquatic plant monitoring. Accessed January 28, 2011. Website: <http://www.ecy.wa.gov/programs/eap/lakes/aquaticplants/index.html#classa>

- Ecology (Washington Department of Ecology). 2010a. Non-native invasive freshwater plants: *Myriophyllum spicatum* (*Eurasian watermilfoil*). Accessed on February 17, 2011. Website: <http://www.ecy.wa.gov/programs/wq/plants/weeds/aqua004.html>
- Ecology (Washington Department of Ecology). 2010b. Non-native invasive freshwater plants: Purple loosestrife (*Lythrum salicaria*). Accessed on February 17, 2011. Website: <http://www.ecy.wa.gov/programs/wq/plants/weeds/aqua009.html>
- Ecology (Washington Department of Ecology). 2011. Aquatic Plant Monitoring. Accessed 24 October 2011. Website: <http://www.ecy.wa.gov/programs/eap/lakes/aquaticplants/index.html>
- Meacham, P. 2001. Washington State aquatic nuisance species management plan. Washington Department of Fish and Wildlife for the Washington Aquatic Nuisance Species Coordinating Committee. WDFW 517.
- NISC (The National Invasive Species Council). 2008. 2008-2012 National invasive species management plan. Washington, D.C. 35 pp. Website: http://www.invasivespecies.gov/home_documents/2008-2012%20National%20Invasive%20Species%20Management%20Plan.pdf
- District (Public Utility District No. 1 of Okanogan County). 2008. Enloe Hydroelectric Project (FERC Project No. 12569), Final license application. Before the Federal Energy Regulatory Commission. August 2008.
- NWCB (Washington State Noxious Weed Control Board) 2011. 2011 Washington State Noxious Weed List. Accessed 24 October 2011. http://www.nwcb.wa.gov/documents/weed%20lists/2011%20State%20Weed%20List_Scientific_Name.pdf
- Pleus, A., E. Anderson, J. Schultz, L. LeClair, and B. Balcom. 2010. Washington State aquatic invasive species prevention and enforcement program: Report to the Legislature. Washington Department of Fish and Wildlife and Washington State Patrol. Olympia, WA.
- UCSRB (Upper Columbia River Salmon Recovery Board). 2007. Upper Columbia spring Chinook salmon and steelhead recovery plan. 352 pp. Website: <http://www.ucsrp.com/theplan.asp>
- USGS (United State Geological Survey). 2010. Nonindigenous aquatic species database. Accessed January 27, 2011. Website: <http://nas.er.usgs.gov/queries/default.aspx>

WDFW (Washington Department of Fish and Wildlife). 2005. Warmwater Fishes of Washington. Report number FM93-9, Revised April 2005.. Accessed January 8, 2007. Available at: http://wdfw.wa.gov/fish/warmwater/warmwater_2005.pdf



Legend

- Current FERC Boundary (136.4 acres)
- Additional Proposed FERC Boundary (142.7 acres*)
- Enloe Dam
- Existing Road
- Railroad
- Railroad Tunnel
- Planned Road
- Section Boundary

*Includes current FERC boundary

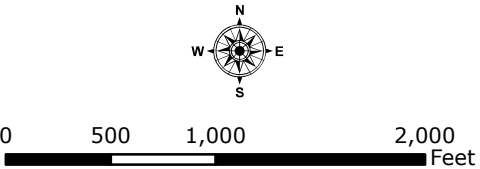


Image sources: USDA National Agriculture Imagery Program, 2005 and PUD No. 1 of Okanogan County, 2006.

Enloe Dam Licensing Project

Proposed FERC Boundary

