



**US Army Corps
of Engineers®**
Seattle District

Howard A. Hanson Dam Master Plan

June 2026





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of Engineers®**

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U.S. Army Corps of Engineers Seattle District

4735 E. Marginal Way South, Building 1202

Seattle, WA 98134-2388



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Acronyms and Abbreviations

ac-ft	acre-feet
APE	area of potential effects
AWSP	Additional Water Storage Project
BA	Biological Assessment
BiOp(s)	Biological Opinion(s)
C	Celsius
CFR	Code of Federal Regulations
CH	critical habitat
cfs	cubic feet per second
CRMP	Cultural Resources Management Plan
DPS	distinct population segment
EP	Engineering Pamphlet
ER	Engineer Regulation
ERDC	Engineer Research & Development Center
ESA	Endangered Species Act
EO	Executive Order
F	Fahrenheit
FPF	fish passage facility
GMU	game management unit
GRFMCC	Green River Flow Management Coordination Committee
HHAD	Howard Hanson Dam Archaeological District
HPMP	Historic Properties Management Plan



ITC	Implementation Technical Committee
MOA	Memorandum of Agreement
MIT	Muckleshoot Indian Tribe
MRM	Multiple Resource Management
M&I	Municipal and Industrial
NRHP	National Register of Historic Places
O&M	Operations and Maintenance
OMP	Operational Management Plan
PDFPS	permanent downstream fish passage system
RM	river mile
SBA	Supplemental Biological Assessment
SHPO	State Historic Preservation Office/Officer
Tacoma	City of Tacoma, Tacoma Water (Division of Tacoma Public Utilities)
USACE	U.S. Army Corps of Engineers
USFS	U.S. Forest Service
WDFW	Washington Department of Fish and Wildlife
WRIA-9	Water Resource Inventory Area 9
WEF	Watershed Ecosystem Forum



1. Introduction

The Howard A. Hanson Dam – Eagle Gorge Reservoir Project includes the Howard Hanson Dam (HAHD) and the lands of the Eagle Gorge Reservoir. In this document, “HAHD” refers to the entire project and not just the dam. Master Plans are prepared in accordance with Engineer Regulation 1130-2-550 for civil works projects and other fee-owned lands (lands owned outright by the U.S. Government) for which the U.S. Army Corps of Engineers (USACE) has administrative responsibility for management. This Master Plan focuses on the natural resource management mission, managing the lands and associated recreational, natural, and cultural resources of the HAHD Project. It does not cover the operational aspects of the flood control mission at HAHD. This document builds upon and replaces the existing Master Plan for HAHD (Design Memorandum No. 27), which was prepared in 1999. Detailed management and administrative functions based on guidance provided in a Master Plan are identified in the Operational Management Plan (OMP). Historic preservation activities are identified in the comprehensive Historic Properties Management Plan (HPMP) which manages and protects the historic resources at HAHD. The Master Plan anticipates what could and should happen and is flexible to changing conditions.

1.1 Project Authorization

In 1949, the Chief of Engineers, U.S. Army Corps of Engineers (USACE) recommended in House Document 271 (81st Congress, 1st Session) the creation of the Eagle Gorge Reservoir, including a flood control dam, on the Green River in Washington state. The Flood Control Act of 1950 (Public Law 516, 81st Congress, Title II, Section 204), approved May 17, 1950, authorized the construction, repair, and preservation of certain public works on rivers and harbors for navigation, flood control, and for other purposes, to include the Eagle Gorge Reservoir.

President Truman approved the construction of the dam on May 14, 1952.

Legislation to name the dam after Howard A. Hanson was signed August 6, 1958 (Public Law 85-592). The prominent attorney and civic leader was an active sponsor of the project. Utility relocations were initiated in 1955 and USACE began construction of the dam in 1959. It became operational for flood control in 1961. USACE completed construction in April 1962 (Figure 1).

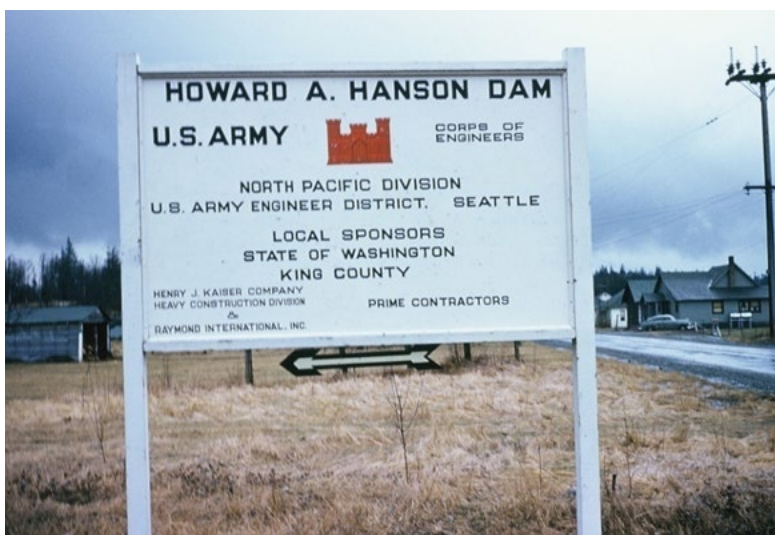


Figure 1. Sign for HAHD during construction.

In April 1997, Congress granted approval under Section 1135 of the 1986 Water Resources Development Act (WRDA), as amended, for an ecosystem restoration project to increase the volume of summer water conservation storage ("pool"). The City of Tacoma served as the local sponsor for the project, which included additional water storage of up to 5,000 acre-feet for low-flow augmentation and a collection of habitat restoration projects around the reservoir and tributaries (USACE and TPU 1996). Water capture and use was to be adaptive depending on the ecosystem restoration objectives.

Ecosystem restoration and water supply projects were later authorized by Section 101 (b) (15) of the WRDA of 1999 (Public Law 106-53). These initiatives are collectively called the Additional Water



Storage Project (AWSP). The City of Tacoma is the local sponsor with Tacoma Water, a Division of Tacoma Public Utilities, as the implementing agency within the City of Tacoma (collectively referred to as Tacoma).

1.2 Project Purpose

The Chief of Engineers, with concurrence from local interests, provided recommendations for the Green River basin in 1949. The Chief recommended the development of the Green River basin in the interest of five goals:

1. flood control (now called flood risk management)
2. fish conservation (low flow augmentation)
3. municipal and industrial (M&I) water supply
4. irrigation*
5. water quality benefits (pollution abatement?)*

*= not implemented at time of construction

This included construction of a dam and creation of a reservoir on the Green River. Of the three sites considered in the early studies, the deep valley section in the vicinity of Eagle Gorge was the most economical and the only site situated far enough upstream to serve the combined purposes listed above.

While flood control and fish conservation were among the authorized purposes initially implemented, irrigation in the valley is no longer a priority. With the control of flooding came industrial expansion in the Green River valley, including aerospace complexes and other industry in the Tukwila, Kent, and Auburn areas. This expansion catalyzed an increase in housing development for area workers and new residents. Development overtook much of the original agricultural lands.

The Section 1135 Fish & Wildlife Restoration Project was approved in 1997. The project enabled USACE to modify operations to improve environmental quality around water resource projects. The



restoration project authorized an additional 5,000 ac-ft of water (between elevation 1,141 and 1,147 feet) to be stored during the spring refill above the original fish conservation water storage elevation of 1,141 feet. The water would be used to augment flows for fish resources in consideration of the individual perspectives expressed by members of the Green River Flow Management Coordination Committee (GRFMCC), which includes Tacoma and the Muckleshoot Indian Tribe (MIT or Tribe). In addition to the 5,000 ac-ft of water storage, four habitat restoration projects were constructed around the reservoir under the Section 1135 project. Large woody material has also been incorporated into Section 1135 habitat restoration projects around the reservoir. The habitat restoration projects have been completed, and they are now in the operations and maintenance (O&M) phase (USACE 2004). O&M of the habitat restoration projects is the responsibility of Tacoma, except for the capture, storage, and release of the 5,000 ac-ft of water, which is the responsibility of USACE.

USACE and Tacoma documented the implementation of the Additional Water Storage Project (AWSP) in the summer of 2003 with the signing of the Project Cooperation Agreement (Appendix C). The AWSP is a dual-purpose water supply and ecosystem restoration project designed to meet the water supply needs of Puget Sound residents in two phases. The AWSP included the construction of a fish passage facility at HAHD and increased reservoir storage. Phase I of the AWSP was authorized in the WRDA of 1999 and included raising the summer conservation pool from 1,147 feet to 1,167 feet, storing 20,000 ac-ft of municipal and industrial purpose (M&I) water stored upriver of HAHD. Water storage under the AWSP began in 2006.

Phase I of the AWSP also included a suite of habitat mitigation and restoration projects in addition to a fish passage facility. The habitat mitigation projects were designed to offset adverse habitat effects of water storage. Two of these projects, gravel nourishment and wood nourishment, have been implemented and are now in the O&M



phase. USACE is responsible for all O&M of these two projects as discussed later in the document.

Phase II implementation of the AWSP depends on the success of Phase I and the consensus of tribal, state, and Federal resource agencies, the Tribe, Tacoma, and USACE. The Phase II proposal included an additional 12,000 ac-ft of storage. The proposal allocated 2,400 ac-ft for Municipal and Industrial (M&I) water and 9,600 ac-ft for low-flow augmentation by raising the conservation pool to 1,177 feet. If Phase II were implemented, additional mitigation features would be included to offset environmental impacts to inundated lands. Phase II has not been implemented.

With the implementation of the Section 1135 projects in 1997 and Phase I of the AWSP in 1999, HAHD priorities are:

1. flood risk management (primary purpose)
2. low-flow augmentation for fish conservation during summer and fall
3. ecosystem restoration
4. water supply for M&I

1.2.1 Flood Risk Management

HAHD operates for flood risk management, fish conservation, ecosystem restoration, and water supply. Flood risk management for the Green River valley is managed through the impoundment of water from streams and tributaries in the upper watershed into Eagle Gorge Reservoir during the peak flood season, generally November through February. The project is authorized to provide maximum flood storage up to 106,000 ac-ft from November through February. However, the storage capacity has been reduced to about 104,000 ac-ft due to sedimentation in the reservoir since 1962.



1.2.2 Fish Conservation

Water is captured and stored behind the dam in the spring for the purpose of augmenting stream flows during the summer and fall low flow season. Depending on hydrologic and biological conditions, the timeframe and rate of water capture can be modified due to high flows, snowpack conditions, fish spawning, or other factors. The objective is reservoir storage of 24,000 acre-feet of water which equates to a reservoir elevation of 1,141 feet. This water is gradually released during the summer and fall to provide fish benefit in the downstream river.

1.2.3 Ecosystem Restoration

Operations in support of the Section 1135 ecosystem restoration project, which added additional low-flow augmentation storage, have been conducted annually since 1998. Phase I AWSP ecosystem restoration projects of gravel and large wood nourishment to the river system below the dam have been implemented annually by USACE since 2003 and 2004, respectively.

1.2.4 Municipal and Industrial Water Supply

The city of Tacoma diverts its principal municipal water supply from the Green River by means of a diversion dam that was constructed in 1912. The diversion dam is located three miles downstream from HAHD. Currently, the reservoir elevation between 1,147 and 1,167 feet is storage for water supply. For Phase I of the AWSP, the stored water is discharged from HAHD between June and November in accordance with a schedule developed by Tacoma in response to customer demand. USACE discharges all stored water on or around November 1, including water stored for M&I purposes prior to the onset of flood season.



1.3 Purpose and Scope of MP

The HAHD Master Plan, hereafter referred to as the “Master Plan”, will guide and direct the future use, development and management of the natural resources and cultural resources programs of HAHD, which also includes the lands of Eagle Gorge Reservoir. Lands managed by USACE, including fee-owned and easements, may be referred to as project lands in this document. This master plan does not evaluate operational aspects of the project, thus flood risk management, fish passage, water supply, facility design, and daily/regular operations are included in other plans.

All USACE Civil Works projects and other fee-owned lands are required by Engineer Regulation (ER) 1130-2-550, *Project Operations - Recreation Operations and Maintenance Policies*, to have master plans. Per Engineering Pamphlet (EP) 1130-2-550, the master planning process encompasses a conceptual framework of four primary components:

1. regional and ecosystem needs,
2. project resource capabilities and suitability,
3. expressed public interests that are compatible with the project authorized purposes, and
4. environmental sustainability elements.

This master plan is a formal land use planning document which identifies and assigns the management practices being considered and implemented on USACE lands. It is the basic document guiding USACE’s responsibilities, pursuant to Federal laws, to preserve, conserve, restore, maintain, manage, and develop lands, waters, and related resources associated only with USACE lands on and around HAHD. Subsequent planning, design, development, and management decisions, including outgrants, will be consistent with the land use classifications and resource objectives assigned and established in this master plan. The master plan is both flexible and conceptual by design and is subject to revision and updating as indicated by



changing needs and conditions. An operational management plan (OMP) is currently being developed to prescribe the functional objectives within the approved master plan.

This revised Master Plan was prepared in accordance with the following guidance:

- Engineer Pamphlet (EP) 1130-2-550, Project Operations – Recreation Operations and Maintenance Guidance and Procedures, 15 November 1996 (revised 1 October 1999, 1 March 2002, 15 August 2002, 30 August 2008, and 30 January 2013),
- Engineer Regulation (ER) 1130-2-550, Project Operations – Recreation Operations and Maintenance Policies, 15 November 1996 (revised 1 October 1999, 1 March 2002, 15 August 2002, 30 August 2008, 30 March 2009, 30 September 2013 and 30 January 2013),
- ER 200-1-5, Environmental Quality – Policy for Implementation and Integrated Application of the USACE Environmental Operating Principles and Doctrine, 30 October 2003,
- ER 200-2-2, Environmental Quality – Procedures for Implementing NEPA, 4 March 1988
- ER 1105-2-100, Planning Guidance Notebook, 22 April 2000.

The Engineer Pamphlets and Regulations listed above may be found online at <https://www.publications.usace.army.mil/>.

1.4 Brief Watershed and Project Description

1.4.1 Project location

HAHD is located in Western Washington, 45 miles southeast of Seattle, 35 miles east of Tacoma, and 64.3 river miles (RM) above the mouth of the Green-Duwamish River system in Section 28, Township 21 North, Range 8 East, Willamette Meridian (Figure 2). The dam lies within the Tacoma municipal watershed, a primary drinking water

supply for the region, and access to much of the over 220 square miles of watershed above HAHD is closed to the public.

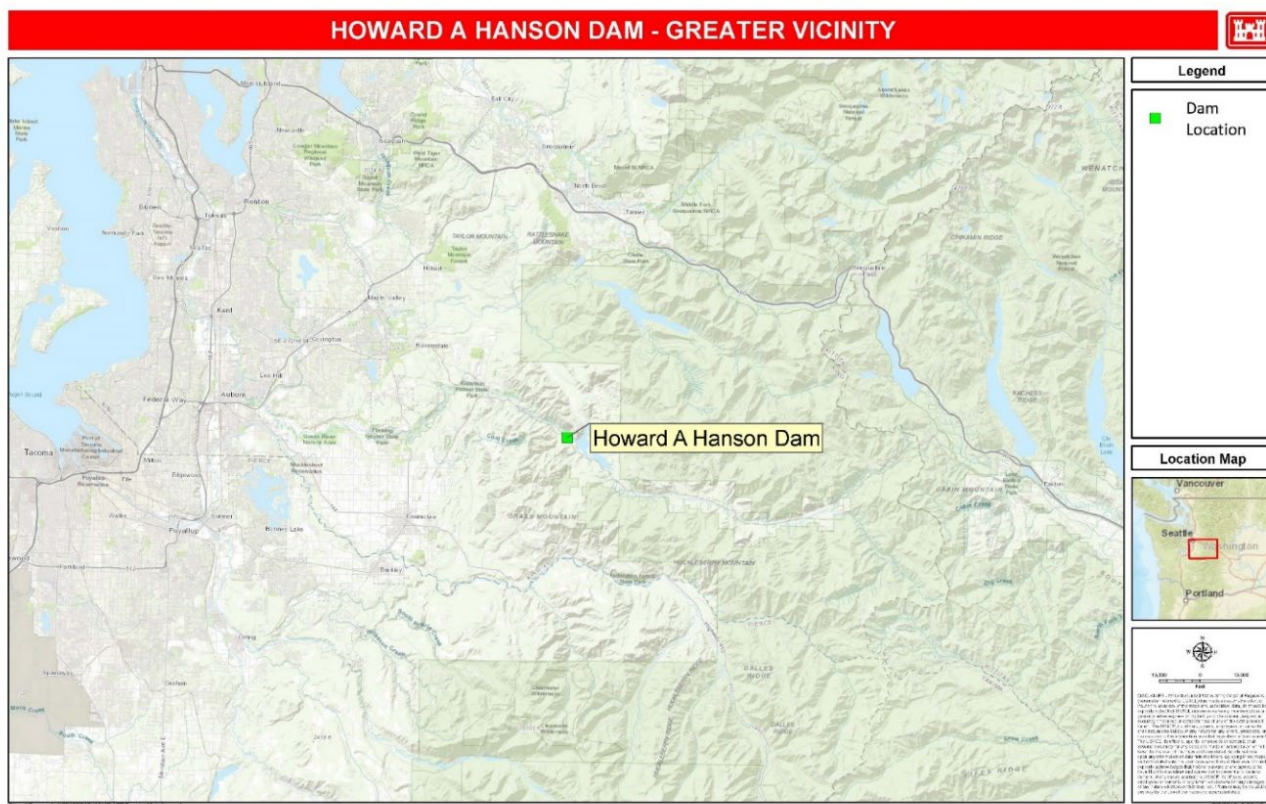


Figure 2. Location of HAHD in Washington state

1.4.2 Watershed Description

HAHD is located within the Green-Duwamish River watershed, specifically the Upper Green River subwatershed (Figure 3). The entire watershed is approximately 483 square miles, and the overall length of the Green-Duwamish River is approximately 93 miles (WDOE 2021), with the headwaters of the Green River on the west flank of Blowout Mountain. There are 48 tributaries that enter the system above HAHD with the largest being the North Fork of the Green River. These tributaries lie within the snow zone and exhibit two distinct discharge peaks associated with fall rainstorms and spring snowmelt. Beyond the Tacoma municipal watershed within the Green-Duwamish River watershed, the rest of the area is owned by private timber companies,



the Burlington Northern and Santa Fe Railway Company, the Washington State Department of Natural Resources, and the US Forest Service (USFS). USFS land is managed as part of the Mt. Baker-Snoqualmie National Forest. Downstream of HAHD, development increases as the Green River becomes the Duwamish River at the former confluence with the Black and White Rivers around RM 12.

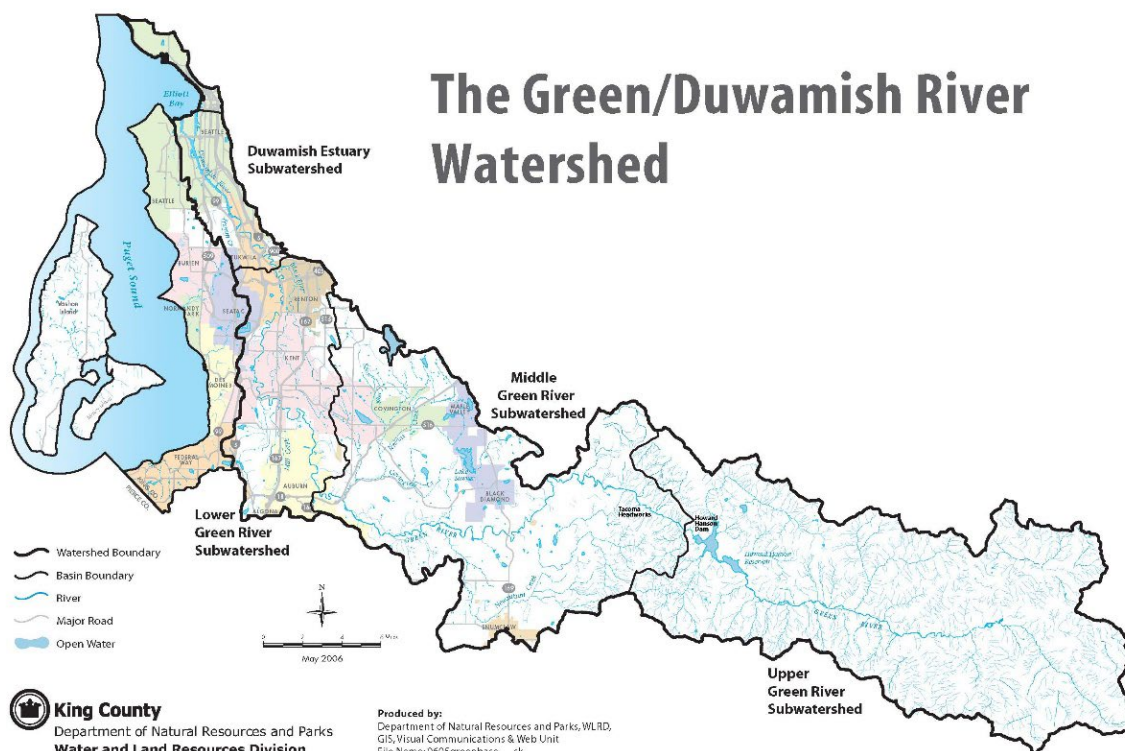


Figure 3. The Green/Duwamish River Watershed (King County Department of Natural Resources and Parks)

1.4.3 Project Description

The project encompasses 430.6 acres under Federal ownership around the immediate vicinity of the dam. USACE retains 3004.5 acres in easements for the reservoir, road access, and monitoring locations. Figure 4 illustrates the location of the dam relative to certain landmarks and important project areas. Figure 5 further illustrates features in the immediate vicinity of the dam and forebay.

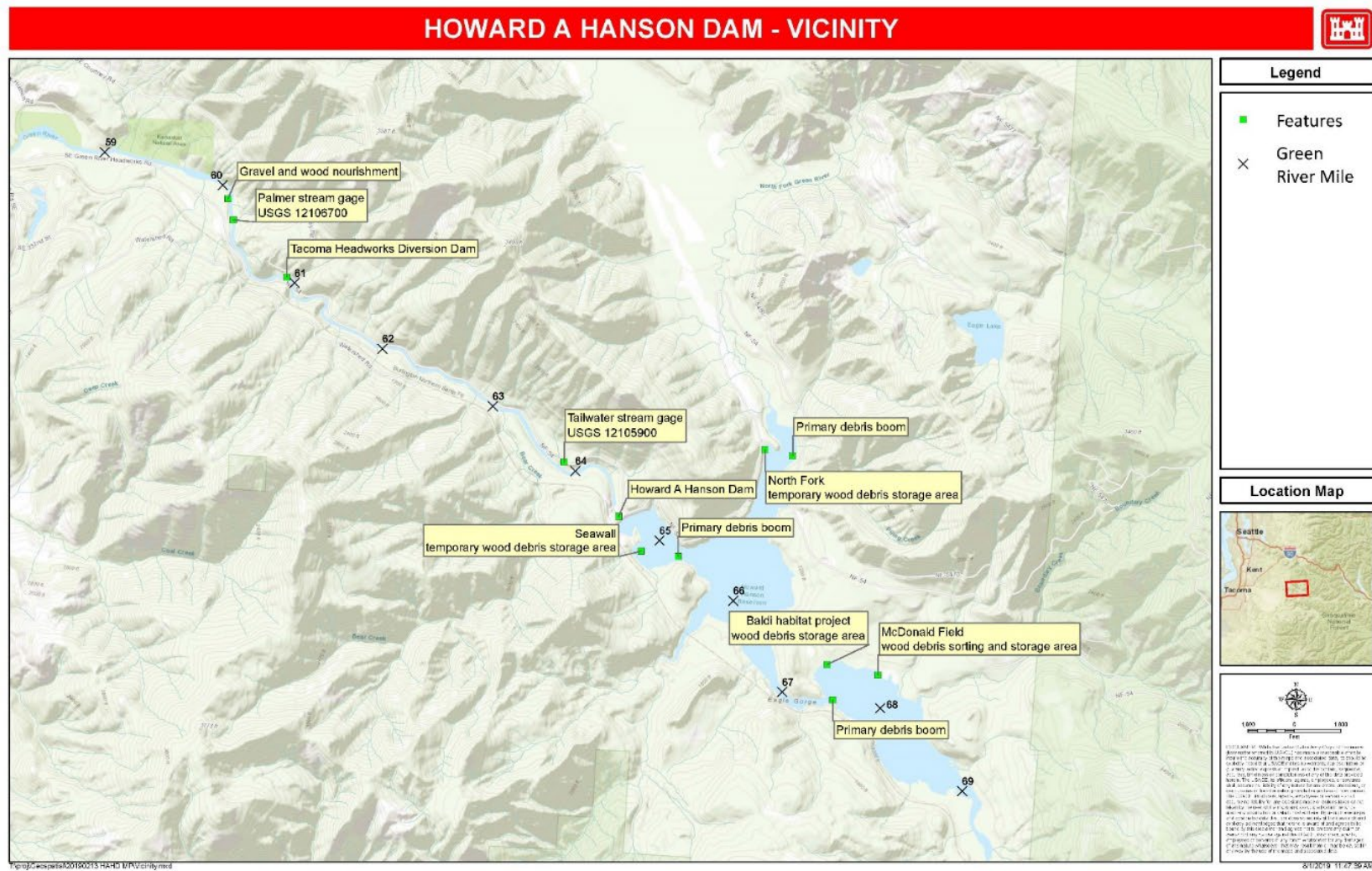


Figure 4. Location of HAHD structures and project areas

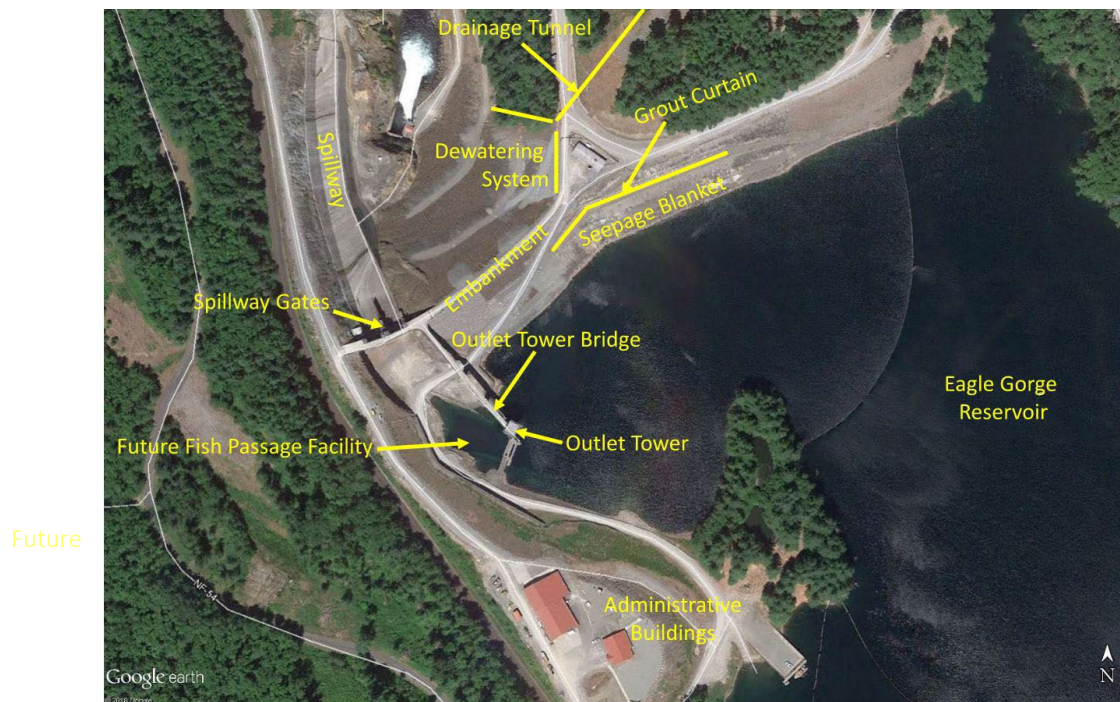


Figure 5. HAHD landmarks near the dam and forebay

The project consists of the following components and features:

- embankment dam (earth-and-rock fill)
- outlet works tower
- outlet tower bridge
- primary outlet tunnel
- bypass tunnel
- stilling basin
- gated spillway
- right abutment drainage tunnel
- right abutment grout curtain
- a seepage control blanket on the upstream face of the right abutment
- a right abutment/embankment dewatering system



- a partially constructed fish passage facility

Figure 5 highlights these elements. There is no powerhouse as the project does not generate power. The embankment has an inclined core of sand and gravel material and riprap protection. The embankment is 450 feet long and 235 feet high from bedrock to crest. Its thickness is 960 feet at the base, decreasing to 23 feet at the crest, and contains 1,420,000 cubic yards of material. The dam's total length, including spillway and abutment structures, is 675 feet.

The right abutment of the dam is a pre-historic landslide deposit. Subsequent modifications were made to the dam structure after water seepage was discovered during a high-water period that occurred in February 1965. The seepage was controlled by a gravel blanket supported by a crib wall. In 1968, construction began for a drainage tunnel within the downstream side of the right abutment at elevation 1,100 feet and extending 640 feet into the right abutment. Twelve relief wells were drilled and extended 20 feet below the tunnel floor. These original relief wells were modified in 2011 to provide a properly filtered outlet. In 2010, a 450-foot-long double-row grout curtain was constructed along the right abutment. The top height of the grout curtain is at elevation 1,206 feet.

The gate-controlled spillway is anchored in rock on the left abutment and in a concrete monolith adjacent to the embankment. The spillway is a concrete ogee overflow section with two 30-foot high by 45-foot-wide tainter gates to control major flood flows and prevent overtopping of the dam. The lowest elevation of the gates is 1,176 feet. The downstream chute has a curved alignment and is paved for 712 feet downstream from the weir. The tainter gates permit storage to elevation 1,206 feet without spillway discharge. The reservoir provides 104,000 ac-ft of flood control storage at elevation 1,206 feet. The highest pool elevation attained was 1,189 feet in December 2025. The maximum spillway discharge is 108,000 cfs at the spillway design flood pool elevation.



In 2003, USACE began construction of a fish passage facility (FPF). Rock anchors, shotcrete and drains were installed to stabilize the excavation walls. A dewatering system pumps water from the south side of the excavation to relieve pressure from the excavation walls. Completion of the FPF at HAHD intends to restore fish migration to historical upstream salmon habitat.

As a part of regular operations, HAHD maintains debris booms and collection areas near the dam, in the North Fork and near McDonald Field (Figure 6), to protect the dam from potential damage from woody material. Under pre-dam conditions, debris was passed down river during high water events. However, dam operations have blocked the historical downstream movement of large wood. Wood is managed in partnership with Tacoma. USACE transports a percentage of the large wood to a release location in the river downstream of the dam as a measure to comply with the Endangered Species Act. Tacoma manages the remaining wood.

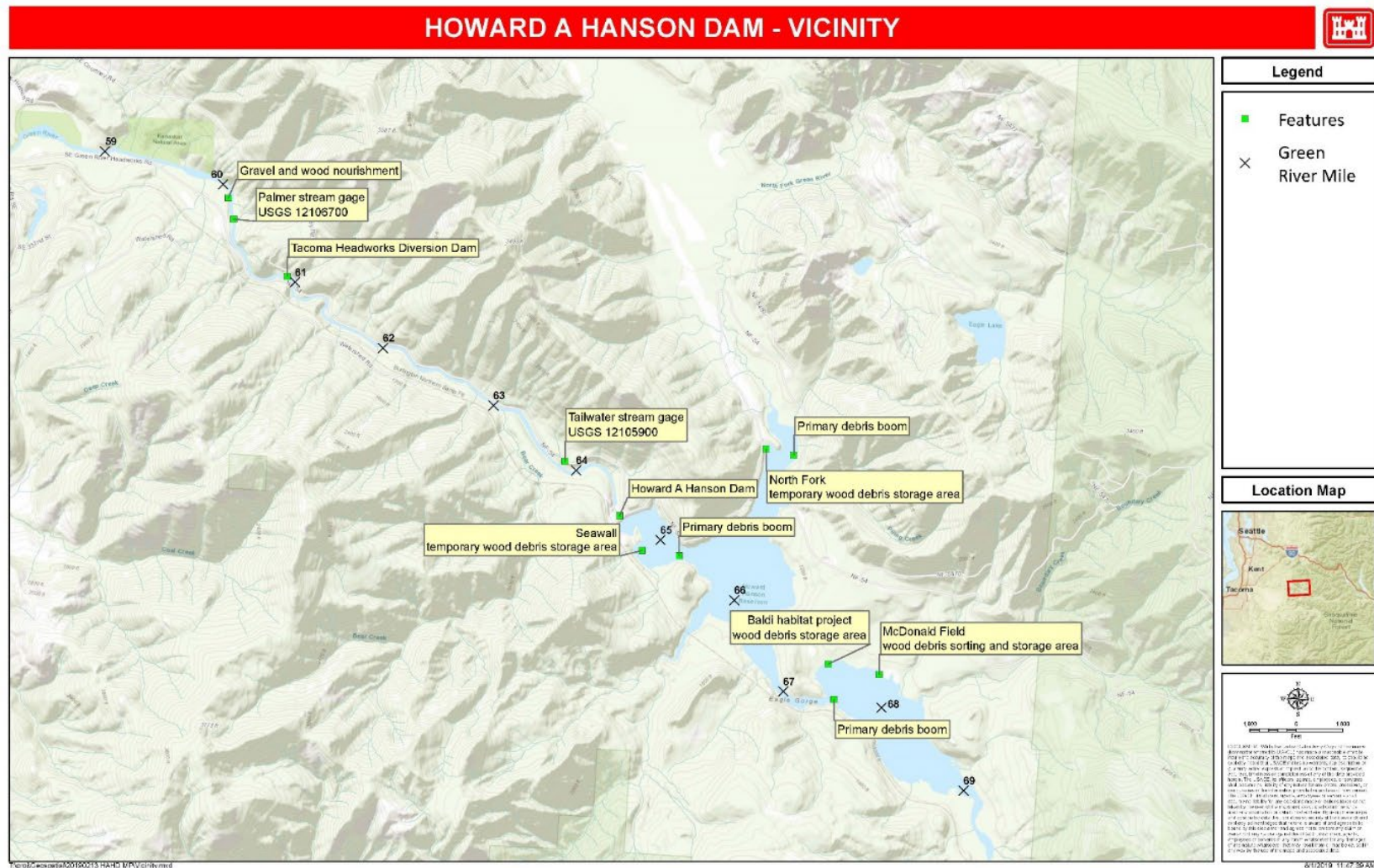


Figure 6. Location of HAHD and project areas.



1.5 Listing of Prior Design Memorandums

Prior to 1999, Design Memorandums were the formal documents which defined engineering responsibilities, requirements, and procedures during the planning, design, construction, and operations phases of civil works projects. This system of indexing documents is no longer used per ER 1110-2-1150. The previous Master Plan for Howard A. Hanson Dam and the full list of Design Memorandums, National Environmental Policy Act (NEPA) documents, and other studies can be found in Appendix A.

- Howard A. Hanson Dam Master Plan, Design Memorandum No. 27. August 1999

1.6 Listing of Pertinent Project Information

Tables 1-1 to 1-9 provide pertinent information of HAHD.



Table 1-1. HAHD General Information

Project Name	Howard A. Hanson Dam ¹
Drainage Basin/Watershed	Green-Duwamish River watershed
Drainage area above dam	221 of 483 square miles
River	Green River
Tributaries	48 tributaries enter the Green River watershed above HAHD. Large tributaries include the North Fork of the Green River, Sunday, Smay, Charley, Gale, Twin Camp, Sawmill, and Friday creeks.
Location of Dam	River Mile 64.5 in Section 28, Township 21 North, Range 8 East, Willamette Meridian
County, State	King County, Washington State
Operating and Managing Agency	Seattle District, U.S. Army Corps of Engineers (Nov 1961)
Federal ID Number	WA00298
Purposes	Flood risk management, low-flow augmentation for fish conservation during summer and fall, ecosystem restoration, and water supply for municipal and industrial purposes (M&I)
Authorization	Section 204 of the Flood Control Act of 1950 (PL 81-516)
Date of Dam Construction	1955-1969 ²
Year Dam Placed into Operation	1962
Construction Cost	\$16.3 million

¹ The project for the Eagle Gorge Reservoir was authorized at an estimated cost of \$16,300,000. Name change for the dam was approved in PL 85-592 (85th Cong, 2nd Sess; August 6, 1958).

² Road, railroad, utility relocations initiated in 1955. Dam started 1959, completed April 1962. Right bank drainage tunnel completed 1969.

**Table 1-2. HAHD Dam Specifications**

Type	Earth-filled; rock, sand, gravel core
Elevation (top of dam)	1,228 feet (NGVD ³)
Height (above bedrock)	235 feet (71.6 m)
Width at Crest (thickness)	23 feet (7 m)
Width at Base (thickness)	960 feet (292.6 m)
Length at Crest (elev. 1,228 feet)	450 feet (137.2 m)
Total Length (incl. abutments & spillway)	675 feet (205.7 m)
Volume of Concrete (entire project)	48,000 cubic yards
Volume of Fill (incl. shell & core)	1,502,000 cubic yards

Table 1-3. HAHD Spillway Specifications

Spillway Type	Concrete gravity section founded on rock, concrete-lined channel, and flow controlled by Tainter gates.
Location	Left abutment
Elevation (at crest)	1,176 feet NGVD
Chute Length	656 feet long
Gates and Type	2, tainter, 45 x 30 feet each
Design Capacity (outflow)	108,000 cfs
Use	Never used to date

³ National Geodetic Vertical Datum. Same as mean sea level, but a more accurate measurement

**Table 1-4. HAHD Outlet Works Specifications**

Intake Tower Location	Left bank
Total Capacity	23,000 cfs
Tunnel Type	Gated (emergency radial gates), semi-horseshoe, concrete lined tunnel
Tunnel Dimensions	19 feet in diameter x 900 feet long
Tunnel Gates, Type, Size	2, tainter, 10 feet x 15 feet
Bypass	48-inch diameter steel pipe ⁴
Capacity (at max conservation pool)	500 cfs
Bypass Gates	1 48-inch diameter ball valve
	1 48-inch x 48-inch slide gate
Emergency Gate, Type, Size	1, tractor, 16.7 feet x 48-inch slide gate
Stilling Basin	40.8 feet wide x 172 feet long

Table 1-5. HAHD Drainage Tunnel Specifications

Construction Date (elev. 1,100 feet)	1968
Location	Right abutment
Type	Horseshoe, concrete-lined
Dimensions	5 feet wide x 8.5 feet high x 650 feet long

Table 1-6. HAHD Lands Data

USACE-administered (Fee)	430.6 acres
Easement	2,499.9 acres
Lease	0.01 acres
Letter of Permission	0.002 acres
License	66.1 acres
Permit	7.87 acres

⁴ A 36-inch diameter bypass extension pipe is provided for use when inspection and repairs of the spilling basin are made. The 36-inch bypass extension pipe is connected to the 48-inch bypass by a Y-branch between the slide gate and the ball valve and is normally capped.



Table 1-7. Eagle Gorge Reservoir Data

Reservoir		
Name	Eagle Gorge Reservoir	
Shoreline Miles	Data not available	
	Elevation (ft-NGDV29)	Storage (acre feet) ⁵
Top of dam	1,228	
Spillway design flood pool (max. pool)	1,223.9	136,700
Project design flood pool (top of gates)	1,206	105,463
Conservation pool with Phase 2 storage	1,177	62,350
Conservation pool with Phase 1 storage	1,167	50,450
Section 1135 Storage Pool	1,147	30,395
Originally authorized conservation pool	1,141	25,375
Flood control storage pool	1,075	-
Stilling basin	981	-

Table 1-8. HAHD Maximum Regulated Flood Pool Data

Maximum Regulated Flood Pool	
Elevation (highest)	1,188.8 NVGD (January 9, 2009)
Elevation (next highest)	1,183.24 NVGD (February 10, 1996)
Surface Area	1,344 acres
Storage Capacity	76,146 acre-feet

⁵ Storage volumes provided by King County in the Green River, King County, Washington System Wide Improvement Framework Howard Hanson Dam Preliminary Capacity Evaluation, September 3, 2014.



Table 1-9. HAHD Maximum Design Flood Pool Data

Maximum Design Flood Pool	
Elevation	1,206 feet NVGD
Length	7 miles Green River, and
	4 miles North Fork Green River
Surface Area	1,750 acres
Storage Capacity	106,000-acre feet
Maximum Depth	171 feet at the tunnel inlet
Total Drawdown	136 feet
Elev. 1,070 to 1,141 feet	71 feet
Elev. 1,141 to 1,206 feet	65 feet

2 Project Setting and Factors Influencing Resource Management & Development

2.1 Description of Reservoir

During the late fall and winter, HAHD operates solely for flood risk management. The winter pool, or 'turbidity pool', ranges from 1,074 to 1,076 feet (Figure 7). The turbidity pool fluctuates between this range due to reservoir elevation, inflow, and outflow. In the spring, water retention behind the dam begins no earlier than February 20 and lasts until June. The water is captured for fish conservation and ecosystem restoration (Section 1135 project) and M&I capture (AWSP project). The typical target date for a full reservoir at 1,167 feet elevation is June 1. At full reservoir, water storage includes the following:

- Approximately 24,000 acre-feet for fish conservation (elevation 1,141 ft)
- Approximately 5,000 acre-feet for ecosystem restoration (elevation 1,141 – 1,147 ft), and



- Approximately 20,000 acre-feet for water supply (M&I) (elevation 1,147 – 1,167 ft).

During the summer, generally from late June to as late as November, the dam commonly passes inflow of water and maintains the full reservoir until water releases are needed for fish conservation, ecosystem restoration, or M&I. In the event the reservoir is not filled to 1,167 feet for a given year, stored water would be allocated based on the historical implementation dates for the various storage purposes with the earlier implemented project purposes receiving priority. The order of priority would be flow augmentation for purposes of downstream fish conservation, flow augmentation in support of the Section 1135 ecosystem restoration project, and then M&I water supply. Draw down of the reservoir to the turbidity pool elevation occurs in the late fall to prepare for winter flood operations.

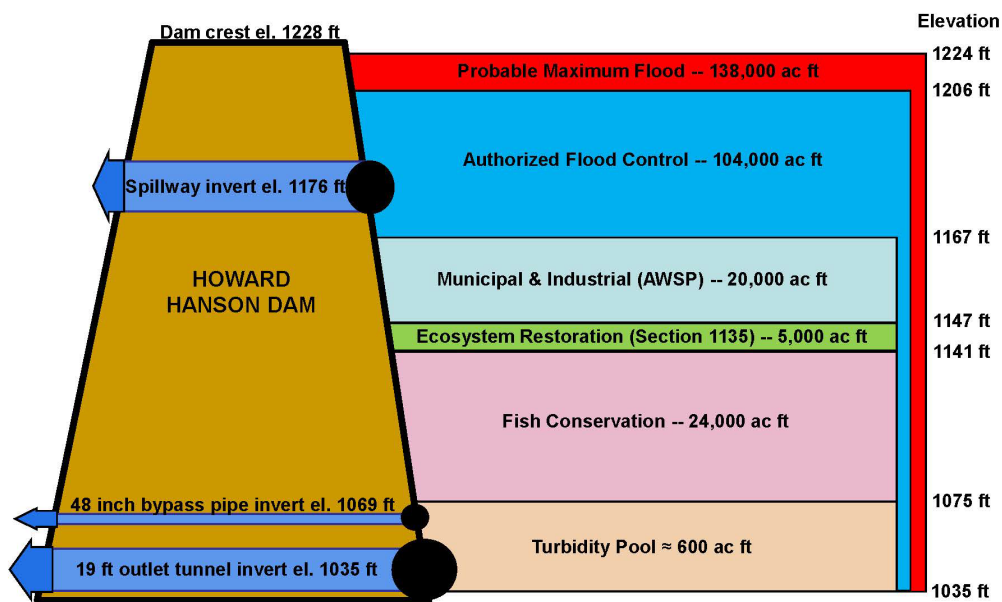


Figure 7. HAHD reservoir storage volumes and allocations



HAHD is located within the Green-Duwamish River watershed. The entire watershed is approximately 486 square miles (HUC 8 1710013, WDOE 2019) with the watershed area above HAHD approximately 220 square miles. The total length of the Green-Duwamish River is approximately 93 miles (Bergeron 2004), with the headwaters of the Green River on the west flank of Blowout Mountain. There are 48 tributaries that enter the system above HAHD with the largest the North Fork of the Green River. These tributaries lie within the snow zone and exhibit two distinct discharge peaks associated with fall rainstorms and spring snowmelt. During the summer conservation pool, the reservoir's storage is 50,400 ac-ft with a surface area of 1,134 acres (USACE 2011).

2.2 Project Access

HAHD and all lands surrounding the dam are closed to public access.

2.3 Climate

The western Washington area in the vicinity of HAHD has a typical west coast maritime climate characterized by mild winters and cool summers. Weather in the project area is influenced by the nearby Cascade Mountain range, Mount Rainier, and Puget Sound. Prevailing winds from the southwest bring in moist air; winds from the north and northwest generally bring clearer weather.

Changing weather patterns have affected aquatic habitats across the region and at HAHD. During the last century, average air temperatures in the Pacific Northwest have increased by 1°F to 1.4°F, and up to 2°F in some seasons (based on average linear increase per decade; Abatzoglou et al. 2014; Kunkel et al. 2013). Recent temperatures in all but two years since 1998 ranked above the 20th century average (Mote et al. 2013). Warming is likely to continue during the next century as average temperatures are projected to increase another 3°F to 10°F, with the largest increases predicted to occur in the summer (Mote et al. 2014). Decreases in summer



precipitation of as much as 30 percent by the end of the century are consistently predicted across climate models (Mote et al. 2014). Precipitation is more likely to occur during October through March, less during summer months, and more winter precipitation will be rain than snow (ISAB 2007; Mote et al. 2013, 2014). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB 2007; Mote et al. 2014). Climate models consistently predict increases in the frequency of severe winter precipitation events (i.e., 20-year and 50-year events), in the western United States (Dominguez et al. 2012).

Table 2-1 shows temperature averages as stated from the 1999 Master Plan (USACE 1999) compared to the averages from 2000 to 2023 at HAHD (Weather 2023).

Table 2-1. Temperatures and Precipitation Averages at HAHD.

	Mean Annual Temperature (°F)	July Low Temperature (°F)	July High Temperature (°F)	Average Annual Precipitation (in.)	July Mean Precipitation (in.)	December Mean Precipitation (in.)	Annual Snowfall Averages (in.)
1999 MP	48	51	72	54	1.6	6.8	15
2000 - 2023	50.4	60.7	68.6	81.3	1.3	10.2	13.4

2.4 Topography, Geology, and Soils

The project lies within a series of western Cascade Tertiary volcanic rocks. These rocks are predominantly andesite flows, andesitic tuffs, and breccias with smaller amounts of basalt and basaltic, pyroclastic, and felsitic rocks. Eocene sandstones of the Puget Group dip beneath the volcanic rocks at the mountain front, about five miles west of the dam.

At the project site, the Green River Valley is characterized by a present-day canyon made by glacial action and a deeper, older buried



channel immediately to the north. The buried channel is deeply cut into rock and then over time was filled, eroded, and partially filled with glacial, stream, and lake-derived materials. After a time, the north wall of the valley collapsed, creating a large rockslide mass that covered the older valley floor and shoved the Green River against the south valley side where the pre-dam canyon is located.

The right abutment of the dam is within the ancient collapsed valley wall and the left abutment is in bedrock. Geologic conditions in the right abutment are complex and create a seepage problem due to the presence of two major aquifers. The lower aquifer is found within the buried valley's alluvial materials where the pre-landslide ancestral Green River was located. Porous zones in the overlying glacial and landslide materials form the upper aquifer. The two aquifer systems are separated by a lacustrine (lake sediments) layer that is widespread but discontinuous.

With a pool elevation of 1,167 feet, the pool along the North Fork extends approximately 2.5 miles upstream of the dam northwards. The pool along the main stem of the Green River extends approximately 4.5 miles upstream of the dam in an eastward direction. The only large slide was a quarter mile-long slump/block failure of a terrace in glaciolacustrine sediments along the east side of the North Fork shortly after the reservoir was initially impounded. The slide was in a remote area and caused no damage to Howard Hanson Dam or private facilities.

Considering the steepness of the slopes surrounding the reservoir, and the geologic character of slope materials, the reservoir has been remarkably free from slides other than small failures because of inundation. There has been erosion along the shoreline since 2007 because of the higher pool. No significant slides have occurred between 2007 and the present.

Much of the gently sloping land adjacent to the Green River has historically been, and continues to be, flooded. Two sites along the reservoir are old farmsteads, with soils formed by sedimentation left



behind by flood events. These soils are generally not well suited for crop farming but are excellent for pasturing.

2.5 Ecological Setting

As the ecological setting pertains to wildlife habitat, to include salmonids, the habitat is described as Westside Lowlands Conifer-Hardwood Forest, which occurs throughout low-elevation western Washington with a mean annual precipitation ranging from 35-100 inches, transitory snowfall (snow does not remain on the ground for months) with elevation ranging from sea level to a maximum of about 2,000 feet (Chappell et al. 2001). Pacific Northwest forests can be highly productive, with the Cascade Mountains having a potential for high species richness. The Upper Green River watershed is largely surrounded by Federally owned land, which is all part of the band of National Forests and National Parks running the length of the Cascades from Canada south through Oregon and into California. Approximately 99% of the Upper Green River watershed is protected by various habitat conservation or forest management plans that are in place to protect water quality and manage forested lands for fish, wildlife and ecosystem function. This protection, especially for water quality, provides a foundation for a healthy watershed ecosystem that enables species richness and diversity to include apex predators, such as mountain lions, lynx, wolves and wolverines. Additionally, complex relationships have evolved within and between anadromous salmon and other inhabitants (both aquatic and terrestrial) within the watershed. Ecological relationships between Pacific salmonids and terrestrial and aquatic animals have been examined and over 100 species of wildlife have a relationship that is demonstrably positive with salmonids. Examples include salmonids in trophic relations (consumed) and organismal relations (by changing the structure of the stream bed), or indirectly through carcass provision of nutrients for aquatic insects which are then fed on by other species (Cederholm et al. 2001). Lastly, the NMFS BiOp (2019) has indicated that there is high quality spawning and rearing upstream of HAHD, which not only



highlights the quality, but also recognizes the efforts of landowners and their cooperative actions in managing and maintaining the watershed.

2.5.1 Antifever Fontinalis Moss Aquatic Vegetation

Antifever Fontinalis Moss (*Fontinalis antipyretica* [var. *antipyretica*, var. *oregonensis*]) Aquatic Vegetation dominated wetlands occur below or at the emergent marsh zone. This habitat occurs on seasonally or perennially flooded waters with the moss forming a submerged bed that tolerates perennial submergence or seasonal exposures (USNVC 2019). At HAHD, this moss occurs in middle and lower portions of drawdown zones and are typically inundated with water from about June through September (Figure 8). The stands gradually become exposed as water levels recede beginning in summer drawdown. Upper portions that are exposed for much of the growing season are co-dominated by annual blue grass (*Poa annua*) and lesser spearwort (*Ranunculus flammula*). Few small mammals use these wetlands due to the summer flooding from the reservoir. However, Canada goose (*Branta canadensis*) and several duck species utilize these areas for nesting and foraging and amphibians utilize this aquatic edge vegetation for refuge from predators and larval forage habitat.



Figure 8. Antifever Fontinalis moss exposed on portions of drawdown zone at HAHD (Philley et al. 2019).

2.5.2 Slough Sedge (*Carex obnupta*) Wet Meadow Alliance and Common Rush Marsh Community Types

These community types are wet meadows with seasonally saturated soils through most of the growing season. In general, slough sedge is dominant, with spikerush (*Eleocharis* spp.) and bulrush (*Scirpus* spp.) as minor components. In one area, the wetland type was dominated by common rush (*Juncus effuses*) and was labeled as a separate community type in the wetland report. In this context, a wet meadow dominated by common rush is still considered a slough sedge wet meadow (USNVC 2019).

2.5.3 Pacific Willow/California Nettle Swamp Woodland

This community type is shrub swamp around shallow lakes and ponds with the primary tree being Pacific willow (*Salix lucida* ssp. *lasiandra*) (USNVC 2019). At HAHD, these stands occurred within depressional features within riparian habitats, often immediately downslope of the community type, Red Alder / Salmonberry Riparian Forest.

2.5.4 Panicked Bulrush Marsh

Panicked bulrush (*Scirpus microcarpus*) marsh at HAHD occurs on upper portions of the drawdown zone (Figure 9). The bulrush marsh transitions downslope to antifever fontinalis moss, annual bluegrass, and lesser spearwort, where periods of inundation during the growing season are too long to support bulrush. Panicked bulrush often dominated this community type ($\geq 70\%$ cover) with most other species occurring as minor components.



Figure 9. Panicked bulrush marsh along the upper edges of drawdown zones at HAHD (Phillee et al. 2019).



2.5.5 Red Alder/Common Ladyfern – Yellow Skunk-cabbage Swamp Forest

The red alder (*Alnus rubra*)/common ladyfern (*Athyrium filix-femina*) – yellow skunk-cabbage (*Lysichiton americanus*) swamp forest was recorded along the main access road, with the most notable site occurring on a hillside seep near McDonald Field. Skunk cabbage and salmonberry dominated the understory throughout most of the stands.

2.5.6 Red-osier Dogwood – Sitka Willow Shrub Swamp

Red-osier dogwood (*Cornus sericea*) – Sitka willow shrub swamp occurs within oxbows and other depressional features on HAHD.

2.5.7 Open Water/Stream

There is only one sizable pond on project easement lands - Page Mill Pond. It was created in the 1930s to store logs for Page Mill log operation. A timber crib dam was built across Page Creek to form the pond. The dam and pond are still there but the dam is partially broken, and the pond does not effectively hold historic quantities of water. Page Mill Pond is surrounded by dense vegetation which reduces predation on animals seeking water and shelter. In addition, this pond provides food in the form of aquatic plants and insects.

Eagle Gorge Reservoir provides open water habitat but is greatly reduced in size when the reservoir is drawn down. The riverbed is confined within the river channel and consists of exposed river bars that are within the ordinary high-water mark. These areas are generally unvegetated with a substrate consisting of cobble, gravel, and some sand. Gravel bars are important for several species of wildlife, primarily as feeding habitat and as nesting spotted sandpiper and killdeer habitat (upstream from the reservoir and downstream from the dam where nests will not become inundated). Named streams and drainages flowing into the reservoir include the main stem of the Green River, Elder Creek, Charley Creek, North Fork of the



Green River, Page Mill Creek, Cottonwood Creek, Piling Creek, McDonald Creek, and Gale Creek.

2.5.8 Western Cattail Marsh

These marshes are near-monotypic stands of cattail (*Typha latifolia*) along margins of beaver ponds and oxbows. Some stands occurred on shallow zones that dry to mudflats during the late summer and early fall. Several occurrences of cattail at HAHD were too small to delineate.

2.5.9 Western Hemlock – Western Red-cedar/American Skunk-cabbage – Common Ladyfern Swamp Forest

This swamp forest occurs on poorly drained sites that are saturated or seasonally flood (USNVC 2019). At HAHD, this forest type is often embedded or adjacent to upland forests dominated by the same evergreen tree species, western hemlock (*Tsuga heterophylla*) and western red cedar (*Thuja plicata*). Downed logs and hummocks create slight elevation increases that facilitate the presence of plants that are regarded as upland species. Swamp forests dominated by conifers are susceptible to wind-throw damage due to shallow-rooting in the saturated soils.

2.6 Resource Analysis

Inventories are used to estimate the natural resources present at USACE operating projects and are conducted to provide baseline information for Master Plan purposes. Inventory data is used to support the resource objectives and land-use classifications for the Master Plan. Inventories may vary from performing literature research to actively conducting fieldwork to identifying and confirming project resources.

Developed areas at the dam and portions of the original (pre-reservoir) Green River channel are classified as Project Operations. A land use classification map of USACE-managed areas is provided in



Chapter 4. Although these areas are not managed explicitly for wildlife, animals are frequently observed and utilize the habitat year-round. USACE fee-owned lands under the Multiple Resource Management (MRM) classification, as described in this plan, are managed for one or more uses but with compatibility to the primary land allocation. Currently, all 135 acres of HAHD MRM lands are managed for vegetation with the intent to protect and enhance fish and wildlife habitat. These lands have relatively high fish and wildlife value when managed as contiguous habitat with Tacoma lands. The following are brief descriptions of habitats and plant species that have been observed within the HAHD project area.

2.7 Vegetative Resources

The upper Green River basin is within the Western Hemlock Forest Zone (Franklin and Dyrness 1988). The Western Hemlock Forest Zone is characterized by climax western hemlock (*Tsuga heterophylla*) and western red cedar (*Thuja plicata*) forests and sub-climax Douglas-fir (*Pseudotsuga menziesii*) forests. Although western hemlock is the potential climax species in this zone, Douglas-fir forests cover large areas of the landscape. Douglas-fir-dominated forests develop following disturbance, such as fire and clearcut logging practices, and can persist for several centuries. Hardwood forests are commonly restricted to moist, early successional sites, where red alder (*Alnus rubra*) often dominates and big-leaf maple (*Acer macrophyllum*) is common. Topography, aspect, geology, soil, and available groundwater all influence plant community patterns at the local level, particularly for understory species. Common understory species include sword fern (*Polystichum munitum*) in moist sites, salal (*Gaultheria shallon*) in dry sites, and Oregon grape (*Mahonia aquifolium*) in sites with intermediate moisture status. Vine maple (*Acer circinatum*) is a common shrub in the middle understory. Disturbance has had a major impact on forest patterns in the upper Green River basin due primarily to extensive timber harvest and past wildfires. Timber harvest activities have resulted in the predominance



of second growth, even-aged coniferous stands. There is also a large area of hardwood dominated by red alder with an understory of western hemlock and western red cedar present. Most of the stands are over 30 to 90 years old and, until about 50 years ago, regenerated naturally. More recently harvested areas have been planted with Douglas-fir. Deciduous forests comprised of red alder, big-leaf maple, and black cottonwood (*Populus balsamifera*) occur on wetter slopes.

Within USACE managed lands, smaller vegetative zones have been identified along with a variety of wildlife species associated with each. Habitat types include mixed, deciduous and coniferous forests, grassland communities, a range of wetlands and riparian habitats, and open water. Above the typical reservoir high pool elevation of 1,167 feet, USACE fee-owned land and surrounding TPU holdings are typically characterized as conifer forest dominated by Douglas-fir (*Pseudotsuga menziesii*). Several upland habitats have been replaced with low quality or homogenous conifer stands and/or invasion of nuisance species such as reed canary grass (*Phalaris arundinacea*) and Scotch broom (*Cytisus scoparius*). Several upland elk forage pastures have evolved on the once-forested uplands surrounding the reservoir. These are maintained by Tacoma as mitigation for low gradient grassland and wetland sedge habitat that were lost in association with the AWSP pool raise.

2.7.1 Coniferous Forest

Douglas fir, western hemlock, western red cedar (*Thuja plicata*), and Sitka spruce (*Picea sitchensis*) are the predominant evergreen trees throughout most of the project lands. Both Douglas fir and western hemlock thrive on drier, well-drained soils. Douglas fir dominates the slopes surrounding the reservoir while Western red cedar and Sitka spruce grow in moister soil conditions. Understory vegetation commonly includes western sword fern (*Polystichum munitum*), bracken fern (*Pteridium aquilinum*), salmonberry (*Rubus spectabilis*), trailing blackberry (*Rubus ursinus*), bleeding heart (*Dicentra* sp.), miner's lettuce (*Claytonia perfoliata*), and devil's club (*Oplopanax*



horridus). Evergreen forests are home to a set of animals adapted to the needle leaves, cones, deep shade, moss, and needle-covered forest floor unique to these ecosystems. In 2018, the Engineer Research & Development Center (ERDC), provided a botanical inventory and identified wetland features within project lands owned and operated by USACE (Philley *et al.* 2019). Two community types, Douglas-fir – (Red Alder, Western Hemlock)/Salmonberry Forest (a subset of Coniferous Forest) and Sitka Spruce – Douglas-fir – Western red-cedar terrace forest were identified and the map and acreages are shown in Table 2-2. and Figure 13 in section 2.8.6. It was noted in the report that most of the stands of this community type appeared to have regenerated relatively recently following logging activity (Philley *et al.* 2019) identified in section 2.16.5 Leases, Easements, and Outgrants.

2.7.2 Deciduous Forest

Deciduous forests are prevalent in wetter areas with moist soil conditions and tend to be much brighter in understory than coniferous forests due to the better light transmissivity of the canopy (Figure 10). As a result, the understory and three-dimensional structure of the forest vegetation tends to be more diverse and much denser than in a coniferous forest. Deciduous forest habitat types occur along the eastern half of the reservoir upstream from Eagle Gorge, along much of the southern reservoir edge, and along the Green River main stem, North Fork main stem, and most of the larger reservoir tributaries. Dominant trees include red alder (*Alnus rubra*), black cottonwood (*Populus balsamifera* var. *trichocarpa*), vine maple (*Acer circinatum*), and big leaf maple (*Acer macrophyllum*). Cottonwood is an especially valuable wildlife tree that is most common along the edge of the Green River. Understory trees, shrubs and forbs include cascara (*Rhamnus purshiana*), willow (*Salix* sp.), bitter cherry (*Prunus emarginata*), Pacific dogwood (*Cornus nuttallii*), red elderberry (*Sambucus racemosa*), hazelnut (*Cornuta* sp.), thimbleberry (*Rubus parviflorus*), trailing blackberry, red huckleberry (*Vaccinium*

parvifolium), devil's club, Indian plum (*Oemleria cerasiformis*), sword fern, bracken fern, and piggyback plant (*Tolmiea menziesii*).



Figure 10. Deciduous forest along a tributary to the Green River above HAHD in 2019.

2.7.3 Deciduous Forest – Riparian (Alder/Cottonwood)

This habitat warrants a separate description because of the tendency for alder and cottonwood to form monotypic stands in various locations. Alder tends to be one of the pioneer species (first to colonize) following clear-cutting or fire and may form nearly monotypic stands for a few years until shade-tolerant trees (such as western hemlock) outgrow the alders or the alders die off (alder is a short-lived species usually living less than 100 years). Stands of alders are scattered near the upper end of the reservoir. Cottonwoods commonly grow alongside rivers, occasionally forming dense stands



called “overflow forests” where water pools along the forest floor and forms ephemeral ponds. In the project area, these dense stands are rare, occurring primarily at the extreme upper end of the reservoir. These forests provide excellent riparian habitat for numerous faunal species and are essential to some taxa such as amphibians. Animals using mixed forests are primarily those of deciduous forests, as well as those that are deciduous forest specialists and habitat generalists.

ERDC’s 2018 vegetation survey identified the following community types; black cottonwood (*Populus balsamifera* ssp. *trichocarpa*) - red alder (*Alnus rubra*) /salmonberry (*Rubus spectabilis*) riparian forest, red alder/salmonberry riparian forest, red alder/western swordfern forest, and Sitka Willow Cobble Bar Wet Shrubland (Philly *et al.* 2019, Figure 11). The map and acreage for these communities are shown in Table 2-2. and Figure 13 in section 2.8.6.



Figure 11. Red alder/salmonberry riparian forest at HAHD (Philly et al. 2019).

2.7.4 Mixed Coniferous Forest

A mixed forest includes both the coniferous and deciduous tree species described above. It is generally a seral stage that, if left to succeed, will often become a mature coniferous forest (although soil and hydrologic conditions may keep some stands in a mixed species condition virtually forever). Douglas fir reportedly comprises 40 to 60 percent of the canopy within this habitat type. Western red cedar, western hemlock, big leaf maple, and red alder comprise the remainder of the overstory canopy. Oregon grape (*Mahonia* sp.), trailing blackberry, salmonberry and sword fern are dominant understory species in this habitat type.

2.7.5 Grassland and Shrubland (Ruderal Vegetation)

Grasses and weedy forbs occur along portions of the abandoned railway embankment above elevation 1,160 feet and in the upper areas of McDonald field (Figure 12). Grass species include timothy (*Phleum pretense*), red fescue (*Festuca rubra*), quackgrass (*Elymus repens*), and redtop bentgrass (*Agrostis stolonifera*). Other plant species include sedges (*Carex* sp.), rushes (*Juncus* sp.), Indian thistle and invasive tansy ragwort (*Senecio jacobaea*), scotch broom, reed canary grass and knapweed (*Centaurea* sp.). These areas are heavily browsed by elk and geese and are managed primarily as elk forage areas by Tacoma and the MIT.

ERDC's 2018 vegetation survey identified the following community types, Himalayan blackberry ruderal shrubland, ruderal vegetation, and Scotch broom ruderal shrubland (observed on cobble bars) (Philley *et al.* 2019). The map and acreage for these communities are shown in Table 2-2 and Figure 13.



Figure 12. Grasses and weedy forbs at McDonald Field (January 2021)



2.8 Wetlands

Prior to construction of the dam, the Green River flowed unobstructed through Eagle Gorge in the upper watershed. The river gradient was steep compared to much of the lower watershed. Because of these topographic conditions, wetland distribution was likely limited to the few flat riparian areas adjacent to the river. Based on the topography, there were probably fewer wetlands in the upper watershed prior to construction of the dam and the subsequent formation of the reservoir than what currently exists. However, unlike present conditions, water level fluctuations were not as extreme and thus wetland hydrologic regimes were likely to have been more stable.

Operation of the dam and resultant seasonal changes in lake pool levels are primary factors controlling the extent and nature of wetland communities. A detailed survey conducted for habitat mapping of wetlands and upland habitats was conducted in the early 1980s by Shapiro and Associates in the vicinity of the reservoir and surrounding lands up to elevation 1,220 feet, which is now below the typical pool elevation. The early 1980s mapping identified five wetland sub-types in the upper watershed: mudflats, forested wetlands, moss-dominated wetlands, emergent marsh, and open water and stream. With changes in water management because of the AWSP, the previous wetland inventory was not current because of the conservation pool raise. Funding was acquired and a wetland survey was conducted in 2018.

The 2018 survey, conducted by ERDC, provided a botanical inventory, and identified vegetation wetland features within project lands owned and operated by USACE (Philly *et al.* 2019). The survey included fee-owned and easement lands above and below HAHD. Table 2-2. provides the community types identified and the acreages for those types.



Table 2-2. Community type and area (acres) at HAHD

Community Type (Common Name)	Acres
Antifever Fontinalis Moss Aquatic Vegetation	183.9
Black Cottonwood - Red Alder / Salmonberry Riparian Forest (not necessarily a wetland)	128.9
Slough Sedge (<i>Carex obnupta</i>) Wet Meadow Alliance	0.5
Common Rush Marsh	0.7
Douglas-fir - (Red Alder, Western Hemlock) / Salmonberry Forest (not a wetland)	11.5
Himalayan blackberry Ruderal Shrubland (not a wetland)	0.3
Maintained/Disturbed (not a wetland/predominantly non- or sparsely vegetated)	276.0
Pacific Willow / California Nettle Swamp Woodland	0.3
Panicled Bulrush Marsh	51.3
Red Alder / Common Ladyfern - Yellow Skunk-cabbage Swamp Forest	7.7
Red Alder / Salmonberry Riparian Forest (not a wetland)	152.5
Red Alder / Western Swordfern Forest (not a wetland)	570.6
Red-osier Dogwood - Sitka Willow Shrub Swamp	0.9
Ruderal Vegetation (not a wetland)	70.4
Scotch Broom Ruderal Shrubland (not a wetland)	4.4
Sitka Spruce - Douglas-fir - Western red-cedar Terrace Forest (not a wetland)	4.7
Sitka Willow Cobble Bar Wet Shrubland (not a wetland)	18.1
Water	860.3
Western Cattail Marsh	1.3
Western Hemlock - (Douglas-fir) / Devil's-club / Western Swordfern Forest (not a wetland)	16.7
Western Hemlock - (Douglas-fir, Western Red-cedar) / Western Swordfern - Common Ladyfern Forest (not a wetland)	254.2



Community Type (Common Name)	Acres
Western Hemlock - Western Red-cedar / American Skunk-cabbage - Common Ladyfern Swamp Forest	2.6
Total	2618.8

The communities highlighted in gray are not wetlands and have been noted within section 2.7. Table 2-2 shows the vegetation classifications at HAHD. Unless otherwise cited, the descriptions of the nine wetland community types identified in Table 2-2 (not highlighted in gray) are from Philley *et al.* 2019.

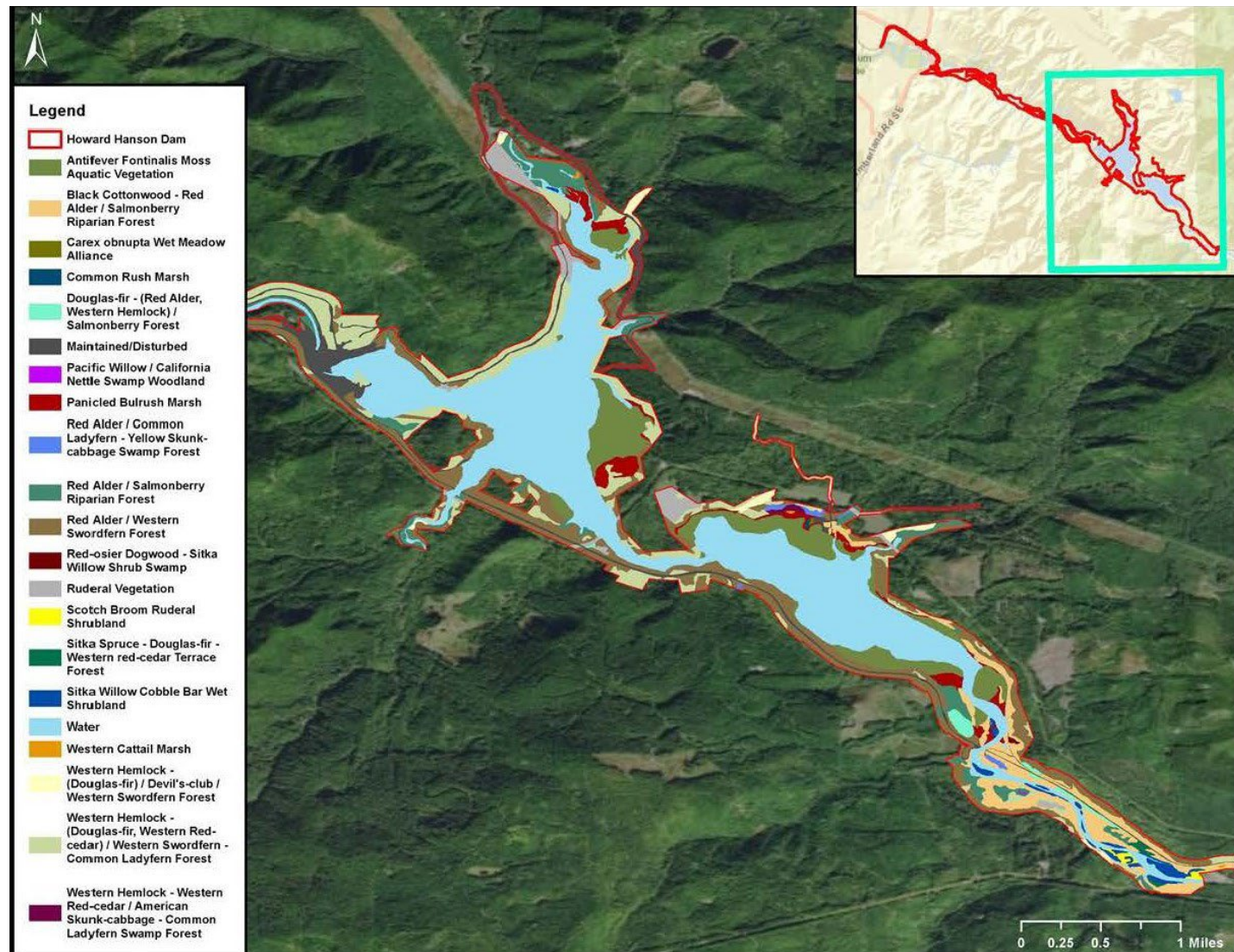


Figure 13. Vegetation classification of HAHD, using the National Vegetation Classification System (Philley et al. 2019)



2.9 Fish

More than 30 species of fish inhabit the Green River, including resident and anadromous stocks (TPU 2001). Wild anadromous fish were present up the full length of the Green River until 1911 when Tacoma constructed a water diversion dam at RM 61. Because HAHD was built above this upstream limit of fish migration, fish passage facilities were not included during the initial construction of the dam. Green River fish populations affected by USACE operations and facilities include those that rear both above and below HAHD. Natural spawning of fish above the reservoir is presently limited to resident cutthroat, rainbow/steelhead trout, and mountain whitefish (Figure 14).



Figure 14. Rainbow trout captured during a 2008 survey of predator fish in Eagle Gorge Reservoir.

The runs for the salmon/trout species are as follows:

- The Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*) in the Green River starts in July and continues through October.
- The winter run of Puget Sound steelhead (*Oncorhynchus mykiss*) starts in November and continues through July. There are hatchery-raised steelhead within the system and they have a summer run.
- There are no Coastal/Puget Sound bull trout (*Salvelinus confluentus*) runs within the Green/Duwamish River. The lower Green/Duwamish River is known to be used for foraging and over wintering by bull trout.
- The coho (*Oncorhynchus kisutch*) run starts in August and continues through January.



- The chum (*Oncorhynchus keta*) run starts in November and continues through December.
- There are resident populations of both cutthroat and rainbow trout above the dam.

Tacoma has constructed a trap-and-haul facility at the water diversion dam. It is intended that fish will be hauled from the diversion dam and released upstream, above HAHD. However, because there is no downstream fish passage from HAHD, Tacoma is not operating their trap-and-haul. Following the NMFS 2019 BiOp on HAHD operations and maintenance (NMFS 2019), USACE committed to implementing the Reasonable and Prudent Alternative of designing and building a permanent downstream fish passage system. The objective is to construct a downstream fish passage system within six years of authorization and appropriation and provide operational downstream passage of juvenile Chinook salmon in the first outmigration season following construction. (NMFS 2019).

Shoreline and instream fish habitats of the Green River through the HAHD include clear cold water that feeds a gravel- and boulder-bottomed river bordered by cottonwood, alder, and second growth coniferous trees. Reservoir substrates are primarily sand and mud. Shoreline habitat is largely shaped through water fluctuations—during high pool, reservoir waters rise to meet the hardwood and coniferous tree stands along the banks. During low pool, fish habitat is relegated to a gravel-bottomed stream bordered by an unbroken shoreline of mud and sand. Upstream from the reservoir, fish habitats are shaped by annual changes in water flows and include gravel- and boulder-bottomed substrates shaded by hardwood and coniferous trees and associated understory.

Instream cover within the main stem and tributaries is provided by logs and woody debris, but somewhat reduced in quantity due to logging. Cold-water fishes of the Green River rely on instream cover and shade provided by shoreline vegetation for regulation of water temperatures and as a substrate for food production, particularly

terrestrial insects. Geological and hydrological processes provide backwater and off channel habitats as well as the formation of undercut banks, gravel bars, and pool/riffle complexes. This fish habitat complexity is necessary for the survival of juvenile and adult anadromous and resident fishes.



2.9.1 Puget Sound Chinook

Adult Chinook salmon migrate upstream into the Green River from Puget Sound from July through October (Grette and Salo 1986). Spawning occurs from mid-September until the end of October. The peak of redd construction is typically the first week of October. Preferred spawning areas for Chinook salmon in the Green River include the main river channel and large side channels between RM 25 and the Tacoma Headworks dam at RM 61 (USACE 2014). Most juvenile Chinook salmon in the Green River display an ocean-type life history, meaning they migrate to the ocean during the year they emerge from spawning gravel. There are usually a few yearling or stream-type Chinook salmon caught in the Green River smolt trap annually (Topping and Zimmerman 2011). These fish rear in the river



for about a year before migrating to salt water. Both life history types use the estuary to feed and grow for several weeks before migrating offshore. Chinook salmon outmigration generally occurs from January until July. Detailed species information for Chinook salmon can be found in the 2000 Biological Assessment (BA) (USACE 2000), the 2014 Supplemental Biological Assessment (SBA) (USACE 2014) and their respective BiOps (NMFS 2000, NMFS 2019).

2.9.2 Puget Sound Steelhead

The Green River supports both winter and summer populations of Puget Sound steelhead. The winter stock includes an early run Chambers Creek hatchery derived population and a later run natural population. The latter natural run population is the ESA-listed population. The summer stock is entirely hatchery supported. Adults of the ESA-listed winter population typically enter freshwater between November and May (Hard et al. 2007). Spawning begins in March and continues into June with the peak of spawning typically in April. Juveniles are present in the river year-round. They typically hatch in the spring and early summer. The majority remain in the river for two years and in the ocean for two years (Hard et al. 2007, Pautzke and Meigs, 1940). Outmigration timing generally peaks in April or May. Detailed species information for Puget Sound steelhead can be found in the 2000 BA (USACE 2000), the 2014 SBA (USACE 2014) and their respective BiOps (NMFS 2000, NMFS 2019).

2.9.3 Coastal/Puget Sound Bull Trout

Bull trout have both resident and migratory life history strategies, and both forms may be found together in the same rivers, lakes and coastal areas (USFWS 2015a). They have the most specific habitat requirements of the native salmonids in the Pacific Northwest, which are cold water temperatures, clean stream substrates, complex stream habitat, and connectivity between spawning and rearing areas along with foraging, migrating and overwintering habitat (FMO) downstream (USFWS 2015a). Although historical accounts indicate a



much greater use of the Green River watershed by bull trout in the past, current use appears to be limited (USFWS 1999). While there are no documented spawning populations either above or below HAHD, low numbers of bull trout appear to use the Green River for two of the FMO habitat uses: foraging and, potentially, overwintering (USFWS 2015a). USFWS (2015b) currently classifies the Lower Green River as a shared FMO habitat for bull trout. There is evidence from captures that bull trout regularly use the lower Duwamish River downstream of RM 5.8, especially in the spring. The primary threat to bull trout along the Lower Green River is forage fish availability because the prey base of small juvenile salmon and steelhead is depressed (USFWS 2015b). Bull trout in this watershed are believed to be migratory visitors from other watersheds that may enter the Duwamish to forage on emigrating smolts. WDFW (2004) had documented that bull trout were only as far upstream as RM 40. Additionally, monitoring surveys for the initial AWSP habitat restoration projects, recorded no bull trout in the middle Green River (R2 2002) or upstream of HAHD (R2 2005). In October 2017, Tacoma biologists recorded a bull trout with an approximate total length of 350-400 mm at the upstream trap and haul facility at the Tacoma Headworks Dam (Patterson 2022), which is at RM 61. At present, a bull trout stock is not recognized in the Green River (WDFW 2004).

2.10 Birds

Many of the non-marine avian species recorded in King County are winter migrants. Resident species of ducks and Canada geese (*Branta canadensis*) nest and rear their young on and around the lake. The project area also hosts wading birds such as great blue herons (*Ardea herodias*); shorebirds such as killdeer (*Charadrius vociferus*); substantial populations of nesting raptors including hawks, owls, bald eagles (*Haliaeetus leucocephalus*), and osprey (*Pandion haliaetus*); upland game birds such as quail and grouse; multiple woodpecker species; and a myriad of passerine birds. Birds that may utilize the habitat at HAHD include the marbled murrelet (*Brachyramphus*



marmoratus), the northern spotted owl (*Strix occidentalis caurina*), and the yellow-billed cuckoo (*Coccyzus americanus*).

Three USFWS Birds of Conservation Concern were observed during the 2019 surveys: an olive-sided flycatcher (*Contopus cooperi*), Rufous hummingbirds (*Selasphorus rufus*), and bald eagles (*Haliaeetus leucocephalus*) (Fischer & Niepert 2022).

The following sections discuss the federal-listed bird species that may have a presence in the project area around HAHD.

2.10.1 Bald Eagle

Bald eagle distribution is widespread throughout the United States, with much of the eagle population in Washington occurring in the lowlands west of the Cascade Range (Kalasz and Buchanan 2016). Bald eagles are primarily piscivorous and spend much of their time near bodies of water. The Eagle Gorge Reservoir is known to support wintering bald eagles and annual surveys are conducted each winter at HAHD. Bald eagles continue to receive protections under the Bald and Golden Eagle Act, the Migratory Bird Treaty Act, and the Lacey Act.

2.10.2 Marbled Murrelet

The current marine distribution of threatened marbled murrelets in Washington includes Puget Sound, the Strait of Juan de Fuca and the outer coast along the Pacific Ocean. The known terrestrial nesting habitat includes western Washington coniferous forest within approximately 55 miles of marine waters (Desimone 2016). HAHD is located within approximately 25 miles of marine waters. In 1994, surveys for marbled murrelets were conducted at HAHD with no birds detected within the project area (USACE 1998). There were no records of marbled murrelets during the most recent bird survey in 2019 (Fischer & Niepert 2022).



2.10.3 Northern Spotted Owl

The threatened Northern spotted owl range consists of conifer forests of western Washington and the eastern slope of the Cascade Range (Buchanan 2016). Spotted owls use mature and old-growth forests that contain large-diameter trees, snags, and downed wood, with a high canopy cover and multiple size-classes of trees (Buchanan 2016). While in consultation with USFWS for the AWSP project in the mid-1990s, it was determined that the forest age and structure in the project area was not suitable for spotted owl nesting (USACE 1998). During the 2019 bird survey conducted by ERDC, a spotted owl was detected within a mature deciduous forest not far from the Eagle Gorge Reservoir on Tacoma Public Utilities easement lands (Fischer & Niepert 2022). Suitable habitat may exist at HAHD in surrounding undeveloped easement lands for the species, although none have been documented at the dam.

2.10.4 Yellow-billed Cuckoo

The threatened yellow-billed cuckoo (cuckoo) nests in deciduous habitats with clearings and dense shrubby vegetation, especially those near rivers, streams, and wetlands. In the western U.S., they are strongly associated with large patches of low to mid-elevation riparian habitat characterized by high humidity and dominated by cottonwoods (*Populus* spp.) and willows (*Salix* spp.). Patch size is a key feature of breeding habitat for western cuckoo populations, with larger, wider areas of habitat strongly preferred (Wiles and Kalasz 2017).

Historical records indicate that the species may have nested in King County around Lake Washington and Seattle, with the last confirmed nesting record in 1923 in Seattle and after 1950, only two nests were recorded in King County (Wiles and Kalasz 2017). No yellow-billed cuckoos were observed during the HAHD 2019 bird surveys conducted by ERDC (Fischer & Niepert 2022). There are no known occurrences of the yellow-billed cuckoo at or near HAHD.



2.11 Other Terrestrial animals

Other resident large mammals include elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*) and white-tailed deer (*Odocoileus virginianus*); large mammals that may be present but are not known to be present at HAHD include Canada lynx (*Lynx canadensis*), North American wolverine (*Gulo gulo luscus*), Grizzly bear (*Ursus arctos horribilis*), and Gray wolf (*Canis lupus*); numerous small mammals such as shrews, mice, squirrel, coyotes (*Canis latrans*), raccoons (*Procyon lotor*), and skunks. Aquatic furbearers including beaver (*Castor canadensis*) and river otter (*Lontra canadensis*) are prevalent in the reservoir around the dam and in wood debris storage areas (Figure 15). Of note, pika (*Ochanta princeps*) have been observed on the rock slopes along the railroad grade (USACE 1998) and most recently, in 2019 in a rock pile adjacent to the river (Niepert 2019). Several species of riparian and wetland-dependent amphibians are also present, to include the western toad (*Anaxyrus boreas*), larch mountain salamander (*Plethodon larselli*), cascade torrent salamander (*Rhyacotriton kezeri*), and Van Dyke's salamander (*Plethodon vandykei*). (USACE 1999; TPU 2001; Dickerson *et al.* 2019).



Figure 15. Beaver activity in the North Fork area in 2019.

2.11.1 Elk

Elk are on and near the HAHD project area. HAHD is within the Green River game management unit (GMU) 485 and elk are actively managed within this unit (WDFW 2020). The MIT have conducted studies and monitoring within GMU 485 since 1998 (WDFW 2020) and it is common to see radio-collared elk above the dam on easement lands along the river. The current population estimate within GMU 485 is over 600 elk and permitted hunting is allowed within the upper watershed in designated areas (WDFW 2020) that are not controlled by USACE. Hunting permits, elk numbers, and hunting seasons are jointly agreed upon by WDFW, Tacoma, and MIT (WDFW 2020). The main predators of elk in this area are cougar (*Puma concolor*), black



bear (*Ursus americanus*), and bobcat (*Lynx rufus*). According to Washington Department of Fish and Wildlife (WDFW 2020), the cougar population in the area is stable and are the leading cause of mortality of collared elk in the MIT study areas. Additionally, the MIT have estimated black bear density within GMUs 485 and 466 (Stampede unit) as 17.5 bears/100 km² (McDaniel and Middleton 2014).

2.11.2 Canada Lynx

Canada lynx, listed as threatened under the ESA, inhabit boreal, sub-boreal and subalpine forests in North America and, in Washington, occur in mid- to high-elevation forested habitats in the northeastern portion of the Cascade Range. During juvenile dispersal or to follow prey, it is possible for lynx to move south down the Cascade Range as they have been documented to make long distance movements up to 684 miles (Lewis 2016). Lynx have not been recorded at or near HAHD.

2.11.3 Northern American Wolverine

Wolverines were listed as a threatened species under the ESA in 2024 and may occur on project lands. The wolverine population in Washington is small and they generally occur in the North Cascades and northeastern Washington. Wolverines are moving farther south in Washington and have been detected near Mt. Adams and in the Goat Rocks Wilderness Area (WDFW 2019). Most recently, the first reproductive female wolverine with two kits was observed in 2020 (NPS 2020). Wolverines commonly occur in high elevation mountainous areas and, in Washington, occupy alpine and subalpine forest habitats. Wolverines are known to travel long distances and are resident in Mt. Rainier National Park, so may travel through or near the Upper Green watershed. Northern American wolverines have not been recorded at or near HAHD.

2.11.4 Grizzly Bear

Historically, grizzly bears occurred throughout most of Washington but now occur in the Selkirk Mountains of northeastern Pend Oreille



County with occasional observations in Stevens and Ferry Counties of northeastern Washington (Lewis 2019). Generally, they are habitat generalists but are now largely restricted to areas with fewer human interactions, of which the Upper Green River watershed is potentially suitable. However, there have been no recorded sightings of grizzly bears at or near HAHD.

2.11.5 Gray Wolf

Wolves are social and live in packs typically of 5-10 animals. They are habitat generalists and were formerly common throughout most of Washington (WDFW 2012). HAHD is included within the Southern Cascades and Northwest Coast recovery area as defined in the Wolf Conservation and Management Plan (WDFW et al. 2017). According to the plan, there are no wolf pack territories within or adjacent to HAHD. The Teanaway pack is the pack that is closest to HAHD. The pack's range location is northwest of Ellensburg, north of Easton and encompasses Little Kachess and Cle Elum Lakes. There have been no wolf observations on HAHD, however, because wolves can be wide-ranging, there is the potential for gray wolves to move through or use the Upper Green River watershed.

2.12 Threatened and Endangered Species

The Endangered Species Act (ESA), Title 16 United States Code, Sections 1531-1544, requires protection and conservation of federally listed threatened and endangered species and their habitats. Section 7(a)(1) of ESA requires USACE to carry out programs for the conservation of listed species, using all methods and procedures necessary to bring any listed species to a point where protection is no longer necessary. Section 7(a)(2) of ESA requires federal agencies to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat (CH). All USACE projects and activities are subject to ESA requirements for the protection of listed and proposed species and their CH.



The original 1999 Master Plan listed the following species as Threatened (T) or Endangered (E):

- bald eagle (T)
- gray wolf (E)
- grizzly bear (T)
- marbled murrelet (T)
- northern spotted owl (T)
- Chinook salmon (T)

Since 1999, Canada lynx, yellow-billed cuckoo, Puget Sound bull trout, and Puget Sound steelhead salmon have been listed as Threatened. The bald eagle was delisted in 2007 due to successful recovery efforts. In 2024, the Suckley cuckoo bumble bee was proposed as Endangered and the monarch butterfly was proposed as Threatened.

Currently, the Northern spotted owl is the only listed species known to occur on or near HAHD (Table 2-4). The following tables provide descriptions of federally listed species known to occur, or have the potential to occur, at HAHD.

Table 2-3. Fish that are federally listed threatened, endangered, delisted that are known to, or have the potential to occur at HAHD.

Common Name (Scientific Name)	ESA Status; Year Listed	Status at HAHD	Critical Habitat	CH at HAHD	Recovery Plan?
Puget Sound Chinook salmon (<i>Oncorhynchus tshawytscha</i>)	Threatened; 2005 (70 FR 37160-37204)	Present below the Tacoma Diversion Dam	2005 (70 FR 52630- 52685)	Yes	NMFS 2007
Puget Sound steelhead (<i>Oncorhynchus mykiss</i>)	Threatened; 2007 (72 FR 26722-26735)	Present below Tacoma Diversion Dam	2016 (81 FR 9252- 9325)	Yes	NMFS 2019



Coastal/Puget Bull Trout (<i>Salvelinus confluentus</i>)	Threatened; 1998 (63 FR 31647-31674)	Identified up to RM 43 (21 miles downstream of dam)	2010 (75 FR 63898-64070)	Yes	USFWS 2015
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Table 2-4. Birds that are federally listed threatened, endangered, delisted that are known to, or have the potential to occur at HAHD.

Common Name (Scientific Name)	ESA Status; Year Listed	Status at HAHD	Critical Habitat	CH at HAHD	Recovery Plan?
Bald eagle (<i>Haliaeetus leucocephalus</i>)	Delisted 2007	Present	None	No	No
Marbled murrelet (<i>Brachyramphus marmoratus</i>)	Threatened; 1992 (59 FR 58982-59028)	No known occurrences, could transit HAHD	2016 (81 FR 51348-51370); 1996 (61 FR 26256)	No	USFWS 1997
Northern spotted owl (<i>Strix occidentalis caurina</i>)	Threatened; 1990 (55 FR 26114-26194)	Present in adjacent contiguous forest.	1992, Revised 2012 (77 FR 71875-72068)	No	USFWS Revised 2011
Yellow-billed cuckoo (<i>Coccyzus americanus</i>)	Threatened; 2014 (79, 59992-60038)	Not known to be present	2020 proposed does not include WA	No	No



Table 2-5. Mammals that are federally listed threatened, endangered, delisted that are known to, or have the potential to occur at HAHD.

Common Name (Scientific Name)	ESA Status; Year Listed	Status at HAHD	Critical Habitat	CH at HAHD	Recovery Plan?
Canada lynx (<i>Lynx canadensis</i>)	Threatened; 2000 (65 FR 16052-06086)	Not known to be present	2006 (70 FR 68294-68328), revised 2014 (79 FR 54781-54846)	No	No, USFWS outline (2000)
North American wolverine (<i>Gulo gulo luscus</i>)	Threatened; 2024 (88 FR 83726- 83772)	Not known to be present	None	No	No
Grizzly bear (<i>Ursus arctos horribilis</i>)	Threatened; 1975 (40 FR 31734-31736)	Not known to be present	None	No	Yes, USFWS 1993
Gray wolf (<i>Canis lupus</i>)	Delisted 2020 (85 FR 69778-69895)	Not known to be present	None	No	No

Table 2-6. Insects that are federally listed threatened, endangered, delisted that are known to, or have the potential to occur at HAHD.

Common Name (Scientific Name)	ESA Status; Year Listed	Status at HAHD	Critical Habitat	CH at HAHD	Recovery Plan?
Suckley cuckoo bumble bee (<i>Bombus suckleyi</i>)	Proposed Endangered; 2024 (89 FR 102074)	Not known to be present	Not determinable at proposed listing	No	No
Monarch butterfly (<i>Danaus plexippus</i>)	Proposed Threatened; 2024 (89 FR 100662)	May be present	2024 proposed does not include WA	No	No



2.12.1 Killer Whale

The Southern Resident killer whale distinct population segment (DPS) occurs in the Puget Sound. Actions at HAHD that may adversely affect anadromous fish populations have the potential to also adversely affect the killer whale DPS and their associated CH. This may occur by reducing the water quality and the quantity and quality of prey for killer whales by affecting anadromous fish habitat and connectivity, or the fish populations themselves. Habitat improvement projects have been incorporated to increase benefits to salmon spawning.

2.13 Washington State Listed Species

Several state-listed species are known to occur at or near HAHD. Table 2-7 provides a list of state-listed species, their status, and whether they are known to occur at HAHD. The following is a brief description of notable species that have been observed at HAHD.

Common loons (*Gavia immer*) have been present on Eagle Gorge reservoir since 1991 and a pair started successfully nesting in 1997. Common loons cannot walk on land and their breeding habitats in western Washington are freshwater lakes and reservoirs. Since 2006, USACE has participated in an interagency working group and funded monitoring efforts for the resident pair of common loons that routinely breed on the reservoir. Additionally, in the mid-2000s, USACE established two floating breeding platforms, or loon logs, on the North Fork and Charley Creek portions of the reservoir. The platforms are monitored annually by USACE biologists using game cameras. Currently, Washington's common loon breeding population is currently known at approximately 23 pairs with an estimated total of less than 50 pairs (WDFW 2023).

Western toads (*Anaxyrus boreas*) have been recorded periodically at HAHD. In 2018, surveys for reptiles and amphibians were conducted and then in 2019, surveys for breeding western toads were



conducted. The 2019 surveys recorded active breeding at 5 sites below and above HAHD proper. There were observations of western toads mating as well as thousands of eggs. One breeding area was recorded within the control tower/deep hole area of the dam structure (Dickerson *et al.* 2019).

There is anecdotal information that larch mountain salamanders (*Plethodon larselli*) have been observed previously at HAHD and on Tacoma lands. There is suitable habitat for this species within HAHD project lands. Because these salamanders are terrestrial and mainly nocturnal, they are more difficult to observe, and surveys, should they be needed, must be targeted to their lifestyle and habitat.

Table 2-7. Washington State-listed species, their status, and potential occurrence at HAHD.

Species	State Status	At HAHD
Puget Sound Chinook	Not applicable	Present, below the dam
Puget Sound bull trout	Candidate	Present, below the dam
Puget Sound steelhead	Not applicable	Present, below the dam
Western toad	Candidate	Present
Larch Mountain salamander	Sensitive	Present
Cascade torrent salamander	Candidate	Not known to be present
Van Dyke's salamander	Candidate	Not known to be present
Common loon	Sensitive	Present
Northern goshawk	Candidate	Present
Marbled murrelet	Endangered	Not known to be present
Yellow-billed cuckoo	Endangered	Not known to be present
Northern spotted owl	Endangered	Present
Canada lynx	Endangered	Not known to be present
Fisher	Endangered	Not known to be present
Wolverine	Candidate	Not known to be present
Grizzly bear	Endangered	Not known to be present
Gray wolf	Endangered	Not known to be present
Keen's myotis	Candidate	Present
Townsend's big-eared bat	Candidate	Present
Monarch butterfly	Candidate	May be present



2.14 Invasive Species

Invasive species are a national concern and represent a significant threat to ecosystems, human and animal health, infrastructure, the economy and cultural resources. Executive Order (EO) 131121 for invasive species was first signed in 1999 and then amended in 2016, with a follow-on, EO 13751 “Safeguarding the Nation from the Impacts of Invasive Species” which state that “it is the policy of the United States to prevent the introduction, establishment, and spread of invasive species, as well as to eradicate and control populations of invasive species that are established.” USACE’s invasive species policy states that all Civil Works projects and programs shall meet the spirit of the National Invasive Species Act and will implement measures to prevent or reduce establishment of invasive and non-native species. The Seattle District is updating the draft integrated pest management plan for common pest problems (USACE 2010) throughout the Seattle District area of operations, which includes Washington, Idaho, and Montana.

2.14.1 Plants

There is biannual control of noxious weeds using herbicides of approximately 8 acres along the dam and surrounding Federal property. Control occurs for dam safety along with controlling invasive plants, per King County’s noxious weed control program. Two species of note that are controlled are scotch broom (*Cytisus scoparius*) and tansy ragwort (*Jacobaea vulgaris*). Due to concerns associated with maintaining drinking water quality in the Tacoma Municipal Watershed, Tacoma maintains a list of approved herbicides which include Glyphosate, Triclopyr, and Aminopyralid (TPU 2018). USACE limits herbicide use to these compounds. Use of herbicides for grounds maintenance on USACE operating project lands is intended to follow established, appropriate application guidelines. As such, herbicide application is not anticipated to result in any releases that would create contamination issues in surface water or groundwater.



Aside from control actions, HAHD also records any new noxious or invasive plants observed via the USACE Civil Works Operations and Maintenance Business Information program and integrates those plants into future control actions.

2.14.2 Animals

Introduced (nonnative) animal species that occur or have the potential to occur at HAHD are (Witmer and Lewis, 2001):

- Mountain quail (*Oreortyx pictus*)
- European starling (*Sturnus vulgaris*)
- Red fox (*Vulpes vulpes*)
- Cats (*Felis catus*)
- Dogs (*Canis familiaris*)
- Fallow deer (*Dama dama*)
- Eastern gray squirrel (*Sciurus carolinensis*)
- House mouse (*Mus musculus*)
- Norway rat (*Rattus norvegicus*)
- Black rat (*Rattus rattus*)
- Nutria (*Myocastor coypus*)
- Bullfrog (*Rana catesbeiana*)
- Green frog (*Rana clamitans*)
- Red-eared slider (*Trachemys scripta elegans*)

Most bird species were introduced for hunting or aesthetic purposes while many of the mammals were escapees, stowaways, or animals released when no longer needed.

Aquatic invasive species not present but with potential to occur at HAHD are:



- New Zealand mud snail (*Potamopyrgus antipodarum*)
- Quagga and zebra mussels (QZMs) (*Dreissena bugensis*, *Dreissena polymorpha*)
- Golden mussels (*Limnoperna fortune*)

These species are of concern due to their potential impacts to infrastructure, to include blocking water intake systems, and their difficulty being eliminated from native ecosystems once established.

2.15 Cultural Resources

Cultural resources are defined as sites, structures, objects, or practices that reflect prehistoric or historic habitation, and traditional knowledge and practices by humans. Cultural resources are non-renewable and therefore must be managed with sufficient care to ensure their preservation. The most common potential causes of loss of cultural resources include landscape modifications, erosion, vandalism, and looting. Through requirements of historic preservation policies in public laws, executive orders, and USACE regulations, it is the responsibility of the USACE to ensure the identification and protection of prehistoric and historic cultural resources located on project lands controlled and/or owned by the USACE.

Much of the archaeology found in the river valleys and the foothills of the Cascade Mountains was left by early cultures and the ancestors of today's Native Americans who hunted in the forests, fished the rivers and lakes, and gathered their subsistence foods and medicinal plants as part of a seasonal round timed to the migration of animals and fish, and the ripening and harvest of plants. Lithic sites consisting of stone tools and debitage inform scientists of subsistence strategies and technology dating as far back as 11,000 years B.P. or earlier. Stone and bone tools found near rivers indicate how early people exploited fisheries and gathered shellfish. Remains of campsites and village sites, often near rivers, streams, and lakes are evidenced by



artifacts, fire-cracked rock, hearths, and storage features called rock cairns made from stone. Other artifacts were made from more perishable materials including hats and clothing made from cedar bark, mats from cattails, and dugout canoes carved out of a cedar tree and fashioned using hand tools made from ground stone implements.

The people who lived on these early landscapes were ancestors of the Muckleshoot Indian Tribe. The central Green River valley was historically inhabited by the Skopamish people. The Smulkamish people lived near the modern-day town of Enumclaw. Other bands who exploited resources in the area included the Stkamish, Yilalkoamish, Tkwakwamish, and the Buklshuhl. The people of the Green River area often traded with Native peoples east of the Cascade Mountains. The Naches Trail originated as an Indian trail over Naches Pass, allowing the Green River people and eastern bands from the Yakama and Klickitat to move freely across the mountains to engage in trade.

Post-contact, Euro-Americans moved into the territory once inhabited by Native peoples and constructed log-style cabins or homes built from hand-hewn or milled wood harvested from the nearby forests. These and other structures built above ground are categorized as historic buildings and structures.

For the purposes of cultural resources at HAHD, the area of potential effects (APE) is the 430.6 acres under Federal ownership and the 2,499.9 acres in easements USACE has for the reservoir, road access and monitoring locations. A 2003 memorandum of agreement (MOA 2003) signed by USACE, the State Historic Preservation Officer (SHPO) and the City of Tacoma for the Additional Water Supply Project identified several actions for USACE: developing the National Register eligibility for the Howard Hanson Dam Archaeological District (HHDAD), develop an interim site evaluation and treatment plan to manage National Register sites to be replaced by a cultural resources management plan (CRMP)/historic properties management plan



(HPMP), development of a CRMP/HPMP, data recovery at six sites within the reservoir, an ethnohistoric study, and an established Inadvertent Discovery Plan to address any newly discovered human remains. All these actions have been completed except for the CRMP/HPMP, which is currently being drafted. Finally, the USACE shall retain all artifacts, specimens and documents relating to the cultural resources from the AWSP. In 2011, the SHPO concurred with the archaeological survey report provided by USACE for the AWSP that identified "No Historic Properties Affected."

Cultural resource investigations have occurred at HAHD since 1985. The cultural resource investigations range from survey to data recovery. Approximately, 90% of the HAHD Project (including fee-owned land and easements) have been surveyed for cultural resources. Cultural resource surveys have been conducted for specific projects or actions that have occurred at HAHD. It is important to stress that because an area has been previously surveyed for cultural resources, it does not mean that it will not require a survey in the future. The determination on whether to survey an area depends on whether a survey has been conducted there before and, if so, the type of survey conducted previously along with the type of disturbance a project or action will have on a given location. Table 2-8 lists the cultural resources surveys.

The HHDAD is submerged within the reservoir. Sixteen archaeological sites are located within the HHDAD and are considered contributing resources to the district under Criterion D. The inundated sites in the HHDAD are of prehistoric importance and have been identified as representing hunter-fisher-gatherer base camps associated with food procurement, processing and lithic reduction activities. In addition to the prehistoric components, the archaeological sites also contain historic era artifacts related to logging and railroad activities that occurred in the APE prior to the construction of HAHD (Kent 2003). The remaining five archaeological sites have not yet been evaluated



for eligibility and have been identified as a historic homestead, a railroad camp, logging camp, railroad grade and a pre contact camp.

The archaeological sites, isolates, and HAHD associated structures that are over fifty years of age should be evaluated for inclusion on the National Register of Historic Places (NRHP). In 2010, a historic context statement and national register evaluation was prepared for HAHD and associated structures. At that time HAHD was less than fifty years of age and the evaluation determined that the HAHD meet the exceptional criteria that allows a property to be determined eligible to the national register when it is less than fifty years of age. HAHD's is eligible under Criterion A for its "...pronounced and measurable effects on the economic development of the lower Green River Valley in and around the communities of Auburn and Kent, and the Duwamish waterway." The evaluation goes on to state that HAHD has had significant impact on local and regional economics and that the impoundment of the Green River caused downstream communities to experience rapid commercial and industrial development (McCroskey and Story 2010).

Table 2-8. Cultural Resource Surveys conducted at HAHD

Author	Year	Report Title
Cooper, Jason	2012	Howard A. Hanson Dam Archaeological District (DT 184) Data Recovery, Site Monitoring, and Cultural Resources Survey
Kent, Ronald	2011	Historic Properties Studies for Howard Hanson Dam Additional Water Storage Phase I Stream Habitat Project, Upper Green River Basin
Kanaby, Kara	2014	Cultural Resources Assessment for the Howard Hanson Dam Left Bank Drainage Project, King County, Washington
Storey, Danielle	2010	A Cultural Resources Inventory for the Howard Hanson Dam Safety Modification
McCroskey, Lauren and Danielle Storey	2010	Howard A. Hanson Dam Historic Context and National Register Evaluation of Historic Properties
Walker, Sarah	2009	Archaeological Investigations at Sites 45KI280 and 45KI281 Howard Hanson Dam Reservoir, King County



Author	Year	Report Title
Cooper, Jason	2008	Addendum to Data Recovery at Archaeological Sites 45KI272, 45KI275, and 45KI277 within the Register Eligible Howard Hanson Dam Archaeological District, King County
Cooper, Jason	2007	Data Recovery at Archaeological Sites 45KI272, 45KI275, and 45KI277 within the Register Eligible Howard Hanson Dam Archaeological District, King County
Kent, Ronald	2003	Initial Report on Phased Identification of Historic Properties for the Howard A. Hanson Dam Additional Water Supply Project Wildlife Mitigation Areas in the Upper Green Watershed
Boreson, Keo	1999	Archaeological Investigations at Howard Hanson Dam Reservoir
Lewarch, Dennis et. Al.	1996	Cultural Resources Survey of the Additional Water Storage Project Area Howard A. Hanson Dam
Benson, James	1985	An Archaeological Reconnaissance of Howard A. Hanson Dam Project

2.15.1 Consultation under Section 106 of the National Historic Preservation Act

Cultural resources at HAHD are addressed under Section 106 of the NHPA of 1966 (Public Law 89-665), as amended. As projects are developed for HAHD, the assigned cultural resources specialist will review the project and initiates consultation with the Washington Department of Archaeology and Historic Preservation and interested tribes. Depending on the size, scope, and location of the project at HAHD, a cultural resource survey may need to occur. In addition, due to the presence of 21 archaeological sites, 16 isolates, and the HHDAD and HAHD eligibility to the National Register, each proposed project is reviewed to determine if there will be an adverse effect to any of the known cultural resources within the APE.

2.16 Real Estate

Real estate considerations influence land and resource management at the HAHD. These considerations include the quantity of USACE-owned real estate interests, outgrants, and the ownership and use of



adjacent lands. USACE acquired approximately 2,616 acres of land and water consisting of various real estate interests in multiple tracts.

2.16.1 Land Acquisition History

Under the Flood Control Act of 1950 (PL 81-516), USACE acquired large acreages of land for HAHD. At the time of acquisition, it was the general desire of the administration that new land be restricted to the minimum amounts required for operation and maintenance. Original acquisition criteria followed by USACE were generally consistent with that policy. The initial authorized project purpose, as set forth in PL 81-516, Title II, was *"for the benefit of navigation, and the control of destructive floodwaters and other purposes."* All land originally acquired was allocated to project operations, in accordance with the initial acquisition purposes.

2.16.2 Current Landholdings

Property acquired by USACE consists of approximately 2,930.5 acres of land and water areas located along the Green River including 430.6 acres fee, 2,499.9 acres various easements, and the remaining acreage is comprised of lesser interests (lease, license, and permit). Figure 16 shows the HAHD land holdings.

2.16.3 Boundary Monumentation and Encroachments

Most of the fee land boundary lines have been surveyed, except for boundaries that are delineated by physical or natural features such as railroads, roadways, or rivers. Surveys of the fee-owned lands were conducted in 2010, except the portion of submerged railroad on the southeast portion of the project. It is estimated the total length of fee land boundary lines from surveys for all parcels is approximately 5.78 miles. Project personnel inspect these boundary lines every three years to ensure the line is adequately marked and to check for unauthorized use or encroachments, with survey monuments inspected as required. Missing survey monuments will be reported annually for replacement.



Encroachments are defined as unauthorized use that has occurred on USACE-owned Project lands. Encroachments may include structures, livestock, waterlines, driveways, etc. Encroachments may also occur on easement lands where habitable structures may be constructed in violation of the terms of the easements. Easement encroachments are generally identified through inspections by boat and surveys. If encroachments occur, they are resolved through personal visits and verbal communication by the project staff and Real Estate personnel or by written communication by the project staff or Real Estate personnel as prescribed in the Encroachment Action Handbook (2018a). Encroachments may also be resolved through the lifting of restrictions (particularly in easement violations), through outgrants, or through disposal actions. Records including letters, memoranda and maps are maintained for all violations. This project currently has no known existing encroachments.

2.16.4 Fences and Gates

Fencing is utilized on USACE lands to delineate property boundaries, prevent livestock encroachment, and prevent access to restricted or hazardous areas around a project. Fencing may consist of four-strand barbed wire, smooth galvanized wire, or cyclone (chain-link) fencing. Due to rough terrain and fluctuating reservoir levels, fencing of all boundaries is not cost effective. The USACE Sign Standards Manual, Vol. 1 (EP 310-1-6a), provides guidance on use of appropriate combinations of fencing and signage. At HAHD, there is fencing on the north side of the main dam area. Gates are located throughout the USACE lands to provide security but are also used to keep vehicles from entering during seasonal closures or to areas where vehicular access is not allowed. Direct access to HAHD is via a security gate operated by the city Tacoma and is not open to general public access.

2.16.5 Leases, Easements, and Outgrants

Outgrants have been granted via easements, letter permits, license, or permit to cities, states, other Federal agencies, and logging



companies for utilities, fish and wildlife management, and access to cross lands or for joint use of roads. Written agreements to control access and activities at HAHD have been executed with the USFS, Washington State Department of Natural Resources, BNSF, WDFW, USACE, Hancock Forest Management (owned by the Muckleshoot Federal Cooperation), and Weyerhaeuser (C. Luciano, personal communication, 3 April 2025, "Current USACE agreements at HAHD").

The easement holders and right-of-way (ROW) utility owners at HAHD for power transmission line maintenance and use are the BPA and Puget Sound Energy, telephone lines are maintained by Century Link, and the Stampede Pass railroad line is in the BNSF ROW. (TPU 2018) The ROWs are included as a part of easement lands.

Development and use of land by others outside of the USACE may be allowed when in accordance with this approved master plan. Use must be consistent with policies, procedures, and regulations prescribed by the USACE. Prior to their approval, any future leases, easements, and outgrants must be carefully examined to ensure compatibility with project resource objectives and land classifications.



Current Land Holdings

Legend

Layer

- Easement
- Fee
- Letter Per
- License
- Permit

Location Map



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Figure 16. Current land holdings at HAHD.



2.16.6 Adjacent Land Use and Ownership

Neighboring land use and ownership can influence development and management of project lands. The project land and surrounding areas are mostly forest. City of Tacoma owns much of the surrounding land and it is managed in accordance with the Tacoma Water Habitat Conservation Plan (TPU 2001). Other ownerships include logging companies. There are also some farmland and low-density residential ownerships.

Offsite influences can be minimized or eliminated if considered ahead of time. Responsible state and local planning officials should be alerted when zoning, ownership, current use plans, and land use changes on adjacent lands might endanger existing project resources or proposed improvements.

2.17 Pertinent Public Laws

All project-related actions and policies must comply with Federal laws and regulations. Please see Appendix B.

2.18 Management Plans

Management plans direct activities and expenditures for USACE owned and managed lands in and around HAHD. These plans, if needed, are interrelated in land management actions and must be considered when planning future actions. Presently, HAHD has a:

Wildlife Management Plan

The primary purpose of the Wildlife Management Plan is to assist the Natural Resource Managers at HAHD in meeting the goals of wildlife protection and habitat preservation. Wildlife program priorities include five major categories: (1) Assessment, Monitoring and Reporting, (2) Biodiversity and Stewardship, (3) Maintenance, (4)



Coordination, and (5) Best Science. The last update to the Wildlife Management Plan was completed in 2013.

3 Resource Objectives

ER 1130-2-540 establishes the policy for the administration and management of natural resources activities at USACE civil works water resource projects. The overall program objectives are to manage natural resources on USACE administered land and water in accordance with ecosystem management principles, to ensure continued availability, provide a safe and healthful environment and to develop and fully implement project master plans and operational management plans.

ER 1130-2-540 (6-1) establishes guidance for the management of collecting, preserving, and curating archaeological and historical materials at civil works water resource projects, as well as establishing a Historic Preservation Program for construction, operations and maintenance activities at these locations. It unifies USACE historic preservation activities by the consistent and uniform application of policy administered for the public benefit.

The master plan provides resource objectives for the stewardship of project resources, both natural and manmade. Resource objectives are realistically obtainable outcomes for the use, development, and management of natural resources. Resource objectives are developed with full consideration of authorized project purposes, applicable Federal laws and directives, resource capabilities, regional needs, plans and goals of regional and local governmental units, and expressed public desires. These objectives enhance project benefits, meet public needs, and foster environmental sustainability.

These benefits should be provided in a safe, effective and efficient manner.

Resource objectives for the HAHD project include:



- Provide the ideal combination of resource uses and project operations to meet the needs of the public.
- Ensure all natural resources inventories (Levels I and II) are completed and updated, if required.
- Provide for the management of natural resources associated with the Project to include the protection and preservation of native habitat, the protection of water quality, and the protection and preservation of fish and wildlife species.
- Continue invasive species management activities.
- Review and assess the project operations and other fee-owned lands for fire resilience.
- Continue to monitor embankments and exposed sediments during drawdowns for the protection of natural and cultural resources.
- Conduct cultural resources surveys as needed.
- Protect and conserve cultural resources; including evaluating the significance of known archaeological sites and determine appropriate levels of cultural resource management.
- Continue to monitor easement lands for unauthorized activity (looting).
- To routinely consult with the Muckleshoot Tribe on an annual basis.
- To report inadvertent discoveries of human remains in the HAHD APE.
- Develop a CRMP/HPMP for the HAHD Project.
- Preserve, protect, monitor and/or enhance habitat and habitat components important to the survival and proliferation of threatened, endangered, special status, and other regionally important species.
- Control shoreline erosion.
- Prevent unauthorized use of government property through boundary surveillance, mapping and management.



- Provide consistency and compatibility with national objectives and other state and regional goals and programs.

In addition to the above encompassing resource objectives, there are objectives for specific areas or land classifications and are detailed below.

3.1 Project Operations

- Maintain, upgrade, or build new structures and/or facilities with consideration to natural resource impacts.
- Continue invasive species management activities. Assess and manage natural resources for fire resilience.

3.2 Multiple Resource Management

- Promote ecological integrity and native habitat diversity and maintain quality habitat for native species
- Minimize erosion and sloughing along steep hillside
- Maintain and adaptively manage AWSP-derived projects
- Manage fuels and vegetation for fire resilience

3.3 Easement Lands

- Maintain routine coordination with Tacoma and the MIT to discuss natural and cultural resources issues at least on an annual basis
- Continue to monitor dam and reservoir embankments and exposed sediments during drawdowns for the protection of natural and cultural resources
- Conduct cultural resources surveys as required for USACE projects that may occur on easement lands
- To determine the significance of known cultural resources sites and determine appropriate levels of cultural resource management for



archaeological sites on easement lands in consultation with Tacoma and the Muckleshoot Indian Tribe

- Document USACE responsibility for archaeological sites located on lands where USACE holds easement in the CRMP/HPMP
- Work with Tacoma and the MIT if inadvertent discoveries of archaeological or human remains are found on USACE easements. Develop a standard operating procedure.

4 Land Allocation & Land Classification

Specific parcels of land are classified into land use categories based on resource capability. HAHD lands are divided into land classifications and then into management areas, in which specific natural resources management actions are taken.

4.1 Land Allocation

In accordance with EP 1130-2-550, land allocations identify the congressionally authorized purpose for which USACE project lands were acquired. There are four categories of allocation: 1] Operations, 2] Recreation, 3] Fish and Wildlife, and 4] Mitigation. All the HAHD land is allocated for Operations, which totals 2,930.5 acres including easements (Figure 17). Operations lands are lands acquired for the congressionally authorized purpose of constructing and operating the HAHD project.

Project lands are further broken down into land classifications, which indicate the primary use for which the project lands are managed. EP 1130-2-550 provides the following land classifications:

- Project Operations – includes lands required for the dam, spillway, offices, maintenance facilities, and other areas used solely for the operation of the project.



- High Density Recreation – lands developed for intensive recreation activities for the visiting public including day use areas and/or campgrounds.
- Mitigation – only used for lands with an allocation of Mitigation (congressionally authorized) purposed of offsetting losses associated with development of the project.
- Environmentally Sensitive Areas – areas where scientific, ecological, cultural or aesthetic features have been identified.
- Multiple Resource Management Lands – allows for the designation of a predominate use, with the understanding that other compatible uses may also occur on these lands:
 - Low Density Recreation
 - Wildlife Management
 - Vegetative Management
 - Future or Inactive Recreation Areas
- Water Surface – used if a project administers a surface water zoning program:
 - Restricted
 - Designated No-Wake
 - Fish and Wildlife Sanctuary
 - Open Recreation

The HAHD land classifications are considered Project Operations and Multiple Resource Management – Vegetation. The sections below describe each of the land classifications and Figure 18 depicts the HAHD Land Classifications.

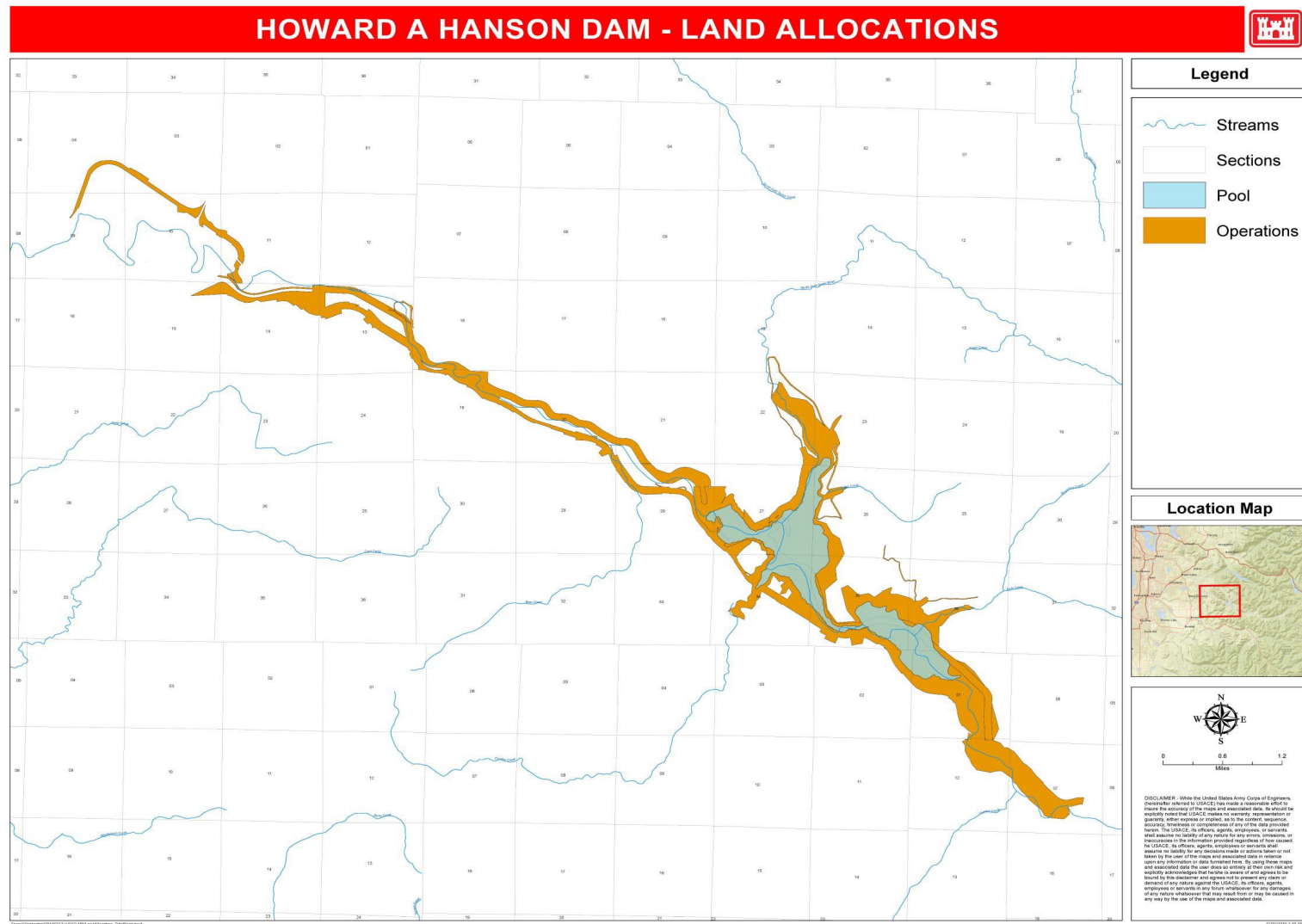


Figure 17. HAHD Land Allocations

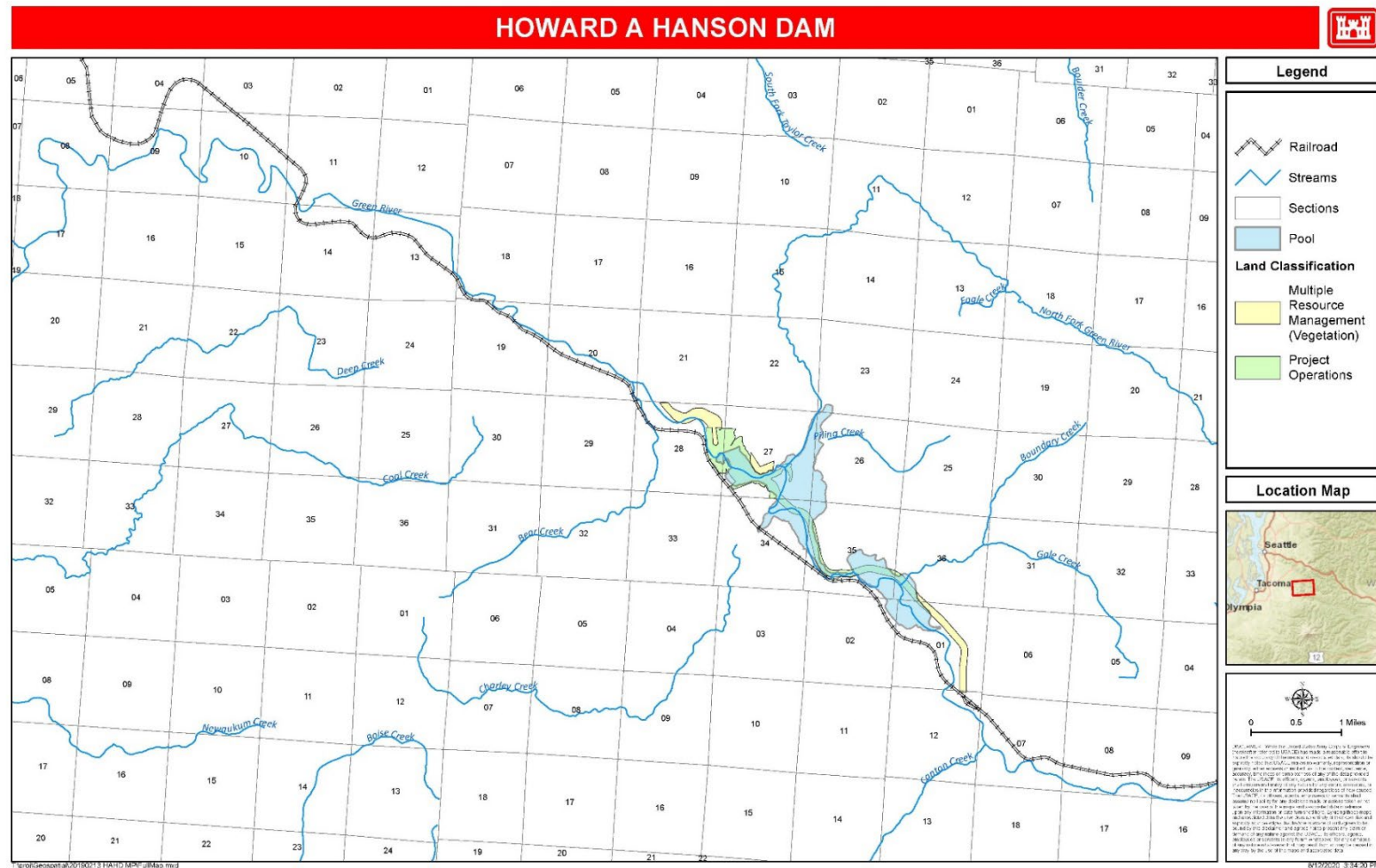


Figure 18 HAHD Master Plan Land Classifications



4.1.1 Project Operations

Project Operations land are needed solely for the daily operation of the project and at HAHD are used for flood control structures, an operations center, administration office, and a maintenance compound. Flood control is the primary purpose of HAHD and takes precedence over all other land use classifications in time of need. These lands total 293.7 acres.

4.1.2 Multiple Resource Management Lands – Vegetation

Currently, all Howard Hanson Dam Multiple Resource Management (MRM) lands are managed for vegetation with the intent to protect and enhance fish and wildlife habitat. Agreements with Tacoma and various state and federal resource agencies provide for specific fish and wildlife management areas near the dam and reservoir as described in section 4.3. Changes in management to restore or enhance fish and wildlife habitat must be handled through studies with approval from authorities other than those that guide the operations of HAHD. These lands total 135.0 acres.

4.2 Project Easement Lands

Project Easement Lands are lands for which USACE holds an easement interest, but not fee title. There are three types of easement lands: operations easement, flowage easement, and road and utility right-of ways easement. Use and management of these lands are in strict accordance with the terms and conditions of the easement agreement. Most easement lands around HAHD are used for flowage or inundation, the rest primarily for road and utility rights-of-way. This also includes other real estate easement-like agreements to include leases, letter permits, and licenses. Cultural resources have been located and documented within the boundaries of easement lands. These lands total 2,175 acres.



5 Resource Plan

As described in Chapter 3, all USACE lands within the HAHD project are congressionally allocated as Operations. Within the Operations allocation, properties are classified as Project Operations and Multiple Resource Management – Vegetation. This chapter will identify and describe three areas for resource management within the HAHD project area. Figure 19 shows the location of the three management areas which are 3-mile, Eagle Gorge, and Old McDonald Area. Within the OMP these areas are also identified as Management Units.

Each area provides the classification, which agency manages the land, the location and acreage, and the description and use of the land. Additionally, resource objectives applicable for that area will be highlighted. The development needs for each area will consider any currently proposed or projected activity needed in the future that helps achieve the resource objective(s) identified including but not limited to: vegetative plans, invasive species control, construction of facilities, cultural monitoring, initiatives, etc. Full descriptions of development needs are given in the OMP that is updated annually. Given below is an outline of tasks applicable to each area of management.

Special Considerations are special issues directly affecting the management of an area. These could include, but are not limited to legal issues, cultural sites, adjacent land use, and environmental concerns.

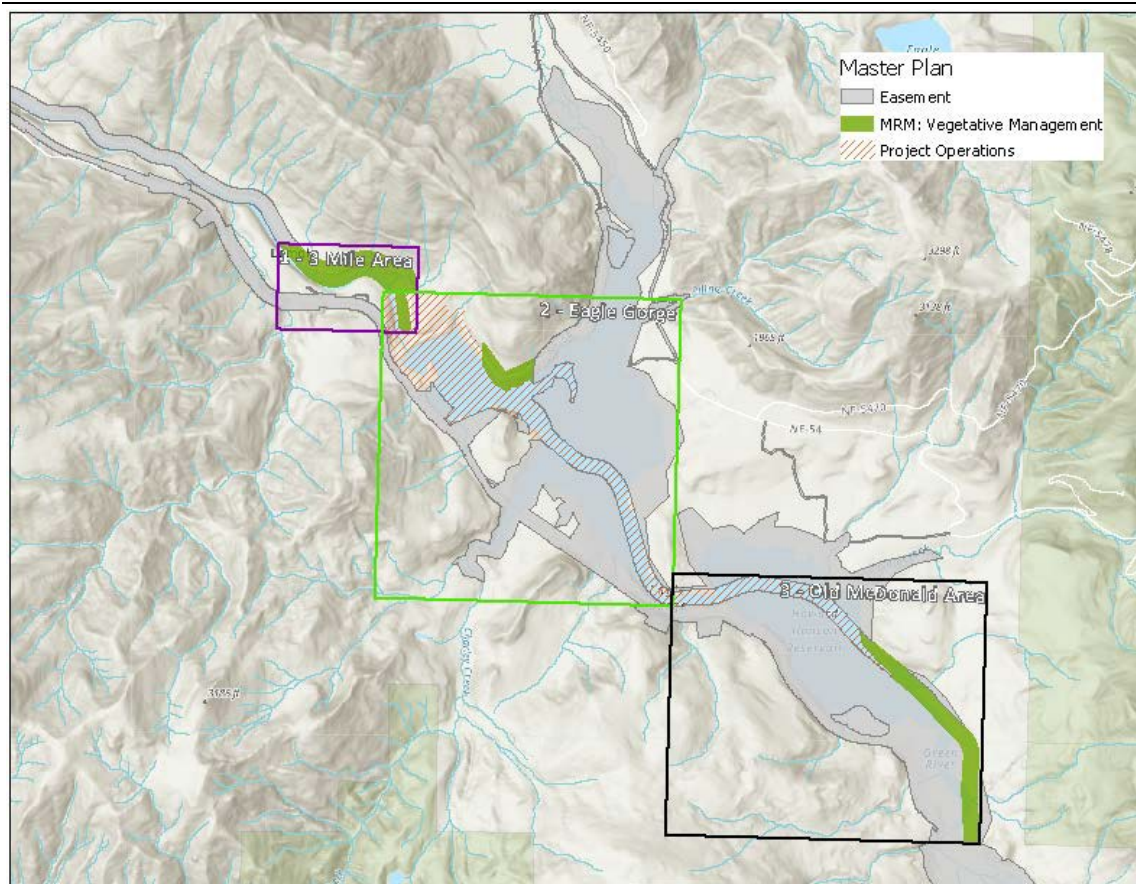


Figure 19. Management Areas at HAHD

5.1 Overall Project Area

Most of the land management occurs in the three management areas discussed in sections 4.2 – 4.4. There are several natural resources projects that occur outside of the designated management areas. Two are AWSP-derived projects and one is a general environmental stewardship program. Archaeological sites are located throughout the project area. While much of the project area has been surveyed, there are areas that have not been surveyed. In addition, depending on the survey methods of previous surveys it is possible that areas that have previously been surveyed may need to be re-surveyed. The total length of the Green River provides essential economic and spiritual sustenance to the MIT and Suquamish people.

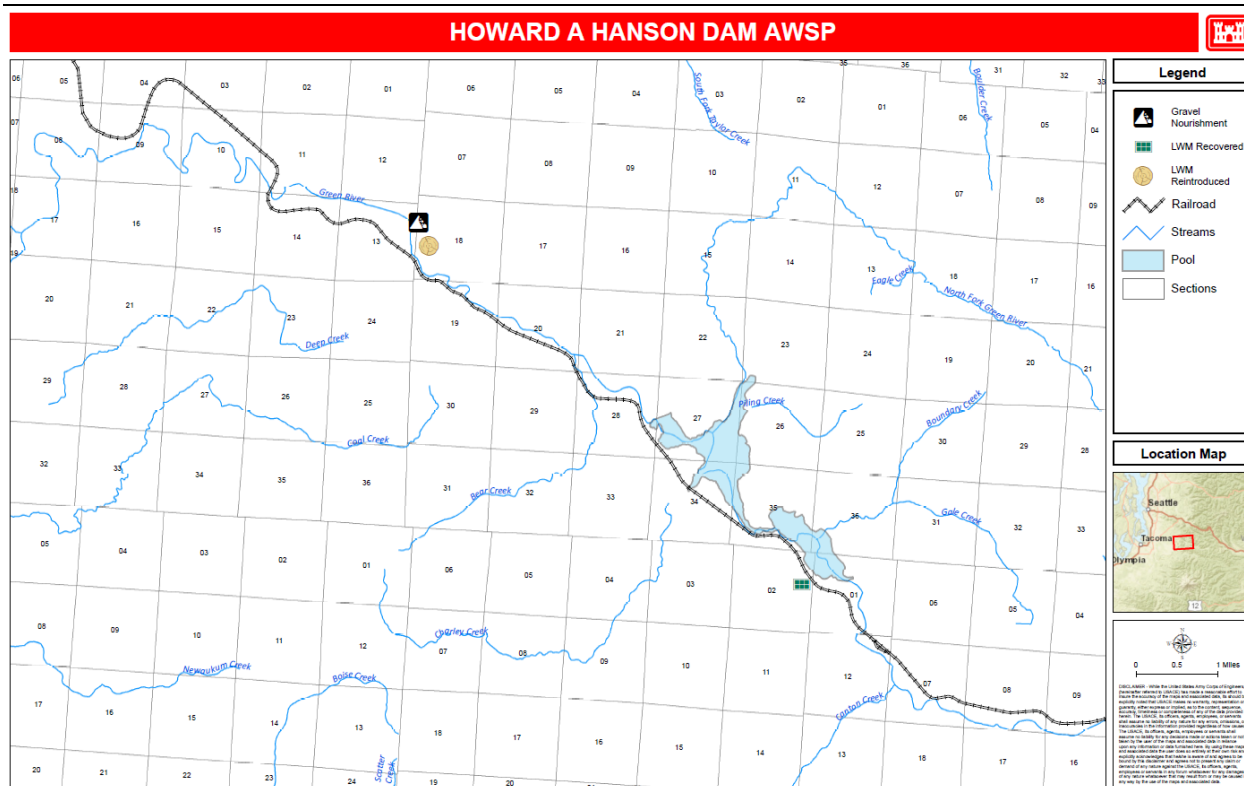


Figure 20. HAHD AWSP Projects

5.1.1 AWSP Projects

Several AWSP-associated projects to improve the habitat for fish spawning, resting, and foraging have been ongoing. Phase 1 of the AWSP included USACE construction of a fish passage facility at HAHD and this project is ongoing. Two projects remain USACE responsibilities: gravel nourishment and wood debris management (Figure 20).

5.1.2 Gravel Nourishment

Since 2003, USACE has added spawning gravel annually to the Green River below the dam near RM 60, to improve fish spawning conditions (Figure 20, Figure 21). The gravel location is in the general vicinity of the Tacoma security gate. The amount of gravel is based on annual monitoring data and hydrologic conditions to ensure benefits to salmon spawning. USACE has added between 7,000 to 14,000 tons of gravel each year (Figure 21). Spawning gravel additions will continue each fall/winter for the foreseeable future, subject to funding and

adaptive management as determined by hydraulic conditions or modified agreements. USACE will continue periodic physical and biological monitoring to assess effects on salmonid habitat, to include channel surveys, aerial ortho-photography, photo point occupation, pebble counts, gravel patch mapping, and water quality (2018b).

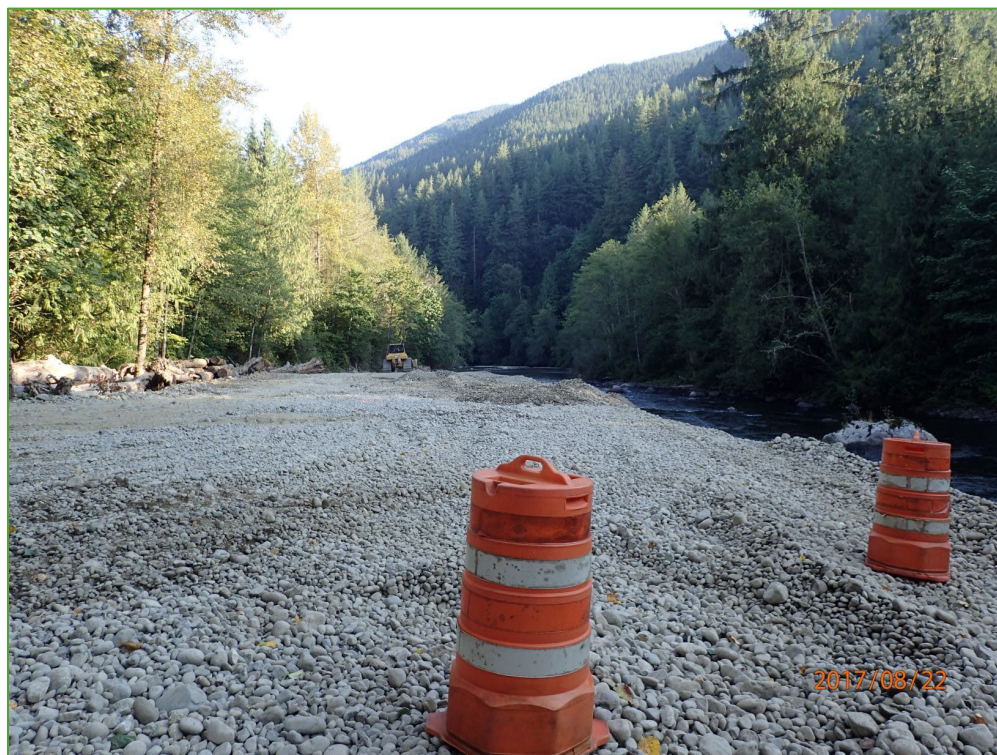


Figure 21. Placed gravel awaiting transport downstream.

5.1.3 Large Wood Management

Wood material management is conducted annually at HAHD by agreement and jointly managed with Tacoma (Figure 22). Natural processes within the watershed require the project to collect large woody material that makes its way into the reservoir, an amount that varies annually and is episodic. A portion of the logs that are collected above the dam are transported to the downstream side of the dam and placed on the edge of the river at RM 60. The logs are tagged and allowed to be carried downstream by the river to improve salmon habitat. For the foreseeable future, USACE will target an average of 50% (approximate maximum practicable) of all logs collected to be

placed at the downstream location, subject to funding and adaptive management, and as determined by hydraulic conditions or modified agreements (NMFS 2019). Large wood density is monitored downstream to determine where the wood collects over time and verify it is staying in the system providing habitat benefit. NMFS has determined that 80 pieces of large wood per mile is an indicator of properly functioning habitat (NMFS 1996).



Figure 22. Large wood placed for downstream disbursement.

5.1.4 Environmental Stewardship

An annual bald eagle survey is conducted from the 3-mile area to Bridge 71. The survey occurs in January or February and is conducted during the Midwinter Bald Eagle Survey, which is a program that involves Federal and State resource agencies working in partnership.

5.1.5 Operations and Maintenance Activities

Regular operations and maintenance activities include:



- Timber management as a part of vegetative maintenance, to include the recovery of large woody material from the reservoir,
- Maintenance, repair, and replacement of existing structures within the developed area,
- Boundary monument surveys, maintenance, and repair,
- Road maintenance (grading) and repair, to include culverts (culvert work remains within the existing footprint),
- Maintenance of the right-of-way (50-feet off either side of the center (power) line) for HAHD utility lines (includes tree cutting/trimming, erosion control will be maintained) along with replacement,
- Maintenance, repair, and replacement of the power poles on the utility line,
- As needed repair, maintenance, and replacement of signs, and
- Maintaining security requirements (maintain, repair, or replace fences and gates).

5.1.6 Development Needs

- Annual management of spawning gravel and large woody material,
- Control for invasive species,
- Commercial timber harvest sales.

5.2 3-Mile Area

5.2.1 Classification

The 3-Mile Area has two land classifications: Project Operations and MRM-Vegetation along with Project Easement lands (Figure 23).



Figure 23. 3-Mile Area Management Area

5.2.2 Management Agency

U.S. Army Corps of Engineers (fee-owned lands) and Tacoma Public Utilities (easement lands).

5.2.3 Location and Acreage

The 3-Mile Area is located along Road 5500 (the access road) downstream of the dam on both banks of the Green River. This includes the area on the right bank on the uphill side from the 4-mile road marker downstream to the 3-mile road marker at the Section 21 post up to the project's north boundary along with vegetated areas between Road 5500 and Access Road B, and Road 5500 and the river for about 1 mile downstream from the stilling basin and seepage tunnel. The left bank area is directly opposite of the right bank area from just below the stilling basin. This management area includes the old 3-mile forested area and the right bank and left bank vegetative



areas from the 1999 MP. No facilities for the operation of HAHD are in this management area.

Land Type	Acres
Land Classification – Project Operations	0
Land Classification – MRM – Vegetation	59.6
Project Easement Lands	610.0
Total Acreage	669.6

5.2.4 Description and Use

The area is the vegetated slope and riverbanks along both sides of Road 5500 downriver of the stilling basin. Vegetation includes western hemlock, Douglas fir, big-leaf maple, vine maple, and alder. In general, no vegetative management has been conducted on this land. It remains in a natural state to control erosion on the steep hillside and the short, steep banks to the river, which provide shade for fish. Regular actions include invasive species (weed) control along the road's edge to reduce the spread of nonnative species into the upper watershed, water quality monitoring, and maintaining the stilling basin.

5.2.5 Resource Objectives

- Promote ecological integrity and native habitat diversity and maintain quality habitat for native species.
- Minimize erosion and sloughing along steep hillside.
- Mitigate impacts to vegetation because of road maintenance and/or construction.
- Continue to monitor embankments and exposed sediments during drawdowns for the protection of natural and cultural resources.
- Per ER 1130-2-540's Chapter 6 (Cultural Resources Stewardship), ensure that all lands held in fee title are inventoried for historic



properties and conduct site evaluations is archaeological sites and/or historic buildings are structures are found during the inventory.

- Routinely consult with the Muckleshoot Tribe to discuss cultural resources issues at least annually.
- Report inadvertent discoveries of archaeological or human remains on USACE fee-owned land in accordance with the Native American Graves Protection and Repatriation Act. To report inadvertent discoveries of archeological or human remains in accordance with the USACE Inadvertent Discovery Plan and Human Remains Protocol on USACE easements to Tacoma and MIT.

5.2.6 Development Needs

Utilize a holistic approach to managing the area. Considerations include:

- Maintain a sustained level of snags and logs for cavity nesters.
- Control for invasive species
- Manage fuels levels for fire resilience.
- Minimize erosion and sloughing along steep hillsides for fish.
- Maintain riparian areas for minimum flow and shade required by fish.
- Improve and maintain the walls of the stilling basin on both banks.
- Conduct cultural resource surveys within this area and record any archaeological sites identified during the survey(s).
- Report inadvertent discoveries of human remains found on USACE fee-owned lands and USACE easements according to the Inadvertent Discovery Plan and the Human Remains Protocol.

5.3 Eagle Gorge Area

5.3.1 Classification

The Eagle Gorge Area has two land classifications: Project Operations and MRM-Vegetation along with Project Easement lands (Figure 24).

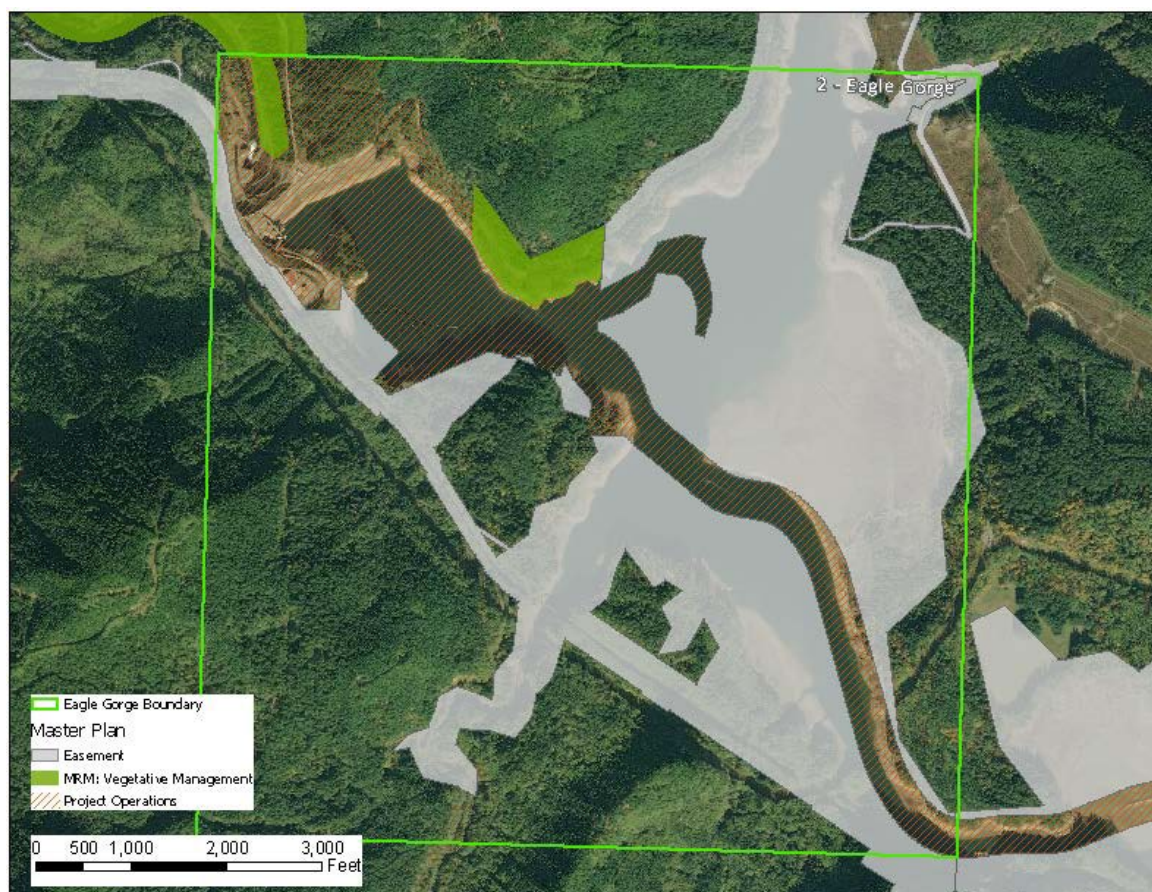


Figure 24. Eagle Gorge Management Area

5.3.2 Management Agency

U.S. Army Corps of Engineers (fee-owned lands) and Tacoma Public Utilities (easement lands).

5.3.3 Location and Acreage

The Eagle Gorge Area includes the dam and appurtenant structures, buildings and associated roads, upstream debris storage areas (near



MM 5 and the seawall and the North Fork) and the 5-mile Forested Area.

Land Type	Acres
Land Classification – Project Operations	238.7
Land Classification – MRM – Vegetation	17.2
Project Easement Lands	786.6
TOTAL ACREAGE	1,042.5

5.3.4 Description and Use

The Project Operations classification includes the USACE-owned dam and associated structures (including instrumentation), the roads, and the shoreline of the upstream forested knoll. Within the MRM-Vegetation classification is an area called the 5-Mile Forested area, which is located on the right bank upstream of the dam at the 5-mile road marker of Road 5500. This is managed for vegetation to maintain stabilization of the steep slope to protect Road 5500 from mudslides.

After implementation of the Section 1135 and AWSP projects, a new administration building and maintenance shop (Figure 25) were constructed on the left bank hillside in the area previously used as and called the “Quonset Hut Storage and Staging Area.” The old administrative building is currently used as a dry storage building (Figure 26). Additional changes include the decommissioning of the fuel dispensing station, changes to the boat dock, and new security measures. Fuel is no longer dispensed at HAHD. The decommissioned fuel dispensing station has one underground storage tank that has been rendered inert but has remained in place due to dam safety concerns. The pumps at the station have been removed and the remaining concrete block building is now used as bulk oil storage and contains the herbicide locker for the integrated pest management program. As a result of the pool rise, modifications to the boat dock were required to make it usable for the higher pool during the summer.



Figure 25. New Maintenance Shop (left) and Administration Building (right) in January 2021.



Figure 26. Locations of new and old buildings at HAHD.



Figure 27. Boat dock area in January 2021. The lines visible in the reservoir are debris booms.

At the dam, between the new maintenance shop building and the old administrative building, the upper road is the “Dam Crest Road”. The “Dam Face Road”, the lower road closest to the reservoir, was more accessible before the AWSP pool raise but has been maintained during low pool (part of the Dam Face Road is visible on the bottom right side of Figure 27). During low pool, HAHD will use an existing turn around area that has been improved as a crane pad/staging area to move a crawling crane from land via a ramp onto a floating barge.

There is security fencing into and around certain portions of the area at the dam structure. Additional security measures include security cameras installed in strategic locations around the operations areas. There are multiple security gates around the HAHD area which are maintained and replaced, if required. The gates that are not owned, but may be maintained by USACE, if required, are the McDonald gate and the Bridge 71 gate. Gates that are owned and maintained by



USACE are the 5509 Road gate and the “Big Yellow” gate on the south road. Typical operations and maintenance actions for all these security measures are to maintain, repair, and replace in-kind for the fences, cameras, and gates.

All other structures are maintained and are repaired when required. This includes, but is not limited to painting, fixing windows, doors, interior areas (e.g., floors, bathrooms, kitchen, other equipment), and roof repair and/or replacement.

In the reservoir, near the dam and the administrative area, are the debris booms. There are three stationary booms that collect floating debris during periods of high water. The debris is held behind log booms until the temporary pool drops. Debris trapped by the booms is collected in sack booms and towed by barge to the temporary holding areas. Larger floating and sunken debris passing the booms may lodge against the intake structure trashrack bars and is removed periodically. During the spring, the debris floats again as the pool is raised for the low flow augmentation season. When the conservation pool is at the maximum elevation, the debris is towed from the temporary holding areas to the permanent holding areas. Then, when the pool level has been lowered and ground conditions permit operations in the Baldi and McDonald Field wood debris and sorting areas, the sack booms and salvageable materials are removed, and the unsalvageable materials are chipped and left in place.

HAHD maintains and repairs the anchorages, chains, and access roads of all stationary booms throughout the project area. The log booms at the three stationary booms before the dam are currently being replaced with steel booms.



Figure 28. Upstream forested knoll in January 2021.

Near the administration area is a forested knoll which is directly over the old Northern Pacific Railway tunnel used prior to construction of the dam (Figure 28). Vegetation on the knoll is primarily Douglas fir. Stormwater sedimentation ponds were installed in the middle of the knoll to support the construction of the downstream fish passage facility in 2008 – 2009. The purpose was to facilitate dewatering the excavated material to protect Tacoma’s drinking water supply. Otherwise, the knoll is used only for accessing the boom tail holds.

The northwest portion of the reservoir within the Eagle Gorge Area contains the North Fork temporary debris storage area, which is on easement land. Within the waters of the North Fork portion of the reservoir is an area where loons are monitored as part of an interagency working group that includes USACE, Tacoma, and WDFW. Loons are listed as a Washington state sensitive species and have been observed nesting within the reservoir since 1994. Since 2006, USACE has participated in a multi-agency collaborative effort to support loon breeding habitat and monitoring efforts. Two floating breeding platforms, or loon logs, were installed in the mid-2000s

(Figure 29) and are maintained by USACE and Tacoma. Annual loon monitoring occurs from mid-April – July. Because of high nest site fidelity, one loon log is fitted with at least four game cameras before the loons initiate nesting. The cameras are not checked during the breeding season to minimize disturbance and are removed when the breeding season is complete (Figure 30).



Figure 29. A loon log in the North Fork area of the reservoir in 2007.



Figure 30. Photo of the camera setup on the loon log and loons using the log for nesting I in April 2019.

5.3.5 Resource Objectives

- Manage shoreline erosion.
- Prevent unauthorized use of government property through boundary surveillance, mapping and management.
- Control for invasive species within project operations area.
- Continue to monitor embankments and exposed sediments during drawdowns for the protection of natural and cultural resources.
- Continue to monitor easement lands for erosion or other effects from natural processes, unauthorized activity, and effects from human-caused disturbances.
- Monitor known archaeological sites for erosion, looting, and other effects.
- Routinely consult with the Muckleshoot Tribe to discuss fisheries, wildlife, and cultural resources issues at least on an annual basis.



- To report inadvertent discoveries of archaeological or human remains within USACE fee-owned land in accordance with the Native American Graves Protection and Repatriation Act.
- Repair and maintain loon logs and continue loon monitoring.
- Maintenance, repair, and replacement of steel log booms.

5.3.6 Development Needs

- Identify projects or actions that may directly or indirectly effect wildlife or terrestrial habitat features, such as fish passage or constructions activities.
- Vegetation management
- Hazard tree removal, brush clearing, planting, seeding
- Assess the projects operations area for fire resilience. Manage fuels and vegetation near structures and the dam. Ensure fire fuels are more than 120 feet from any structure and control/secure any flammable items.
- Invasive species control
- Security upgrades, to include fencing around the maintenance shop and administration building and the upgrade of the security system (upgrading security equipment within the administration building and installing additional cameras on existing buildings)
- Conduct cultural resource surveys in areas of Eagle Gorge that have not been previously surveyed.
- Monitor known archaeological sites and the HHDAD for erosion, looting and other effects.
- Develop a CRMP/HPMP in consultation with Tacoma and MIT for HAHD.



5.4 Old McDonald Area

5.4.1 Classification

The Old McDonald Area has two land classifications: Project Operations and MRM-Vegetation along with Project Easement lands (Figure 31).

5.4.2 Management Agency

U.S. Army Corps of Engineers (fee-owned lands) and Tacoma Public Utilities (easement lands).

5.4.3 Location and Acreage

The Old McDonald Area includes the land management area upstream of the dam. Project operations are located primarily along the centerline of the riverbed, with much of the area included within the Project Easement Lands. The easement lands include the Baldi habitat project and the McDonald Field wood debris sorting and storage area, located in the easement lands to the north, off-figure (Figure 31). The wood sorting area previously used in the area is no longer available due to higher pool (identified by the grey outline in Figure 31). Areas within the MRM – Vegetation classification includes the old railroad grade on the right bank of the river. It follows the right bank of the Green River and ends just downstream from Bridge 71.

Land Type	Acres
Land Classification-- Project Operations	55.0
Land Classification-- MRM-- Vegetation	58.2
Project Easement Lands	783.5
TOTAL ACREAGE	896.7

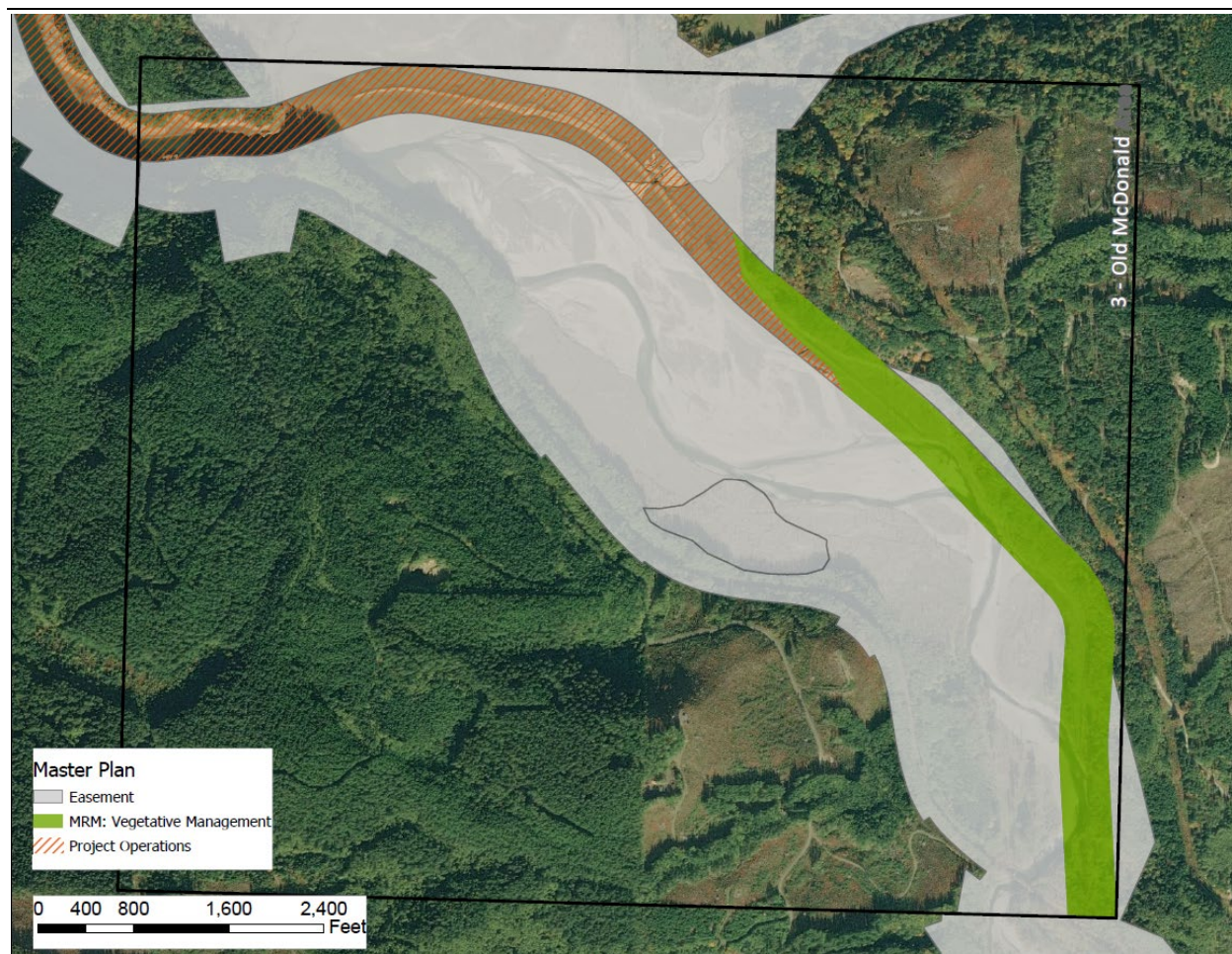


Figure 31. Old McDonald Management Area

5.4.4 Description and Use

This area includes portions of the old Northern Pacific Railway railroad grade. A portion of the railroad grade is under the reservoir with the section of the grade above the summer conservation pool at the southeast boundary of HAHD fee lands. Deciduous trees and saplings mixed with conifers, grass, and shrubs cover the area. The natural vegetation is left intact except when road access becomes obstructed. Four areas are used for temporary and permanent wood storage. These include McDonald Field temporary holding and sorting, Baldi Habitat Boom, the North Fork Green River boomed area near road milepost 5, and the seawall temporary wood holding area. The Baldi habitat boom and the North Fork boomed area are the only



permanent wood storage areas. The seawall and McDonald Field areas are temporary holding areas. McDonald Field is used to sort wood each year and temporarily store wood for later transport downstream. Other areas may also be temporarily used if needed during and after large influxes of wood to the reservoir. Near road milepost 18.5, there is an area used by western toads which is monitored. Water quality monitoring is conducted daily at Bridge 71 and the information is shared with Tacoma. Other natural resource management occurs at the Baldi Habitat Boom (Figure 32 and Figure 33). The habitat boom was initiated as a pilot project in 2009 for the purpose of providing additional habitat for wildlife and fish within the reservoir. The debris boom project was designed to benefit resources while simultaneously minimizing operational costs and risks associated with reservoir wood management. Periodic monitoring for vegetation cover and species diversity along with wildlife use occurs. The area is known to provide habitat for amphibians, fish, and birds. Deer, elk, and other mammals use the area behind the boom because it has good forage and cover.



Figure 32. Baldi Habitat Boom during high pool.



Figure 33. Baldi Habitat Boom during low pool in January 2021.



5.4.5 Resource Objectives

- Promote ecological integrity and native habitat diversity and maintain quality habitat for native species.
- Minimize erosion and sloughing along steep hillside.
- Mitigate impacts to vegetation because of road maintenance and/or construction.
- Continue periodic monitoring at Baldi Habitat Boom (approximately every 4-5 years).
- To continue to monitor embankments and exposed sediments during drawdowns for the protection of natural and cultural resources.
- To continue to monitor easement lands for unauthorized activity (looting of archaeological sites).
- To routinely consult with the Muckleshoot Tribe to discuss fisheries, and cultural resources issues at least on an annual basis.
- To report inadvertent discoveries of archaeological or human remains within the USACE jurisdiction in accordance with the Native American Graves Protection and Repatriation Act.

5.4.6 Development Needs

- Maintaining a sustained level of snags and logs for cavity nesters.
- Hazard tree removal, brush clearing, planting, and seeding.
- Controlling for invasive species
- Managing fuels levels for fire resilience.
- Minimizing erosion and sloughing along steep hillsides for fish.
- Maintaining riparian areas for minimum flow and shade required by fish.
- Continue cultural resource site evaluations.



- Develop a CRMP/HPMP in consultation with Tacoma and MIT that describes historic properties, site evaluation efforts, and priority for treatment, including data recovery of significant features, specimens, and scientific samples, in-place protection, and curation of collections.
- Reporting inadvertent discoveries of human remains within the USACE's jurisdiction in accordance with the Native American Graves Protection and Repatriation Act

6 Special Topics/Issues Considerations

The reservoir and much of the watershed above HAHD is closed to the public because it is within Tacoma's municipal watershed, which is a primary drinking water supply for the region. Because of this, this project does not have as many competing interests as other similar projects such as recreation or power generation.

6.1 Stakeholders

HAHD is very reliant on its associations within the Green River basin. The following are the most prominent:

6.1.1 USACE and Tacoma

USACE has a close partnership with Tacoma due to the operation of HAHD within the Tacoma Watershed, the primary source of drinking water for the City of Tacoma, the numerous real estate easements that exist between the parties, the Section 1135 project and the AWSP. There is regular communication regarding dam operations, water storage, facility maintenance, land management, and many other issues due to the close proximity of the agency's activities, requirements for interaction (such as for water management) and the potential for incidental unintended interaction.

6.1.2 WRIA-9 ITC

Water Resource Inventory Area 9 (WRIA-9) includes the Green/Duwamish and Central Puget Sound Watershed. The WRIA 9



Implementation Technical Committee (ITC) holds monthly meetings with stakeholders within the WRIA 9 geographic area. The purpose of the ITC is to oversee the collection and interpretation of physical and biological monitoring data related to salmon recovery in the Green River/Duwamish watershed to determine the success of current projects. The ITC provides recommendations to the Watershed Ecosystem Forum (WEF) which oversees efforts to improve watershed health and salmon recovery. USACE may provide updates to the committee on current USACE-specific monitoring studies and actions within the watershed. Meeting attendance maintains positive relations with watershed stakeholders as well as keeping current with other ongoing projects within the watershed.

6.1.3 USACE and MIT

There are several areas at the HAHD project where USACE has developed a shared working relationship with the Muckleshoot Indian Tribe. USACE archaeologists communicate as required, on a technical level with cultural specialists at the MIT to share project information, and to work together to identify and find strategies to preserve and protect archaeological and other cultural resources within the project area that are significant to the Tribe.

6.1.4 Green River Smolt Trap Study

The smolt trap on the Green River is a project to monitor juvenile salmon with a focus on freshwater production and survival of sub-yearling Chinook salmon, as well as providing abundance and biological characteristics of other juvenile migrant salmonids present in the watershed (Figure 34). Results of this project help evaluate the impacts of operations at HAHD, operations by Tacoma, and projects constructed by King County (WRIA-9) on juvenile salmon below the dam. In addition, the counts of juvenile outmigrants collected at the trap contribute to the evaluation and management (by WDFW and the MIT) of Chinook salmon and steelhead. A juvenile salmon screw trap

has been operated in the Green River at RM 34.5 since 2000. The project is cost-shared between WDFW, WRIA-9, TPU, MIT and USACE.



Figure 34. Photo of the juvenile salmonid screw trap on the Green River.

6.1.5 Monitoring of Dam and Abutment

Seattle Public Utilities and Central Washington University have installed monitoring equipment above the 19-foot tunnel that uses light detection and ranging (LIDAR), a remote sensing method to measure movement of the abutment and the physical dam itself. This equipment was placed after the 2001 Nisqually earthquake and is maintained by Central Washington University.

6.2 Downstream Fish Passage Facility

Compliance with NMFS 2019 BiOp (NMFS 2019) requires the construction of a permanent downstream fish passage system. This system is not evaluated in the Master Plan, but is included for context. The purpose of the fish passage system is to provide safe, timely, and effective downstream fish passage through the range of conditions likely to occur during the annual smolt migration. Design and



construction of this structure will be the largest construction project at the dam since the construction of the dam.

7 Agency and Public Coordination

7.1 Public Scoping

Master Plan scoping for the HAHD master plan revisions occurred from April 11 - May 15, 2019. The public announcement for project scoping was provided to local newspapers and sent out via email on April 9, 2019. The opportunity to provide comments was afforded via the following:

NWS booth at the Washington State Spring Fair, April 11 – 14: The display was next to the booth for water safety. It was estimated that approximately 20 people per day looked at the posters for the master plan.

Enumclaw City Council meeting April 22: Up to seven people asked questions or made comments. The questions were general questions about the dam and the purpose of a master plan. One commenter suggested opening public access to the reservoir at HAHD.

Dam Safety Day and Daffodil Valley Volkssport's "Just another dam walk", May 11; Three people looked over the display. One had general questions about the dam and the purpose of a master plan. The third asked questions about dams in general.

Via email (nwsmasterplan@usace.army.mil); USACE received twelve emails. Of those, two requested additional information, one inquired about hunting and fishing, two advocated for breaching the dams, six commented on the fish passage facility, one advocated for the Whooshh Innovations fish passage program, and one proposed an alternate form of energy.



7.2 Tribal Coordination

7.3 On March 7, 2019, USACE mailed an initial coordination letter to the Confederated Tribes and Bands of the Yakama Nation, the Muckleshoot Indian Tribe, the Nisqually Indian Tribe, the Puyallup Tribe of the Puyallup Reservation and the Squaxin Island Tribe of the Squaxin Island Reservation requesting comments to assist in the development of the proposed master plan. USACE will notify the five Tribes once the master plan is available for public comment.

In 2019, NMFS issued the most recent BiOP regarding the AWSP. In support of the downstream FPF, USACE is currently coordinating with NMFS and Tacoma for planning, design, and implementation.

8 Summary of Recommendations

Development of the HAHD Master Plan allows for an improvement in the environmental quality for the present and future longevity of the project. It requires continued involvement of the general public, as well as Federal, state, and local agencies. This input will aid in the efficient, effective, and timely implementation of resource use objectives as funding becomes available. It required the appraisal of natural and cultural resources around the reservoir and examination of environmental considerations. This Master Plan will guide the use, development, and management of HAHD in a manner that optimizes public benefits within resource potentials and the authorized function of the project while remaining consistent with the USACE policies, regulations, and environmental operating principles. The plan is stewardship-driven, seeking to balance recreational development and



use with protection and conservation of natural and cultural resources.

8.1 Real Estate

This master plan includes changes to real estate interests since the 1999 master plan. The total acreages increased from 2,271.97 acres to 3004.5 acres, to include an increase in fee-owned lands from 419.33 acres to 430.6 acres. As changes occur in real estate interests, land classifications should be reviewed to maintain compliance with current Engineering Regulations and Engineering Pamphlets along with ensuring that new lands are included in the land management practices outlined in the master plan.

8.2 Natural Resources

Ensure Level II surveys follow current Engineering Regulations and Engineering Pamphlets. If possible, follow up on recommendations provided in Level II surveys such as invasive species management actions or determining management priorities for listed species occurring on USACE property.

Wildland fire is on the rise in Washington, including Western Washington. In 2020, wildland fires impacted both the Chief Joseph Dam and Mud Mountain Dam projects. Wildland fire should be considered in both the emergency planning (response and communications) and in ensuring fire resilience at HAHD.

8.3 Cultural Resources

Cultural Resources operations and objectives include:

- Conduct cultural resources surveys in areas that have not been previously surveyed.
- Review previous cultural resources survey methodology to determine if previously surveyed areas need to be resurveyed or if areas have been overlooked.



- Continue to monitor known archaeological sites for erosion, looting and other effects.
- Review the 2003 MOA for the additional water storage project to ensure all stipulations have been met. If not, develop a plan to finish meeting the stipulations of the MOA.
- Develop a Cultural Resources Management Plan that would provide guidance for the management of cultural resources at HAHD. This includes describing historic properties (both archaeological and built environment) at the project, site evaluation efforts, and prioritizing sites for treatment efforts (i.e. stabilization, data recovery, etc.).
- Conduct appropriate public outreach and conduct cultural resources training for HAHD staff.
- USACE should meet at least annually with Tacoma and the MIT to discuss cultural resources issues and concerns.

8.4 Partnerships

Continue to build partnerships within the Green River basin. In today's challenging fiscal environment, it is imperative for USACE to work with local, state, other federal agencies, and stakeholders towards common goals. These goals can range from combating invasive species, improving stream habitat, and downstream fish passage.

8.5 Lands Actively Managed by USACE

The only major work planned in the future is construction of the downstream fish passage facility and associated structures. Other work includes maintaining existing facilities, adoption of the AWSP phase II storage elevation, improving some existing facilities, and protecting natural areas and natural resources. Future improvements could include, but are not limited to the following:

- Large woody material transport and gravel nourishment



- Maintenance of snags and logs for cavity nesters
- Minimization of erosion and sloughing along steep hillsides
- Management of invasive species
- Wildlife disease management
- Construct or repair houses for birds and bats
- Level I and II surveys - bats, avians, small mammals, insects and aquatic macroinvertebrates
- Baldi Habitat boom management
- Common loon breeding and nesting efforts
- Western toad monitoring
- Boundary surveillance and mapping

8.6 Conclusion

It is recommended that USACE management, both at HAHD and at the district headquarters; continue coordination with stakeholders after the finalization of this Master Plan. Meetings offer information exchange and present challenges and needs. Input received in these meetings will be considered for applicability to Master Plan updates.



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10 Appendices

Appendix A: Lists of Prior Design Memoranda, National Environmental Policy Act Documents, and Studies

Appendix B: References

Appendix C: Project Cooperation Agreements with Tacoma, Department of Public Utilities

Appendix D: Species List – Vegetation

Appendix E: Species List – Animals

Appendix F: Public Scoping for the Master Plan



Appendix A Lists of Prior Design Memoranda, National Environmental Policy Act Documents, and Studies

Table 10-1. Design Memoranda

DM No.	Date Issued	Subject
1	13 Feb 1953	Hydroelectric Power Development
2	3 Mar 1953	Derivation of Spillway Design Flood
3	16 Feb 1954	Location and Type of Dam
4	23 Jul 1954	Relocation of Northern Pacific Railway Company's Facilities
---	03 Mar 1958	Addendum to Design Memorandum 4, Fireproofing Chicago, Milwaukee, St. Paul and Pacific Railroad Company's Bridge No. FF-706
Supplemental to DM 4, 1	29 Jan 1955	Bridge No. 1, Upper Crossing of Green River
Supplemental to DM 4, 2	20 Jan 1955	Bridge No. 2, Charley Creek
Supplemental to DM 4, 4	Unknown	Bridge No. 4 (Deleted)
Supplemental to DM 4, 5	25 Apr 1955	Design Analysis on Determination of Culvert Capacity
---	28 May 1956	Addendum No. 1
Supplemental to DM 4, 3A	Jun 1956	Bridge No. 3, Lower Crossing of Green River Addendum No. 1. To Suppl. 3A
---	07 Dec 1956	Addendum No. 2
Supplemental to DM 4, 6	05 Aug 1955	Design Analysis on Stability of Embankment and Cut Slopes - Humphrey to Charley Creek
---	20 Sep 1955	Addendum No. 1
---	14 Nov 1955	Addendum No. 2
Supplemental to DM 4, 7	28 May 1956	Design Analysis on Stability of Embankment and Cut Slopes Charley Creek, Station 10654+30 to Station 11073+00
Supplemental to DM 4, 8	17 Aug 1956	Design Analysis on Stability of Embankment Slopes, Bridge No. 81 Abutments, Station 11122+25 to Station 11131+21
---	16 Oct 1956	Addendum No. 1



DM No.	Date Issued	Subject
Supplemental to DM 4, 9	08 Nov 1956	Design Analysis on Stability of Embankment and Cut Slopes, Station 10557+00 to Station 10597+30, Main Line ; Station 10071+85 to Station 11123+50, Main Line ; Station 11130+45 to Station 11267, Main Line ; Station 11130+45 to Station 11267, Main Line ; Buckley Branch and West Connection, Green River Branch and West Leg of Wye
5	15 Oct 1954	City of Tacoma Water Supply
	12 Jan 1955	Supplemental No. 1 to Design Memo No. 5
6	20 Oct 1954	Relocation of Power Transmission Lines - BPA
7	01 Dec 1954	General Design Memo
---	28 Dec 1960	Supplemental Report to DM 7, Physical Security Measures
8	14 Jan 1955	Real Estate Memo: Norther Pacific Railway Relocation Segment "A", Humphrey to Charley Creek
9	18 Feb 1955	Relocation of Long Distance Telephone Lines, Pacific Telephone and Telegraph Company
10	19 Aug 1955	Real Estate Memo: Norther Pacific Railway Relocation, Segment "B", Charley Creek to Tacoma Headworks
11	13 Dec 1955	Report on Necessity for Relocation of Facilities Puget Sound Power and Light Company
12	14 Jun 1956	Rock Fill Dam, Spillway, Outlet Works, and Related Project Facilities
---	07 Dec 1955	Supplemental No. 1 to DM 12
---	08 Aug 1958	Supplemental No. 2 to DM 12 Rockfill Dam - Spillway, Outlet Works, Rel. Bridge Project Fac
---	08 Jan 1960	Supplemental No. 3 Embankment
---	---	Supplemental No. 4 Spillway Channel Revisions
---	---	Supplemental No. 5 Power Supply
---	---	Supplemental No. 6 Right Abutment Seepage
---	---	Supplemental No. 7 Right Abutment Seepage (again)
---	01 Feb 1967	Supplemental No. 8 Geological and Soil Data, Right Abutment Seepage
---	23 Nov 1977	Supplemental No. 9 Rock Fill Dam, Spillway, Outlet Works & Related Proj Fac
13	14 Dec 1956	Real Estate Memo: Northern Pacific Railway Relocation, Segment "C" Tacoma Headworks to Kanaskat; Segment "E" Dam Site Construction Area
14	30 Aug 1956	Concrete Aggregate Investigation
15	06 Sep 1956	Report on Necessity for Relocation of Country Roads Nos. 1224, 381, and 191; King County, Washington



DM No.	Date Issued	Subject
16	22 Mar 1957	Real Estate Memo: Reservoir Area, Segments "F" and "G"
17	10 Apr 1958	Report on Necessity for Relocation of U.S. Forest Service Road No. 212 (rescinded and superseded by Design Mem No. 18)
18	10 Aug 1959	Relocation U.S.F.S. Road No. 212 (Rev)
19	15 May 1959	Reservoir Clearing
---	13 Jun 1960	Supplemental No. 1 Slide Treatment
20	Sep 1959	Hydrologic and Communication Facilities for Project Operations
21	29 July 1960	Drift Control Facilities
22	11 Feb 1960	Plan for Sedimentation Observation
25	30 Apr 1968	Right Abutment Seepage Control
26	Sep 1983	Earthquake Analysis
	8 Oct 1992	Change 1 Earthquake Analysis
27	Aug 1999	HHD – Eagle Gorge Reservoir Project Master Plan
29	Apr 2003	Right Bank Seepage Control Measures



Table 10-2. NEPA Documents

Date	Subject
1985	Archaeological Reconnaissance of Howard A. Hanson Dam Project
1995	Feasibility of Cofferdam Construction HHD, Additional Water Storage Project, King County, WA
1995	Feasibility Study Fish Passage Wildlife Flood Control Reservation Studies Tacoma Water Supply, HHD Additional Water Storage Project, King County, WA
1996	Cultural Resources Survey of the Additional Water Storage Project Area, Howard A. Hanson Dam, King County, Washington
1996	Howard Hanson Dam Section 1135 Fish & Wildlife Restoration Project Final Project Modification Report/Environmental Assessment. Prepared by HDR Engineering, Inc. and Beak Consultants, Inc. September 1996.
1997	Howard A. Hanson Dam Final EIS for Operations and Maintenance of Howard Hanson Dam.
1998	Additional Water Storage Project, Final Feasibility Study Report and Final EIS, Howard Hanson Dam, Green River, Washington
2000	Biological Opinion (FWS Reference: 1-3-00-F-1381) for the Howard Hanson Additional Water Storage Project
2001	Record of Decision Howard A. Hanson Additional Water Storage Project Green River, Washington
2009	FEA Howard Hanson Dam Right Abutment investigation, Reservoir Refill, Reservoir Drawdown, and Interim Repair, Green River, King County, Washington
2010	FSEA FEA Howard Hanson Dam Right Abutment investigation, Reservoir Refill, Reservoir Drawdown, and Interim Repair, Green River, King County, Washington
2010	Final EA for July 2010 Interim Risk Reduction Measures Plan and Dam Safety Modification Project, October 2010
2011	Water Control Manual Howard A. Hanson Dam, Green River, Washington
2019	Biological Opinion on Howard Hanson Dam, Operations, and Maintenance, Green River (HUC 17110013) King County, Washington



Appendix B References

1. 33 U.S.C. 403, Section 10 of the Rivers and Harbors Appropriation Act of 1899 - compliant
2. Antiquities Act of 1906 – compliant
3. Migratory Bird Treaty Act of 1918 – compliant
4. Fish and Wildlife Coordination Act of 1934 – compliant
5. Bald and Golden Eagle Act of 1940 – compliant
6. Flood Control Act of 1944 (PL 78-534) – compliant
7. Flood Control Act of 1950 (PL 81-516) – compliant
8. The Reservoir Salvage Act of 1960 – compliant
9. Forest Cover Act of 1960 – compliant
10. The National Historic Preservation Act of 1966 (as amended) – compliant
11. National Environmental Policy Act of 1969 – compliant
12. Endangered Species Act of 1973– compliant
13. The Water Resource Development Act of 1974, Sec. 77 – compliant
14. The Archeological and Historic Preservation Act of 1974 – compliant
15. Safe Drinking Water Act of 1974 – compliant
16. Federal Land Policy and Management Act of 1976 – compliant
17. The Clean Water Act of 1977 – compliant
18. The Archeological Resources Protection Act of 1979 – compliant
19. The Emergency Wetlands Resources Act of 1986 – compliant
20. The North American Wetlands Conservation Act of 1989 – compliant
21. Native American Graves Protection and Repatriation Act of 1990 – compliant
22. Americans with Disabilities Act of 1990, A Amendments Act of 2008 – compliant



23. Preservation of American Antiquities Act, Jan. 2008, as amended – compliant
24. Executive Order (EO) 11593: Protection and Enhancement of the Cultural Environment, May 1971 – compliant
25. EO 11988: Floodplain Management, May 1977 – compliant
26. EO 11990: Protection of Wetlands, May 1977, as amended – compliant
27. EO 13112: Invasive Species, Feb. 1999, as amended – compliant
28. EO 13186: Responsibilities of Federal Agencies to Protect Migratory Birds, Jan 2001 – compliant
29. EO 13751: Safeguarding the Nation from the Impacts of Invasive Species, Dec 2016– compliant
30. Code of Federal Regulations (CFR), Title 33, Part 325: Processing of Department of the Army permits; Procedures for the Protection of Historic Properties, Nov 1986 – compliant
31. CFR, Title 36, Parks, Forests, and Public Property – compliant
32. 50 CFR Part 17: Endangered and Threatened Wildlife and Plants, Sept. 1975, as amended – compliant
33. Sec. 1 (42 U.S.C 1856a): Reciprocal Fire Protection Act of 1955 – compliant
34. AR 190-29: Misdemeanors and Uniform Violation Notices Referred to U.S. Magistrates, 20 August 84 – compliant
35. Federal Highway Administration. 2009. Manual on Uniform Traffic Control Devices. Revisions numbers 1 and 2 incorporated, May 2012 – compliant



Appendix C Project Cooperation Agreements with Tacoma Department of Public Utilities



PROJECT COOPERATION AGREEMENT
BETWEEN
THE DEPARTMENT OF THE ARMY
AND
THE CITY OF TACOMA
FOR MODIFICATION OF THE
HOWARD HANSON DAM
FOR ECOSYSTEM RESTORATION
AND
MUNICIPAL & INDUSTRIAL (M&I) WATER SUPPLY

THIS AGREEMENT is entered into this 17th day of July, 2013, by and between the DEPARTMENT OF THE ARMY (hereinafter the "Government"), represented by the Principle Deputy Assistant Secretary of the Army (Civil Works) and the CITY OF TACOMA, DEPARTMENT OF PUBLIC UTILITIES (hereinafter the "Non-Federal Sponsor"), represented by the Director, Department of Public Utilities.

WITNESSETH, THAT:

WHEREAS, the Secretary of the Army completed construction of the HOWARD HANSON DAM (hereinafter the "Existing Project", as defined in Article I.A. of this Agreement) in 1961;

WHEREAS, modification of the Existing Project for ecosystem restoration and municipal and industrial water supply is authorized by Section 101 (b) (15) of Public Law 106-53 to be carried out by the Secretary substantially in accordance with the plans, and subject to the conditions, recommended in a final report of the Chief of Engineers;

WHEREAS, the Government and the Non-Federal Sponsor desire to enter into a Project Cooperation Agreement for implementation of the project for ecosystem restoration and municipal and industrial water supply at Howard Hanson Dam, Washington, (hereinafter the "Project Modifications", as defined in Article I.B. of this Agreement);

WHEREAS, Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, specifies the cost-sharing requirements applicable to this Project Modification; and the Water Supply Act of 1958, as amended (43 U.S.C. 390b-f) specifies additional payment of costs by the Non-Federal Sponsor for the use of storage added to the Existing Project by action of this agreement for municipal and industrial water supply;

WHEREAS, Section 215 of the Flood Control Act of 1968, Public Law 90-483, as amended, provides that the Secretary of the Army may enter into an agreement to credit the costs of



certain work accomplished by States or political subdivisions thereof, which later is incorporated by the Government into an authorized project, when it is determined that such credit is in the public interest;

WHEREAS, Section 215 of the Flood Control Act of 1968, Public Law 90-483, as amended, limits Federal credit or reimbursement for a single project to not more than \$5,000,000 or one percent of the project costs, whichever is greater;

WHEREAS, Section 221 of the Flood Control Act of 1970, Public Law 91-611, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, provide that the Secretary of the Army shall not commence construction of any water resources project, or separable element thereof, until each non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element;

WHEREAS, Section 902 of Public Law 99-662 establishes the maximum amount of costs for the Project Modifications and sets forth procedures for adjusting such maximum amount;

WHEREAS, a Biological Opinion from the National Marine Fisheries Service (NMFS) dated October 24, 2000 specifies reasonable and prudent measures for protection of Puget Sound Chinook Salmon that are related to the operation of the existing project;

WHEREAS, the Government and Non-Federal Sponsor have the full authority and capability to perform as hereinafter set forth and intend to cooperate in cost-sharing and financing of the implementation of the Project Modification in accordance with the terms of this Agreement.

NOW, THEREFORE, the Government and the Non-Federal Sponsor agree as follows:

ARTICLE I - DEFINITIONS AND GENERAL PROVISIONS

For purposes of this Agreement:

A. The term "Existing Project" shall mean Howard Hanson Dam and Reservoir that was authorized on May 17, 1950, by Public Law 516, 81st Congress substantially in accordance with House Document 271 for the purpose of providing flood control and low flow augmentation.

B. The term "Project Modification" shall mean the project modifications for Ecosystem Restoration, and project modifications for Municipal and Industrial Water Supply, all as generally described in a final report of the Chief of Engineers, dated 13 August 1999, and "Additional Water Storage Project, Final Feasibility Study Report & Final EIS", dated August 1998.



C. The term "Mitigation Modifications" shall mean those modifications directly related to the existing project to reduce impacts of the existing project on the Puget Sound Chinook Salmon as identified in the Biological Opinion from the NMFS and consisting of that portion of a downstream juvenile Fish Passage Facility (FPF) that will operate between the reservoir elevations of 1080 and 1147 and other salmon habitat mitigation features such as gravel nourishment and placement of large woody debris downstream of Howard Hanson Dam and the monitoring thereof.

D. The term "Project Modification for Ecosystem Restoration" shall mean construction of fish habitat restoration sites on the Green River and its tributaries in the vicinity of Howard Hanson Dam; the storage of 9600 acre-feet of water behind Howard Hanson Dam for Ecosystem Restoration low flow augmentation; a portion of the north abutment drainage remedies and any other measures the District Engineer finds necessary to modify the dam to properly impound the additional storage for Ecosystem Restoration low flow augmentation, if necessary; and a portion of the downstream juvenile FPF that will operate between the reservoir elevations of 1169 to 1177, as necessitated by the Ecosystem Restoration low flow augmentation water storage pool.

E. The term "Project Modification for Municipal and Industrial Water Supply" shall mean the storage of an additional 22,400 acre-feet of water behind Howard Hanson Dam for Municipal and Industrial use; a portion of the north abutment drainage remedies and any other measures the District Engineer finds necessary to modify the dam to properly impound the additional water supply storage for Municipal and Industrial Water Supply in Phase 1 and Phase 2 Water Supply; that portion of a downstream juvenile FPF that will operate between the reservoir elevations of 1147 to 1169 as necessitated by the additional Municipal and Industrial water supply storage pool; and environmental mitigation features associated with the additional storage such as planting of sedge meadows and creation of sub-impoundments and monitoring of these sites. The project modification for Municipal and Industrial Water Supply will be executed in two operational phases. In Phase 1 the project will store 20,000 acre-feet of Municipal and Industrial water to an elevation of 1167 National Geodetic Vertical Datum (NGVD). In Phase 2 the project will store an additional 12,000 acre-feet of water to elevation 1177 NGVD of which 2,400 acre-feet will be for Municipal and Industrial water supply. Phase 2 will be executed in accordance with the authorizing documents.

F. The term "total project modification costs" shall mean all costs incurred by the Non-Federal Sponsor and the Government in accordance with the terms of this Agreement directly related to implementation of the Project Modification. Subject to the provisions of this Agreement, the term shall include, but is not necessarily limited to, all engineering and design costs, including those incurred in the Pre-construction Engineering and Design (PED) phase; the costs of investigations to identify the existence and extent of hazardous substances in accordance with Article XVI.A. of this Agreement; the costs incurred by the Government for clean-up and response in accordance with Article XVI.C. of this Agreement; costs of historic preservation activities in accordance with Article XIX.A. of this Agreement; actual implementation costs; the amount of credit afforded for the Section 215 work; supervision and administration costs; costs of



participation in the Project Modification Coordination Team in accordance with Article VI of this Agreement; costs of contract dispute settlements or awards; the value of lands, easements, rights-of-way, relocations, and suitable borrow and dredged or excavated material disposal areas for which the Government affords credit in accordance with Article V of this Agreement; and costs of audit in accordance with Article XI of this Agreement. The term does not include any costs for operation, maintenance, repair, replacement, or rehabilitation; any costs due to betterments; or any costs of dispute resolution under Article VIII of this Agreement.

G. The term "total project modification costs for Mitigation Modifications" shall mean those costs that the Government assigns to the Mitigation Modification for construction and monitoring of a downstream juvenile FPF that will operate between the reservoir elevations of 1080 and 1147, but does not include the costs of building the structure to operate above the elevation of 1147. It has been determined by an approved cost allocation analysis that the cost for construction of the downstream FPF that will operate between the reservoir elevations of 1080 and 1147 is 98.4 percent of the total costs for the construction of the downstream juvenile Fish Passage Facility. The term also includes costs for gravel nourishment and placement of large woody debris downstream of Howard Hanson Dam, and other measures in accordance with the project Biological Opinion from the National Marine Fisheries Service (NMFS) dated October 24, 2000 that specifies reasonable and prudent measures for protection of Puget Sound Chinook Salmon that are related to the existing project.

H. The term "total project modification costs for Ecosystem Restoration" shall mean that portion of the total project costs that the Government assigns to the Project Modification for Ecosystem Restoration. It includes all of the Ecosystem Restoration costs for construction and monitoring of fish restoration sites on the Green River and its tributaries in the vicinity of Howard Hanson Dam and 38.8 per cent of the total water supply project joint use construction cost. It does not include measures in accordance with the Biological Opinion from the National Marine Fisheries Service (NMFS) for protection of Puget Sound Chinook Salmon that are related to the existing project.

I. The term "total project modification costs for Municipal and Industrial Water Supply" shall mean that portion of the total project costs that the Government assigns to the Project Modification for Municipal and Industrial Water Supply, and includes 100 per cent of the specific water supply construction costs; 61.2 per cent of the total water supply project modification related joint use costs; and a share of the Existing Project Investment Costs;

J. The term "financial obligation for implementation" shall mean a financial obligation of the Government, or a financial obligation of the Non-Federal Sponsor for Section 215 work, other than an obligation pertaining to the provision of lands, easements, rights-of-way, relocations, and borrow and dredged or excavated material disposal areas, that results or would result in a cost that is or would be included in total project modification costs.

K. The term "implementation" shall mean all actions required to carry out the Project Modification including all actions required for modification in operations of the Existing Project,



but does not include operation, maintenance, repair, replacement and rehabilitation.

L. The term "non-Federal proportionate share" shall mean the ratio of the Non-Federal Sponsor's total cash contribution required in accordance with Article II.D of this Agreement to total financial obligations for implementation as projected by the Government.

M. The term "period of implementation" shall mean the time from the effective date of this Agreement to the date that the District Engineer notifies the Non-Federal Sponsor in writing of the Government's determination that implementation of the Project Modification is complete.

N. The term "highway" shall mean any public highway, roadway, street, or way, including any bridge thereof.

O. The term "relocation" shall mean providing a functionally equivalent facility to the owner of an existing utility, cemetery, highway or other public facility, or railroad when such action is authorized in accordance with applicable legal principles of just compensation or as otherwise provided in the authorizing legislation for the Project Modification or any report referenced therein. Providing a functionally equivalent facility may take the form of alteration, lowering, raising, or replacement and attendant removal of the affected facility or part thereof.

P. The term "fiscal year" shall mean one fiscal year of the Government. The Government fiscal year begins on October 1 and ends on September 30.

Q. The term "functional portion of the Project Modification" shall mean a portion of the Project Modification that is suitable for tender to the Non-Federal Sponsor to operate and maintain in advance of completion of the entire Project Modification. For a portion of the Project Modification to be suitable for tender, the District Engineer must notify the Non-Federal Sponsor in writing of the Government's determination that the portion of the Project Modification is complete and can function independently and for a useful purpose, although the balance of the Project Modification is not complete.

R. The term "betterment" shall mean a change, requested by the project Non-Federal Sponsor, in the design and construction of an element of the Project Modification resulting from the application of standards that the Government determines exceed those that the Government would otherwise apply for accomplishing the design and construction of that element.

S. The term "Section 215 Work" means Project work for which the Government will give credit pursuant to Section 215 of Public Law 90-483. The Section 215 work includes implementation of the authorized improvements for ecosystem restoration work on the Green River, large and small culvert replacements, provision of wood materials for habitat restoration, and installation of electrical utilities, as well as planning, engineering, design, supervision and administration, and other activities associated with implementation, but does not include the implementation of betterments or the provision of lands, easements, rights-of-way, relocations, or



suitable borrow and dredged or excavated material disposal areas associated with the Section 215 work.

T. The term “conservation season” shall mean the annual period at Howard Hanson Dam in which a percentage of reservoir inflows are stored and subsequently released to provide water for Municipal and Industrial use and/or low flow augmentation and is generally the period from late February to early November. It is the opposite of flood control season in which the reservoir storage space is kept evacuated until temporary storage of water is required to prevent flooding downstream of the dam.

U. The term “Specific costs” as used in this agreement shall mean the costs of Project Modification features serving only one particular Project Modification purpose. All of the costs associated with the Mitigation Modification are specific costs. For the Project Modification for Ecosystem Restoration, the specific costs are the costs associated with construction and monitoring of fish habitat restoration sites on the Green River and its tributaries in the vicinity of Howard Hanson Dam. For the Project Modification for Municipal and Industrial Water Supply, the specific costs are the costs associated with construction and monitoring of mitigation features associated with the inundation of existing habitat caused by Phase 1 additional water storage such as planting of sedge meadows and creation of sub-impoundments.

V. The term “Joint-use costs” shall mean the costs of features used for any two or more Project purposes. For the purposes of this agreement, the Joint-use costs shall mean the non-Specific costs of the Project Modification for Municipal and Industrial Water Supply and Ecosystem Restoration low flow augmentation such as north abutment drainage remedies and any other measures the District Engineer finds necessary to modify the dam to properly impound the additional storage for Municipal and Industrial Water Supply and Ecosystem Restoration low flow augmentation in Phase 1 and Phase 2; and that portion of a downstream juvenile FPF that will operate between the reservoir elevations of 1147 to 1177 as necessitated by the additional Municipal and Industrial Water Supply and Ecosystem Restoration low flow augmentation storage pool.

ARTICLE II - OBLIGATIONS OF THE GOVERNMENT AND THE NON-FEDERAL SPONSOR

A. The Government, subject to the availability of funds and using those funds and funds provided by the Non-Federal Sponsor, shall expeditiously implement the Mitigation Modification and the Project Modification, except for Section 215 Work, applying those procedures usually applied to Federal projects, pursuant to Federal laws, regulations, and policies.

1. The Government shall afford the Non-Federal Sponsor the opportunity to review and comment on the solicitations for all contracts, including relevant plans and specifications, prior to the Government's issuance of such solicitations. The Government shall not issue the solicitation for the first contract for implementation until the Non-Federal Sponsor



has confirmed in writing its willingness to proceed with the Project Modification. To the extent possible, the Government shall afford the Non-Federal Sponsor the opportunity to review and comment on all contract modifications, including change orders, prior to the issuance to the contractor of a Notice to Proceed. In any instance where providing the Non-Federal Sponsor with notification of a contract modification or change order is not possible prior to issuance of the Notice to Proceed, the Government shall provide such notification in writing at the earliest date possible. To the extent possible, the Government also shall afford the Non-Federal Sponsor the opportunity to review and comment on all contract claims prior to resolution thereof. The Government shall consider in good faith the comments of the Non-Federal Sponsor, but the contents of solicitations, award of contracts, execution of contract modifications, issuance of change orders, resolution of contract claims, and performance of all work on the Project Modification, with the exception of the Section 215 Work (whether the work is performed under contract or by Government personnel), shall be exclusively within the control of the Government.

2. Throughout the period of implementation, the District Engineer shall furnish the Non-Federal Sponsor with a copy of the Government's Written Notice of Acceptance of Completed Work for each contract for the Project Modification.

3. For Section 215 Work, the Government shall be afforded an opportunity to review and comment on the solicitations for all contracts, including relevant plans and specifications, prior to the Non-Federal Sponsor's issuance of such solicitations. No construction shall commence under this Agreement until the designs, detailed plans and specifications, and arrangements for prosecution of the Section 215 Work have been approved in writing by the District Engineer, or his representative. All bids received and proposed provisions of any contract shall be subject to review by the Government prior to contract award. In addition, all proposed changes in approved designs, plans, and specifications also must be reviewed and approved by the District Engineer or his representative in writing in advance of the related construction where practicable. To the extent possible, the Non-Federal Sponsor also shall afford the Government the opportunity to review and comment on all contract claims prior to resolution thereof. The Non-Federal Sponsor shall consider in good faith the comments of the Government made as a result of its review, but the contents of solicitations, award of contracts, execution of contract modifications, issuance of change orders, resolution of contract claims, and performance of all Section 215 Work shall be exclusively within the control of the Non-Federal Sponsor. However, the failure of the Non-Federal Sponsor to comply with direction received from the District Engineer with respect to the Section 215 Work may result in the costs associated with such work being determined ineligible for credit towards the Non-Federal Sponsor's share of total project costs. The District Engineer or his designee is authorized to inspect the work at any and all times.

B. The Non-Federal Sponsor may request the Government to accomplish betterments. Such requests shall be in writing and shall describe the betterments requested to be accomplished. If the Government in its sole discretion elects to accomplish the requested betterments or any portion thereof, it shall so notify the Non-Federal Sponsor in a writing that sets forth any applicable terms and conditions, which must be consistent with this Agreement. In



the event of conflict between such a writing and this Agreement, this Agreement shall control. The Non-Federal Sponsor shall be solely responsible for all costs due to the requested betterments and shall pay all such costs in accordance with Article VII.C. of this Agreement.

C. The Government shall allocate all costs between total project modification costs for Mitigation Modification and total project modification costs, and shall allocate all costs to be included in total project modification costs to total project modification costs for Ecosystem Restoration and total project modification costs for Municipal and Industrial Water Supply.

D. The Government shall contribute 100 percent of the total project modification costs for the Mitigation Modification and 65% of the total project modification costs for Ecosystem Restoration. The Non-Federal Sponsor shall contribute 100 percent of the total project modification costs allocable to Municipal and Industrial Water Supply, and 35 percent of total project modification costs allocable to Ecosystem Restoration.

1. In accordance with Article IV of this Agreement, the Non-Federal Sponsor shall provide all lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas that the Government determines must be provided for the implementation, operation, and maintenance of the Project Modification for Municipal and Industrial Water Supply and the Project Modification for Ecosystem Restoration, and shall perform or ensure performance of all relocations that the Government determines to be necessary for the implementation, operation, and maintenance of such modifications.

2. As authorized by Section 215 of Public Law 90-483, as amended, the Government may afford credit toward the Non-Federal Sponsor's total contribution required in accordance with paragraph D of this Article for Section 215 Work that may be performed to implement the Project Modification for Ecosystem Restoration. The affording of such credit shall be subject to a technical review by the Government to verify that the credited work was accomplished in a satisfactory manner and in accordance with the limitations contained in this Agreement. To afford any such credit, the Government, as further specified in Article VII.B of this Agreement, shall apply the actual amount of credit toward the Non-Federal Sponsor's contribution required by paragraph D of this Article. The actual amount of credit shall not exceed the Non-Federal Sponsor's actual costs attributable to the Section 215 Work. Such credit may be afforded in increments as useful increments of the Section 215 Work are completed by the Non-Federal Sponsor. The actual amount of credit shall be subject to an audit in accordance with Article XI.C of this Agreement to determine reasonableness, allocability, and allowability of costs. If the actual amount of credit exceeds the cash contribution required by paragraph D of this Article, the Government, subject to the availability of funds, shall, on behalf of the Non-Federal Sponsor, provide Project lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas, or perform Project relocations, equal in value to such excess credit amount. As an alternative, and in its sole discretion, the government may, subject to the availability of funds, reimburse the Non-Federal Sponsor in an amount equal to such excess credit amount.



3. If the Government projects that the value of the Non-Federal Sponsor's contributions under paragraph D.1 and D.2 of this Article and Articles VI, XI, and XVI.A of this Agreement will be less than the Non-Federal Sponsor's total contribution required in accordance with paragraph D of this Article, the Non-Federal Sponsor shall provide an additional cash contribution, in accordance with Article VII.B, in the amount necessary to make the Non-Federal Sponsor's total contribution equal to that required in accordance with paragraph D of this Article.

4. If the Government determines that the value of the Non-Federal Sponsor's contributions provided under paragraphs D.1 and D.2 of this Article and Articles VI, XI, and XVI.A of this Agreement has exceeded the Non-Federal Sponsor's total contribution required in accordance with paragraph D of this Article, the Government, subject to the availability of funds, shall reimburse the Non-Federal Sponsor for any such value in excess of the Non-Federal sponsor's total contribution required in accordance with paragraph D of this Article. After such a determination, the Government, in its sole discretion, may provide any remaining Project Modification lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas and perform any remaining Project Modification relocations on behalf of the Non-Federal Sponsor. Notwithstanding the provision of lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas or performance of relocations by the Government under this paragraph, the Non-Federal Sponsor shall be responsible, as between the Government and the Non-Federal Sponsor, for the costs of cleanup and response in accordance with Article XVI.C. of this Agreement.

E. The Government and the Non-Federal Sponsor shall operate, maintain, repair, replace, and rehabilitate the Project Modification and the Mitigation Modification according to this paragraph, Article III, and Article IX of this agreement.

1. When the District Engineer determines that the entire Fish Habitat component of the Project Modification for Ecosystem Restoration is complete or that a portion of the Fish Habitat component of the Project Modification for Ecosystem Restoration has become a functional portion of the Project Modification, the District Engineer shall so notify the Non-Federal Sponsor in writing and furnish the Non-Federal Sponsor with an Operation, Maintenance, Repair, Replacement, and Rehabilitation Manual (hereinafter the "OMRR&R Manual") and with copies of all of the Government's Written Notices of Acceptance of Completed Work for all contracts for the Fish Habitat component of the Project Modification for Ecosystem Restoration or the functional portion of the Fish Habitat component of the Project Modification for Ecosystem Restoration that have not been provided previously. Upon such notification, the Non-Federal Sponsor shall operate, maintain, repair, replace, and rehabilitate the Fish Habitat component of the Project Modification for Ecosystem Restoration or the functional portion of the Fish Habitat component of the Project Modification for Ecosystem Restoration in accordance with Article IX of this Agreement.

2. The Government shall operate, maintain, repair, replace, and rehabilitate the Mitigation Modifications.



3. The Government shall operate, maintain, repair, replace and rehabilitate the Project Modification for Municipal and Industrial Water Supply and Ecosystem Restoration low flow augmentation including OMRR&R of any measures to modify the dam to properly impound the additional storage of water. The Non-Federal Sponsor shall pay all costs of operation, maintenance, repair, replacement, and rehabilitation of the Project Modification for Municipal and Industrial Water Supply and Ecosystem Restoration low flow augmentation in accordance with Article III, VII, and IX of this document. The Non-Federal Sponsor shall also pay a share of the operation, maintenance, repair, replacement, and rehabilitation of the existing project, according to Articles III and VII of this document.

F. In addition to any other limitations contained in this Agreement, the affording and the amount of Section 215 credit is subject to the following additional limitations:

1. No credit shall be given until the District Engineer has certified that the work subject to the credit has been completed and performed in accordance with the terms of this Agreement.

2. This Agreement shall not be construed as committing the Government to assume any responsibilities placed upon the Non-Federal Sponsor or any other non-Federal entity by the conditions of Federal Project authorization or any other applicable statute or regulation or as committing the Government to reimburse the Non-Federal Sponsor if the Project Modification is not undertaken or is modified so as to make the work performed by the Non-Federal Sponsor no longer an integral part of the authorized Project.

3. The amount of credit or reimbursement, or combination thereof, to be provided by the Government to the Non-Federal Sponsor shall not exceed the Government's estimate of what the cost of the proposed work would be if it were to be accomplished by the Government as a component of the Project modification, or the Non-Federal Sponsor's actual auditable costs for the proposed work, whichever is less. Credit shall not be made for any work that does not, in the judgment of the Government, conform to the Project Modification.

4. The amount of credit provided by the Government to the Non-Federal Sponsor for the Proposed Work described herein, in combination with any credit or reimbursement provided pursuant to Section 215 for the Project Modification, shall not exceed the statutory limitation of \$5,000,000 or one percent of total project costs, whichever is greater.

5. The amount of credit or reimbursement for which the Non-Federal Sponsor may be eligible pursuant to this Agreement is neither subject to interest charges nor to adjustment to reflect changes in price levels between the time the proposed work is completed and the time that the credit or reimbursement is afforded.

6. No credit or reimbursement shall be afforded for costs incurred by the Non-Federal Sponsor before the effective date of this Agreement.



G. The Non-Federal Sponsor may request the Government to provide lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas or perform relocations on behalf of the Non-Federal Sponsor. Such requests shall be in writing and shall describe the services requested to be performed. If in its sole discretion the Government elects to perform the requested services or any portion thereof, it shall so notify the Non-Federal Sponsor in a writing that sets forth any applicable terms and conditions, which must be consistent with this Agreement. In the event of conflict between such a writing and this Agreement, this Agreement shall control. The Non-Federal Sponsor shall be solely responsible for all costs of the requested services and shall pay all such costs in accordance with Article VII.C. of this Agreement. Notwithstanding the provision of lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas or performance of relocations by the Government under this paragraph, the Non-Federal Sponsor shall be responsible, as between the Government and the Non-Federal Sponsor, for the costs of cleanup and response in accordance with Article XVI.C. of this Agreement.

H. The Government shall perform a final accounting in accordance with Article VII.D of this Agreement to determine the contributions provided by the Non-Federal Sponsor in accordance with paragraphs B, D, and G. of this Article and Articles VI, XI, and XVI.A of this Agreement and to determine whether the Non-Federal Sponsor has met its obligations under paragraphs B, D, and G of this Article.

I. The Non-Federal Sponsor shall not use Federal funds to meet its share of total project modification costs under this Agreement unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized by statute.

J. Crediting and/or reimbursement is subject to satisfactory compliance with applicable federal labor laws covering non-Federal construction, including, but not limited to applicable federal labor standards in 40 U.S.C. 3141–3148 and 40 U.S.C. 3701-3708 (revising, codifying and enacting without substantive change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a *et seq.*), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 *et seq.*) and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c)). Crediting and/or reimbursement may be withheld, in whole or in part, as a result of the Non-Federal Sponsor's failure to comply with its obligations under these laws.

K. The Non-Federal Sponsor shall prescribe and enforce regulations, within its authority, to prevent obstructions of or encroachment on the Project Modification and the Mitigation Modification that would reduce or hinder the operation or maintenance of the Project Modification and the Existing Project, including the Mitigation Modification.

ARTICLE III – WATER SUPPLY STORAGE

A. The Government, subject to the directions of Federal law and any limitations imposed thereby, shall modify the Existing Project so as to include the storage of water for use by the Non-Federal Sponsor. The Non-Federal Sponsor shall have the right to utilize the usable



storage space in the Project Modification between elevations 1147 feet and 1167 feet above National Geodetic Vertical Datum for Phase 1 Municipal and Industrial water supply, which usable storage space is estimated to contain 20,000 acre-feet after adjustment for sediment deposits; and the usable storage space in the Project Modification between elevations 1147 feet and 1177 feet above National Geodetic Vertical Datum for Phase 2 water supply, which usable storage space is estimated to contain 32,000 acre-feet after adjustment for sediment deposits, 22,400 acre-feet for Municipal and Industrial water and 9,600 acre-feet for Ecosystem Restoration low flow augmentation.

B. The Non-Federal Sponsor shall have the right to withdraw water from the lake, or to request releases to be made by the Government through the outlet works in the Dam, subject to the provisions of Article III.C and to the extent the aforesaid storage space will provide, and shall have the right to construct all such works, plants, pipelines, and appurtenances as may be necessary and convenient for the purpose of diversion or withdrawals, subject to the approval of the District Engineer as to design and location. The grant of an easement for right-of-way, across, in and upon land of the Government at the Howard Hanson Dam and Reservoir shall be by a separate instrument in a form satisfactory to the Secretary of the Army, without additional cost to the Non-Federal Sponsor, under the authority of and in accordance with the provisions of 10 U.S.C. 2669 and such other authorities as may be necessary. Subject to the conditions of such easement, the Non-Federal Sponsor shall have the right to use so much of the Howard Hanson Dam and Reservoir land as may reasonably be required in the exercise of the rights and privileges granted under this agreement.

C. The Government reserves the right to control and use all storage in the Existing Project or Project Modification in accordance with authorized purposes of Howard Hanson Dam and Reservoir. The Government further reserves the right to take such measures as may be necessary in the operation of the Howard Hanson Dam and Reservoir to preserve life and/or property, including the right not to make downstream releases during such periods of time as are deemed necessary, in its sole discretion, to inspect, maintain, or repair the Howard Hanson Dam and Reservoir.

D. The Non-Federal Sponsor recognizes that the Government provides storage space for raw water and makes no representations with respect to the quality or availability of water and assumes no responsibility therefore, or for the treatment of the water.

E. Sedimentation Surveys.

1. Sedimentation surveys will be made by the District Engineer at intervals not to exceed fifteen (15) years unless the District Engineer determines that such surveys are unnecessary. When, in the opinion of the District Engineer, the findings of such survey indicate any Project purpose will be affected by unanticipated sedimentation distribution, there shall be an equitable redistribution of the sediment reserve storage space among the purposes served by the Howard Hanson Dam and Reservoir including Municipal and Industrial water supply. The total available remaining storage space in the Howard Hanson Dam and Reservoir will then be divided



among the various Howard Hanson Dam and Reservoir features in the same ratio as was initially utilized. Adjusted pool elevations will be rounded to the nearest one-half foot. Such findings and the storage space allocated to Municipal and Industrial water supply shall be defined and described as an exhibit that will be made a part of this agreement and the water control manual will be modified accordingly.

2. The Government assumes no responsibility for deviations from estimated rates of sedimentation, or the distribution thereof. Such deviations may cause unequal distribution of sediment reserve storage greater than estimated, and/or encroachment on the total storage at the Project.

F. The regulation of the use of water withdrawn or released from the aforesaid storage space shall be the sole responsibility of the Non-Federal Sponsor. The Non-Federal Sponsor has the full responsibility to acquire in accordance with State laws and regulations, and, if necessary, to establish or defend, any and all water rights needed for utilization of the storage provided under this agreement. The Government shall not be responsible for diversions by others, nor will it become a party to any controversies involving the use of the storage space by the User except as such controversies may affect the operations of the Howard Hanson Dam and Reservoir by the Government.

G. The Government shall operate, maintain, repair, replace, and rehabilitate the Project Modification for Municipal and Industrial Water Supply and Ecosystem Restoration low flow augmentation and the Non-Federal Sponsor shall pay to the Government the costs to operate, maintain, repair, replace, and rehabilitate the project as provided in paragraph I of this Article. The Non-Federal Sponsor shall be responsible for operation and maintenance of all installations and facilities that it may construct for the diversion or withdrawal of water, and shall bear all costs of construction, operation and maintenance of such installations and facilities.

H. The Non-Federal Sponsor agrees to furnish and install, without cost to the Government, suitable meters or measuring devices satisfactory to the District Engineer for the measurement of water which is withdrawn from the Howard Hanson Dam and Reservoir by any means other than through the Howard Hanson Dam and Reservoir outlet works. The Non-Federal Sponsor shall furnish to the Government monthly statements of all such withdrawals. Prior to the construction of any facilities for withdrawal of water from the Howard Hanson Dam and Reservoir, the Non-Federal Sponsor will obtain the District Engineer's approval of the design, location and installation of the facilities including the meters or measuring devices. Such devices shall be available for inspection by Government representatives at all reasonable times. Releases from the water supply storage space through the Howard Hanson Dam and Reservoir outlet works shall be made in accordance with written schedules furnished by the Non-Federal Sponsor and approved by the District Engineer and shall be subject to Article III.C. The measure of all such releases shall be by means of a rating curve of the outlet works, or by such other suitable means as may be agreed upon prior to use of the water supply storage space.

I. In consideration of the right to utilize the Project Modification for Municipal and



Industrial Water Supply, the Non-Federal Sponsor shall pay to the government the applicable costs of the Project Modifications for Municipal and Industrial Water Supply and Ecosystem Restoration low flow augmentation; a share of the Existing Project Investment Costs; applicable Municipal and Industrial Water Supply and Ecosystem Restoration low flow augmentation Project Modification Operation, Maintenance, Repair, Rehabilitation, and Replacement (OMRR&R) Costs; and a share of the existing project OMRR&R costs; as described below and as listed in Articles II and IX of this agreement utilizing the methods of payment listed in this Article and Article VII of this agreement.

1. The Non-Federal Sponsor shall contribute 100 percent of the specific project modification costs for Municipal and Industrial Water Supply. In addition, the Non-Federal Sponsor shall pay 61.2 percent of the joint use costs for Municipal and Industrial Water Supply and Ecosystem Restoration low flow augmentation, in accordance with the provisions of Article VII of this agreement. The Non-federal sponsor's share of the joint use costs for Municipal and Industrial Water Supply and Ecosystem Restoration low flow augmentation includes 1.6 percent of the costs for the construction of the downstream juvenile Fish Passage Facility as determined by an approved cost allocation analysis.

2. The Non-Federal Sponsor shall pay a share of the existing project investment costs as required by law, equal to one half the difference of the least cost alternative of providing equivalent water supply less the present-worth cost of the total project modification costs for Municipal and Industrial Water Supply, in accordance with the provisions of this paragraph. At the time of authorization of the project, this amount was estimated to be \$842,000. This amount will be revised at the end of the period of implementation by adjusting it for inflation. The inflation factor is hereby set in this agreement to be 2.7 percent per year until such time as the District Engineer notifies the Non-Federal Sponsor in writing that the project for water supply is complete and that storage of water will commence. This cost shall be paid in accordance with Article VII.B of this agreement.

3. The Non-Federal Sponsor will be required to pay 100 percent of the cost of any repair, rehabilitation, or replacement of the water supply facilities for the Municipal and Industrial Water Supply and Ecosystem Restoration low flow augmentation project modifications including all costs required to repair, replace, and rehabilitate that part of the downstream juvenile FPF above elevation 1147 to elevation 1177. The cost of the repair, replacement, and rehabilitation of the additional structure of the downstream juvenile FPF required to operate above the elevation of 1147 to the elevation of 1177 shall be set by this agreement to be 2.2 percent of the total costs of the repair, replacement, and rehabilitation of the downstream juvenile FPF. In addition, the Non-Federal Sponsor will be required to pay 7.8% of the annual net costs of joint-use repair, rehabilitation, or replacement of existing project facilities during Phase 1 water storage and 8.8% of the annual net costs of joint-use repair, rehabilitation, or replacement of existing project facilities during Phase 2 water storage. Not less than 120 calendar days prior to the scheduled date for issuance of the solicitation for any construction contract required for the Repair, and/or Replacement, and/or Rehabilitation of specific or joint-use facilities, the Government shall notify the Non-Federal Sponsor in writing of such scheduled date and the



funds the Government determines to be required from the Non-Federal Sponsor for the construction. Not later than such scheduled date, the Non-Federal Sponsor shall provide the Government with the full amount of the required funds by delivering a check payable to "FAO, USAED, Seattle District" to the District Engineer. If at any time during the construction required for Repair, and/or Replacement, and/or Rehabilitation of specific or joint-use facilities the Government determines that additional funds will be needed from the Non-Federal Sponsor to cover the financial obligations for construction, the Government shall notify the Non-Federal Sponsor in writing of the additional funds required, and the Non-Federal Sponsor, no later than 60 calendar days from receipt of such notice, shall make the additional required funds available through the payment mechanism specified above in this paragraph.

4. The Non-Federal Sponsor will be required to pay 100 percent of the cost of Annual Operation and Maintenance (O&M) Expense of Municipal and Industrial Water Supply and Ecosystem Restoration low flow augmentation facilities, including all costs required to operate and maintain that part of the downstream juvenile FPF that will operate above elevation 1147 to elevation 1177, in accordance with Article IX of this Agreement. In addition, the Non-Federal Sponsor will be required to pay 7.8% of the annual experienced joint-use O&M expense of the project during Phase 1 water storage and 8.8% of the annual experienced joint-use O&M expense of the project during Phase 2 water storage. Payments for such O&M expenses are due and payable in advance of the annual reservoir conservation pool refill beginning date and shall be based on O&M costs for the Government fiscal year most recently ended. The amount of each annual payment will be the actual experienced O&M expense for Municipal and Industrial Water Supply and Ecosystem Restoration low flow augmentation plus the proper percentage of the actual experienced O&M expense for existing facilities for the preceding fiscal year or an estimate thereof when actual expense information is not available. Not later than such scheduled date, the Non-Federal Sponsor shall provide the Government with the full amount of the required funds by delivering a check payable to "FAO, USAED, Seattle District" to the District Engineer.

5. If the Non-Federal Sponsor shall fail to make any of the annual O&M Expense payments when due, then the overdue payments shall bear interest compounded annually until paid. The interest rate to be used for overdue payments due shall be that determined by the Department of Treasury's Treasury Fiscal Requirements Manual (1 TFRM 6-8000, "Cash Management"). The amount charged on payments overdue for a period of less than one year shall be figured on a monthly basis. For example, if the payment is made within the first month after being overdue after a 15-day grace period from the anniversary date of the date of notification, one month's interest shall be charged. Thereafter a month's interest will be charged for any portion of each succeeding month that the payment is delinquent. This provision shall not be construed as giving the Non-Federal Sponsor a choice of either making payments when due or paying interest, nor shall it be construed as waiving any other rights of the Government, at law or in equity, which might result from any default by the Non-Federal Sponsor.

J. Upon completion of contributions by the Non-Federal Sponsor, as provided in



Article II. D, and III.I.1 and 2, the Non-Federal Sponsor shall have a permanent right under the provisions of the Act of 16 October 1963 (Public Law 88-140, 43 USC 390e), to the use of the water supply storage space in the Howard Hanson Dam and Reservoir as provided in this Article, subject to the following:

1. The Non-Federal Sponsor shall continue payment of annual operation and maintenance costs allocated to specific and joint-use water supply.

2. The Non-Federal Sponsor shall bear the costs allocated to water supply of any necessary reconstruction, rehabilitation, or replacement of Project features which may be required to continue satisfactory operation of the Project. Such costs will be established by the District Engineer, and repayment arrangements shall be in accordance with the terms and conditions set forth in this Article and Article VII of this agreement for reconstruction, rehabilitation, and replacement costs, and be made a part of this agreement.

3. The District Engineer shall re-determine the storage space for Municipal and Industrial Water Supply in accordance with the provisions of Article III.E. Such re-determination of reservoir storage capacity may be further adjusted from time to time as the result of sedimentation resurveys to reflect actual rates of sedimentation.

4. The permanent rights of the Non-Federal Sponsor under this agreement shall be continued so long as the Government continues to operate Howard Hanson Dam and Reservoir. In the event the Government or its successor in interest in the Howard Hanson Dam and Reservoir no longer operates Howard Hanson Dam and Reservoir, such rights shall be continued subject to the execution of a separate agreement or additional supplemental agreement providing for:

(a) continued operation by the Non-Federal Sponsor of such part of the facility as is necessary for utilization of the water supply storage space allocated to it;

(b) if deemed necessary, terms which will protect the public interest; and

(c) effective absolvment of the Government by the Non-Federal Sponsor from liability in connection with such continued operation.

(d) no significant increase in cost or obligations to the Non-Federal Sponsor.

K. Transfers and Assignments.

1. The User shall not transfer or assign any water storage rights acquired under this Agreement, nor sub-allot said water supply storage space or any part thereof, nor grant any interest, privilege or license whatsoever in connection with this agreement, without the approval of the Secretary of the Army, or his duly authorized representative provided that, unless contrary to the public interest, this restriction shall not be construed to apply to any water that



may be obtained from the water supply storage space by the Non-Federal Sponsor and furnished to any third party or parties, nor any method of allocation thereof.

2. Regarding approval of assignments, references to restriction of assignments shall not apply to any transfer or assignment to the Rural Economic Community Development (RECD), formerly Farmers Home Administration, or its successor agency, or nominee, given in connection with the pledging of this agreement as security for any loans or arising out of the foreclosure or liquidation of said loans. The Non-Federal Sponsor will notify the Corps in writing 15 days prior to applying for a RECD loan. A copy of the final loan instrument will be furnished to the Corps for their record.

3. In the event Howard Hanson Dam is transferred to another entity, all rights, interests and responsibilities of the Government and the Non-Federal Sponsor are assignable, subject to Congressional authorization.

L. After the period of implementation is complete, should the Non-federal Sponsor desire to terminate its responsibilities for the Project Modification for Municipal and Industrial Water Supply, it shall give 180 day's written notice to the Government of its intent.

1. If the Government determines it to be in its best interests to terminate that part of the Agreement, the Government shall conduct a final accounting to determine the Non-Federal Sponsor's portion of costs for repair, rehabilitation and/or replacement of the construction related to Municipal and Industrial Water Supply, and furnish the Non-Federal Sponsor with the results of the final accounting.

2. In the event that the final accounting shows that the Non-Federal Sponsor is responsible for a portion of the costs of repair, rehabilitation and/or replacement any component of the Project Modification for Municipal and Industrial Water Supply, the Non-Federal Sponsor shall, no later than 90 calendar days after receipt of written notice, make a cash payment to the Government of whatever sum is required to meet the Non-Federal Sponsor's required share of such costs.

ARTICLE IV - LANDS, RELOCATIONS, DISPOSAL AREAS, AND PUBLIC LAW 91-646 COMPLIANCE

A. The Government, after consultation with the Non-Federal Sponsor, shall determine the lands, easements, and rights-of-way required for the implementation, operation, and maintenance of the Project Modification, including those required for relocations, borrow materials, and dredged or excavated material disposal. The Government shall indicate which of the required lands, easements, and rights-of-way are required for the Project Modification for Ecosystem Restoration and the Project Modification for Municipal and Industrial Water Supply. The Government in a timely manner shall provide the Non-Federal Sponsor with general written descriptions, including maps as appropriate, of the lands, easements, and rights-of-way that the Government determines the Non-Federal Sponsor must provide, in detail sufficient to enable the



Non-Federal Sponsor to fulfill its obligations under this paragraph, and shall provide the Non-Federal Sponsor with a written notice to proceed with acquisition of such lands, easements, and rights-of-way. Prior to the end of the period of implementation, the Non-Federal Sponsor shall acquire all lands, easements, and rights-of-way set forth in such descriptions. Furthermore, prior to issuance of the solicitation for each construction contract, the Non-Federal Sponsor shall provide the Government with authorization for entry to all lands, easements, and rights-of-way the Government determines the Non-Federal Sponsor must provide for that contract. The Non-Federal Sponsor shall ensure that lands, easements, and rights-of-way that the Government determines to be required for the operation and maintenance of the Project Modification and that were provided by the Non-Federal Sponsor are retained in public ownership for uses compatible with the authorized purposes of the Project Modification.

B. The Government, after consultation with the Non-Federal Sponsor, shall determine the improvements required on lands, easements, and rights-of-way to enable the proper disposal of dredged or excavated material associated with the implementation, operation, and maintenance of the Project Modification. The Government shall delineate which of the required improvements are associated with the Project Modification for Ecosystem Restoration and the Project Modification for Municipal and Industrial Water Supply. Such improvements may include, but are not necessarily limited to, retaining dikes, waste-weirs, bulkheads, embankments, monitoring features, stilling basins, and de-watering pumps and pipes. The Government in a timely manner shall provide the Non-Federal Sponsor with general written descriptions of such improvements in detail sufficient to enable the Non-Federal Sponsor to fulfill its obligations under this paragraph, and shall provide the Non-Federal Sponsor with a written notice to proceed with construction of such improvements. Prior to the end of the period of implementation, the Non-Federal Sponsor shall provide all improvements set forth in such descriptions. Furthermore, prior to issuance of the solicitation for each Government construction contract, the Non-Federal Sponsor shall prepare plans and specifications for all improvements the Government determines to be required for the proper disposal of dredged or excavated material under that contract, submit such plans and specifications to the Government for approval, and provide such improvements in accordance with the approved plans and specifications.

C. The Government, after consultation with the Non-Federal Sponsor, shall determine the relocations necessary for the implementation, operation, and maintenance of the Project Modification, including those necessary to enable the removal of borrow materials and the proper disposal of dredged or excavated material. The Government shall delineate which of the relocations are necessary for the Project Modification for Ecosystem Restoration and the Project Modification for Municipal and Industrial Water Supply. The Government in a timely manner shall provide the Non-Federal Sponsor with general written descriptions, including maps as appropriate, of such relocations in detail sufficient to enable the Non-Federal Sponsor to fulfill its obligations under this paragraph, and shall provide the Non-Federal Sponsor with a written notice to proceed with such relocations. Prior to the end of the period of implementation, the Non-Federal Sponsor shall perform or ensure the performance of all relocations as set forth in such descriptions. Furthermore, prior to issuance of the solicitation for each Government construction contract, the Non-Federal Sponsor shall prepare or ensure the preparation of plans



and specifications for, and perform or ensure the performance of, all relocations the Government determines to be necessary for that contract.

D. The Non-Federal Sponsor in a timely manner shall provide the Government with such documents as are sufficient to enable the Government to determine the value of any contribution provided pursuant to paragraphs A., B., or C. of this Article. Upon receipt of such documents the Government, in accordance with Article V of this Agreement and in a timely manner, shall determine the value of such contribution, include such value in total project modification costs, and afford credit for such value toward the Non-Federal Sponsor's share of total project modification costs for Ecosystem Restoration.

E. The Non-Federal Sponsor shall comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 C.F.R. Part 24, in acquiring lands, easements, and rights-of-way required for the implementation, operation, and maintenance of the Project Modification, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, and shall inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

F. The Government shall make available to the Non-Federal Sponsor by lease those lands administered by the Government that the Government determines to be required for the implementation, operation and maintenance of the Project Modification. If there is an existing lease or license covering the property required for the Project Modification, such lease will be modified to delete this area prior to the issuance of the lease or license to the Non-Federal Sponsor of the Project Modification. No provision of this Agreement shall merge into any lease executed pursuant to this paragraph.

ARTICLE V - CREDIT FOR LANDS, RELOCATIONS, AND DISPOSAL AREAS

A. The Non-Federal Sponsor shall receive credit toward its share of total project modification costs for the value of the lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas that the Non-Federal Sponsor must provide pursuant to Article IV of this Agreement for the Project Modification for Ecosystem Restoration.

The Non-Federal Sponsor shall also receive credit for the value of the relocations that the Non-Federal Sponsor must perform or for which it must ensure performance pursuant to Article IV of this Agreement for the Project Modification for Ecosystem Restoration. However, the Non-Federal Sponsor shall not receive credit for the value of any lands, easements, rights-of-way, relocations, or borrow and dredged or excavated material disposal areas that have been provided previously as an item of cooperation for another Federal project, including the Existing Project. The Non-Federal Sponsor also shall not receive credit for the value of lands, easements, rights-of-way, relocations, or borrow and dredged or excavated material disposal areas to the extent that such items are provided using Federal funds unless the Federal granting agency verifies in



writing that such credit is expressly authorized by statute. For lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas that the Non-Federal Sponsor must provide pursuant to Article IV of this Agreement related to the Project Modification for Municipal and Industrial Water Supply, no credit shall be provided.

B. For the sole purpose of affording credit in accordance with this Agreement, the value of lands, easements, and rights-of-way, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, shall be the fair market value of the real property interests, plus certain incidental costs of acquiring those interests, as determined in accordance with the provisions of this paragraph.

1. Date of Valuation. The fair market value of lands, easements, or rights-of-way owned by the Non-Federal Sponsor on the effective date of this Agreement shall be the fair market value of such real property interests as of the date the Non-Federal Sponsor provides the Government with authorization for entry thereto. However, for lands, easements, or rights-of-way owned by the Non-Federal Sponsor on the effective date of this Agreement that are required for the construction of the Section 215 work, fair market value shall be the value of such real property interests as of the date the Non-Federal Sponsor awards the first construction contract for the Section 215 work, or, if the Non-Federal Sponsor performs the implementation with its own labor, the date that the Non-Federal Sponsor begins implementation of the Section 215 work. The fair market value of lands, easements, or rights-of-way acquired by the Non-Federal Sponsor after the effective date of this Agreement shall be the fair market value of such real property interests at the time the interests are acquired.

2. General Valuation Procedure. Except as provided in paragraph B.3. of this Article, the fair market value of lands, easements, or rights-of-way shall be determined in accordance with paragraph B.2.a. of this Article, unless thereafter a different amount is determined to represent fair market value in accordance with paragraph B.2.b. of this Article.

a. The Non-Federal Sponsor shall obtain, for each real property interest, an appraisal that is prepared by a qualified appraiser who is acceptable to the Non-Federal Sponsor and the Government. The appraisal must be prepared in accordance with the applicable rules of just compensation, as specified by the Government. The fair market value shall be the amount set forth in the Non-Federal Sponsor's appraisal, if such appraisal is approved by the Government. In the event the Government does not approve the Non-Federal Sponsor's appraisal, the Non-Federal Sponsor may obtain a second appraisal, and the fair market value shall be the amount set forth in the Non-Federal Sponsor's second appraisal, if such appraisal is approved by the Government. In the event the Government does not approve the Non-Federal Sponsor's second appraisal, or the Non-Federal Sponsor chooses not to obtain a second appraisal, the Government shall obtain an appraisal, and the fair market value shall be the amount set forth in the Government's appraisal, if such appraisal is approved by the Non-Federal Sponsor. In the event the Non-Federal Sponsor does not approve the Government's appraisal, the Government, after consultation with the Non-Federal Sponsor, shall consider the Government's and the Non-Federal Sponsor's appraisals and determine an amount based thereon, which shall be deemed to



be the fair market value.

b. Where the amount paid or proposed to be paid by the Non-Federal Sponsor for the real property interest exceeds the amount determined pursuant to paragraph B.2.a. of this Article, the Government, at the request of the Non-Federal Sponsor, shall consider all factors relevant to determining fair market value and, in its sole discretion, after consultation with the Non-Federal Sponsor, may approve in writing an amount greater than the amount determined pursuant to paragraph B.2.a. of this Article, but not to exceed the amount actually paid or proposed to be paid. If the Government approves such an amount, the fair market value shall be the lesser of the approved amount or the amount paid by the Non-Federal Sponsor, but not less than the amount determined pursuant to paragraph B.2.a. of this Article.

3. Eminent Domain Valuation Procedure. For lands, easements, or rights-of-way acquired by eminent domain proceedings instituted after the effective date of this Agreement, the Non-Federal Sponsor shall, prior to instituting such proceedings, submit to the Government notification in writing of its intent to institute such proceedings and an appraisal of the specific real property interests to be acquired in such proceedings. The Government shall have 60 days after receipt of such a notice and appraisal within which to review the appraisal, if not previously approved by the Government in writing.

a. If the Government previously has approved the appraisal in writing, or if the Government provides written approval of, or takes no action on, the appraisal within such 60-day period, the Non-Federal Sponsor shall use the amount set forth in such appraisal as the estimate of just compensation for the purpose of instituting the eminent domain proceeding.

b. If the Government provides written disapproval of the appraisal, including the reasons for disapproval, within such 60-day period, the Government and the Non-Federal Sponsor shall consult in good faith to promptly resolve the issues or areas of disagreement that are identified in the Government's written disapproval. If, after such good faith consultation, the Government and the Non-Federal Sponsor agree as to an appropriate amount, then the Non-Federal Sponsor shall use that amount as the estimate of just compensation for the purpose of instituting the eminent domain proceeding. If, after such good faith consultation, the Government and the Non-Federal Sponsor cannot agree as to an appropriate amount, then the Non-Federal Sponsor may use the amount set forth in its appraisal as the estimate of just compensation for the purpose of instituting the eminent domain proceeding.

c. For lands, easements, or rights-of-way acquired by eminent domain proceedings instituted in accordance with sub-paragraph B.3. of this Article, fair market value shall be either the amount of the court award for the real property interests taken, to the extent the Government determined such interests are required for the implementation, operation, and maintenance of the Project Modification, or the amount of any stipulated settlement or portion thereof that the Government approves in writing.



4. Incidental Costs. For lands, easements, or rights-of-way acquired by the Non-Federal Sponsor within a five-year period preceding the effective date of this Agreement, or at any time after the effective date of this Agreement, the value of the interest shall include the documented incidental costs of acquiring the interest, as determined by the Government, subject to an audit in accordance with Article XI.C. of this Agreement to determine reasonableness, allocability, and allowability of costs. Such incidental costs shall include, but not necessarily be limited to, closing and title costs, appraisal costs, survey costs, attorney's fees, plat maps, and mapping costs, as well as the actual amounts expended for payment of any Public Law 91-646 relocation assistance benefits provided in accordance with Article IV.E. of this Agreement.

C. After consultation with the Non-Federal Sponsor, the Government shall determine the value of relocations in accordance with the provisions of this paragraph.

1. For a relocation other than a highway, the value shall be only that portion of relocation costs that the Government determines is necessary to provide a functionally equivalent facility, reduced by depreciation, as applicable, and by the salvage value of any removed items.

2. For a relocation of a highway, the value shall be only that portion of relocation costs that would be necessary to accomplish the relocation in accordance with the design standard that the State of Washington would apply under similar conditions of geography and traffic load, reduced by the salvage value of any removed items.

3. Relocation costs shall include, but not necessarily be limited to, actual costs of performing the relocation; planning, engineering and design costs; supervision and administration costs; and documented incidental costs associated with performance of the relocation, but shall not include any costs due to betterments, as determined by the Government, nor any additional cost of using new material when suitable used material is available. Relocation costs shall be subject to an audit in accordance with Article XI.C. of this Agreement to determine reasonableness, allocability, and allowability of costs.

4. Crediting for relocations performed within the Project boundaries is subject to satisfactory compliance with applicable federal labor standards in 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3701 (revising, codifying, and enacting without substantive change the provisions of the Davis-Bacon Act (40 U.S.C. 276a *et seq.*), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 *et seq.*) and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c)). Crediting may be withheld, in whole or in part, as a result of the Non-Federal Sponsor's failure to comply with its obligations under these laws.

D. The value of the improvements made to lands, easements, and rights-of-way for the proper disposal of dredged or excavated material shall be the costs of the improvements, as determined by the Government, subject to an audit in accordance with Article XI.C. of this Agreement to determine reasonableness, allocability, and allowability of costs. Such costs shall include, but not necessarily be limited to, actual costs of providing the improvements; planning,



engineering and design costs; supervision and administration costs; and documented incidental costs associated with providing the improvements, but shall not include any costs due to betterments, as determined by the Government.

ARTICLE VI - PROJECT MODIFICATION COORDINATION TEAM

A. To provide for consistent and effective communication, the Non-Federal Sponsor and the Government, not later than 30 days after the effective date of this Agreement, shall appoint named senior representatives to a Project Modification Coordination Team. Thereafter, the Project Modification Coordination Team shall meet regularly until the end of the period of implementation. The Government's Project Manager and a counterpart named by the Non-Federal Sponsor shall co-chair the Project Modification Coordination Team.

B. The Government's Project Manager and the Non-Federal Sponsor's counterpart shall keep the Project Modification Coordination Team informed of the progress of implementation and of significant pending issues and actions, and shall seek the views of the Project Modification Coordination Team on matters that the Project Modification Coordination Team generally oversees.

C. Until the end of the period of implementation, the Project Modification Coordination Team shall generally oversee the Project Modification and the Mitigation Modification, including issues related to design; plans and specifications; scheduling; real property and relocation requirements; real property acquisition; contract awards and modifications; the Section 215 Work; contract costs; the application of and compliance with the standards in 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3701 (revising, codifying, and enacting without substantive change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a *et seq.*), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 *et seq.*) and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c)) for relocations and construction portion of the non-Federal Section 215 Work; the Government's cost projections; final inspection of the entire Project Modification or functional portions of the Project Modification; preparation of the proposed OMRR&R Manual; anticipated requirements and needed capabilities for performance of operation, maintenance, repair, replacement, and rehabilitation of the Project Modification; and other related matters.

D. The Project Modification Coordination Team may make recommendations that it deems warranted to the District Engineer on matters that the Project Modification Coordination Team generally oversees, including suggestions to avoid potential sources of dispute. The Government in good faith shall consider the recommendations of the Project Modification Coordination Team. The Government, having the legal authority and responsibility for implementation of the Project Modification and the Mitigation Modification, has the discretion to accept, reject, or modify the Project Modification Coordination Team's recommendations.

E. The costs of participation in the Project Coordination Team shall be included in total project costs according to project purpose and cost shared in accordance with the provisions of this Agreement.



ARTICLE VII- METHOD OF PAYMENT

A. The Government shall maintain current records of contributions provided by the parties and current projections of total project modification costs and costs due to betterments. By 15 January of each year and at least quarterly thereafter, the Government shall provide the Non-Federal Sponsor with a report setting forth all contributions provided to date and the current projections of total project modification costs, of total costs due to betterments, of the components of total project modification costs, of total project modification costs for the Mitigation Modifications, of total project modification costs for Ecosystem Restoration, of total project modification costs for Municipal and Industrial Water Supply, of each party's share of total project modification costs, of the Non-Federal Sponsor's total cash contributions required in accordance with Articles II.B, II.D, II.G and III.I.2 of this Agreement, of the non-Federal proportionate share, and of the funds the Government projects to be required from the Non-Federal Sponsor for the upcoming fiscal year. On the effective date of this Agreement, costs for the Mitigation Modifications and the Project Modification are projected to be \$83,825,000. Costs for the Mitigation Modification are projected to be \$53,271,000; total Project Modification costs are projected to be \$30,554,000, with \$12,186,000 projected for Ecosystem Restoration and \$18,368,000 projected for Municipal and Industrial Water Supply. The amount of credit for the Section 215 Work to be afforded against the Non-Federal Sponsor's required contribution towards the total project modification costs in accordance with Article II of this Agreement is projected to be \$5,000,000. The Non-Federal Sponsor's cash contribution required under Article II.D and Article III.I.2 of this Agreement is projected to be \$13,055,000. The above amounts are estimates subject to adjustment by the Government and are not to be construed as the total financial responsibilities of the Government and the Non-Federal Sponsor.

B. The Non-Federal Sponsor shall provide the cash contribution required under Article II.B, II.D, II.G, and Article III.I.2 of this Agreement in accordance with the provisions of this paragraph.

1. Not less than 60 calendar days prior to the scheduled date for issuance of the solicitation for the first construction contract, the Government shall notify the Non-Federal Sponsor in writing of such scheduled date and of the funds the Government, after consideration of any credit afforded pursuant to Article II.F of this Agreement, determines to be required from the Non-Federal Sponsor to meet the non-Federal proportionate share of projected financial obligations for implementation through the first fiscal year of implementation, including the non-Federal proportionate share of financial obligations for implementation incurred prior to the period of implementation and including a pro-rated portion of the share of the existing project investment costs identified in Article III.I.2 of this Agreement so that the total amount of the share of the existing project investment costs will be paid within the period of implementation of the Project Modification for Municipal and Industrial Water Supply. Not later than such scheduled date, the Non-Federal Sponsor shall provide the Government with the full amount of the required funds by delivering a check payable to "FAO, USAED, Seattle District" to the District Engineer.



2. For the second and subsequent fiscal years of implementation, the Government shall notify the Non-Federal Sponsor in writing, no later than 60 calendar days prior to the beginning of that fiscal year, of the funds the Government, after consideration of any credit afforded pursuant to Article II.F of this Agreement, determines to be required from the Non-Federal Sponsor to meet the non-Federal proportionate share of projected financial obligations for implementation for that fiscal year including a pro-rated portion of the share of the existing project investment costs identified in Article III.I.2 of this Agreement so that the total amount of the share of the existing project investment costs will be paid within the period of implementation of the Project Modification for Municipal and Industrial Water Supply. No later than 30 calendar days prior to the beginning of the fiscal year, the Non-Federal Sponsor shall make the full amount of the required funds for that fiscal year available to the Government through the funding mechanism specified in Article VII.B.1 of this Agreement.

3. The Government shall draw from the funds provided by the Non-Federal Sponsor such sums as the Government, after consideration of any credit afforded pursuant to Article II.F of this Agreement, deems necessary to cover: (a) the non-Federal proportionate share of financial obligations for implementation incurred prior to the period of implementation; and (b) the non-Federal proportionate share of financial obligations for implementation as they are incurred during the period of implementation, including the Non-Federal Sponsor's share of the existing project investment costs in accordance with Article III.I.2 of this Agreement.

4. If at any time during the period of implementation the Government determines that additional funds will be needed from the Non-Federal Sponsor to cover the non-Federal proportionate share of projected financial obligations for implementation for the current fiscal year, the Government shall notify the Non-Federal Sponsor in writing of the additional funds required, and the Non-Federal Sponsor, no later than 60 calendar days from receipt of such notice, shall make the additional required funds available through the payment mechanism specified in Article VII.B.1 of this Agreement.

5. Upon completion of the final accounting, the Government shall notify the Non-Federal Sponsor in writing of the remaining funds the Government determines to be required from the Non-Federal Sponsor in accordance with Article III.I.2 of this Agreement. No later than 60 calendar days after such notification, the Non-Federal Sponsor shall provide the Government with a check for the full amount of such required funds.

C. In advance of the Government incurring any financial obligation associated with additional work under Article II.B or II.G of this Agreement, the Non-Federal Sponsor shall provide the Government with the full amount of the funds required to pay for such additional work by delivering a check payable to "FAO, USAED, Seattle District" to the District Engineer. The Government shall draw from the funds provided by the Non-Federal Sponsor such sums the Government deems necessary to cover the Government's financial obligations for such additional work as they are incurred. In the event the Government determines that the Non-Federal Sponsor must provide additional funds to meet its cash contribution, the Government shall notify the



Non-Federal Sponsor in writing of the additional funds required. Within 30 calendar days thereafter, the Non-Federal Sponsor shall provide the Government with a check for the full amount of the additional required funds.

D. Upon completion of the Project Modification or termination of this Agreement, and upon resolution of all relevant claims and appeals, the Government shall conduct a final accounting and furnish the Non-Federal Sponsor with the results of the final accounting for the implementation of the Project Modification. The final accounting shall determine total project modification costs, total project modification costs for Ecosystem Restoration, total project modification costs for Municipal and Industrial Water Supply, each party's contribution provided thereto, and each party's required share thereof. The final accounting also shall determine costs due to betterments and the Non-Federal Sponsor's cash contribution provided pursuant to Article II.B of this Agreement.

1. In the event the final accounting shows that the total contribution provided by the Non-Federal Sponsor is less than its required share for the implementation of total project modification costs plus costs due to any betterments provided in accordance with Article II.B of this Agreement, as well as credits associated with the Section 215 Work provided in accordance with Article II.D.2 of this Agreement, the Non-Federal Sponsor shall, no later than 90 calendar days after receipt of written notice, make a cash payment to the Government of whatever sum is required to meet the Non-Federal Sponsor's required share of total project modification costs plus costs due to any betterments provided in accordance with Article II.B of this Agreement.

2. In the event the final accounting shows that the total contribution provided by the Non-Federal Sponsor exceeds its required share of total project modification costs plus costs due to any betterments provided in accordance with Article II.B of this Agreement, the Government shall, subject to the availability of funds, refund the excess to the Non-Federal Sponsor no later than 90 calendar days after the final accounting is complete. In the event existing funds are not available to refund the excess to the Non-Federal Sponsor, the Government shall seek such appropriations as are necessary to make the refund.

E. The method of payment for the Non-Federal Sponsor's financial responsibilities for the OMRR&R of the Project Modification for Municipal and Industrial Water Supply and Ecosystem Restoration low flow augmentation shall be as stated in Article III of this agreement.

ARTICLE VIII- DISPUTE RESOLUTION

As a condition precedent to a party bringing any suit for breach of this Agreement, that party must first notify the other party in writing of the nature of the purported breach and seek in good faith to resolve the dispute through negotiation. If the parties cannot resolve the dispute through negotiation, they may agree to a mutually acceptable method of non-binding alternative dispute resolution with a qualified third party acceptable to both parties. The parties shall each pay 50 percent of any costs for the services provided by such a third party as such costs are incurred. The existence of a dispute shall not excuse the parties from performance pursuant to



this Agreement.

**ARTICLE IX - OPERATION, MAINTENANCE, REPAIR, REPLACEMENT,
AND REHABILITATION (OMRR&R)**

A. Upon notification in accordance with Article II.E of this Agreement and for so long as the Project Modification remains authorized, the Non-Federal Sponsor shall operate, maintain, repair, replace, and rehabilitate the entire Fish Habitat component of the Project Modification for Ecosystem Restoration or the functional portion of the Fish Habitat component of the Project Modification for Ecosystem Restoration, at no cost to the Government, in a manner compatible with the Project Modification's authorized purposes and in accordance with applicable Federal and State laws as provided in Article XII of this Agreement and specific directions prescribed by the Government in the OMRR&R Manual and any subsequent amendments thereto.

B. The Government shall operate, maintain, repair, replace, and rehabilitate the project modifications for Municipal and Industrial Water Supply and Ecosystem Restoration low flow augmentation including OMRR&R of any measures to modify the dam to properly impound the additional storage of water. The Non-Federal Sponsor shall pay to the Government the total costs of OMRR&R allocated to Municipal and Industrial Water Supply and Ecosystem Restoration low flow augmentation in accordance with Article III and Article VII of this Agreement.

C. The Government shall operate, maintain, repair, replace and rehabilitate the Mitigation Modifications.

D. The Government shall operate, maintain, repair, replace and rehabilitate the downstream juvenile Fish Passage Facility. The Non-Federal Sponsor is responsible for all costs of the operation, maintenance, repair, replacement, and rehabilitation of the downstream juvenile Fish Passage Facility above elevation 1147 to elevation 1177 as part of the requirements of paragraph B of this Article, and Article III.I.3 and Article III.I.4 of this Agreement.

E. The Non-Federal Sponsor hereby gives the Government a right to enter, at reasonable times and in a reasonable manner, upon property that the Non-Federal Sponsor owns or controls for access to the Project Modification for the purpose of inspection and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project Modification. If an inspection shows that the Non-Federal Sponsor for any reason is failing to perform its obligations under this Agreement, the Government shall send a written notice describing the non-performance to the Non-Federal Sponsor. If, after 30 calendar days from receipt of the notice, the Non-Federal Sponsor continues to fail to perform, then the Government shall have the right to enter, at reasonable times and in a reasonable manner, upon property the Non-Federal Sponsor owns or controls for access to the Project Modification for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project Modification. No completion, operation, maintenance, repair, replacement, or rehabilitation by



the Government shall operate to relieve the Non-Federal Sponsor's obligations as set forth in this Agreement, or to preclude the Government from pursuing any other remedy at law or equity to ensure faithful performance pursuant to this Agreement.

ARTICLE X - INDEMNIFICATION

The Non-Federal Sponsor shall hold and save the Government free from all damages arising from the implementation, operation, maintenance, repair, replacement and rehabilitation of the Project Modification, except for damages due to the fault or negligence of the Government or its contractors.

ARTICLE XI- MAINTENANCE OF RECORDS AND AUDIT

A. Not later than 60 calendar days after the effective date of this Agreement, the Government and the Non-Federal Sponsor shall develop procedures for keeping books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to this Agreement. These procedures shall incorporate, and apply as appropriate, the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 C.F.R. Section 33.20. The Government and the Non-Federal Sponsor shall maintain such books, records, documents, and other evidence in accordance with these procedures and for a minimum of three years after the period of implementation and resolution of all relevant claims arising therefrom. To the extent permitted under applicable Federal laws and regulations, the Government and the Non-Federal Sponsor shall each allow the other to inspect such books, documents, records, and other evidence.

B. Pursuant to 32 C.F.R. Section 33.26, the Non-Federal Sponsor is responsible for complying with the Single Audit Act of 1984, 31 U.S.C. Sections 7501-7507, as implemented by Office of Management and Budget (OMB) Circular No. A-133 and Department of Defense Directive 7600.10. Upon request of the Non-Federal Sponsor and to the extent permitted under applicable Federal laws and regulations, the Government shall provide to the Non-Federal Sponsor and independent auditors any information necessary to enable an audit of the Non-Federal Sponsor's activities under this Agreement. The costs of any non-Federal audits performed in accordance with this paragraph shall be allocated in accordance with the provisions of OMB Circulars A-87 and A-133, and such costs as are allocated to the Project Modification shall be included in total project modification costs and cost shared in accordance with the provisions of this Agreement.

C. In accordance with 31 U.S.C. Section 7503, the Government may conduct audits in addition to any audit that the Non-Federal Sponsor is required to conduct under the Single Audit Act. Any such Government audits shall be conducted in accordance with Government Auditing Standards and the cost principles in OMB Circular No. A-87 and other applicable cost principles and regulations. The costs of Government audits performed in accordance with this paragraph shall be included in total project modification costs and cost shared in accordance with



the provisions of this Agreement.

ARTICLE XII -FEDERAL AND STATE LAWS

In the exercise of their respective rights and obligations under this Agreement, the Non-Federal Sponsor and the Government agree to comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulations 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army". The Non-Federal Sponsor is also required to comply with all applicable federal labor standards requirements including, but not limited to, the applicable federal labor standards in 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3708 (revising, codifying, and enacting without substantive change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a *et seq.*), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 *et seq.*) and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c)).

ARTICLE XIII - RELATIONSHIP OF PARTIES

A. In the exercise of their respective rights and obligations under this Agreement the Government and the Non-Federal Sponsor each act in an independent capacity, and neither is to be considered the officer, agent, or employee of the other.

B. In the exercise of its rights and obligations under this Agreement, neither party shall provide, without the consent of the other party, any contractor with a release that waives or purports to waive any rights such other party may have to seek relief or redress against such contractor either pursuant to any cause of action that such other party may have or for violation of any law.

ARTICLE XIV - OFFICIALS NOT TO BENEFIT

No member of or delegate to the Congress, nor any resident commissioner, shall be admitted to any share or part of this Agreement, or to any benefit that may arise therefrom.

ARTICLE XV - TERMINATION OR SUSPENSION

A. If at any time the Non-Federal Sponsor fails to fulfill its obligations under Article II.B, II.D, II.G, VII, or XIX.C of this Agreement, the Assistant Secretary of the Army (Civil Works) shall terminate this Agreement or suspend future performance under this Agreement unless he determines that continuation of work on the Project Modification is in the interest of the United States or is necessary in order to satisfy agreements with any other non-Federal interests in connection with the Project Modification.

B. If appropriations are not available in amounts sufficient to meet the Government's share of Project Modification expenditures for the then-current or upcoming fiscal year, the



Government shall so notify the Non-Federal Sponsor in writing, and 60 calendar days thereafter either party may elect without penalty to terminate this Agreement or to suspend future performance under this Agreement. In the event that either party elects to suspend future performance under this Agreement pursuant to this paragraph, such suspension shall remain in effect until such time as the Government receives sufficient appropriations or until either the Government or the Non-Federal Sponsor elects to terminate this Agreement.

C. In the event that either party elects to terminate this Agreement pursuant to this Article or Article XVI of this Agreement, both parties shall conclude their activities relating to the Project Modification and proceed to a final accounting in accordance with Article VII.D. of this Agreement.

D. Any termination of this Agreement or suspension of future performance under this Agreement in accordance with this Article or Article XVI of this Agreement shall not relieve the parties of any obligation previously incurred. Any delinquent payment owed by the Non-Federal Sponsor, except for payments under Article III.I.2, III.I.3, III.I.4, shall be charged interest at a rate, to be determined by the Secretary of the Treasury, equal to 150 per centum of the average bond equivalent rate of the 13-week Treasury bills auctioned immediately prior to the date on which such payment became delinquent, or auctioned immediately prior to the beginning of each additional 3-month period if the period of delinquency exceeds 3 months.

E. The Non-Federal Sponsor may terminate this Agreement without giving cause for its own reasons provided that it gives 180 days written notice to the Government of its intent to terminate and satisfies all existing obligations (set forth in this Agreement) up to the date of termination.

ARTICLE XVI- HAZARDOUS SUBSTANCES

A. After execution of this Agreement and upon direction by the District Engineer, the Non-Federal Sponsor shall perform, or cause to be performed, any investigations for hazardous substances that the Government or the Non-Federal Sponsor determines to be necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (hereinafter "CERCLA"), 42 U.S.C. Sections 9601-9675, that may exist in, on, or under lands, easements, and rights-of-way that the Government determines, pursuant to Article IV of this Agreement, to be required for the implementation, operation, and maintenance of the Project Modification, except for any such lands, easements, or rights-of-way that are owned by the United States and administered by the Government, and except for any such lands that the Government determines to be subject to the navigation servitude. The Government shall perform, or cause to be performed, all investigations on lands, easements, or rights-of-way that are owned by the United States and administered by the Government. For lands that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigations unless the District Engineer provides the Non-Federal Sponsor with prior specific written direction, in which case the Non-Federal Sponsor shall perform such investigations in accordance with such written direction. All



actual costs incurred by the Non-Federal Sponsor or the Government for such investigations for hazardous substances shall be included in total project modification costs as applicable, and cost shared in accordance with the provisions of this Agreement, subject to an audit in accordance with Article XI.C. of this Agreement to determine reasonableness, allocability, and allowability of costs.

B. In the event it is discovered through any investigation for hazardous substances or other means that hazardous substances regulated under CERCLA exist in, on, or under any lands, easements, or rights-of-way, that the Government determines, pursuant to Article IV of this Agreement, the Non-Federal Sponsor must provide for the implementation, operation, and maintenance of the Project Modification, the Non-Federal Sponsor and the Government shall provide prompt written notice to each other, and the Non-Federal Sponsor shall not proceed with the acquisition of the real property interests until both parties agree that the Non-Federal Sponsor should proceed.

C. The Government and the Non-Federal Sponsor shall determine whether to initiate implementation of the Project Modification, or, if already in implementation, whether to continue with work on the Project Modification, suspend future performance under this Agreement, or terminate this Agreement for the convenience of the Government, in any case where hazardous substances regulated under CERCLA are found to exist in, on, or under any lands, easements, or rights-of-way that the Government determines, pursuant to Article IV of this Agreement, to be required for the implementation, operation, and maintenance of the Project Modification. Should the Government and the Non-Federal Sponsor determine to initiate or continue with implementation after considering any liability that may arise under CERCLA, the Non-Federal Sponsor shall be responsible, as between the Government and the Non-Federal Sponsor, for the costs of clean-up and response, to include the costs of any studies and investigations necessary to determine an appropriate response to the contamination. Such costs shall not be considered a part of total project modification costs. In the event the Non-Federal Sponsor fails to provide any funds necessary to pay for clean-up and response costs or to otherwise discharge the Non-Federal Sponsor's responsibilities under this paragraph upon direction by the Government, the Government may, in its sole discretion, either terminate this Agreement for the convenience of the Government, suspend future performance under this Agreement, or continue work on the Project Modification. The Government shall be responsible, as between the Government and the Non-Federal Sponsor, for the costs of clean up and response, to include the costs of any studies and investigations necessary to determine an appropriate response to the contamination on lands, easements, or rights of way owned by the United States and administered by the Government. All costs incurred by the Government shall be included in total project modification costs and cost shared in accordance with the terms of this Agreement.

D. The Non-Federal Sponsor and the Government shall consult with each other in accordance with Article VI of this Agreement in an effort to ensure that responsible parties bear any necessary cleanup and response costs as defined in CERCLA. Any decision made pursuant to paragraph C. of this Article shall not relieve any third party from any liability that may arise under CERCLA.



E. As between the Government and the Non-Federal Sponsor, the Non-Federal Sponsor shall be considered the operator of the Project Modification for purposes of CERCLA liability. To the maximum extent practicable, the Non-Federal Sponsor shall operate, maintain, repair, replace, and rehabilitate the Project Modification for Ecosystem Restoration in a manner that will not cause liability to arise under CERCLA.

ARTICLE XVII- NOTICES

A. Any notice, request, demand, or other communication required or permitted to be given under this Agreement shall be deemed to have been duly given if in writing and either delivered personally, or by telegram, or mailed by first-class, registered, or certified mail, as follows:

If to the Non-Federal Sponsor:

Director of Utilities
PO Box 11007
Tacoma, Washington 98411

If to the Government:

District Engineer
Department of the Army, Seattle District
PO Box 3755
Seattle, Washington 98124-3755

B. A party may change the address to which such communications are to be directed by giving written notice to the other party in the manner provided in this Article.

C. Any notice, request, demand, or other communication made pursuant to this Article shall be deemed to have been received by the addressee at the earlier of such time as it is actually received or seven calendar days after it is mailed.

ARTICLE XVIII- CONFIDENTIALITY

To the extent permitted by the laws governing each party, the parties agree to maintain the confidentiality of exchanged information when requested to do so by the providing party.

ARTICLE XIX - HISTORIC PRESERVATION

A. The costs of identification, survey and evaluation of historic properties, assigned to the Project Modifications for Municipal and Industrial Water Supply, shall be included in total



project modification costs for Municipal and Industrial Water Supply and cost shared in accordance with the provisions of this Agreement.

B. The costs of identification, survey and evaluation of historic properties, assigned to the Project Modifications for Ecosystem Restoration, shall be included in total project modification costs for Ecosystem Restoration and cost shared in accordance with the provisions of this Agreement.

C. The costs of identification, survey and evaluation of historic properties, assigned to the Mitigation Modification, shall be included in total project modification costs for Endangered Species and cost shared in accordance with the provisions of this Agreement.

D. Pursuant to Section 7(a) of Public Law 93-291 (16 U.S.C. Section 469c(a)), the costs of mitigation and data recovery activities associated with historic preservation shall be borne entirely by the Government and shall not be included in total project modification costs, up to the statutory limit of one percent of the total amount the Government is authorized to expend for the Project Modification.

E. The Government shall not incur costs for mitigation and data recovery that exceed the statutory one percent limit specified in paragraph D. of this Article unless and until the Assistant Secretary of the Army (Civil Works) has waived that limit in accordance with Section 208(3) of Public Law 96-515 (16 U.S.C. Section 469c-2(3)). Any costs of mitigation and data recovery that exceed the one percent limit shall be included in total project modification costs for Municipal and Industrial Water Supply, total project modification costs for Ecosystem Restoration, or total project modification costs for the Mitigation Modification, as appropriate, and shall be cost shared in accordance with the provisions of this Agreement.

ARTICLE XX -SECTION 902 PROJECT COST LIMITS

The Non-Federal Sponsor has reviewed the provisions set forth in Section 902 of Public Law 99-662, as amended, and understands that Section 902 establishes the maximum amount of total project modification costs at Howard Hanson Dam. Notwithstanding any other provision of this Agreement, the Government shall not make a new Project Modification financial obligation, make a Project Modification expenditure, or afford credit toward total project modification costs for the value of any contribution provided by the Non-Federal Sponsor, if such obligation, expenditure, or credit would result in total project modification costs exceeding this maximum amount, unless otherwise authorized by law. On the effective date of this Agreement, this maximum amount is estimated to be \$101,460,000, as calculated in accordance with ER 1105-2-100 using October 1, 1998 price levels and allowances for projected future inflation. The Government shall adjust this maximum amount in accordance with Section 902.

ARTICLE XXI - OBLIGATIONS OF FUTURE APPROPRIATIONS

A. Nothing herein shall constitute, nor be deemed to constitute, an obligation of



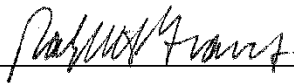
future appropriations by the City of Tacoma of the State of Washington, where creating such an obligation would be inconsistent with R.C.W. 35.34.200 or the City of Tacoma Charter for Tacoma, Washington.

B. The Non-Federal Sponsor intends to satisfy its obligations under this Agreement. The Non-Federal Sponsor shall include in its budget request or otherwise propose, for each fiscal period, appropriations sufficient to cover the Non-Federal Sponsor's obligations under this Agreement for each biennium, and will use all reasonable and lawful means to secure the appropriations for that biennium sufficient to make the payments necessary to fulfill its obligations hereunder. The Non-Federal Sponsor reasonably believes that funds in amounts sufficient to discharge these obligations can and will lawfully be appropriated and made available for this purpose. In the event the budget or other means of appropriations does not provide funds in sufficient amounts to discharge these obligations, the Non-Federal Sponsor shall use its best efforts to satisfy any requirements for payments under this Agreement from any other source of funds legally available for this purpose. Further, if the Non-Federal Sponsor is unable to satisfy its obligations hereunder, the Government may exercise any legal rights it has to protect the Government's interests related to this Agreement.

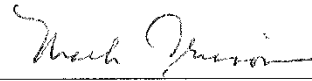
IN WITNESS WHEREOF, the parties hereto have executed this Agreement, which shall become effective upon the date it is signed by the Department of the Army.

THE DEPARTMENT OF THE ARMY

THE CITY OF TACOMA, DEPARTMENT
OF PUBLIC UTILITIES

BY: 

Ralph H. Graves
Colonel, Corps of Engineers
District Engineer

BY: 

Mark Crisson
Director of Utilities

DATE: 17 July 2003

DATE: 7-17-03



CERTIFICATE OF AUTHORITY

I, Mark Bubenik, do hereby certify that I am the principal legal officer of the City of Tacoma, Department of Public Utilities, that the City of Tacoma, Department of Public Utilities is a legally constituted public body with full authority and legal capability to perform the terms of the Agreement between the Department of the Army and the City of Tacoma, Department of Public Utilities in connection with the Howard Hanson Dam Ecosystem Restoration and Additional Water Storage Project, and to pay damages in accordance with the terms of this Agreement, if necessary, in the event of the failure to perform, as required by Section 221 of Public Law 91-611 (42 U.S. C. Section 1962d-5b), and that the persons who have executed this Agreement on behalf of the City of Tacoma, Department of Public Utilities have acted within their statutory authority.

IN WITNESS WHEREOF, I have made and executed this certification this
9th day of July 2003.

Mark Bubenik
Chief Assistant City Attorney



CERTIFICATION REGARDING LOBBYING

The undersigned certifies, to the best of his or her knowledge and belief that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

Mark Crisson
Director of Utilities

DATE: 7-17-03



Appendix D Plant Species Lists

D.1 Species List Wetland Survey from 2019

Following is a list the species observed during the 2019 wetland surveys and Howard A. Hanson and Mud Mountain Dams (Philly *et. al.* 2019). Species that are considered non-native to North America have a star (*). Species that are considered native to North America, but not to King and Pierce Counties, have a dagger (†). Species that have questionable nativity and/or occur as a mix of native and non-native varieties or genotypes have a darkened circle (**).

Table 10-3. Upland Deciduous Forest Habitat Types

Plant	Common Name	Latin Binomial
Trees	red alder	<i>Alnus rubra</i>
	cascara	<i>Rhamnus purshiana</i>
	western red cedar	<i>Thuja plicata</i>
	bitter cherry	<i>Prunus emarginata</i>
	black cottonwood	<i>Populus balsamifera</i>
	Pacific dogwood	<i>Cornus nuttallii</i>
	Douglas fir	<i>Pseudotsuga menziesii</i>
	western hemlock	<i>Tsuga heterophylla</i>
	madrona	<i>Arbutus menziesii</i>
	big-leaf maple	<i>Acer macrophyllum</i>
	vine maple	<i>Acer circinatum</i>
	Pacific willow	<i>Salix lasiandra</i>
Shrubs	trailing blackberry	<i>Rubus ursinus</i>
	devil's club	<i>Oploplanax horridum</i>
	red-osier dogwood	<i>Cornus stolonifera</i>
	red elderberry	<i>Sambucus racemosa</i>
	hazelnut (filbert)	<i>Corylus cornuta</i>
	evergreen huckleberry	<i>Vaccinium ovatum</i>
	red huckleberry	<i>Vaccinium parviflorum</i>
	Indian plum	<i>Oemleria cerasiformis</i>



Plant	Common Name	Latin Binomial
	salmonberry	<i>Rubus spectabilis</i>
	thimbleberry	<i>Rubus parviflorus</i>
Forbs	bedstraw	<i>Galium</i> spp.
	bleeding heart	<i>Dicentra formosa</i>
	creeping buttercup	<i>Ranunculus repens</i>
	docks	<i>Rumex</i> spp.
	bracken fern	<i>Pteridium aquilinum</i>
	sword fern	<i>Polystichum munitum</i>
	grasses	Poaceae
	self-heal	<i>Prunella vulgaris</i>
	stinging nettle	<i>Urtica dioica</i>
	Pacific water parsley	<i>Oenanthe sarmentosa</i>
	cow parsnip	<i>Heracleum lanatum</i>
	pig-a-back/piggyback	<i>Tolmiea menziesii</i>
	rushes	<i>Juncus</i> spp.

Table 10-4. Upland Deciduous Forest Riparian Habitat Types

Plant	Common Name	Latin Binomial
Trees	red alder	<i>Alnus rubra</i>
	black cottonwood	<i>Populus balsamifera</i>
	vine maple	<i>Acer circinatum</i>
	western red cedar	<i>Thuja plicata</i>
	western hemlock	<i>Tsuga heterophylla</i>
Shrubs	Himalayan blackberry	<i>Rubus discolor</i>
	salmonberry	<i>Rubus spectabilis</i>
	thimbleberry	<i>Rubus parviflorus</i>
	red flowering currant	<i>Ribes sanguineum</i>
	red-osier dogwood	<i>Cornus stolonifera</i>
	red elderberry	<i>Sambucus racemosa</i>



	Indian plum	<i>Oemleria cerasiformis</i>
Forbs	creeping buttercup	<i>Ranunculus repens</i>
	false lily-of-the-valley	<i>Maianthemum dilatatum</i>
	lady fern	<i>Athyrium filix-femina</i>
	sword fern	<i>Polystichum munitum</i>
	foam flower	<i>Tiarella trifoliata</i>
	grasses	Poaceae
	pig-a-back	<i>Tolmiea menziesii</i>

Table 10-5. Deciduous Forest - Seedling/Sapling Habitat

Plant	Common Name	Latin Binomial
Trees	red alder	<i>Alnus rubra</i>
	vine maple	<i>Acer circinatum</i>
Shrubs	Himalayan blackberry	<i>Rubus discolor</i>
	trailing blackberry	<i>Rubus ursinus</i>
	salmonberry	<i>Rubus spectabilis</i>
Forbs	redtop bentgrass	<i>Agrostis alba</i>
	bracken fern	<i>Pteridium aquilinum</i>
	sword fern	<i>Polystichum munitum</i>
	fireweed	<i>Epilobium angustifolium</i>
	grasses	Poaceae

Table 10-6. Coniferous Forest Mature Habitat

Plant	Common Name	Latin Binomial
Trees	red alder	<i>Alnus rubra</i>
	western red cedar	<i>Thuja plicata</i>
	Douglas fir	<i>Pseudotsuga menziesii</i>
	western hemlock	<i>Tsuga heterophylla</i>
	vine maple	<i>Acer circinatum</i>
Shrubs	trailing blackberry	<i>Rubus ursinus</i>
	salmonberry	<i>Rubus spectabilis</i>



	thimbleberry	<i>Rubus parviflorus</i>
	devil's club	<i>Oploplanax horridum</i>
	red elderberry	<i>Sambucus racemosa</i>
	ocean spray	<i>Holodiscus discolor</i>
	tall Oregon grape	<i>Berberis aquifolium</i>
	salal	<i>Gaultheria shallon</i>
Forbs	cleavers	<i>Galium aparine</i>
	false lily-of-the-valley	<i>Maianthemum dilatatum</i>
	false Solomon's seal	<i>Smilacina racemosa</i>
	bracken fern	<i>Pteridium aquilinum</i>
	sword fern	<i>Polystichum munitum</i>
	grasses	Poaceae
	pig-a-back	<i>Tolmiea menziesii</i>
	twinflower	<i>Linnaea triphylla</i>
	vanilla leaf	<i>Achlys triphylla</i>
	western spring beauty	<i>Montia sibirica</i>

Table 10-7. Coniferous Forest - Seedling/Sapling Habitat

Plant	Common Name	Latin Binomial
Shrubs	red alder (sapling)	<i>Alnus rubra</i>
	Himalayan blackberry	<i>Rubus discolor</i>
	trailing blackberry	<i>Rubus ursinus</i>
	salmonberry	<i>Rubus spectabilis</i>
	thimbleberry	<i>Rubus parviflorus</i>
	Douglas fir (sapling)	<i>Pseudotsuga menziesii</i>
	Indian plum	<i>Oemleria cerasiformis</i>
Forbs	redtop bentgrass	<i>Agrostis alba</i>
	bracken fern	<i>Pteridium aquilinum</i>
	sword fern	<i>Polystichum munitum</i>
	fireweed	<i>Epilobium angustifolium</i>



	grasses	Poaceae
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Table 10-8. Mixed Coniferous Forest Habitat

Plant	Common Name	Latin Binomial
Trees	red alder	<i>Alnus rubra</i>
	Douglas fir	<i>Pseudotsuga menziesii</i>
	western red cedar	<i>Thuja plicata</i>
	western hemlock	<i>Tsuga heterophylla</i>
	big-leaf maple	<i>Acer macrophyllum</i>
Shrubs	trailing blackberry	<i>Rubus ursinus</i>
	salmonberry	<i>Rubus spectabilis</i>
	thimbleberry	<i>Rubus parviflorus</i>
	red elderberry	<i>Sambucus racemosa</i>
	tall Oregon grape	<i>Berberis aquifolium</i>
Forbs	cleavers	<i>Galium aparine</i>
	false lily-of-the-valley	<i>Maianthemum dilatatum</i>
	false Solomon's seal	<i>Smilacina racemosa</i>
	bracken fern	<i>Pteridium aquilinum</i>
	deer fern	<i>Blechnum spicant</i>
	sword fern	<i>Polystichum munitum</i>
	grasses	Poaceae
	pig-a-back	<i>Tolmiea menziesii</i>
	vanilla leaf	<i>Achlys triphylla</i>
	western spring beauty	<i>Montia sibirica</i>

Table 10-9. Upland Shrubland Habitat

Plant	Common Name	Latin Binomial
Trees	red alder	<i>Alnus rubra</i>
	Douglas fir	<i>Pseudotsuga menziesii</i>
	western hemlock	<i>Tsuga heterophylla</i>
	vine maple	<i>Acer circinatum</i>



Shrubs	Himalayan blackberry	<i>Rubus discolor</i>
	trailing blackberry	<i>Rubus ursinus</i>
	salmonberry	<i>Rubus spectabilis</i>
	red elderberry	<i>Sambucus racemosa</i>
	Scot's broom	<i>Cytisus scoparius</i>
	ocean spray	<i>Holodiscus discolor</i>
Forbs	creeping buttercup	<i>Ranunculus repens</i>
	docks	<i>Rumex</i> spp.
	bracken fern	<i>Pteridium aquilinum</i>
	sword fern	<i>Polystichum munitum</i>
	fireweed	<i>Epilobium angustifolium</i>
	grasses	Poaceae
	horsetail	<i>Equisetum arvense</i>
	common mullein	<i>Verbascum thapsus</i>
	pearly everlasting	<i>Anaphalis margaritacea</i>
	pig-a-back	<i>Tolmiea menziesii</i>
	Canada thistle	<i>Cirsium arvense</i>

Table 10-10. Upland Grassland Habitat

Plant	Common Name	Latin Binomial
Shrubs	trailing blackberry	<i>Rubus ursinus</i>
Forbs	clovers	<i>Trifolium</i> spp.
	dandelions	<i>Taraxacum</i> spp.
	docks	<i>Rumex</i> spp.
	Indian thistle	<i>Cirsium addule</i>
	Canada thistle	<i>Cirsium arvense</i>
	redtop bentgrass	<i>Agrostis alba</i>
	Kentucky bluegrass	<i>Poa pratensis</i>
	red fescue	<i>Festuca rubra</i>
	quack grass (wheatgrass)	<i>Agropyron repens</i>



	western ryegrass	<i>Elymus glaucus</i>
	common velvet-grass	<i>Holcus lanatus</i>
	ragworts	<i>Senecio</i> spp.
	tansy ragwort	<i>Senecio jacobaea</i>
	timothy	<i>Phleum</i> spp.

Table 10-11. Talus Slope / Rock Habitat

Plant	Common Name	Latin Binomial
Shrubs	red alder (sapling)	<i>Alnus rubra</i>
	Douglas fir (sapling)	<i>Pseudotsuga menziesii</i>
	western hemlock (sapling)	<i>Tsuga heterophylla</i>
Forbs	redtop bentgrass	<i>Agrostis alba</i>
	clovers	<i>Trifolium</i> spp.
	fireweed	<i>Epilobium angustifolium</i>
	grasses	Poaceae
	common mullein	<i>Verbascum thapsus</i>
	unknown mustard	<i>Crucifer</i> spp.
	pearly everlasting	<i>Anaphalis margaritacea</i>
	St. John's wort	<i>Hypericum perforatum</i>

Table 10-12. Roadway / Railroad Habitat

Plant	Common Name	Latin Binomial
Shrubs	Himalayan blackberry	<i>Rubus discolor</i>
	salmonberry	<i>Rubus spectabilis</i>
Forbs	fireweed	<i>Epilobium angustifolium</i>
	grasses	Poaceae
	common mullein	<i>Verbascum thapsus</i>
	pearly everlasting	<i>Anaphalis margaritacea</i>
	ragworts	<i>Senecio</i> spp.



	Canada thistle	<i>Cirsium arvense</i>
	yarrow	<i>Achillea millefolium</i>

D.2 2019 Species Wetland Survey

The following tables list the species observed during the 2019 wetland surveys and Howard A. Hanson and Mud Mountain Dams (Philly et al. 2019). Species that are considered non-native to North America are preceded by an asterisk (*). Species that are considered native to North America, but not to King and Pierce Counties, have a plus sign (+). Species that have questionable nativity or occur as a mix of native and non-native varieties or genotypes have two asterisks (**).

Table 10-13. Equisetophytes

Family	Common Name	Latin Binomial
<i>Equisetaceae</i>	Field horsetail	<i>Equisetum arvense</i>
	Water horsetail	<i>Equisetum fluviatile</i> L.
	Scouringrush horsetail	<i>Equisetum hyemale</i> L. var. <i>affine</i>
	Giant horsetail	<i>Equisetum telmateia</i> ssp. <i>braunii</i>

Table 10-14. Pteridophytes

Family	Common Name	Latin Binomial
<i>Aspleniaceae</i>	Maidenhair spleenwort	<i>Asplenium trichomanes</i> L.
<i>Blechnaceae</i>	Deer fern	<i>Blechnum spicant</i>
<i>Cystopteridaceae</i>	Brittle fern	<i>Cystopteris fragilis</i>
<i>Dennstaedtiaceae</i>	Bracken fern	<i>Pteridium aquilinum</i> ssp. <i>Pubescens</i>
<i>Dryopteridaceae</i>	Subarctic ladyfern	<i>Athyrium filix-femina</i> var. <i>cyclosorum</i>
	Spiny wood fern	<i>Dryopteris expansa</i>
	Western oakfern	<i>Gymnocarpium dryopteris</i>
	Western swordfern	<i>Polystichum munitum</i>
<i>Polypodiaceae</i>	Licorice fern	<i>Polypodium glycyrrhiza</i>
<i>Pteridaceae</i>	Aleutian maidenhair fern	<i>Adiantum aleuticum</i>





Table 10-15. Coniferophytes

Family	Common Name	Latin Binomial
Cupressaceae	Western red cedar	<i>Thuja plicata</i>
Pinaceae	Sitka spruce	<i>Picea sitchensis</i>
	Pine	<i>Pinus</i> sp.
	Douglas fir	<i>Pseudotsuga menziesii</i>
	Western hemlock	<i>Tsuga heterophylla</i>

Table 10-16. Magnoliophytes

Species that are considered non-native to North America are preceded by an asterisk (*). Species that are considered native to North America, but not to King and Pierce Counties, have a plus sign (+). Species that have questionable nativity or occur as a mix of native and non-native varieties or genotypes have two asterisks (**).

Family	Common Name	Latin Binomial
<i>Alismataceae</i>	Northern water plantain	<i>Alisma triviale</i>
<i>Apiaceae</i>	Bishops' goutweed	* <i>Aegopodium podagraria</i>
	Cow parsnip	<i>Heracleum sphondylium</i> ssp. <i>montanum</i>
	Water parsely	<i>Oenanthe sarmentosa</i>
	Sweetcicely	<i>Oenanthe sarmentosa</i>
	Sweetcicely	<i>Osmorhiza berteroi</i>
	Water parsnip	<i>Sium suave</i>
<i>Aquifoliaceae</i>	English holly	* <i>Ilex aquifolium</i>
<i>Araceae</i>	Common duckweed	<i>Lemna minor</i>
	American skunkcabbage	<i>Lysichiton americanus</i>
<i>Araliaceae</i>	English ivy	* <i>Hedera helix</i>
	Floating marsh pennywort	<i>Hydrocotyle ranunculoides</i>
	Devil's club	<i>Oplopanax horridus</i>
<i>Aristolochiaceae</i>	Western wild ginger	<i>Asarum caudatum</i>
<i>Asparagaceae</i>	False lily of the valley	<i>Maianthemum dilatatum</i>
	Feathery false lily of the valley	<i>Maianthemum racemosum</i>
	Starry false lily of the valley	<i>Maianthemum stellatum</i>



Family	Common Name	Latin Binomial
<i>Asteraceae</i>	Common yarrow	<i>**Achillea millefolium</i>
	American trailplant	<i>Adenocaulon bicolor</i>
	Western pearly everlasting	<i>Anaphalis margaritacea</i>
	Lesser burdock	<i>*Arctium minus</i>
	Coastal wormwood	<i>Artemisia suksdorfii</i>
	Nodding beggartick	<i>Bidens cernua</i>
	Bur-marigold	<i>Bidens frondosa</i>
	Creeping/Canada thistle	<i>*Cirsium arvense</i>
	Clustered thistle	<i>Cirsium brevistylum</i>
	Bull thistle	<i>*Cirsium vulgare</i>
	Canadian horseweed	<i>Conyza canadensis</i>
	Fleabane	<i>Erigeron acris</i>
	Featherweed, cudweed	<i>Gamochaeta ustulata</i>
	Marsh cudweed	<i>Gnaphalium uliginosum</i>
	White flowered hawkweed	<i>Hieracium albiflorum</i>
	Meadow hawkweed	<i>*Hieracium caespitosum</i>
	Hairy cat's ear	<i>*Hypochaeris radicata</i>
	Prickly lettuce	<i>*Lactuca serriola</i>
	Common nipplewort	<i>*Lapsana communis</i>
	Oxeye-daisy	<i>*Leucanthemum vulgare</i>
	Pineapple weed	<i>Matricaria discoidea</i>
	Wall lettuce	<i>*Mycelis muralis</i>
	Coltsfoot	<i>Petasites frigidus var. palmatus</i>
	Meadow fescue	<i>*Schedonorus pratensis</i>
	Tansy ragwort	<i>*Senecio jacobaea</i>
	Woodland ragwort	<i>*Senecio sylvaticus</i>
	Arrowleaf groundsel	<i>Senecio triangularis</i>
	Rough Canada goldenrod	<i>Solidago elongata</i>
	Sowthistle	<i>*Sonchus oleraceus</i>
	Common tansy	<i>*Tanacetum vulgare</i>



Family	Common Name	Latin Binomial
	Common dandelion	<i>*Taraxacum officinale</i>
<i>Berberidaceae</i>	Vanilla-leaf	<i>Achlys triphylla</i>
	Cascade Oregon-grape	<i>Berberis nervosa</i>
<i>Betulaceae</i>	Red alder	<i>Alnus rubra</i>
	Green alder	<i>Alnus viridis</i>
	Beaked hazelnut	<i>Corylus cornuta</i>
<i>Boraginaceae</i>	Rough forget-me-not	<i>Myosotis arvensis</i>
	Small forget-me-not	<i>Myosotis laxa</i>
	Water forget-me-not	<i>*Myosotis scorpioides</i>
	American yellowrocket	<i>Barbarea orthoceras</i>
	Garden yellowrocket	<i>*Barbarea vulgaris</i>
	Angled bittercress	<i>Cardamine angulata</i>
	Pennsylvania bittercress	<i>Cardamine pensylvanica</i>
	Tall pepperweed	<i>Lepidium virginicum</i>
	Curvepod yellowcress	<i>Rorippa curvisiliqua</i>
<i>Brassicaceae</i>	Bog yellowcress	<i>Rorippa palustris</i>
<i>Caprifoliaceae</i>	Orange honeysuckle	<i>Lonicera ciliosa</i>
	Twinberry honeysuckle	<i>Lonicera involucrata</i>
	Common snowberry	<i>Symphoricarpos albus</i>
<i>Caryophyllaceae</i>	Mouse-ear chickweed	<i>*Cerastium fontanum</i>
	Large-leaf sandwort	<i>Moehringia macrophylla</i>
	Bird-eye pearlwort	<i>*Sagina procumbens</i>
	Red sand-spurry	<i>*Spergularia rubra</i>
	Night-flowering catchfly	<i>*Silene noctiflora</i>
	Boreal starwort	<i>Stellaria borealis</i>
	Common chickweed	<i>*Stellaria media</i>
<i>Cornaceae</i>	Western redosier dogwood	<i>Cornus occidentalis</i>
	Western cordilleran bunchberry	<i>Cornus unalaschkensis</i>
<i>Crassulaceae</i>	Oregon stonecrop	<i>Sedum oreganum</i>
<i>Cyperaceae</i>	Bigleaf sedge	<i>Carex amplifolia</i>



Family	Common Name	Latin Binomial
	Water sedge	<i>Carex aquatilis</i>
	Western inflated sedge	<i>Carex exsiccata</i>
	Slough sedge	<i>Carex obnupta</i>
	Hanging sedge	* <i>Carex pendula</i>
	Awlfruit sedge	<i>Carex stipata</i>
	Blunt broom sedge	+ <i>Carex tribuloides</i>
	Common spikerush	<i>Eleocharis palustris</i>
	Hardstem Bulrush	<i>Schoenoplectus acutus</i>
	Panicled bulrush	<i>Scirpus microcarpus</i>
<i>Ericaceae</i>	Little prince's-pine	<i>Chimaphila menziesii</i>
	Salal	<i>Gaultheria shallon</i>
	False azalea, fool's-huckleberry	<i>Menziesia ferruginea</i>
	Indianpipe, ghost plant	<i>Monotropa uniflora</i>
	Bog wintergreen	<i>Pyrola asarifolia</i>
	Bog Labrador tea	<i>Rhododendron groenlandicum</i>
	Oval-leaf blueberry	<i>Vaccinium ovalifolium</i>
	Red huckleberry	<i>Vaccinium parvifolium</i>
<i>Fabaceae</i>	Scotch broom	* <i>Cytisus scoparius</i>
	Sierra pea	<i>Lathyrus nevadensis</i>
	Bird's-foot trefoil	* <i>Lotus corniculatus</i>
	Riverbank lupine	<i>Lupinus rivularis</i>
	Black medic	* <i>Medicago lupulina</i>
	Rabbitfoot clover	* <i>Trifolium arvense</i>
	Suckling clover	* <i>Trifolium dubium</i>
	Alsike clover	* <i>Trifolium hybridum</i>
	Red clover	* <i>Trifolium pratense</i>
	White clover	* <i>Trifolium repens</i>
	Tiny vetch	* <i>Vicia hirsuta</i>
	Common vetch	* <i>Vicia sativa</i>
	Slender vetch	* <i>Vicia tetrasperma</i>



Family	Common Name	Latin Binomial
<i>Gentianaceae</i>	European centaury	* <i>Centaurium erythraea</i>
<i>Geraniaceae</i>	Dovefoot geranium	* <i>Geranium molle</i>
	Robert geranium, Herb-robert	* <i>Geranium robertianum</i>
<i>Grossulariaceae</i>	Stink currant	<i>Ribes bracteosum</i>
<i>Hydrophyllaceae</i>	Prickly currant	<i>Ribes lacustre</i>
	Pacific waterleaf	<i>Hydrophyllum tenuipes</i>
	Small-flowered nemophila	<i>Nemophila parviflora</i>
	Shade phacelia	<i>Phacelia nemoralis</i>
<i>Iridaceae</i>	Siberian iris	* <i>Iris sibirica</i>
<i>Juglandaceae</i>	English walnut	<i>Juglans regia</i>
<i>Juncaceae</i>	Pacific woodrush	<i>Luzula comosa</i>
	Small-flowered woodrush	<i>Luzula parviflora</i>
	Tapertip rush	<i>Juncus acuminatus</i>
	Joint-leaved rush	<i>Juncus articulatus</i>
	Baltic rush	<i>Juncus balticus</i>
	Toad rush	<i>Juncus bufonius</i>
	Common rush	<i>Juncus effusus</i>
	Swordleaf rush	<i>Juncus ensifolius</i>
	Spreading rush	<i>Juncus supiniformis</i>
	Path rush	<i>Juncus tenuis</i>
<i>Lamiaceae</i>	Ground-ivy	* <i>Glechoma hederacea</i>
	Water mint	<i>Mentha aquatica</i>
	Selfheal	<i>Prunella vulgaris</i>
	Coastal hedgenettle	<i>Stachys chamissonis</i> Benth. var. <i>cooleyae</i>
<i>Liliaceae</i>	Columbia lily	<i>Lilium columbianum</i>
	Drops-of-gold	<i>Prosartes hookeri</i>
	Clasping twistedstalk	<i>Streptopus amplexifolius</i>
<i>Melanthiaceae</i>	Pacific trillium	<i>Trillium ovatum</i>
<i>Montiaceae</i>	Siberian springbeauty	<i>Claytonia sibirica</i>
	Narrowleaf minerslettuce	<i>Montia linearis</i>



Family	Common Name	Latin Binomial
	Littleleaf minerslettuce	<i>Montia parvifolia</i>
<i>Nymphaeaceae</i>	Rocky Mountain pond-lily	<i>Nuphar polysepala</i>
<i>Onagraceae</i>	Fireweed	<i>Chamerion angustifolium</i>
	Small enchanter's nightshade	<i>Circaea alpina ssp. pacifica</i>
	Fringed willowherb	<i>Epilobium ciliatum</i>
<i>Orchidaceae</i>	Spotted coralroot	<i>Corallorhiza maculata</i>
	Pacific coralroot	<i>Corallorhiza mertensiana</i>
	Western rattlesnake plantain	<i>Goodyera oblongifolia</i>
<i>Orobanchaceae</i>	Yellow glandweed	* <i>Parentucellia viscosa</i>
<i>Oxalidaceae</i>	Wood sorrel	<i>Oxalis sp.</i>
<i>Papaveraceae</i>	Scouler's fumewort	<i>Corydalis scouleri</i>
	Pacific bleeding heart	<i>Dicentra formosa</i>
<i>Phrymaceae</i>	Seep monkeyflower	<i>Erythranthe guttata</i>
<i>Plantaginaceae</i>	Water starwort	<i>Callitriche heterophylla</i>
	Pond water-starwort	* <i>Callitriche stagnalis</i>
	Dwarf-snapdragon	* <i>Chaenorhinum minus</i>
	Foxglove	* <i>Digitalis purpurea</i>
	Dalmatian toadflax	* <i>Linaria dalmatica</i>
	Woodland beardtongue	<i>Nothochelone nemorosa</i>
	Cascade beardtongue	<i>Penstemon serrulatus</i>
	Narrowleaf plantain	* <i>Plantago lanceolata</i>
	Common plantain	* <i>Plantago major</i>
	Common gypsyweed	* <i>Veronica officinalis</i>
	Thyme-leaved speedwell	** <i>Veronica serpyllifolia</i>
<i>Poaceae</i>	Spiked bentgrass	<i>Agrostis exarata</i>
	Oregon bentgrass	<i>Agrostis oregonensis</i>
	Creeping bentgrass	* <i>Agrostis stolonifera</i>
	Silver hairgrass	* <i>Aira caryophyllea</i>
	Field meadow-foxtail	* <i>Alopecurus pratensis</i>
	Sweet vernal grass	* <i>Anthoxanthum odoratum</i>



Family	Common Name	Latin Binomial
	Tall oatgrass	* <i>Arrhenatherum elatius</i>
	Soft brome	* <i>Bromus hordeaceus</i>
	Cheat grass	* <i>Bromus tectorum</i>
	Purple reedgrass	<i>Calamagrostis purpurascens</i>
	Crested dogtail	* <i>Cynosurus cristatus</i>
	Dogtail grass	* <i>Cynosurus echinatus</i>
	Orchard grass	* <i>Dactylis glomerata</i>
	Tufted hairgrass	<i>Deschampsia cespitosa</i>
	Blue wild-rye	<i>Elymus glaucus</i> Buckley ssp. <i>glaucus</i>
	Western fescue	<i>Festuca occidentalis</i>
	Red fescue	** <i>Festuca rubra</i>
	Tall mannagrass	<i>Glyceria elata</i>
	Common velvetgrass	* <i>Holcus lanatus</i>
	Reed canarygrass	** <i>Phalaris arundinacea</i>
	Common timothy	* <i>Phleum pratense</i> ssp. <i>pratense</i>
	Annual bluegrass	* <i>Poa annua</i>
	Kentucky bluegrass	* <i>Poa pratensis</i>
	Nodding oatgrass	<i>Trisetum cernuum</i>
	Bread wheat	* <i>Triticum aestivum</i>
	Brome fescue	* <i>Vulpia bromoides</i>
	Rat-tail six-weeks grass	* <i>Vulpia myuros</i>
<i>Polemoniaceae</i>	Variable-leaf mountain-trumpet	<i>Collomia heterophylla</i>
<i>Polygonaceae</i>	Water knotweed	<i>Persicaria amphibia</i>
	Water-pepper	* <i>Persicaria hydropiper</i>
	Swamp smartweed	<i>Persicaria hydropiperoides</i>
	Spotted lady's thumb	* <i>Persicaria maculosa</i>
	Prostrate knotweed	* <i>Polygonum aviculare</i>
	Sheep sorrel	* <i>Rumex acetosella</i>
	Curly dock	* <i>Rumex crispus</i>
	Curly dock	<i>Rumex salicifolius</i>



Family	Common Name	Latin Binomial
<i>Potamogetonaceae</i>	Floating-leaf pondweed	<i>Potamogeton natans</i>
	Small pondweed	<i>Potamogeton pusillus</i>
<i>Primulaceae</i>	Western starflower	<i>Trientalis latifolia</i>
<i>Ranunculaceae</i>	Red baneberry	<i>Actaea rubra</i>
	Western columbine	<i>Aquilegia formosa</i>
	Lesser spearwort	<i>Ranunculus flammula</i>
	Western buttercup	<i>Ranunculus occidentalis</i>
	Meadow buttercup	* <i>Ranunculus acris</i>
	Creeping buttercup	* <i>Ranunculus repens</i>
	Woodland buttercup	<i>Ranunculus uncinatus</i>
<i>Rhamnaceae</i>	Cascara buckthorn	<i>Rhamnus purshiana</i>
<i>Rosaceae</i>	Pacific serviceberry	<i>Amelanchier alnifolia</i>
	Goat's beard	<i>Aruncus dioicus</i>
	Marsh cinquefoil	<i>Comarum palustre</i>
	Rockspray cotoneaster	* <i>Cotoneaster horizontalis</i>
	Bullate cotoneaster	* <i>Cotoneaster rehderi</i>
	Oneseed hawthorn	* <i>Crataegus monogyna</i>
	Woodland strawberry	<i>Fragaria vesca</i>
	Wild strawberry	<i>Fragaria virginiana</i>
	Largeleaf avens	<i>Geum macrophyllum</i>
	Oceanspray	<i>Holodiscus discolor</i> var. <i>discolor</i>
	Oregon crabapple	<i>Malus fusca</i>
	Indian plum, Osoberry	<i>Oemleria cerasiformis</i>
	Pacific ninebark	<i>Physocarpus capitatus</i>
	Drummond's cinquefoil	<i>Potentilla drummondii</i>
	Bitter cherry	<i>Prunus emarginata</i>
	Dwarf rose	<i>Rosa gymnocarpa</i>
	Nootka rose	<i>Rosa nutkana</i>
	Himalayan blackberry	* <i>Rubus bifrons</i>
	Cutleaf blackberry	* <i>Rubus laciniatus</i>



Family	Common Name	Latin Binomial
	Whitebark raspberry	<i>Rubus leucodermis</i>
	Salmonberry	<i>Rubus spectabilis</i>
	California blackberry	<i>Rubus ursinus</i>
	European blackberry	* <i>Rubus vestitus</i>
	Sitka burnet	<i>Sanguisorba stipulata</i>
	Rose spirea, hardhack	<i>Spiraea douglasii</i>
	Rowan-berry	* <i>Sorbus aucuparia</i>
	Western mountain-ash	<i>Sorbus sitchensis</i>
<i>Rubiaceae</i>	Bedstraw	<i>Galium aparine</i>
	Fragrant bedstraw	<i>Galium triflorum</i>
<i>Salicaceae</i>	Black cottonwood	<i>Populus trichocarpa</i>
	Pacific willow	<i>Salix lasiandra</i> var. <i>lasiandra</i>
	Scouler's willow	<i>Salix scouleriana</i>
	Sitka willow	<i>Salix sitchensis</i>
<i>Sapindaceae</i>	Vine maple	<i>Acer circinatum</i>
	Rocky Mountain maple	<i>Acer glabrum</i>
	Bigleaf maple	<i>Acer macrophyllum</i>
<i>Saxifragaceae</i>	Small-flowered alumroot	<i>Heuchera micrantha</i>
	Merten's saxifrage	<i>Saxifraga mertensiana</i>
	Fringecups	<i>Tellima grandiflora</i>
	Threelf leaf foamflower	<i>Tiarella trifoliata</i>
	Thousand mothers, piggyback	<i>Tolmiea menziesii</i>
<i>Scrophulariaceae</i>	Common mullein	* <i>Verbascum thapsus</i>
	American speedwell	<i>Veronica americana</i>
<i>Solanaceae</i>	Black nightshade	* <i>Solanum americanum</i>
	Climbing nightshade	* <i>Solanum dulcamara</i>
	Garden tomato	* <i>Solanum lycopersicum</i>
<i>Typhaceae</i>	Simplestem bur-reed	<i>Sparganium emersum</i>
	Cattail	<i>Typha latifolia</i>
<i>Urticaceae</i>	Stinging nettle	<i>Urtica dioica</i>



Family	Common Name	Latin Binomial
<i>Valerianaceae</i>	Scouler's valerian	<i>Valeriana scouleri</i>
	valerian	* <i>Valerianella locusta</i>
<i>Violaceae</i>	Smooth yellow violet	<i>Viola glabella</i>

D.3 Species List – Non-native Species

Following is a list species known to occur on Howard A. Hanson land. The King County Noxious Weed List (<https://www.kingcounty.gov/services/environment/animals-and-plants/noxious-weeds/laws/list.aspx>) is used to determine which species require eradication or control. None of the species observed at the project require eradication.

Table 10-17. Regulated Class B noxious weeds, control is required in King County

Common Name	Latin Binomial
Dalmatian toadflax	<i>Linaria dalmatica</i>
Tansy ragwort	<i>Jacobaea vulgaris</i>

Table 10-18. Non-regulated Class B and C noxious weeds - control is recommended but not required.

Common Name	Latin Binomial
English ivy	<i>Hedera helix</i>
Creeping/Canada thistle	<i>Cirsium arvense</i>
Bull thistle	<i>Cirsium vulgare</i>
Hairy cat's ear	<i>Hypochaeris radicata</i>
Oxeye-daisy	<i>Leucanthemum vulgare</i>
Common tansy	<i>Tanacetum vulgare</i>
Scotch broom	<i>Cytisus scoparius</i>
Robert geranium, Herb-robert	<i>Geranium robertianum</i>
Reed canarygrass	<i>Phalaris arundinacea</i>
Oneseed hawthorn	<i>Crataegus monogyna</i>
Cutleaf blackberry	<i>Rubus laciniatus</i>



Table 10-19. King County Weeds of concern - control is recommended where possible and new plantings are discouraged.

Common Name	Latin Binomial
Bishops' goutweed	<i>Aegopodium podagraria</i>
English holly	<i>Ilex aquifolium</i>
Hanging sedge	<i>Carex pendula</i>
Bird's-foot trefoil	<i>Lotus corniculatus</i>
Meadow buttercup	<i>Ranunculus acris</i>
Creeping buttercup	<i>Ranunculus repens</i>
Rowan-berry	<i>Sorbus aucuparia</i>
Climbing nightshade	<i>Solanum dulcamara</i>

D.4 References

Philly, K. D, Berkowitz, J. F., and N. R. Beane. 2019. Level II habitat survey & wetland identification: Howard Hanson Dam and Mud Mountain Dam, King and Pierce Counties, Washington. Engineer Research & Development Center (ERDC), Vicksburg, Mississippi, pp 338.



Appendix E Animal Species List

E.1 Data

Table 10-20. Species List of Birds

Common Name	Latin Binomial	Obs. ¹
Common goldeneye	<i>Bucephala clangula</i>	2019
Barrow's goldeneye	<i>Bucephala islandica</i>	
bufflehead	<i>Bucephala albeola</i>	
harlequin duck	<i>Histrionicus histrionicus</i>	
ring-necked duck	<i>Aythya collaris</i>	
wood duck	<i>Aix sponsa</i>	2019
gadwall	<i>Anas strepera</i>	
green-winged teal	<i>Anas crecca</i>	2019
mallard	<i>Anas platyrhynchos</i>	2019
American wigeon	<i>Anas americana</i>	2019
western grebe	<i>Aechmophorus occidentalis</i>	
lesser scaup	<i>Aythya affinis</i>	
common loon	<i>Gavia immer</i>	2019
great egret	<i>Ardea alba</i>	2019
common merganser	<i>Mergus merganser</i>	2019
hooded merganser	<i>Lophodytes cucullatus</i>	2019
red-breasted merganser	<i>Mergus serrator</i>	2019
great blue heron	<i>Ardea herodias</i>	
green heron	<i>Butorides virescens</i>	
Canada goose	<i>Branta canadensis</i>	2019

¹ Empty cells indicate no observations made in the past five years, but may be present in the project area due to migration, riparian area access, or use of inland freshwater lakes and rivers.



Common Name	Latin Binomial	Obs. ¹
turkey vulture	<i>Cathartes aura</i>	2019
bald eagle	<i>Haliaeetus leucocephalus</i>	2019
northern harrier	<i>Circus cyaneus</i>	
common nighthawk	<i>Chordeiles minor</i>	
red-tailed hawk	<i>Buteo jamaicensis</i>	2019
northern goshawk	<i>Accipiter gentilis</i>	
Cooper's hawk	<i>Accipiter cooperi</i>	
sharp-shinned hawk	<i>Accipiter striatus</i>	2019
American kestrel	<i>Falco sparverius</i>	2019
merlin	<i>Falco columbarius</i>	
peregrine falcon	<i>Falco peregrinus</i>	Brunner*
osprey	<i>Pandion haliaetus</i>	2019
sooty (blue) grouse	<i>Dendragapus fuliginosus</i>	
ruffed grouse	<i>Bonasa umbellus</i>	
killdeer	<i>Charadrius vociferus</i>	2019
Common Name	Scientific Name	Obs. Recently
greater yellowlegs	<i>Tringa melanoleuca</i>	
solitary sandpiper	<i>Tringa solitaria</i>	
spotted sandpiper	<i>Actitis macularia</i>	20112019
western sandpiper	<i>Calidris mauri</i>	
common snipe	<i>Gallinago gallinago</i>	
California gull	<i>Larus californicus</i>	
band-tailed pigeon	<i>Columba fasciata</i>	2019
mourning dove	<i>Zenaida macroura</i>	
barred owl	<i>Strix varia</i>	
spotted owl	<i>Strix occidentalis</i>	2019
great horned owl	<i>Bubo virginianus</i>	
northern pygmy owl	<i>Glaucidium gnoma</i>	



Common Name	Latin Binomial	Obs. ¹
western screech owl	<i>Otus asio kennicottii</i>	
black swift	<i>Cypseloides niger</i>	2019
Vaux's swift	<i>Chaetura vauxi</i>	2019
belted kingfisher	<i>Ceryle alcyon</i>	
red-breasted sapsucker	<i>Sphyrapicus ruber</i>	2019
downy woodpecker	<i>Picoides pubescens</i>	2011/2019
hairy woodpecker	<i>Picoides villosus</i>	2011/2019
pileated woodpecker	<i>Dryocopus pileatus</i>	2019
red-shafted flicker	<i>Colaptes auratus cafer</i>	2019
northern flicker	<i>Colaptes auratus</i>	2011
Hammond's flycatcher	<i>Empidonax hammondi</i>	2011/2019
olive-sided flycatcher	<i>Contopus cooperi</i>	2011/2019
Pacific-slope flycatcher	<i>Empidonax difficilis</i>	2011/2019
willow flycatcher	<i>Empidonax trailii</i>	2019
western wood peewee	<i>Contopus sordidulus</i>	
northern shrike	<i>Lanius excubitor</i>	
Cassin's vireo	<i>Vireo cassinii</i>	2019
Hutton's vireo	<i>Vireo huttoni</i>	2011
red-eyed vireo	<i>Vireo olivaceus</i>	2011
warbling vireo	<i>Vireo gilvus</i>	2011/2019
gray jay	<i>Perisoreus canadensis</i>	
Stellar's jay	<i>Cyanocitta stelleri</i>	2019
American crow	<i>Corvus brachyrhynchos</i>	2011/2019
common raven	<i>Corvus corax</i>	2019
purple martin	<i>Progne subis</i>	
bank swallow	<i>Riparia riparia</i>	2019
barn swallow	<i>Hirundo rustica</i>	2019
cliff swallow	<i>Hirundo pyrrhonota</i>	2019



Common Name	Latin Binomial	Obs. ¹
northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>	2011/2019
tree swallow	<i>Tachycineta bicolor</i>	2019
violet-green swallow	<i>Tachycineta thalassina</i>	2019
black-chinned hummingbird	<i>Archilochus alexandri</i>	2019
rufous hummingbird	<i>Selasphorus rufus</i>	2011/2019
American robin	<i>Turdus migratorius</i>	2011/2019
hermit thrush	<i>Catharus guttatus</i>	
Swainson's thrush	<i>Catharus ustulatus</i>	2011/2019
varied thrush	<i>Ixoreus naevius</i>	2019
European starling	<i>Sturnus vulgaris</i>	2019
American pipit	<i>Anthus rubescens</i>	
cedar waxwing	<i>Bombycilla cedrorum</i>	2019
black-throated gray warbler	<i>Dendroica nigrescens</i>	2011/2019
hermit warbler	<i>Dendroica occidentalis</i>	
MacGillivray's warbler	<i>Oporornis tomiei</i>	2019
Nashville warbler	<i>Vermivora ruficapilla</i>	2011
orange-crowned warbler	<i>Vermivora celata</i>	2019
Townsend's warbler	<i>Dendroica townsendi</i>	2011/2019
yellow warbler	<i>Dendroica petechia</i>	2019
yellow-rumped warbler (Audubon's)	<i>Dendroica coronata</i>	2011/2019
Wilson's warbler	<i>Wilsonia pusilla</i>	2011/2019
common yellowthroat	<i>Geothlypis trichas</i>	2019
western tanager	<i>Piranga ludoviciana</i>	2019
spotted towhee	<i>Pipilo maculatus</i>	2019
dark-eyed junco	<i>Junco hyemalis</i>	2011/2019
black-headed grosbeak	<i>Pheucticus melanocephalus</i>	2011/2019
evening grosbeak	<i>Coccothraustes vespertinus</i>	



Common Name	Latin Binomial	Obs. ¹
Brewer's blackbird	<i>Euphagus cyanocephalus</i>	
red-winged blackbird	<i>Agelaius phoeniceus</i>	2019
western meadowlark	<i>Sturnella neglecta</i>	
brown-headed cowbird	<i>Molothrus ater</i>	2019
Bullock's oriole	<i>Icterus bullockii</i>	2019
house finch	<i>Carpodacus mexicanus</i>	
purple finch	<i>Carpodacus purpurea</i>	2011/2019
American goldfinch	<i>Carduelis tristis</i>	2019
red crossbill	<i>Loxia curvirostra</i>	2019
pine siskin	<i>Carduelis pinus</i>	
golden-crowned sparrow	<i>Zonotrichia atricapilla</i>	
Lincoln's sparrow	<i>Melospiza lincolnii</i>	2019
white-crowned sparrow	<i>Zonotrichia leucophrys</i>	2019
fox sparrow	<i>Passerella iliaca</i>	
house sparrow	<i>Passer domesticus</i>	
savannah sparrow	<i>Passerculus sandwichensis</i>	
song sparrow	<i>Melospiza melodia</i>	2011/2019
black-capped chickadee	<i>Poecile atricapillus</i>	2019
chestnut-backed chickadee	<i>Poecile rufescens</i>	2019
bushtit	<i>Psaltiriparus minimus</i>	2019
red-breasted nuthatch	<i>Sitta canadensis</i>	2011/2019
brown creeper	<i>Certhia americana</i>	2019
Bewick's wren	<i>Thryomanes bewicki</i>	
marsh wren	<i>Cistothorus palustris</i>	
house wren	<i>Troglodytes aedon</i>	2019
Pacific (winter) wren	<i>Troglodytes troglodytes</i>	2011/2019
American dipper	<i>Cinclus mexicanus</i>	2019
golden-crowned kinglet	<i>Regulus satrapa</i>	2019
ruby-crowned kinglet	<i>Regulus calendula</i>	2019



Common Name	Latin Binomial	Obs. ¹
Townsend's solitaire	<i>Myadestes townsendi</i>	

Table 10-21. Species List of Mammals

Common Name	Latin Binomial
big brown bat	<i>Eptesicus fuscus</i>
California myotis	<i>Myotis californicus</i>
hoary bat	<i>Lasiurus cinereus</i>
Keen's myotis	<i>Myotis keenii</i>
little brown bat	<i>Myotis lucifugus</i>
long-eared myotis	<i>Myotis evotis</i>
long-legged myotis	<i>Myotis volans</i>
silver-haired myotis	<i>Lasionycteris noctivagans</i>
Townsend's big-eared bat	<i>Corynorhinus townsendii</i>
Yuma myotis	<i>Myotis yumanensis</i>
Pacific jumping mouse	<i>Zapus trinotatus</i>
deer mouse	<i>Peromyscus maniculatus</i>
meadow mouse	<i>Microtus</i> spp.
boreal red-backed vole	<i>Clethrionomys gapperi</i>
heather vole	<i>Phenacomys intermedius</i>
longtail vole	<i>Microtus longicaudus</i>
Oregon vole	<i>Microtus oregoni</i>
Townsend vole	<i>Microtus townsendi</i>
muskrat	<i>Ondatra zibethica</i>
bushy-tailed woodrat	<i>Neotoma cinerea</i>
dusky shrew	<i>Sorex obscurus</i>



marsh shrew	<i>Sorex bendirii</i>
northern water shrew	<i>Sorex palustris</i>
vagrant shrew	<i>Sorex vagrans</i>
coast mole	<i>Scapanus orarius</i>
shrew-mole	<i>Neurotrichus gibbsi</i>
Townsend's mole	<i>Scapanus townsendii</i>
Townsend's chipmunk	<i>Eutamias townsendii</i>
Douglas squirrel	<i>Tamiasciurus douglasii</i>
northern flying squirrel	<i>Glaucomys sabrinus</i>
pika	<i>Ochotona princeps</i>
snowshoe hare	<i>Lepus americanus</i>
Virginian opossum	<i>Didelphis virginiana</i>
raccoon	<i>Procyon lotor</i>
porcupine	<i>Erethizon dorsatum</i>
pine marten	<i>Martes americana</i>
mink	<i>Mustela vison</i>
spotted skunk	<i>Spilogale putorius</i>
striped skunk	<i>Mephitis mephitis</i>
long-tailed weasel	<i>Mustela frenata</i>
short-tailed weasel	<i>Mustela erminea</i>
river otter	<i>Lutra canadensis</i>
beaver	<i>Castor canadensis</i>
mountain beaver	<i>Aplodontia rufa</i>
common red fox	<i>Vulpes fulva</i>
coyote	<i>Canis latrans</i>
bobcat	<i>Lynx rufus</i>
mountain lion	<i>Felis concolor</i>
black-tailed deer	<i>Odocoileus hemionus</i>
Rocky Mountain elk	<i>Cervus canadensis</i>
black bear	<i>Ursus americanus</i>



Table 10-22. Species List of Reptiles

Common Name	Latin Binomial	Recent Observations
common garter snake	<i>Thamnophis sirtalis</i>	2018
northwestern garter snake	<i>Thamnophis ordinoides</i>	2018
western garter snake	<i>Thamnophis elegans</i>	
northern alligator lizard	<i>Elgaria coerulea</i>	2018

Table 10-23. Species List of Amphibians

Common Name	Latin Binomial	Recent Observations
long-toed salamander	<i>Ambystoma macrodactylum</i>	Not obs during 2018 Level II svy
northwestern salamander	<i>Ambystoma gracile</i>	2018
Ensatina salamander	<i>Ensatina eschscholtzii</i>	Not obs during 2018 Level II svy
larch mountain salamander	<i>Plethodon larselli</i>	sensitive
western red-backed salamander	<i>Plethodon vehiculum</i>	2018
coastal giant salamander	<i>Dicamptodon tenebrosus</i>	seen during electrofishing/2018
rough-skinned newt	<i>Taricha granulosa</i>	2019
coastal tailed frog	<i>Ascaphus truei</i>	2018
Pacific treefrog	<i>Hyla regilla/Pseudacris regilla</i>	2018
Cascades frog	<i>Rana cascadae</i>	2018
northern red-legged frog	<i>Rana aurora</i>	Baldi hab boom (2013)
western toad	<i>Bufo boreas/Anaxyrus boreas</i>	Baldi hab boom (2013)/2018

Table 10-24. Species List of Fish

Common Name	Scientific Name
Pacific lamprey	<i>Lampetra tridentata</i>



cutthroat trout	<i>Oncorhynchus clarkii</i>
bull trout	<i>Salvelinus confluentus</i>
rainbow trout	<i>Oncorhynchus mykiss</i>
rainbow/cutthroat hybrid	<i>Oncorhynchus mykiss x clarkii</i>
mountain whitefish	<i>Prosopium williamsoni</i>
torrent sculpin	<i>Cottus rhotheus</i>

E.2 References

Dickerson, D.D., D.S. D'Amato, C.T. Theriot, K.D. Philley, K.J. Reine. 2019. Level Herpetofauna Field Surveys: Howard A. Hanson Dam and Mud Mountain Dam, King and Pierce Counties, Washington. A Report to the U.S. Army Corps of Engineers Seattle District. U.S. Army Corps of Engineers, Engineer Research and Development Center, Environmental Laboratory.

Fischer, R.A. and E.S. Neipert. 2020. Draft Planning Level II Surveys of Seasonal Bird Communities on Howard Hanson and Mud Mountain Dams, U.S. Army Corps of Engineers, Seattle District, WA. Prepared by U.S. Army Engineer Research and Development Center, Environmental Laboratory.

Appendix F Public Scoping



From: [Dowell, William R CTV USARMY CENWS \(USA\)](#)
To: [DIL-CENWS-PA Team](#)
Subject: Corps revising master plans at 2 dams, seeking public input
Date: Tuesday, April 9, 2019 3:22:56 PM

SEATTLE – U.S. Army Corps of Engineers officials are revising the Howard A. Hanson and Mud Mountain Dams Master Plans, and seeking public input.

Corps officials will also be available at three public events to answer questions and provide information on the dams, master plans and the master planning process.

As steward of lands and waters at the dams it manages for the nation, Corps officials use the master plan as a strategic land use management document. It guides comprehensive management and development of all project recreational, natural and cultural resources throughout the dam's life.

The original master plans were developed about 20 years ago and do not reflect current conditions at the dams. Changes in Corps regulations and community needs necessitate a revision, or update, to the plan. The revisions will classify the government lands around the dam based on environmental and socioeconomic considerations, public input and an evaluation of past, present, and forecasted trends.

Additional information is available on the Seattle District's Master Plan webpage at www.nws.usace.army.mil/home/master-plans.

The public can begin providing input April 11 by sending comments to nwsmasterplan@usace.army.mil. To find out more information visit the Corps' Seattle District booth at the Washington State Spring Fair 10 a.m. to 6 p.m., April 11 through 14.

The two other public event opportunities are:

April 22, Enumclaw City Hall (1339 Griffin Ave)
 5 to 6:30 p.m., in the Enumclaw City Council chamber

o 7 to 8:30 p.m. outside the chamber – Operations Project Manager Kevin Heape will give a presentation to the Enumclaw City Council on the Master Plan revision

- May 11, Mud Mountain Dam (30525 SE Mud Mountain Rd, Enumclaw, WA)
 - o 9 a.m. to 3 p.m., at the dam's recreation site during the Corps' Dam Safety Day and Daffodil Valley Volkssport's "Just another dam walk."

"We are looking for public input applicable to environmental stewardship of the lands and outdoor recreation," said the dams Operations Project Manager Kevin Heape. "Flood risk management, fish passage, water supply, facility design and daily operations are included in other plans."

Deadline for public input during the scoping period is May 15. The next public input opportunity is during public review of the draft master plans and environmental assessments anticipated in spring 2020.

Howard A Hanson Dam is an earthen dam on the Green River, 21 miles east of Auburn Washington. The dam was authorized by the Flood Control Act of 1950 and completed in 1962. It is a multipurpose project that includes flood risk reduction, fish conservation, water supply and ecosystem restoration. Flood risk reduction is focused on the highly developed Green River Valley. It has prevented an estimated \$21.5 billion in flood damage. The dam and its reservoir is closed to the public as it lies entirely within the City of Tacoma municipal watershed.

Mud Mountain Dam (MMD) is an earthen dam, with a concrete cutoff wall in the core, on the White River, five miles southeast of Enumclaw, Washington. The dam was authorized by the Flood Control Acts of 1936 and 1944 and completed in 1948. It is flood risk reduction dam protecting the lower White and Puyallup River valleys.



MMD regulates flooding by holding back water from heavy rains and melting snow in the reservoir, then releasing it slowly back into the river. The reservoir is usually empty, except for the normal flow of the White River. Completely filled, the reservoir would stretch 5.5 miles and cover 1,200 acres. The Corps also made channel improvements and built levees on the lower Puyallup River. Together, these structures have saved an estimated \$308 million in flood damages and currently helps protect the homes and businesses of about 400,000 people.

The public can also ask questions using the same email: nwsmasterplan@usace.army.mil.

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Read More at: <https://www.nws.usace.army.mil/Media/News-Releases/Article/1809053/corps-revising-master-plans-at-2-dams-seeking-public-input/>

Contact the Seattle District Public Affairs office by replying to this email or via the contact information below.

Contact: Bill Dowell - (206) 764-3464 - william.r.dowell@usace.army.mil

U.S. Army Corps of Engineers - Seattle District - 206-764-3750

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