Forest Habitat Assessment and Restoration Report

PREPARED FOR:

City of Tacoma
747 Market Street, Room 1036
Tacoma, WA 98402

PROJECT:

First Creek
Tacoma, Washington
211215.70

PREPARED BY:

Theresa R. Dusek
Natural Resources Ecologist Project Manager

DATE:

September 2011

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Executive Summary

The findings and conclusions presented in this report are based on an interpretation of information currently available to AHBL. This summary is for introductory purposes and should be used only in conjunction with the full extent of this report.

The methods used for the completion of the forest inventory are in accordance with full forest stand delineation standards. The inventory was conducted using the variable radius plot point sampling method of inventory forest resources. Forest stands were delineated into a vegetative cover type with a size designation based upon the dominant/co-dominant tree species.

Based on the information derived through site reconnaissance and readily available documents, four forest stands were identified on the subject property within approximately 60 acres of forest. In addition, forested, scrub-shrub and emergent wetlands were identified on City owned property associated with First Creek. There is also a 0.5 acre meadow located northeast of East 32nd Street and the First Creek canyon. In addition, there are approximately 10 acres of land owned by the Puyallup Tribe of Indians and 37 acres privately owned within First Creek. The following table summarizes information related to the onsite forest stands.

Stand	Type	Size on Public and Private Land	Dominant Size Class	Health
Stand A	Madrone & Douglas Fir with Alder Wetlands	39 acres plus Swan Creek Park	18-29.9"	Good
Stand B	Douglas Fir & Big Leaf Maple with Alder Wetlands	53 acres	Evenly split 10-17.9" & 18 -29.9"	Fair
Stand C	Cottonwood & Alder	10.5 acres	10-17.9"	Fair
Stand D	Urban Forest Remnants	15 acres	10-17.9"	Poor

The forest stands were then divided into fourteen restoration areas based on ownership, geomorphic conditions and forest type. Recommendations, priorities, and costs to implement restoration in First Creek were provided to support future acquisition of a Programmatic Permit and restoration efforts.

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1.0 INTRODUCTION

In June 2011, an AHBL ecologist conducted a preliminary forest inventory within the public properties at First Creek to complete a forest stand delineation and overall assessment of forest health. First Creek is located within the southeast neighborhood of the City of Tacoma, and public properties reviewed are comprised of 46 parcels and 14 undeveloped rights-of-way, plus several undeveloped alleys (Table 1).

Table 1: Parcel and Property Ownership

Owner	Parcel Number	Acres
Tacoma Housing Authority	5004691300	5.54
	5004220331	10.65
	5003642370	16.42
City of Tacoma	0320151073	0.98
	0320151013	2.18
	4715023050	0.22
	4715022440	0.37
	4715022441	0.22
	4715022341	0.37
	4715022340	0.30
	4715021341	0.52
	4715021230	0.21
	4715021240	0.39
	4715020360	0.69
	4715020312	0.15
	4715020320	0.03
	4715020321	0.07
	4715017191	0.45
	4715017190	0.45
	4715017121	0.30
	4715017120	0.45
	4715016160	0.22
	4715016150	0.52
	4715016060	0.82
	4715015111 (residence encroaching on parcel)	0.15
	4715015110	0.07
	4715015042	0.22
	4715015041	0.67
	4715015040	0.15
	4715014321	0.52
	4715014320	0.15
	4715014240	0.15
	4715013730	0.15
	4715013672	1.34
	4715013671	0.22
	4715013190	0.67
	4715013112	0.30
	2580000010	0.25
	2580000050	0.23
	2580000080	0.14
	2965000010	0.59
	2965000610	0.20
	0320221015	0.20
	2580000100	0.27
	2580000071	0.11
	0320154022	0.10
	East 30th Street right-of-way	0.37
	East 31st Street right-of-way	0.82
	East T Street right-of-way	1.42

Table 1: Parcel and Property Ownership		
Owner	**Parcel Number**	**Acres**
	East 32nd Street right-of-way	0.55
	Wright Avenue right-of-way	0.76
	East 35th Street right-of-way	0.59
	Harrison Street right-of-way	0.62
	Morton Street right-of-way	0.52
	East R Street right-of-way	0.77
	Sherman Street right-of-way	0.25
	East 37th Street right-of-way	0.30
	Columbia Avenue right-of-way	0.45
	Union Pacific right-of-way	3.95
	East 47th Street right-of-way	0.17
	Two Tacoma water parcels	0.00
	TOTAL	60.91+/-

The work conducted for this study included a summary of known existing conditions, natural resources inventory, forest characterization, and the preparation of this Forest Report and detailed resource mapping. This report contains a description of each of the forest stand types encountered during the forest study. The Forest Stand Delineation (FSD) included four separate stands within the site, based on subtle differences in stand composition, soil type and moisture regime, forest structure and condition, invasive species impacts, and human disturbance. A forest stand map is provided in Appendix A. The evaluation was conducted in accordance with basic forest conservation and delineation field study standards. This Forest Habitat Assessment and Restoration Report has been written to support acquisition of a Programmatic Permit to allow the restoration efforts to move forward without annual permit review.

1.1 Scope of Services

The scope of services for this study was limited to the following tasks:

1. Summarize known existing conditions of the First Creek system.

2. Evaluation of the forest ecology using scientific methods appropriate to the Puget Sound Area and Western Washington.

3. Provide recommendations, priorities, and costs to implement restoration.

4. The preparation of a Forest Habitat Assessment and Restoration Report.

2.0 FIRST CREEK OVERVIEW AND HISTORY

The First Creek Watershed is comprised of approximately 2,110 acres, with an additional 570 acres located in Pierce County (Tacoma, 2008). The First Creek Watershed Maps prepared by the City of Tacoma Environmental Services Division, dated December 2010, are located in Appendix B. First Creek consists of the main channel and two tributaries. All three channels of First Creek are located in 20 to 30 foot deep ravines.

- The main branch is located west of East T Street and the open channel begins near East 47th Street where a 48 inch storm pipe discharges water into the channel. The main channel enters an 84 inch stand pipe at East 34th Street. Water then enters a 72 inch pipe that discharges to the Puyallup River approximately 630 feet downstream of Interstate 5. Below 34th Street wetlands and a ditched portion of the historic main channel are present. Water from the wetlands and ditched channel enter a 34 inch inlet at East 29th Street and

enter the Washington Department of Transportation (WDOT) storm pipes which discharge to the Puyallup River north of Pacific Highway (Eells Street). The WDOT discharge point is approximately 640 feet south of the First Creek discharge point into the Puyallup River.

- The West Tributary of First Creek begins near East 50th Street as an open channel where 48 inch pipe discharges water into the channel. The West Tributary of First Creek enters the Main channel approximately 400 feet southwest of the intersection of East R Street and East Sherman Street.

- The West-West Tributary of First Creek begins near East 38th Street and L Street as an open channel where an 18 inch pipe discharges water into the channel. This tributary enters the West Tributary approximately 300 feet north of Columbia Avenue near Portland Avenue. All of this tributary is privately owned and was not evaluated in this study.

First Creek and its tributaries are part of and have been managed by the City of Tacoma as a stormwater conveyance system and utility corridor. Stormwater and sewer lines are located within the First Creek canyons. In the 1990s the City of Tacoma completed modifications including rip rapping the First Creek stream channel to control erosion.

The subject property is bordered by residential development, two schools (First Creek Middle School and Lister Elementary School), Portland Avenue Park and the Puyallup Tribe of Indians Emerald Queen Casino up to the top of the canyon rim. Five roads cross the First Creek canyon as identified in Table 2.

Table 2: Roads Crossing First Creek

Road	Location	Crossing Type
East 44th Street	Main Tributary	Fill prism with a 48 inch culvert
East Fairbanks Street	Main Tributary	Fill prism with a 60 inch culvert
East 34th Street	Main Tributary	Fill prism with no culvert. Water is diverted directly to the Puyallup River at a stand pipe before East 34th Street
East 32nd Street	Main Tributary	Bridge
Portland Avenue	West Tributary	Fill prism with a 42 inch culvert
East 48th Street	West Tributary	Fill prism with a 48 inch culvert
Pipeline Road	West Tributary	Fill prism with a culvert of unknown size
Portland Avenue	West West Tributary	Fill prism with a 36 inch culvert

Information from the City of Tacoma GovMe website and Ecology's website regarding the subject site is located in Table 3 below.

Table 3: GovMe and Ecology Website Information

Habitat corridor: Yes ☒ No ☐
Aquifer recharge area: Yes ☒ No ☐ (rain gardens to treat water quality require health department approval)
Floodway: Yes ☐ No ☒
Flood zone: 100 year ☐ 500 year ☐ None ☒
Habitat zone: Yes ☒ No ☐
Mine hazard area: Yes ☐ No ☒
Steep slopes: <25% ☒ 25% – 40% ☒ >40% ☒
Slope stability: Intermediate ☐ Modified ☐ Unstable slope ☐ Unstable old slide ☐ Unstable recent slide ☐ None ☒
Shoreline: Yes ☐ No ☒
Stream: Yes ☒ No ☐
Wetland: Filled ☐ High probability ☒ Known ☒ Non-jurisdictional ☐ None ☐

Table 3: GovMe and Ecology Website Information
Utilities in project area: Sanitary sewer ☒ Storm sewer ☒ Water lines ☐ Overhead Power ☐ None ☐
Schools: First Creek Middle School, Lister Elementary School nearest creek. Six within the watershed
Arsenic plume in project area: (request information from ecology for cautions for each zone) http://apps.ecy.wa.gov/website/facsite/viewer.htm?sp_area=Tacoma%20Smelter%20Plume None detected ☒ <20ppm ☐ 20-40ppm ☐ 40-100ppm ☐ 100-200ppm ☐ >200ppm ☐

2.1 Document Review

2.1.1 Wetland and Streams

The City of Tacoma identified 16 wetland/stream permits associated with First Creek. The general location of each of the wetland and stream systems is provided in Appendix C as a notation of the Wetland/Stream Number. Although the wetland rating and buffers have changed due to changes in the City of Tacoma Municipal Code 13.11 the surveyed wetland and stream boundaries have not significantly changed. The most recent reports identify First Creek as a Type Ns1 stream and wetlands as Category II and III. First Creek below Fairbanks Street flows year round and would be considered as a Type Np stream. Table 2 provides a summary of the wetland/stream permits provided by the City of Tacoma.

Table 4: Past Wetland/Stream Permit Summary

Report	Wetland/Stream Number	Size (square feet)	Cowardin Classification	Hydrogeomorphic Classification	Rating/ Type	Tacoma Buffer at Permit Issuance
WET1999-40000022619 Salishan	1	76,665	Palustrine forested	None provided	Wetland: Type II (1993) Stream: Type	Variable per averaging and reduction
WET2006-40000070277 Brookwater Preliminary Plan	2	Stream 1,450	Not applicable	Not applicable	Type Ns1	75 feet
Wet2004-40000028819 Subdivisions West	3	Stream no estimate provided	Not applicable	Not applicable	Type V	25 feet
File number not provided. Buddhist Temple	4	Stream no estimate provided	Not applicable	Not applicable	Type V	25 feet
WET2005-40000062899 Habitat for Humanity	5	Offsite no estimate size provided	Palustrine emergent	Slope	Wetland Type III (1991)/ Stream Type 4	75 foot wetland/100 foot stream
WET2003-00008 Precision Northwest Builders	6	Offsite no estimate provided	Not applicable	Not applicable	Type IV	100 feet
WET2008-40000117633 Erickson Preliminary Plat	7	470	Palustrine scrub-shrub	Slope	Wetland Category III (Revised 2006)/Stream Type Ns1	80 feet wetland/ 100 foot stream

Table 4: Past Wetland/Stream Permit Summary						
Report	**Wetland/Stream Number**	**Size (square feet)**	**Cowardin Classification**	**Hydrogeomorphic Classification**	**Rating/ Type**	**Tacoma Buffer at Permit Issuance**
WET202-00003 Verizon Wireless	8	None provided	Not applicable	Not applicable	Stream Type V	25 feet
WET2001-00001 First Samoan Congregational Church	9	Stream 2,091	Not applicable	Not applicable	Type IV	100 feet
No file number provided, Portland Avenue Park	10	Wetland A: 8,450 Wetland B: offsite no estimate provided	Wetland A: Palustrine forested Wetland B: Palustrine foreste/scrub-shrub	Wetland A: Depressional Wetland B: Riverine	Wetland A: Category III Wetland B: Category II (2004) Stream Ns1	Wetland A: 80 feet Wetland B: 150 feet Stream: 75 feet
No file number provided, Rugby Club	11	Estimate 1.5 to 2 acres	Palustrine forested/scrub-shrub/emergent	None provided	Wetland Type 2 Stream Type 4	Wetland and Stream both 100 feet
WET2004-40000042184 Barghausen Consulting Engineers	12	No estimate provided	Palustrine forested	None provided	Type II	100 feet
WET2003-40000034564 Barghausen Consulting Engineers	13	No estimate provided	Palustrine forested/scrub-shrub/emergent	None provided	Wetland: Type II (1991) Stream Type 4	Wetland: 100 feet Stream: 25 feet
2007 Building Plan Review no number provided. Biologist Landau	14	No estimate provided	Palustrine forested	None provided	Category II	150 feet
WET2010-40000142802 MCD Portland Avenue Housing Development	15	Stream no estimate provided	Not applicable	Not applicable	Type Ns1	75 feet
Tacoma Environmental Services	16	Wetlands and Stream no estimate provided	Unknown	Unknown	Wetland: Category II and III. Stream: Type Np.	Wetlands: variable. Stream: 100 feet.

2.1.2 Washington Department of Fish and Wildlife Priority Habitat and Species Review

Review of information dated August 3, 2011, from Washington State Department of Fish and Wildlife Priority Habitat and Species database associated with the First Creek Basin identified the following:

- Big eared bats (Eptesicus fuscus) within the local region.

- A Palustrine wetland habitat from East 34th Street to East 29th Street within the First Creek canyon.

- A biodiversity corridor habitat adjacent to First Creek Middle School that continues into Swan Creek Park and down the Swam Creek canyon.

- Presence of a peregrine falcon (Falco peregrinus) flying overhead in 2000. Peregrine falcons are a federal Species of Concern and a State Sensitive species.

2.2 Wildlife Review

Since the Spring of 2010, AHBL has walked First Creek on numerous occasions to collect data regarding presence of wildlife species, nests, and snags. On two occasions First Creek neighbors have assisted with the data collection. In April 2010, Edwina Magrum assisted with data collection along First Creek from Columbia to Fairbanks. On June 9, 2011, Fan Fears assisted with data collection from Fairbanks to the area approximately 500 feet south of East 34th Street. Additional information was provided by Melissa Buckingham of the Pierce County Conservation District regarding wildlife species identified near First Creek Middle School during restoration efforts. The First Creek forest systems are connected to Swan Creek Park near First Creek Middle School. This connection is a significant wildlife corridor from East Tacoma to Puyallup. Information collected regarding flora and fauna along First Creek is located in Appendix D and E, respectively. Threatened, endangered, sensitive and candidate species have not been observed at First Creek. A peregrine falcon was observed flying over First Creek in 2000 but has not been observed within habitats associated with the creek.

2.3 Present Forest Management

According to the City of Tacoma, present forest management at First Creek has been focused on identifying the forest system and prioritizing large scale areas of the City including First Creek in a Triage Model to estimate general conditions and restoration costs. Currently there are no specific management practices for First Creek. It was determined in the City of Tacoma Restoration Action Plan (Green Tacoma Partnership, 2011) that First Creek has 31.8 acres that is considered to have a low threat from invasive species, 8.79 acres has a moderate threat from invasive species and 22.57 has a high threat from invasive species. The Triage process is intended to be used to prioritize large areas such as the City, but would need to be supplemented with site specific information to be useful for restoration planning and implementation.

3.0 FOREST ANALYSIS

3.1 Methods

The methods used for the completion of the forest inventory are in accordance with full forest stand delineation standards. The inventory was conducted using the variable radius plot point sampling method of inventory forest resources. Sample plots were randomly located throughout the property using preliminary maps to ensure unbiased but complete representation of the stands (Appendix F).

At each sample plot, a ten (10) basal area factor (BAF) wedge prism was used to determine countable trees. All countable trees 2 inches DBH or greater, and greater than 20 feet in height were tallied. The individual diameter of each tree was measured and tallied. Standard protocol was used to measure DBH using a foresters cruising tree stick located 25 inches from the eye at

4.5 feet from the ground level at the uphill side of the tree. DBH can be an indicator of tree age, and obtaining measurements across a stand can give a relative estimate of stand age, regeneration, and diversity.

Additionally, any standing, dead, countable tree greater than 6 inches DBH was also tallied. At each sample point, the overall percentage of canopy closure (trees greater than 20 feet tall), understory canopy aerial coverage (trees and shrubs 3 to 20 feet tall), and herbaceous layer ground cover (woody and herbaceous plants 0 to 3 feet tall) were estimated and recorded. Canopy closure is a visual estimate of the entire plot area, and is an indication of general light levels in the understory and stand maturity. Bare ground percent cover can be estimated by the percent cover of herbaceous species.

Also recorded at each sample plot were (a) common names of all identifiable shrubs and herbs, (b) canopy position of each tree, (c) observation of saplings regenerating, (d) presence of invasive species and their overall percent cover, (d) notation of the presence of large downed woody debris, (e) presence of disturbance, and (f) general condition of the sample point surroundings.

The location of each plot was flagged in the field with orange survey ribbon labeled "FSD" with the corresponding plot number. Data sheets are provided in Appendix B and, in addition to the data described above, each data sheet contains the park name, plot number, date recorded, and the recorders name.

Forest stands were delineated into a vegetative cover type with a size designation based upon the dominant/co-dominant tree species. Note that forests frequently include a mix of several species in various height distribution layers. Any individual tree species or group of similar species (such as "mixed conifers," which could include Douglas fir, Sitka spruce, western red cedar, and western hemlock) may be represented within a stand type, but also could be not dominant/co-dominant, not prevalent (predominant), or both.

A stand is a contiguous area where the species, size, age, and general condition of trees is uniform enough to be distinguished from adjacent areas. The forest map that accompanies this report shows the layout of the property and the various forest stands.

3.2 Stand Characterization

Stand health rankings are provided as follows: poor, fair, good, and excellent.

- Poor: young, dominated by invasive species, and highly disturbed. Extensive enhancement recommended.
- Fair: moderately developed and with large patches of invasive species, with or without human disturbance. Moderate enhancement recommended.
- Good: moderately to well developed and low invasive cover, but with presence of daily human disturbance. Little or no enhancement recommended.
- Excellent: mature, low invasive cover, and minimal human disturbance. No habitat enhancement recommended.

Stocking, or stand density, is a term used to describe how well the trees in a stand utilize the available space. In classifying the stocking of a stand, the following terms will be used.

- Well-stocked: a stand in which the trees are well distributed and all the space is utilized, but the trees still have room for continued growth.

- Understocked: a stand in which there are large open spaces between the trees.

- Overstocked: a stand that is so overcrowded that trees grow very slowly, or have poor form due to heavy competition.

3.3 Results

Four distinct forest stands and a meadow were identified onsite. The onsite stands are dominated by fir and western hardwoods. Western hardwoods onsite include big leaf maple, red alder, madrone, and black cottonwood. In general, the forest cover in Stands A, B and C are well developed, have minimal recruitment of young trees, and include well developed canopy cover and subcanopy layers. The average understory invasive species coverage in Stands B and D is 80 percent or greater, Stand A is 35 percent, and Stand C is 25 percent. A detailed description of each stand is provided below, and forest sample plot data sheets are provided in Appendix F. The stand acreages include public and private land within the First Creek canyon. All plants observed onsite is provided in Appendix D.

Table 5: Forest Stand Summary

Stand	Type	Size on Public and Private Land	Dominant Size Class	Health
Stand A	Madrone & Douglas Fir with Alder Wetlands	39 acres plus Swan Creek Park	18-29.9"	Good
Stand B	Douglas Fir & Big Leaf Maple with Alder Wetlands	53 acres	Evenly split 10-17.9" & 18 -29.9"	Fair
Stand C	Cottonwood & Alder	10.5 acres	10-17.9"	Fair
Stand D	Urban Forest Remnants	15.3 acres	10-17.9"	Poor

3.3.1 Forest Stand A

Forest Cover Type: Mixed Fir/Western Hardwood Forest - Douglas Fir/Pacific Madrone
Acreage: 39 acres plus Swan Creek Park Forest

This stand's overstory is dominated by Douglas fir and Madrone. The stand also contains small populations of ash, alder and hawthorn. The understory and herbaceous layers of the stand contain a variety of species including hazelnut, thimbleberry, cascara, red huckleberry, clustered rose, salal, bracken fern, and trailing blackberry. The topography of the stand is generally flat sloping down from the south to north with slopes up to the east and west. The canyon is approximately 15 feet deep in the south and 30 feet deep near the north portion of the stand. Stand A contains wetlands and the southern end of the main stem of First Creek which start at approximately East 47th Street and continue north. A red tail hawk nest is located in a Douglas fir tree on the eastern slope in Swan Creek Park.

Forest Sample Plots 1, 2 and 3 is located within the stand. Forest Stand A has an average DBH of 20 inches, an average basal area of 197 square feet per acre, and contains an average of 187 trees per acre greater than 2 inches DBH. The dominant size class for the stand is 18 to 29.9 inches. The stand contains an average canopy closure of 31 percent, subcanopy closure of 96 percent, and herbaceous cover of less than 5 percent. Himalayan blackberry was located within the sample plots, though other noxious weeds including herb Robert, ivy, holly and Japanese knotweed are

known to be within this stand. Snags greater than 6 inches DBH were not located within the sample plot. Downed woody debris was present.

This stand is not present within the 1931 aerial photographs although a few scattered trees are present in and near Swan Creek Park near First Creek Middle School, the stand is present in the 1950 aerial photograph, placing its age near 60 years old with scattered trees that may be in excess of 80 years old. First Creek is located underground in a pipe throughout most of this stand. The creek daylights and flows for approximately 1,000 feet before entering a culvert to cross under East 44th Street. The stand includes several gravel roads/pathways, storm sewer pipes, outfalls, and manholes and sanitary sewer pipes and manholes. Bordering the stand to the west is a First Creek Middle School, Salishan (a residential community) and to the east are Swan Creek Park, Lister Elementary School, and Salishan.

3.3.2 Forest Stand B

Forest Cover Type: Mixed Fir/Western Hardwood Forest - Douglas Fir/Big Leaf Maple with Alder Wetlands
Acreage: 53 acres

The stand's overstory is dominated by Douglas fir, big leaf maple, and red alder. A few Douglas fir are also located in this stand. The understory layers include cascara, big leaf maple saplings, Indian plum, red elderberry, hazelnut, salmonberry, vine maple, cedar saplings, red huckleberry, hawthorn, laurel, holly, Himalayan blackberry and Policeman's helmet. Herbaceous layers include lady fern, giant horsetail, sword fern, trailing blackberry, English ivy, Oregon grape, and large leaf avens. The topography of the stand is generally flat sloping down from the south to north with slopes up to the east and west. The canyon is approximately 25 to 30 feet deep. Stand B contains wetlands and the main stem of First Creek until East 34th Street where water from the stream is collected in a stand pipe and flows through culverts to the Puyallup River. The lower 2,500 feet of the west tributary of First Creek is also located in this stand.

Forest Sample Plots 4, 5, 6, 7 and 9 are located within this stand. Forest Stand B has an average DBH of 19 inches, an average basal area of 86 square feet per acre, and contains an average of 77 trees per acre greater than 2 inches DBH. The dominant size class of the stand is evenly split between 10 to 17.9 inches and 18 to 29.9 inches. The stand contains an average canopy closure of 57 percent, a subcanopy closure of 58 percent, and herbaceous cover of 17 percent. Within the subcanopy and herbaceous species, approximately 50 to 80 percent of the cover is comprised of invasive species. Snags greater than 6 inches DBH were not located within the sample plot. Downed woody debris was present.

A review of historical aerial photographs reveals that the stand was dominated by forested vegetation in 1931 with sparse forest in the southern portion of the stand. In the 1998 and 2001 aerial photograph dense forest is present with the exception of the base of the canyon where red alder trees are regenerating and estimated to be 15 years of age. It is estimated that the overall stand is greater than 80 years old with the exception of the base of the canyon. The stand includes several gravel roads/pathways, storm sewer pipes, outfalls, and manholes and sanitary sewer pipes and manholes. Bordering the stand to the west are residential neighborhoods including Salishan and Portland Avenue Park, and to the east are residential neighborhoods including Salishan.

3.3.3 Forest Stand C

Forest Cover Type: Western Hardwood Forest - Cottonwood/Alder
Acreage: 10.5 acres

This stand is a large wetland with a narrow band of upland forest. This stand's overstory is dominated by cottonwood and alder. The understory layers are dominated by Sitka willow, big leaf maple saplings, alder saplings, salmonberry, mountain ash, vine maple, red osier dogwood, hawthorn, Douglas spiraea, Himalayan blackberry and Japanese knotweed. Herbaceous layers include lady fern, giant horsetail, buttercup, skunk cabbage, sedges, rushes, and reed canarygrass. The topography of the stand is generally flat and hummocky, sloping down from the south to north with slopes up to the east and west. The canyon is approximately 25 to 30 feet deep on the west and 10 to 15 feet on the east. Water from the wetland enters a constructed channel near the northeast corner of the system and enters the underground storm system which ultimately enters the Puyallup River.

Forest Sample Plots 10 and 11 are located within this stand. Forest Stand C has an average DBH of 14 inches, an average basal area of 90 square feet per acre, and contains an average of 177 trees per acre greater than 2 inches DBH. The dominant size class of the stand is 10 to 17.9 inches. The small size class and high density of trees is typical of permanently wet systems. The stand contains an average canopy closure of 55 percent, a subcanopy closure of 72 percent, and herbaceous cover of 60 percent. Within the subcanopy species, less than 15 percent of the cover is comprised of reed canary grass, Japanese knotweed and other invasive species. Four snags greater than 6 inches DBH were located within this stand and many of the trees have dead tops. Downed woody debris was present.

This stand is comprised of a wetland forest that is greater than 80 years old and likely greater than 100 years old. Aerial photography from 1931 to present day show the forest intact but the stream channel is no longer present in the 1961 photograph. In addition, the 1996 photograph shows that a portion of the forest southeast of East 32nd Street and Wright Avenue was cleared and is currently a meadow that is mowed annually by the City of Tacoma. The stand includes several gravel roads and pathways, storm sewer pipes, outfalls, and manholes and sanitary sewer pipes and manholes along the east edge of the system. Bordering the stand to the west are residences and parking lots, and to the east are residential neighborhoods and the Emerald Queen Casino.

3.3.4 Forest Stand D

Forest Cover Type: Urban Forest Remnants - Mixed Fir/Red Alder Regeneration
Acreage: 15.3 acres

This stand's overstory is dominated by red alder with remnants of Douglas fir forest. The understory layers are dominated by alder saplings, Himalayan blackberry and Japanese knotweed. The herbaceous layer contains pockets of sedges and rushes along the base of the stream channel. The topography of the stand is generally flat sloping down from the south to north with slopes up to the east and west. The stream channel is in a shallow ravine that is 5 to 10 feet deep. Stand D contains a few small wetlands and the upper 3,000 linear feet of the West Tributary of First Creek. The West West Tributary of First Creek has urban forest remnants but is within private properties and was only visually reviewed from road rights-of-way.

Forest Sample Plot 8 is located within this stand. Forest Stand D has an average DBH of 14.8 inches, an average basal area of 50 square feet per acre, and contains an average of 45 trees per acre greater than 2 inches DBH. The dominant size class of the stand is 10 to 17.9 inches. The small size class and low density of trees is typical of remnant forests and disturbed areas. The stand contains an average canopy closure of 20 percent, a subcanopy closure of 100 percent, and herbaceous cover of 0 percent. Within the subcanopy species, approximately 98 percent of the cover is comprised of invasive species including Himalayan blackberry and Japanese knotweed. Snags greater than 6 inches DBH were not present within this stand and downed woody debris was not present.

This stand is comprised of remnant forest with alder regeneration that has established itself following historic clearing in the 1930s and 1940s. Douglas fir and alder began to forest the stream channel and riparian corridor from 1940 to 1998 when clearing of the channel for the placement of rip rap for erosion control occurred. Since that time alder has begin regenerating and the remnants of Douglas fir forest remain. The Douglas fir remnants are approximately 70 years old and the alder regeneration is approximately 12 years old. Red Alder is a typical second growth species and is a prolific seeder that invades disturbed areas. Himalayan blackberry and Japanese knotweed are also a species that quickly seeds within disturbed areas within western Washington, and grows quickly to inhibit seeding of other native plants. Each grows well in poor soils caused by clearing, grading, and soil compaction. The stand includes several gravel roads and pathways, storm sewer pipes, outfalls, and manholes and sanitary sewer pipes and manholes. Bordering the stand to the west are residences and churches and to the east are residences.

3.4 Recommendations for Management and Habitat Restoration

3.4.1 General Forest Recommendations

Forest Cover in and adjacent to the streams, steep slopes, and wetlands should be protected from development in accordance with federal, state, and local regulations. Development within the open space should be restricted to non-forested areas to allow retention of the areas that are urban, high quality, environmentally sensitive areas of forest. If forest loss or disturbance is unavoidable, alterations should be concentrated or restricted to the following areas:

- The perimeter of the forest.
- Narrow strips of upland forest protruding from the main forest area.
- Small, isolated forest areas.
- Portions of the forest with low quality habitat (i.e., areas that are already heavily fragmented, relatively young, exhibit low structural diversity, etc.).

The following should also be taken into consideration when planning proposed projects or undertaking management activities:

- Minimize forest isolation. Generally, forests that are adjacent, close to, or connected to other forests corridors provide higher quality habitat than more isolated forests.

- Reduce removal of trees for pathways, access points and other recreational facilities.
- Do not plant trees over or within 10 feet of underground utilities.
- Maintain forest canopy closure over paths, roads and driveways.
- Landscape areas with native trees, shrubs, and other plants.
- Remove invasive and non-native species, including but not limited to herb Robert, English ivy, Japanese knotweed, policeman's helmet and Himalayan blackberry.
- Do not mow the forest understory.
- Retain decaying and dead trees, and woody debris.
- Maintain or create contiguous wildlife corridors.
- Maintain forested stream buffers and wetland buffers.
- Minimize impervious area.

3.4.2 Stand A

Stand A is in relatively good health, with mature trees and relatively low invasive cover. It is recommended that ivy be removed from the groundcover and from the tree trunks in this area, and other noxious weeds should be removed. Restoration should include planting of native trees, shrubs and herbaceous species.

There are no set stocking standards for madrone stands and, as such, no recommendations can be given regarding appropriate stand density. According to the Oregon State University Extension Service, this stand would be considered on the cusp of being overstocked if it were an even-aged Douglas fir stand. As it is not a monotypic stand, but a mixed stand of hardwood and fir, it is likely that the stand is appropriately stocked.

3.4.3 Stand B

Stand B is in relatively fair health and contains a large presence of invasive species within the herbaceous and shrub layers. Ideally, the ivy should be removed from both the ground cover and the tree trunks, noxious weeds should be removed and the stand should be restored with native trees, shrubs and herbaceous species.

According to the Oregon State University Extension Service's "Woodland Workbook, Managing Red Alders," Stand B is appropriately stocked. According to the workbook, red alder stands with an average DBH of 19 inches should have a target density around between 60 and 120 trees per acre. Stand B has an average DBH of 19 inches and an average density of 77 trees per acre.

3.4.4 Stand C

Stand C is in relatively fair health, with a mixture of mature and young trees of varying species. The tops of many mature trees are dying but are being replaced by other native western hardwood tree species. Invasive species are present in the wetland and primarily within the upland edge on and near the tops of the slopes. Conifers are lacking in the system and it is recommended that under-planting of conifers occur as part of the restoration efforts.

Conifer under-planting includes the removal of existing understory shrubs within 4 feet or wider of each planting spot, and the planting of large saplings of shade-tolerant conifers. Species of conifers are chosen based upon the aspect of slopes on which the stand may be located, and presence of hydrology. Appropriate species for this stand, which is located on generally flat ground with a slope down to the east and west on the edges of the system and near a freshwater wetland, would be western red cedar, western hemlock, or Sitka spruce in the wetland and Douglas fir and hemlock on the slopes. The intent of under-planting is that, when the alders follow natural succession and begin to decline, the conifers will respond to increased light availability with vigorous growth (WSU Manual EM003).

3.4.5 Stand D

Stand D is in relatively poor health and is the least healthy of the stands onsite, with a high percentage of invasive cover, historically disturbed soils, and heavy surrounding use.

Total rehabilitation of this area would be ideal. Possible restoration efforts could include removal and spraying of the dense noxious weeds including Japanese knotweed, planting of the rip rap stream banks with willow and red osier dogwood stakes, and planting of native trees and shrubs above the stream banks. According to the Oregon State University Extension Service's "Woodland Workbook," this stand is very under stocked and should be planted with Douglas fir and other conifers.

4.0 REGULATORY CONSIDERATIONS

4.1 City of Tacoma

The areas reviewed include publicly owned property. Within the area of First Creek zoning ranges from Community Commercial Mixed use between East 29th Street and East 32nd Street, Urban Residential Mixed Use south of East 32nd Street to Wright Street, One Family Dwelling (R-2) from Wright Street to Salishan. Within Salishan First Creek is zoned Multi Family Dwelling (R-4) with a Planned Residential Development overlay and between Harper Street and East 46th Street is zoned as Commercial (C-1). South of East 46th Street to East 56th Street is zoned Two Family Dwelling (R-3). Steep slopes between 25% and 40% and greater than 40% are located on the site. The site is in the 1873 Puyallup Tribe Treaty Area and the Northeast Tacoma Storm Basin. In addition, wetlands, streams and code required buffers are located at the site. Restoration Areas 1 and 2 do not have wetlands and stream present. Utilities including stormwater and sanitary sewer pipes and manholes are located within the stream/wetland corridor. Approximately seventy percent of the stream channel has had rip rap placed to reduce erosion.

Restoration of First Creek would require approvals from the City of Tacoma since parcels and easements are held by the City. In addition, due to the presence of the Creek, associated wetlands and steep slopes within the canyon review or consultation with the City planning or building departments may be required. Portions of First Creek are on private property and would require property owner permission or would require review of the easements held by the City of Tacoma to determine what work can be completed within the easements on the private properties.

First Creek is located on-site and ranges from a Type Np stream (non-fish bearing perennial flow) to a Type Ns1 stream (Non-fish bearing with seasonal flow that is physically connected by an above ground channel system to a Type F or Np system). The City of Tacoma requires a 100 foot buffer from Type Np streams and 75 foot buffer from Type Ns1 streams as measured from the ordinary high water mark. At this time, it has been documented that First Creek has perennial flow from the intersection of the main tributary and the west tributary. Above this intersection, the flow is seasonal.

Category II to IV wetlands are associated with First Creek. Currently, Category II wetlands have buffers that range from 300 to 50 feet, Category III wetlands have buffers that range from 150 to 75 feet, and Category IV wetlands have buffers that range from 25 to 50 feet, depending on function and proposed land use intensity. The City of Tacoma is in the process of updating the Critical Areas Preservation Ordinance (CAPO), which is located within the Tacoma Municipal Code 13.11. Under the proposed code, Category II wetlands would have 100-foot buffers, Category III wetlands would have 75-foot buffers, and Category IV wetlands would 50-foot buffers.

Impacts to wetlands, streams, and code required buffers require a development permit. Restoration projects that do not propose development may submit a proposal to City staff for approval to complete the restoration effort without a permit. Under the updated CAPO, it is anticipated that the City would be able to complete a Programmatic Permit that would allow for planning, review, and approval of restoration on larger open space areas that can be implemented over a 5 year time frame with staff approval of an additional 5 years for a total of 10 years. Currently the CAPO allows for implementation over a 5 year time frame.

To date restoration efforts at First Creek have not required permits to remove noxious and invasive plants. Coordination with City of Tacoma staff for work on slopes and within wetland and stream buffers has been completed. Future efforts should continue coordination with the City staff. Construction of formal parking areas, access points, and formal trails may require a conditional use permit, SEPA review, clearing and grading permits with a Stormwater Pollution Prevention Plan (SWPPP), and potentially building permits.

There are two types of SWPPP that may apply to projects. According to Appendix C of the City of Tacoma Surface Water Management Manual (September 22, 2008): "Projects falling within the thresholds listed below may use this short form instead of preparing a professionally-designed Construction Stormwater Pollution Prevention Plan (SWPPP). If your project meets the following thresholds and includes or may impact a critical area, please contact the City to determine if the SWPPP short form may be used. The thresholds for using this form are projects that propose to (a) add or replace between 2,000 and 5,000 square feet of impervious surface, (b) clear or disturb between 7,000 square feet and 1 acre of land, or grade/fill 50-499 cubic yards." Greater than 1 acre of clearing or disturbance requires a SWPPP and SEPA review.

Impacts to steep slopes are regulated by TMC 13.11.700. Clearing and grading activities in an erosion hazard area shall also be required to comply with the City amendments to the most recently adopted International Building Code.

City of Tacoma has a sign code that must be considered for placement of signs on the site.

4.2 Federal and State

In addition, impacts (filling, clearing of significant vegetation, draining or flooding) to "Waters of the United States" including wetlands and streams would require appropriate authorizations from the U.S. Army Corps of Engineers (Section 404 of the Clean water Act), the Washington State Departments of Ecology (Section 401 of the Clean Water Act), and the Washington State Department of Fish and Wildlife (Hydraulic Project Approval).

4.3 Non-Native and Invasive Plant Species

Noxious Weeds are non-native plants introduced into Washington State. They spread quickly and can be difficult to control. They out-compete native understory vegetation and prevent the establishment of native trees and shrubs that require sun for germination. Dense, impenetrable non-native and invasive thickets can block access of larger wildlife to water and other resources and impede recreation in parks and natural areas. There are three categories of noxious weeds (a) Class A Weeds, eradication of these weeds is required by law throughout Washington State, (b) Class B Weeds, control of these species is required by law in Pierce County, and (c) Non-Regulated Noxious Weeds, include State Class B and C Weeds that are highly recommended by Pierce County to be controlled on property due to environmental and economic damage caused by their spread. The 2009 Pierce County Noxious Weed List is located in Appendix D. Pierce County Regulated Class A Noxious Weeds were not observed on the site. One Pierce County Regulated Class B Noxious Weed, policeman's helmet, was identified on the site. Pierce County Non-regulated Class B Noxious Weeds, Herb Robert (Geranium robertianum), butterfly bush (Buddleja davidii), ivy (Hedera helix), knotweed (Polygonum cuspidate), and scotch broom (Cytisus scoparius) were observed on the site.

Western touch-me-not (Impatiens noli-tangere) which is a native plant that has a similar appearance to policeman's helmet, is found in similar habitats, and is located in First Creek. Care should be taken to not eradicate this native species while removing policeman's helmet.

Dominant non-native and invasive species observed within First Creek in 2010 and 2011 included those listed in Table 5. Non-native and invasive species were mapped relative to site topography and this forestry study. Native, non-native and invasive species were listed on field data forms to evaluate the existing conditions of each of the mapped plots and are summarized in this report.

Invasive species to be targeted for removal from the restoration areas include those listed in Table 6. Some removal of blackberry, policeman's helmet and ivy have occurred within the Creek corridor and along the existing paths. An eradication program from upstream to downstream will be required to successfully control policeman's helmet and knotweed throughout the stream corridors. The knotweed will require spraying of herbicide to eradicate.

Table 6: Dominant Non-Native and Invasive Species Observed at First Creek

Non-Native	Black locust	Robinia pseudoacacia	
	Butterfly bush	Buddleja davidii	Non-regulated noxious weed
	Hawthorn	Crataegus monogyna	
	Horse chestnut	Aesculus indica	
Invasive	English ivy	Hedera helix	Non-regulated noxious weed
	Herb Robert	Geranium robertianum	Non-regulated noxious weed
	Himalayan blackberry	Rubus armeniacis	Non-regulated noxious weed
	Holly	Ilex aquifolium	
	Japanese knotweed	Polygonum cuspidate	Non-regulated noxious weed
	Policeman's helmet	Impatience glandulifera	Class B noxious weed
	Scot's broom	Cytisus scoparius	Non-regulated noxious weed

Species selected for removal are dominating the lower and/or mid story of the plant communities and negatively impacting the ecology and diversity of First Creek. The impacts that can be caused by the selected invasive species include the following.

Policeman's helmet is a highly invasive, aggressive invader of wetlands, streams and moist woodlands. It displaces native and beneficial plants and contributes to flooding and erosion by changing or stopping water movement.

Blackberry competes with low growing native vegetation and can prevent establishment of shade intolerant trees and shrubs. Dense thickets can form with little or no other vegetation present. The dense thickets can limit movement of larger animals.

Holly can form dense thickets that dominate the tall shrub layer and suppress germination and growth of native tree and shrub species.

Ivy climbs up a tree canopy and shades out deciduous leaves suppressing the overall tree, deprives the bark of normal contact with air and microorganisms, adds weight to trees making the trees top heavy and more susceptible to blow down. Ivy changes natural succession patterns of forests, limits understory regeneration and competes for water and nutrients.

Knotweed spreads rapidly, finding a hold in areas of disturbed soil. It crowds out native plant species, contributes to erosion, and discourages native animals.

Scot's broom displaces native and beneficial plants causing loss of grasslands and open forest habitat.

5.0 RESTORATION

The forest stands were separated into fourteen restoration areas based on ownership, geomorphic conditions and forest type (Appendix A).

5.1 Restoration Goals and Objectives

The goals and objectives listed here were determined at several meetings with the First Creek steering committee and the pubic. The restoration goals and objectives listed below are those that apply specifically to this study for restoration of the plant communities. Other goals and objectives have been determined for First Creek by the City and Tacoma and MIG that are not associated with restoration of the plant communities.

The overall goal of this restoration plan is to remove noxious weeds in select locations and to revegetate the areas with native trees, shrubs and herbaceous species. The overall project objective is to restore a native plant community within First Creek. Specific objectives include:

- Removal of selected noxious weeds and invasive species (Policeman's helmet, Himalayan blackberry, English ivy, holly, Japanese knotweed, butterfly bush and Scot's broom) from the site.
- Establishment of non-invasive, native tree, shrub, or herbaceous vegetation on the site.
- Increase diversity of the plant community on the site by planting species that are present in similar surrounding areas but are not present or dominant on the site.

5.2 Restoration Proposal

All fourteen of the Restoration Areas require removal of noxious weeds and invasive species and planting of native vegetation. First Creek has several stewards that have been trained in the Green Tacoma Partnership Program. First Creek Middle School has a club and classes that have been working to remove noxious weeds and plant native species in the uplands at the southern end of the system beyond First Creek. Salishan has also had some wetland/stream buffer restoration occur in relationship to a Weland/Stream Development Permit. Noxious weed and invasive species plant removal methods will be in accordance with the Green Tacoma Partnership Habitat Steward Field Guide. Generally, species will be removed by hand pulling and cutting of vegetation. Roots of blackberries will be required to be dug out of the ground. Removal of trees or vegetation that requires power tools will be completed by City of Tacoma qualified staff or qualified contractors. Chemical applications will be limited to Japanese knotweed and will be completed by licensed applicators. Work on steep slopes (greater than 25%) will be completed by the Washington Conservation Corps or other professionals as approved by the City of Tacoma.

Since policeman's helmet is aggressive and required by law to be eradicated, and will spread downstream and invade areas that are in the process of being eradicated a watershed wide upstream to downstream eradication program should be completed and implemented by the City of Tacoma with assistance of volunteers. Knotweed is also an aggressive noxious weed that requires an upstream to downstream eradication program that would be completed by the City of Tacoma with certified professionals chemically spraying or inoculating the knotweed.

The plant species selected for the restoration areas are native to the Puget Sound Region. All of the species selected are present in local regional area. The planting plan proposes the establishment of intermixed trees and shrubs and ground cover in the restoration areas. Planting of native species should occur between October and March to take advantage of seasonal rains. Other planting times would require hand watering or irrigation. Clean weed free mulch may be placed around the base of the newly planted trees and shrubs to retain moisture and deter weeds. Species to be planted, their restoration locations and planting specifications are shown in Appendix H and are described in Table 6 below.

Table 7: Restoration Area Descriptions

ID #/Size on Public & Private Land	Existing Condition	Proposed Enhancement
Restoration Area 1/ 10 acres	Located within Forest Stand A. A narrow relatively flat area adjacent to First Creek Middle School. Forest continues into Swan Creek Park. Wetlands and stream not present. Contains 5 to 10% cover Himalayan blackberry, herb Robert, ivy, holly, and Japanese knotweed. Soils are gravelly sand to gravelly sandy loam with pH of 5.9 to 6.1. A portion of this area has been restored by First Creek Middle School and is in the maintenance phase. Trees planted over storm and sanitary sewer should be moved, and shrubs planted within 10 feet of the utilities.	Hand removal of canes and roots. Planting of native vegetation. Placement of weed free mulch. Have a certified professional chemically spray or inoculate knotweed.

Table 7: Restoration Area Descriptions		
ID #/Size on Public & Private Land	**Existing Condition**	**Proposed Enhancement**
Restoration Area 2/ 5 acres	Forest Stand A that is within Salishan and a canyon with steep slopes but no wetlands, stream or associated buffers present. First Creek is located within an underground pipe in this area. Contains approximately 5 to 10% cover Himalayan blackberry, a patch of Japanese knotweed and ivy and herb Robert. Soils are gravelly sandy loam with pH of 5.9 to 6.2.	Hand removal of blackberry canes and roots, ivy, and herb Robert. Have a certified professional chemically spray or inoculate the knotweed. Planting of native vegetation. Placement of weed free mulch.
Restoration Area 3/ 16 acres	Forest Stand A located on steep slopes and above slope flats at Salishan. Wetland buffer and First Creek main stem buffer are located within this restoration area. Work within the buffers will require coordination with the City of Tacoma planning and land use development division. Work on the steep slopes will require coordination with the City building division. Contains 5 to 10% cover of Himalayan blackberry, holly and ivy and herb Robert. Soils are gravelly sandy loam with pH range of 6.0 to 6.2. East 44th Street crosses this restoration area. Approximately 40,000 square feet of wetland buffer in this area has been restored in accordance with a wetland development permit issued by the City of Tacoma and is in the monitoring and maintenance phase. The remainder of the restoration area should be restored.	Steep slopes must have a professional crew hand remove noxious weeds and plant native vegetation. On areas outside of steep slopes, volunteers can remove noxious weeds and plant native vegetation. Placement of weed free mulch.
Restoration Area 4/ 8 acres	Located within Forest Stand A. This restoration area contains wetland and the First Creek main stem within the base of the canyons, and is located at Salishan. Restoration will require coordination with the City of Tacoma planning and land use development division due to the presence of wetland and stream. Contains 5 to 10% cover of Japanese knotweed and ivy and herb Robert. Although policeman's helmet was not observed during this limited study, a review of the area in the late spring should occur to confirm if policeman's helmet is present. Soils are clay loam to silt loam to gravelly sandy loam with pH range of 6.0 to 6.8.	Hand removal of noxious weeds. Have a certified professional chemically spray or inoculate the knotweed. Planting of native vegetation. Placement of weed free mulch.
Restoration Area 5/ 11 acres	Forest Stand B located on steep slopes and above slope flats at Salishan. Wetland buffer, First Creek main stem buffer and First Creek west tributary buffer are located within this restoration area. Work within the buffers will require coordination with the City of Tacoma planning and land use development division. Work on the steep slopes will require coordination with the City building division. Contains greater than 20% cover of blackberry, herb Robert, holly, and knotweed. Soils are gravelly sandy loam with pH range of 6.0 to 6.2. Approximately 58,000 square feet of this area has been restored in accordance with a wetland development permit issued by the City of Tacoma and is in the monitoring and maintenance phase. The remainder of the restoration area should be restored.	Steep slopes must have a professional crew hand remove noxious weeds and plant native vegetation. On areas outside of steep slopes, volunteers can remove noxious weeds and plant native vegetation. Placement of weed free mulch. Have a certified professional chemically spray or inoculate the knotweed.

Table 7: Restoration Area Descriptions		
ID #/Size on Public & Private Land	**Existing Condition**	**Proposed Enhancement**
Restoration Area 6/ 5.6 acres	Located in Forest Stand B. This restoration area contains wetland, First Creek main stem, and First Creek west tributary within the base of the canyons, and is located at Salishan. Restoration will require coordination with the City of Tacoma planning and land use development division due to the presence of wetland and stream. Contains greater than 50% cover of blackberry, holly, and knotweed. Although policeman's helmet was not observed during this limited study, a review of the area in the late spring should occur to confirm if policeman's helmet is present. Soils are clay loam to silt loam to gravelly sandy loam with pH range of 6.0 to 6.8. A significant trash dumping area is located in the southwest portion of the restoration area near the west tributary of First Creek.	Trash should be removed from the dumping location and barriers to future dumping should be placed. Hand removal of noxious weeds. Have a certified professional chemically spray or inoculate the knotweed. Planting of native vegetation. Placement of weed free mulch.
Restoration Area 7/ 16 acres	Forest Stand B located on steep slopes and above slope flats. This restoration area is located on a mix of public and private property located between Salishan and Fairbanks Street. Wetland buffer, First Creek main stem buffer and First Creek west tributary buffer are located within this restoration area. Work within the buffers will require coordination with the City of Tacoma planning and land use development division. Work on the steep slopes will require coordination with the City building division. Contains greater than 5% cover blackberry, holly, knotweed, and herb Robert. Soils are gravelly sandy loam with pH range of 6.0 to 6.5.	Steep slopes must have a professional crew hand remove noxious weeds and plant native vegetation. On areas outside of steep slopes, volunteers can remove noxious weeds and plant native vegetation. Placement of weed free mulch. Have a certified professional chemically spray or inoculate the knotweed.
Restoration Area 8/ 8.1 acres	Located in Forest Stand B. This restoration area contains wetland, First Creek main stem, and First Creek west tributary within the base of the canyons, and is located on public and private properties. Restoration will require coordination with the City of Tacoma planning and land use development division due to the presence of wetland and stream. Contains greater than 25% cover of blackberry and knotweed. Although policeman's helmet was not observed during this limited study, a review of the area in the late spring should occur to confirm if policeman's helmet is present. Soils are clay loam to silt loam to gravelly sandy loam with pH range of 6.0 to 6.8.	Hand removal of noxious weeds. Have a certified professional chemically spray or inoculate the knotweed. Planting of native vegetation. Placement of weed free mulch.

Table 7: Restoration Area Descriptions		
ID #/Size on Public & Private Land	**Existing Condition**	**Proposed Enhancement**
Restoration Area 9/ 4.9 acres	Located in Forest Stand B between Fairbanks Street and East 34th Street on steep slopes and flats above the slopes. This restoration area is located on primarily public property. Slope wetlands, wetland buffer, and First Creek main stem buffer are located within this restoration area. Work within the slope wetlands and buffers will require coordination with the City of Tacoma planning and land use development division. Work on the steep slopes will require coordination with the City building division. Contains greater than 80% cover of blackberry, holly, herb Robert, and knotweed. Soils are gravelly sandy loam with pH range of 6.2 to 6.5.	Steep slopes must have a professional crew hand remove noxious weeds and plant native vegetation. On areas outside of steep slopes, volunteers can remove noxious weeds and plant native vegetation. Placement of weed free mulch. Have a certified professional chemically spray or inoculate the knotweed.
Restoration Area 10/ 4 acres	Located in Forest Stand B between Fairbanks Street and East 34th Street in the base of the canyon. This restoration area contains wetland and the First Creek main stem and is located primarily on public property. This restoration area contains a City stormwater retention area that was dredged in the late Summer of 2011. Depending on natural recovery of this area over the next year restoration planting may occur as mitigation. Restoration will require coordination with the City of Tacoma planning and land use development division due to the presence of wetland and stream. Contains greater than 80% cover of reed canarygrass, blackberry, policeman's helmet. Policeman's helmet is predominant in this area and is in the process of being removed by volunteers. In addition, noxious weeds along the trail system have been removed and are maintained by volunteers. Soils are muck to clay loam to silt loam to gravelly sandy loam with pH range of 6.0 to 6.8.	Hand removal of noxious weeds. Have a certified professional chemically spray or inoculate the knotweed. Planting of native vegetation. Placement of weed free mulch. The removal of policeman's helmet should be part of a system wide removal plan.
Restoration Area 11/ 1 acre	Located in Forest Stand B north of East 34th Street. This restoration area contains wetland and steep slopes. This restoration area is located on primarily public property. Work within the wetlands and wetland buffers will require coordination with the City of Tacoma planning and land use development division. Work on the steep slopes will require coordination with the City building division. Contains greater than 80% cover of blackberry, holly, herb Robert, and knotweed. Soils are gravelly sandy loam with pH range of 6.5 to 6.8.	Steep slopes must have a professional crew hand remove noxious weeds and plant native vegetation. On areas outside of steep slopes, volunteers can remove noxious weeds and plant native vegetation. Placement of weed free mulch. Have a certified professional chemically spray or inoculate the knotweed.

Table 7: Restoration Area Descriptions		
ID #/Size on Public & Private Land	**Existing Condition**	**Proposed Enhancement**
Restoration Area 12/ 10.5 acres	Located in Forest Stand C between East 32nd Street and East 29th Street. This restoration area is a mix of public and Puyallup Tribal owned lands. This restoration area is composed of a wetland and slopes surrounding the wetland. Work within the wetlands and wetland buffers will require coordination with the City of Tacoma planning and land use development division. Work on the steep slopes will require coordination with the City building division. Contains greater than 35% cover of reed canarygrass, blackberry, herb Robert, and knotweed. Soils are peat, muck, silt loam, and clay loam in the wetland and gravelly sandy loam on the slopes. Soil pH in the wetland ranges from 5.8 to 6.5 and within the slopes range from 6.5 to 6.8.	Steep slopes must have a professional crew hand remove noxious weeds and plant native vegetation. On areas outside of steep slopes, volunteers can remove noxious weeds and plant native vegetation. Placement of weed free mulch. Have a certified professional chemically spray or inoculate the knotweed.
Restoration Area 13/ 0.5 acre	Located in a grassy meadow surrounded with blackberry (10% cover) thickets between East 32nd Street and East Wright Street. This area is used for annual picnics by First Creek Neighbors. In the past, this area was used as a staging area when erosion control measures were being implemented along First Creek. Soils in this area are compacted gravelly sandy loam fill. Due to the nature of the compacted fill, this area is wet during the rainy season. The area is hummocky and difficult to maintain.	Blackberries can be removed by volunteers. This area could have surface grading to level the area and be seeded with native grasses and planted with native flowers along the edges. This would create a level surface for annual mowing, seasonal picnicking, and year round education of native grass and flower species.
Restoration Area 14/ 15 acres	Located in Forest Stand D between Portland Avenue and East 50th Street. This restoration area is located on primarily private property. First Creek west tributary and buffer are located within this restoration area. Work within the stream and buffers will require coordination with the City of Tacoma planning and land use development division. Contains approximately 98% cover blackberry and knotweed. Soils are gravelly sandy loam with pH range of 6.5 to 6.8.	Volunteers can remove blackberry and plant native vegetation. Placement of weed free mulch. Have a certified professional chemically spray or inoculate the knotweed.

5.3 Site Management Priorities

Site management priorities are specified to direct efforts in specific areas of the site on a manageable schedule and costs. Restoration areas on the site were run through the triage process identified in the Green Tacoma Partnership Habitat Steward Field Guide to assist in determining the priorities. The lower the results number in the Tri-age Analysis the higher the priority to complete restoration. Exceptions are where work on slopes increases the cost since professional crews are required or if removal of a noxious weed is required by law or the community determines that they have a higher priority due to visibility of an area, an available steward or other considerations.

Table 8: Habitat Tri-Age Analysis			
Restoration Location	**Tree Composition**	**Invasive Species Cover**	**Result**
1	Medium	Low	4
2	Medium	Medium	5
3	Medium	Medium	5
4	Medium	Low	4
5	Medium	Medium	5
6	Medium	High	6
7	Medium	Low	4
8	Low	Medium	8
9	Medium	High	6
10	Medium	High	6
11	Medium	High	6
12	High	Medium	2
13	Low	Medium	8
14	Low	High	9

Site management priorities have been divided into three categories as follows (a) short term goals – to complete within 5 years, (b) medium term goals – to complete in 5 to 10 years and (c) long term goals – may require more than 10 years to complete restoration. The management priorities will depend on available funding for plant material and professional crews, and volunteer interest and available time. For example although Restoration Areas R-9 and R-10 are listed as a medium term goal due to interest by an active steward and activities in process of being completed by the City Environmental Services Division work may be completed within 5 years. The management priorities should be evaluated and adjusted prior to the end of the 10 year time frame. Management priorities for the site were discussed in several meetings with the First Creek Steering Committee and the public include those listed in Table 8.

Table 9: Site Management Priorities			
Short Term Priorities	**Actions to be completed within 5 years**	**Estimated Volunteer Hours and Cost**	
	Prepare a system wide policeman's helmet control program for public and private property from upstream to downstream. May be coordinated with the knotweed control plan.	City staff or consultant	$3,000
	Implement the system wide policeman's helmet control program from upstream to downstream.	Volunteers, City staff and/or professional crews, 10,000 hours	$0.00
	Prepare a system wide knotweed control program on public and private property. May be coordinated with the policeman's helmet control plan.	City staff or consultant	$3,000
	Implement the system wide knotweed control program on public and private property. Have a certified professional chemically spray or inoculate the knotweed patches from upstream to downstream in accordance with the control plan.	Professional 8 weeks	$18,866
	Remove all invasive and nonnative species on public property from Restoration Areas R-1 and R-2.	275 volunteer hours	$0.00
	Plant native species on public property in Restoration Area R-1 and R-2	275 volunteer hours	$3023.50

Table 9: Site Management Priorities			
	Monitor and maintain planted areas R-1 and R-2 for 3 years after planting.	22 hours per year for 3 years 66 hour total	$0.00
	Remove all invasive and nonnative species on public properties from Restoration Area R-4. Salishan.	200 volunteer hours	$0.00
	Plant native species on public properties in Restoration Area R-4. Salishan.	200 volunteer hours	$407.50 plants
	Monitor and maintain planted area R-4 for 3 years after planting. Salishan.	16 hours per year for 3 years 48 hour total	$0.00
	Have professional crews remove noxious weeds on public properties on steep slopes in Restoration Area R-5. Salishan.	2 weeks and one day	$5,130.40
	Plant native species on public properties in Restoration Area R-5. Salishan.	2 weeks and one day	$5,130.40 crew, $2,241.25 plants for total of $7,371.65
	Monitor and maintain planted area R-5 for 3 years after planting. Salishan.	88 hours per year for 3 years 264 hour total	$0.00
	Have professional crews remove noxious weeds on public properties on steep slopes in Restoration Area R-7.	2 days	$932.80
	Plant native species on public properties in Restoration Area R-7.	2 days	$932.80 crew, $51.25 plants for total of $984.05
	Monitor and maintain planted area R-7 for 3 years after planting.	2 hours per year for 3 years 6 hour total	$0.00
	Remove all invasive and nonnative species on public properties from Restoration Area R-8.	125 volunteer hours	$0.00
	Plant native species on public properties in Restoration Area R-8.	125 volunteer hours	$255 plants
	Monitor and maintain planted area R-8 for 3 years after planting.	10 hours per year for 3 years 30 hour total	$0.00
	Remove all invasive and nonnative species on public properties from Restoration Area R-12.	100 volunteer hours	$0.00
	Plant native species on public properties in Restoration Area R-12.	100 volunteer hours	$203.75 plants
	Monitor and maintain planted area R-12 for 3 years after planting.	8 hours per year for 3 years 24 hour total	$0.00
Medium Term Priorities	**Actions to be completed within 5 to 10 years**		
	Remove all invasive and nonnative species on public properties from Restoration Area R-6. Salishan.	1,400 volunteer hours	$0.00

Table 9: Site Management Priorities			
	Plant native species on public properties in Restoration Area R-6. Salishan.	1,400 volunteer hours	$4,981.25 plants
	Monitor and maintain planted area R-6 for 3 years after planting. Salishan.	112 hours per year for 3 years 336 hour total	$0.00
	Have professional crews remove noxious weeds on public properties on steep slopes in Restoration Area R-9.	3 weeks and 2 days	$9,094.80
	Plant native species on public properties in Restoration Area R-9.	3 weeks and 2 days	$9,094.80 crew, $3,972.50 plants for total of $13,067.30
	Monitor and maintain planted area R-9 for 3 years after planting.	156 hours per year for 3 years 468 hour total	$0.00
	Remove all invasive and nonnative species on public properties from Restoration Area R-10.	1,600 volunteer hours	$0.00
	Plant native species on public properties in Restoration Area R-10.	1,600 volunteer hours	$3,260 plants
	Monitor and maintain planted area R-10 for 3 years after planting.	128 hours per year for 3 years 384 hour total	$0.00
	Remove all invasive and nonnative species on public properties from Restoration Area R-11.	400 volunteer hours	$0.00
	Plant native species on public properties in Restoration Area R-11.	400 volunteer hours	$816.25 plants
	Monitor and maintain planted area R-11 for 3 years after planting.	32 hours per year for 3 years 96 hour total	$0.00
Long Term Priorities	**Actions likely to take more than 10 years to complete**		
	Have professional crews remove noxious weeds on steep slopes on public properties in Restoration Area R-3. Salishan.	11 weeks	$25,652
	Plant native species on public properties in Restoration Area R-3. Salishan.	11 weeks	$25,652 crew, $12,226.50 plants for total of $37,878.25
	Monitor and maintain planted area R-3 for 3 years after planting. Salishan.	440 hours per year for 3 years 1,320 hour total	$0.00
	Remove all invasive and nonnative species on public properties from Restoration Area R-13.	25 volunteer hours	$0.00
	Plant native species on public properties in Restoration Area R-13.	25 volunteer hours	$51.25 plants
	Monitor and maintain planted area R-13 for 3 years after planting.	2 hours per year for 3 years 6 hour total	$0.00

Table 9: Site Management Priorities			
	Grade meadow portion of Restoration Area R-13, and seed with native grass and flower seed mix.	8 volunteer hours	$1,500 grading, $50 seed for total of $1,550
	Remove all invasive and nonnative species on public properties from Restoration Area R-14.	500 volunteer hours	$0.00
	Plant native species on public properties in Restoration Area R-14.	500 volunteer hours	$1,018.75 plants
	Monitor and maintain planted area R-14 for 3 years after planting.	40 hours per year for 3 years 120 hour total	$0.00
Annually	Evaluate and determine maintenance requirements annually for areas beyond the 3 year monitoring.	5 hours per acre	$0.00
Year 9	Conduct new inventory of the site and assess management requirements		
Year 10	Write new management plan for the site		
Notes: Estimate at 500 hours per acre for hand removal of blackberry and other noxious weeds. Estimates for professional crews (WCC) were at $2,332 per week. Plant costs for bare root trees and shrubs $1.25. Salvaged or donated plants may decrease costs. Spacing for enhancement 18 feet on center for trees and 8 feet on center for shrubs. Monitoring and maintenance at 40 hours per acre per year.			

6.0 LONG-TERM ADAPTIVE MANAGEMENT PLAN

Upon completion of the enhancement in specific management zones, continued maintenance to keep nonnative and invasive species from becoming dominant in First Creek over time will need to occur. The goals of this long-term adaptive management plan include the following.

1. Evaluation of the site on an annual basis by the City of Tacoma and implementation of items 2 through 4 below by volunteers or professional contractors, if required.

2. Prevention of non-native and invasive species establishment through the placement of natural weed free mulches and/or planting of native species.

3. Early detection to identify the presence, location, overall percent cover and the dominant native plant community that the non-native and invasive species are associated with through annual invasive species review once the areas have been restored.

4. Control and management through removal of the non-native invasive species in the same year that it is detected. Removal may include the use of chemical applications, if required, and will be completed by a licensed applicator.

5. Enhancement by planting of native species appropriate for the dominant native plant community if the target non-native or invasive species cover is greater than 10%. Planting shall occur between October and March following removal of the non-native and invasive species.

7.0 CONCLUSION

The overall health of the forests at First Creek ranges from good condition (Stand A) in the southern portion of the main tributary, fair condition (Stands B and C) in the majority of the main tributary and poor condition (Stand D) in the west tributary. The west west tributary is currently under private ownership and was not evaluated. The four forest stands contain invasive species and relatively poor understory development. With invasive species removal and enhancement of the 14 restoration area with native trees and shrubs, the habitat within these stands could greatly improve beyond current conditions. The presence of wetlands, streams, slopes and buffers will require regulatory review by the City of Tacoma. This Forest Study and Restoration Report has been written to support acquisition of a Programmatic Permit to allow the restoration efforts to move forward without annual permit review.

8.0 CLOSURE

The findings and conclusions documented in this report have been prepared for specific application to this site. They have been developed in a manner consistent with that level of care and skill normally exercised by members of the environmental science profession currently practicing under similar conditions in the area. Our work was also performed in accordance with the terms and conditions set forth in our proposal. The conclusions and recommendations presented in this report are professional opinions based on an interpretation of information currently available to us, and are made within the operation scope, budget, and schedule of this project. No warranty, expressed or implied, is made.

AHBL, Inc.

Theresa R Dusek

Theresa R. Dusek
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TD/lsk

September 2011

9.0 REFERENCES

Apex Engineering. 2002. Fax to Karla Kluge at City of Tacoma Regarding Khmer Krom Buddhist Temple Wetland Maps. August 13.

Barghausen Consulting Engineers, Inc. 2007. Wetland Delineation Report Lister Gulch Bridge and Pedestrian Crossing. Revised May 22.

Baumgartner, D.M., and Hanley, D.P. 2002. Forest Ecology in Washington. Washington State University Cooperative Extension Program. Pullman, Washington.

City of Tacoma Public Works/Environmental Services. 2008. Surface Water Management Manual. September 22.

Cosmopolitan Engineering Group. 1997. T-Street Gulch Drainage Basin Study prepared for City of Tacoma Public Works Utility Services Engineering Division. May.

Emmingham, W.H. and D. Green. 2003. Stand Management, Thinning Systems for Western Oregon Douglas-fir Stands. The Woodland Workbook. Oregon State University Extension Service.

Emmingham, W.H. and D. Green. 2003. Thinning Systems for Western Oregon Douglas-fir Stands. Oregon State University Extension Service. July.

Green Tacoma Partnership. 2011. Restoration Action Plan. April

Grette Associates Environmental Consultants. 2007. Metropolitan Park District of Tacoma Portland Avenue Park Wetland Assessment Report. October.

Grotta, A.T. and Zobrist, K.W. 2009. Management Options for Declining Red Alder Forests. Washington State University Cooperative Extension Manual EM003.

Hibbs, D.E. 1996. Stand Management, Managing Hardwood Stands for Timber Production. The Woodland Workbook. Oregon State University Extension Service.

Hitchcock, C. and Cronquist, Arthur. 1973. Flora of the Pacific Northwest. University of Washington Press. Seattle, Washington.

John Comis Associates. 2008. Wetland and Stream Delineation Report for a Wetland Development Permit for the Erickson Preliminary Plat. April 25.

Land-Tek Wetland Services. Revised May 2006. Wetland and Stream Delineation Report, Buffer Modification Proposal and Final Buffer Enhancement Plan for the Tacoma Nomads Rugby Football Club Gymnasium. May.

Link, Russell. 1999. Landscaping for Wildlife in the Pacific Northwest. Washington State Department of Fish and Wildlife. University of Washington Press. Seattle, Washington.

Parametrix, Inc. 1999. Wetland Delineation Report Salishan Utility Master Plan. July.

Pierce County Noxious Weed Control Board. 2009. The 2009 Pierce County Noxious Weed List.

Ralph J. Alig, Daolan Zheng, Thomas A. Spies, and Brett J. Butler. 2000. Forest Cover Dynamics in the Pacific Northwest West Side: Regional Trends and Projections United States Department of Agriculture, Forest Service, Pacific Northwest Research Station, Research Paper PNW-RP-522, February. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. http://www.fs.fed.us/pnw.

Smith, W.B., Vissage, J.S., Darr, D.R., and Sheffield, R.M., 2000, Forest Resources of the United States, 1997: St. Paul, MN, U.S. Department of Agriculture Forest Service.

Society of American Foresters. 1980. Forest Cover Types of the United States and Canada. Bethesda, MD.

Tacoma Department of Public Works. 2007. Critical Area Notice on Title WET2006-40000070277, SDO, LLC. September 26.

Tacoma Department of Public Works. 2006. Critical Area Notice on Title WET2005-40000062899, Habitat for Humanity. June 16.

Tacoma Department of Public Works. 2005. Critical Area Notice on Title CMB2004-40000042184. William and Crystal Gandy. February 3.

Tacoma Department of Public Works. 2005. Critical Area Notice on Title WET2003-00008. Precision Northwest Builders, LLC. February 24.

Tacoma Department of Public Works. 2004. Critical Area Notice on Title WET2004-40000028819, Subdivisions West, Inc. October 29.

Tacoma Department of Public Works. 2001. Critical Area Notice on Title WET2001-00001, Samoan Congregational Church Tacoma. September 12.

Tacoma Environmental Services Division. 2010. First Creek Watershed Maps. December.

Tetra Tech. 2002. Limited Stream Channel Delineation Tacnportland Property, Tacoma, Washington. January.

United States Department of Interior, U.S. Fish and Wildlife Service (USFWS). 1997. National List of Vascular Plant Species that Occur in Wetlands: 1996 National Summary. A draft revision of: Reed, P.B., Jr. 1988. National List of Plant Species that Occur in Wetlands: Northwest (Region 9). U.S. Fish and Wildlife Service Biological Report 88 (26.9). Washington, D.C.

Washington State Department of Fish and Wildlife. 2011. Priority Habitats and Species Maps in the vicinity of First Creek. August 3.

Washington State Department of Natural Resources. 2010. Washington Natural Heritage Information, Sections that Contain Natural Heritage Features. November 5. http://www.dnr.wa.gov/Publications/amp_nh_trs.pdf

Yellowtail Consulting. 2006. Critical Areas Information provided by Landau Associates. July 14.

Appendix A

Aerial Photograph with Forest Stand Map

Appendix B

First Creek Watershed Maps

Appendix C

First Creek Maps

Appendix D

Vegetative Species Identified at First Creek

Appendix D: Vegetative Species Identified at First Creek		
Stratum	**Scientific Name**	**Common Name**
Tree	*Acer circinatum*	Vine Maple
	Acer macrophyllum	Big Leaf Maple
	Alnus rubra	Red Alder
	Arbutus menziesii	Madrona
	Crataegus douglasii	Black Hawthorn
	Cratagus sp.	Hawthorn
	Fraxinus latifolia	Oregon Ash
	Malus (pyrus) fusca	Western Crabapple
	Populus balsamifera	Black Cottonwood
	Prunus emarginata	Bitter Cherry
	Prunus sp.	Cherry
	Populus tremuloides	Quaking Aspen
	Populus sp.	Poplar
	Pseudotsuga menziesii	Douglas Fir
	Quercus garryana	Garry Oak
	Rhamnus purshiana	Cascara
	Salix lucida	Pacific Willow
	Salix scouleriana	Scouler's Willow
	Salix sitchensis	Sitka Willow
	Sorbus sitchensis	Mountain Ash
	Thuja plicata	Western Red Cedar
	Tsuga heterophylla	Western Hemlock
Shrub	*Cornus sericea*	Red-osier Dogwood
	Corylus cornuta	Beaked Hazelnut
	Cytisus scopairus	Scot's broom
	Gaultheria shallon	Salal
	Hedera helix	English ivy
	Holodiscus discolor	Oceanspray
	Ilex sp.	Holly
	Mahonia aquifolium	Tall Oregon Grape
	Oemleria cerasiformis	Indian Plum
	Rosa nootkana	Nootka Rose
	Rosa pisocarpa	Clustered Rose
	Rubus discolor	Himalayan Blackberry
	Rubus parviflorus	Thimbleberry
	Rubus spectabilis	Salmonberry
	Sambucus racemosa	Red Elderberry
	Spiraea douglasii	Douglas Spiraea
	Symphoricarpos albus	Snowberry
	Vaccinium ovatum	Evergreen Huckleberry
Herb	*Agrostis alba/gigantea*	Redtop
	Athyrium filix-femina	Lady Fern
	Carex deweyana	Dewey's Sedge
	Carex lyngbyei	Lyngbye's Sedge
	Eleocharis palustris	Common Spikerush
	Equisetum arvense	Field Horsetail
	Equisetum telmateia	Giant Horsetail
	Geum macrophyllum Willd.	Large Leaf Avens
	Glyceria elata	Manna grass, tall
	Holcus lanatus	Common Velvet Grass
	Iris pseudacorus	Yellow Iris
	Lysichiton americanum	Skunk Cabbage

Appendix D: Vegetative Species Identified at First Creek		
Stratum	**Scientific Name**	**Common Name**
	Maianthemum dilatatum	False Lily-of-the-Valley
	Oenanthe sarmentosa	Water Parsley
	Phalaris arundinacea	Reed Canary Grass
	Plantago lanceolata	English/ Rib Plantain
	Polygonum sp.	Willow weed
	Polypodium glycyrrhiza	Licorice Fern
	Polystichum munitum	Sword Fern
	potentilla anserina var.pacifica	Silverweed
	Pteridium aquilinum	Bracken Fern
	Ranunculus acris	Tall Buttercup
	Ranunculus repens	Creeping Buttercup
	Rumex crispus	Curly Dock
	Scirpus microcarpus	Small-fruited Bulrush
	Stachys cooleyae	Cooley's Hedge Nettle
	Tiarella trifoliata	Foam flower
	Tolmiea menziesii	Youth-on-Age/ Piggyback Plant
	Trifolium pratense	Red Clover
	Trifolium repens	White Clover
	Trillium ovatum	Trillium
	Typha latifolia	Cattail
	Urtica dioica	Stinging Nettle
Vine	*Galium aparine*	Cleavers/ Catchweed Bedstraw
	Lonicera ciliosa	Orange Honeysuckle
	Rubus ursinus	Trailing Blackberry
	Solanum dulcamara	Climbing Nightshade
Aquatic	*Lemna minor*	Lesser duckweed

Notes:

- This listing represents the major plant species identified on the site during visits. There may be other species present on the project site that are not listed.
- Scientific names and species identification taken from *Flora of the Pacific Northwest* (Hitchcock and Cronquist, 1973), and the USDA Plant Database.

Appendix E

Wildlife and Habitat Associations

WILDLIFE SPECIES Note: Species in bold letters were observed directly or indirectly onsite.		ASSOCIATION WITH HABITAT TYPE			
Common Name	**Scientific Name**	**Upland Forest, Shrub**	**Wetland**	**Urban Environment**	**Riparian**
Amphibians					
Tiger Salamander	*Ambystoma tigrinum*		CA/B	GA/F	
Northwestern Salamander	*Ambystoma gracile*	GA/F	CA/B	P/F	CA/B
Long-toed Salamander	*Ambystoma macrodactylum*	GA/B	CA/B	GA/B	CA/B
Cope's Giant Salamander	*Dicamptodon copei*	GA/F			CA/B
Pacific Giant Salamander	*Dicamptodon tenebrosus*	GA/F		P/F	CA/B
Olympic Torrent Salamander	*Rhyacotriton olympicus*	GA/F			CA/B
Columbia Torrent Salamander	*Rhyacotriton kezeri*	GA/F			CA/B
Cascade Torrent Salamander	*Rhyacotriton cascadae*	GA/F			CA/B
Rough-Skinned Newt	*Taricha granulosa*	GA/F	CA/B	P/F	CA/B
Dunn's Salamander	*Plethodon dunni*	GA/B		P/B	GA/B
Larch Mountain Salamander	*Plethodon larselli*	GA/B			
Van Dyke's Salamander	*Plethodon vandykei*	GA/B			GA/B
Western Red-Backed Salamander	*Plethodon vehiculum*	GA/B		P/F	GA/B
Ensatina	***Ensatina eschscholtzii***	**GA/B**		**P/B**	**GA/B**
Tailed Frog	*Ascaphus truei*	GA/F			CA/B
Great Basin Spadefoot	*Scaphiopus intermontanus*		CA/B	GA/B	
Western Toad	*Bufo boreas*	GA/F	CA/B	P/F	CA/B
Woodhouse's Toad	*Bufo woodhousii*		CA/B	GA/F	
Pacific Chorus (Tree) Frog	***Pseudacris regilla***	**GA/B**	**CA/B**	**GA/B**	**CA/B**
Red-Legged Frog	*Rana aurora*	CA/F	CA/B	P/F	CA/B
Cascades Frog	*Rana cascadae*	GA/F	GA/B		GA/B
Oregon Spotted Frog	*Rana pretiosa*	GA/F	CA/B		CA/B
Columbia Spotted Frog	*Rana luteiventris*		CA/B		
Bullfrog	*Rana catesbeiana*	GA/F	CA/B	GA/F	CA/B
Reptiles					
Snapping Turtle	*Chelydra serpentina*		CA/F		GA/B
Painted Turtle	*Chrysemys picta*		CA/F		GA/B
Western Pond Turtle	*Clemmys marmorata*		CA/F		CA/B
Red-Eared Slider Turtle	*Trachemys scripta*		CA/F	GA/R	GA/B
Northern Alligator Lizard	*Elgaria coerulea*	GA/B		GA/B	GA/B
Southern Alligator Lizard	*Elgaria multicarinata*	P/B		P/B	P/B
Sagebrush Lizard	*Sceloporus graciosus*			GA/B	
Western Fence Lizard	*Sceloporus occidentalis*	GA/B		GA/B	
Western Skink	*Eumeces skiltonianus*	GA/B		P/B	
Rubber Boa	*Charina bottae*	GA/B		GA/B	GA/B
Racer	*Coluber constrictor*			GA/B	
Sharptail Snake	*Contia tenuis*	GA/B		GA/B	GA/B
Ringneck Snake	*Diadophis punctatus*	GA/B		P/B	P/B
California Mountain Kingsnake	*Lampropeltis zonata*	P/B		P/B	P/B
Gopher Snake	*Pituophis catenifer*			GA/B	
Western Terrestrial Garter Snake	*Thamnophis elegans*			GA/B	GA/B
Northwestern Garter Snake	*Thamnophis ordinoides*	GA/B		GA/B	GA/B

WILDLIFE SPECIES **Note: Species in bold letters were observed directly or indirectly onsite.**		ASSOCIATION WITH HABITAT TYPE			
Common Name	**Scientific Name**	**Upland Forest, Shrub**	**Wetland**	**Urban Environment**	**Riparian**
Common Garter Snake	*Thamnophis sirtalis*	GA/B	CA/B	GA/B	CA/B
Western Rattlesnake	*Crotalus viridis*	GA/B			GA/B
Mammals					
Virginia Opossum	*Didelphis virginiana*	GA/B		CA/B	GA/B
Masked Shrew	*Sorex cinereus*	GA/B			P/B
Preble's Shrew	*Sorex preblei*		P/B		
Vagrant Shrew	*Sorex vagrans*	GA/B	GA/B	P/B	P/B
Montane Shrew	*Sorex monticolus*	GA/B			P/B
Water Shrew	*Sorex palustris*	GA/B			CA/B
Pacific Water Shrew	*Sorex bendirii*	GA/B	GA/B		CA/B
Trowbridge's Shrew	*Sorex trowbridgii*	CA/B		GA/B	GA/B
Merriam's Shrew	*Sorex merriami*				
Pygmy Shrew	*Sorex hoyi*				
Shrew-Mole	*Neurotrichus gibbsii*	CA/B	GA/B	GA/B	GA/B
Townsend's Mole	*Scapanus townsendii*	GA/B	GA/B	GA/B	GA/B
Coast Mole	*Scapanus orarius*	CA/B		GA/B	GA/B
California Myotis	*Myotis californicus*	CA/B	GA/B	P/B	GA/B
Western Small-Footed Myotis	*Myotis ciliolabrum*		GA/F	P/B	
Yuma Myotis	*Myotis yumanensis*		CA/F	GA/B	CA/B
Little Brown Myotis	*Myotis lucifugus*		GA/F	GA/B	GA/B
Long-Legged Myotis	*Myotis volans*		GA/F	P/B	GA/B
Fringed Myotis	*Myotis thysanodes*	GA/B	GA/F	P/B	GA/B
Keen's Myotis	*Myotis keenii*	CA/B	GA/F		GA/B
Long-Eared Myotis	*Myotis evotis*	GA/B	GA/F	GA/B	GA/B
Silver-Haired Bat	*Lasionycteris noctivagans*	CA/B	GA/F	P/F	GA/F
Western Pipistrelle	*Pipistrellus hesperus*			P/F	
Big Eared Brown Bat	***Eptesicus fuscus***	**CA/B**	**GA/F**	**CA/B**	**GA/B**
Hoary Bat	*Lasiurus cinereus*	GA/F	GA/F	GA/F	GA/B
Spotted Bat	*Euderma maculatum*		GA/F		
Townsend's Big-Eared Bat	*Corynorhinus townsendii*	GA/B	GA/F	P/B	GA/F
Pallid Bat	*Antrozous pallidus*		CA/F	P/B	GA/F
Eastern Cottontail	*Sylvilagus floridanus*			GA/B	
Nuttall's (Mountain) Cottontail	*Sylvilagus nuttallii*			P/B	
European Rabbit	***Oryctolagus cuniculus***	**P/B**		**GA/B**	
Snowshoe Hare	*Lepus americanus*	GA/B			GA/B
Mountain Beaver	***Aplodontia rufa***	**CA/B**			
Least Chipmunk	***Tamias minimus***			**P/B**	**GA/B**
Yellow-Pine Chipmunk	*Tamias amoenus*			GA/B	
Townsend's Chipmunk	*Tamias townsendii*	CA/B		GA/B	GA/B
Red-Tailed Chipmunk	*Tamias ruficaudus*			GA/B	
Yellow-Bellied Marmot	*Marmota flaviventris*			GA/B	
Columbian Ground Squirrel	*Spermophilus columbianus*			P/B	
California Ground Squirrel	*Spermophilus beecheyi*	GA/B		P/B	
Golden-mantled Ground Squirrel	*Spermophilus lateralis*			GA/B	

WILDLIFE SPECIES **Note: Species in bold letters were observed directly or indirectly onsite.**		ASSOCIATION WITH HABITAT TYPE			
Common Name	**Scientific Name**	**Upland Forest, Shrub**	**Wetland**	**Urban Environment**	**Riparian**
Cascade Golden-Mantled Ground Squirrel	*Spermophilus saturatus*			GA/B	
Eastern Gray Squirrel	***Sciurus carolinensis***			**CA/B**	
Eastern Fox Squirrel	*Sciurus niger*			CA/B	
Western Gray Squirrel	*Sciurus griseus*	P/B		GA/B	
Red Squirrel	*Tamiasciurus hudsonicus*			P/B	
Douglas' Squirrel	*Tamiasciurus douglasii*	CA/B		GA/B	
Northern Flying Squirrel	*Glaucomys sabrinus*	CA/B		P/B	
Northern Pocket Gopher	*Thomomys talpoides*	GA/B		GA/B	
Western Pocket Gopher	*Thomomys mazama*	CA/B		GA/B	
American Beaver	*Castor canadensis*	GA/F	CA/B	P/F	CA/B
Western Harvest Mouse	*Reithrodontomys megalotis*		CA/B		
Deer Mouse	*Peromyscus maniculatus*	CA/B	CA/B	CA/B	CA/B
Columbian Mouse	*Peromyscus keeni*	CA/B			
Bushy-Tailed Woodrat	*Neotoma cinerea*	CA/B		GA/B	
Southern Red-Backed Vole	*Clethrionomys gapperi*	GA/B			
Heather Vole	*Phenacomys intermedius*				P/B
Meadow Vole	*Microtus pennsylvanicus*		CA/B		
Montane Vole	*Microtus montanus*		CA/B	P/B	
Gray-tailed Vole	*Microtus canicaudus*				
Townsend's Vole	*Microtus townsendii*	GA/B	CA/B		GA/B
Long-Tailed Vole	*Microtus longicaudus*	GA/B	CA/B		CA/B
Creeping Vole	*Microtus oregoni*	GA/B			GA/B
Water Vole	*Microtus richardsoni*	P/B			CA/B
Sagebrush Vole	*Lemmiscus curtatus*				
Muskrat	*Ondatra zibethicus*			P/B	CA/B
Black Rat	*Rattus rattus*			CA/B	
Norway Rat	*Rattus norvegicus*			CA/B	
House Mouse	*Mus musculus*			CA/B	
Western Jumping Mouse	*Zapus princeps*		GA/B		
Pacific Jumping Mouse	*Zapus trinotatus*	GA/B	GA/B		CA/B
Common Porcupine	*Erethizon dorsatum*	CA/B	P/F	P/B	GA/B
Nutria	*Myocastor coypus*		CA/B	P/F	CA/B
Coyote	*Canis latrans*	GA/B	GA/F	GA/B	GA/B
Gray Wolf	*Canis lupus*			GA/B	
Red Fox	*Vulpes vulpes*	P/B		GA/B	GA/B
Black Bear	*Ursus americanus*	GA/B	GA/F	GA/F	GA/B
Grizzly Bear	*Ursus arctos*		P/F		
Raccoon	*Procyon lotor*	GA/B	CA/F	CA/B	CA/B
American Marten	*Martes americana*	GA/B			P/B
Fisher	*Martes pennanti*	CA/B			CA/B
Ermine	*Mustela erminea*	GA/B			GA/B
Long-Tailed Weasel	*Mustela frenata*	GA/B	GA/F	GA/B	GA/B
Mink	*Mustela vison*	GA/F	CA/F	P/F	CA/B

WILDLIFE SPECIES **Note: Species in bold letters were observed directly or indirectly onsite.**		ASSOCIATION WITH HABITAT TYPE			
Common Name	**Scientific Name**	**Upland Forest, Shrub**	**Wetland**	**Urban Environment**	**Riparian**
Wolverine	*Gulo gulo*	GA/F			
American Badger	*Taxidea taxus*				
Western Spotted Skunk	*Spilogale gracilis*	GA/B		P/B	GA/B
Striped Skunk	***Mephitis mephitis***	**GA/B**		**P/B**	**GA/B**
Northern River Otter	*Lutra canadensis*		CA/B		CA/B
Mountain Lion	*Puma concolor*	GA/B	GA/F	P/F	
Bobcat	*Lynx rufus*	GA/B	GA/F	GA/B	GA/B
Feral Horse	*Equus caballus*		P/F		
Feral Pig	*Sus scrofa*		GA/B		
Roosevelt Elk	*Cervus elaphus roosevelti*	GA/B	GA/F	P/B	GA/B
Rocky Mountain Elk	*Cervus elaphus nelsoni*	GA/B	GA/F	P/B	GA/B
Black-Tailed Deer	***Odocoileus hemionus columbianus***	**GA/B**	**GA/F**	**GA/B**	**GA/B**
Mule Deer	*Odocoileus hemionus hemionus*		GA/F	GA/B	
Columbian White-Tailed Deer	*Odocoileus virginianus leucurus*	GA/B	GA/F	GA/B	GA/B
Moose	*Alces alces*		GA/F	P/F	
Mountain Caribou	*Rangifer tarandus*		GA/F		
Birds					
Common Loon	*Gavia immer*		CA/B		
Pied-Billed Grebe	*Podilymbus podiceps*				GA/B
Horned Grebe	*Podiceps auritus*		CA/B		
Red-Necked Grebe	*Podiceps grisegena*		CA/B		
Eared Grebe	*Podiceps nigricollis*		CA/B		
Western Grebe	*Aechmophorus occidentalis*		CA/B		
Clark's Grebe	*Aechmophorus clarkii*		CA/B		
American White Pelican	*Pelecanus erythrorhynchos*		GA/F		
Double-Crested Cormorant	*Phalacrocorax auritus*		GA/R		P/B
American Bittern	*Botaurus lentiginosus*		CA/B		
Great Blue Heron	***Ardea herodias***	**GA/R**	**CA/F**	**GA/B**	**CA/B**
Great Egret	*Ardea alba*	P/R	CA/F	P/F	GA/B
Snowy Egret	*Egretta thula*		CA/F		GA/B
Cattle Egret	*Bubulcus ibis*		CA/F		
Green Heron	*Butorides virescens*		CA/F		CA/B
Black-crowned Night-Heron	*Nycticorax nycticorax*		CA/F		GA/F
White-faced Ibis	*Plegadis chihi*		CA/B		
Turkey Vulture	*Cathartes aura*	GA/B	GA/F	P/B	GA/B
Greater White-Fronted Goose	*Anser albifrons*		CA/F		
Snow Goose	*Chen Ccaerulescens*		CA/F		
Ross's Goose	*Chen rossii*		CA/F		
Canada Goose	***Branta canadensis***		**CA/B**		**P/B**
Mute Swan	*Cygnus olor*		CA/B	GA/B	
Trumpeter Swan	*Cygnus buccinator*		CA/B		
Tundra Swan	*Cygnus columbianus*		CA/F		

WILDLIFE SPECIES **Note: Species in bold letters were observed directly or indirectly onsite.**		**ASSOCIATION WITH HABITAT TYPE**			
Common Name	**Scientific Name**	**Upland Forest, Shrub**	**Wetland**	**Urban Environment**	**Riparian**
Wood Duck	*Aix sponsa*		P/F		CA/B
Gadwall	*Anas strepera*		CA/B		
American Wigeon	*Anas americana*		CA/B		GA/B
American Black Duck	*Anas rubripes*				CA/B
Mallard	*Anas platyrhynchos*		CA/B	GA/B	CA/B
Blue-Winged Teal	*Anas discors*		CA/B		
Cinnamon Teal	*Anas cyanoptera*		CA/B		CA/B
Northern Shoveler	*Anas clypeata*		CA/B		
Northern Pintail	*Anas acuta*		CA/B		
Green-Winged Teal	*Anas crecca*		CA/B		
Canvasback	*Aythya valisineria*		CA/B		
Redhead	*Aythya americana*		CA/B		
Ring-Necked Duck	*Aythya collaris*		GA/B		CA/B
Harlequin Duck	*Histrionicus histrionicus*				CA/B
Bufflehead	*Bucephala albeola*				GA/B
Hooded Merganser	*Lophodytes cucullatus*				GA/B
Ruddy Duck	*Oxyura jamaicensis*		CA/B		
Osprey	***Pandion haliaetus***			**GA/R**	**GA/F**
White-Tailed Kite	*Elanus leucurus*	P/R			
Bald Eagle	*Haliaeetus leucocephalus*	GA/R	GA/F	GA/B	GA/B
Northern Harrier	*Circus cyaneus*		GA/B	P/B	
Sharp-Shinned Hawk	*Accipiter striatus*	GA/B	GA/F	P/B	
Cooper's Hawk	*Accipiter cooperii*	GA/B	GA/F	GA/B	GA/B
Northern Goshawk	*Accipiter gentilis*	GA/B	GA/F		
Red-Shouldered Hawk	*Buteo lineatus*	GA/B			
Red-Tailed Hawk	***Buteo jamaicensis***	**GA/B**	**GA/F**	**GA/B**	**GA/F**
Rough-Legged Hawk	*Buteo lagopus*	P/F	GA/F	P/F	P/F
Golden Eagle	*Aquila chrysaetos*	P/B	P/F		
American Kestrel	*Falco sparverius*	GA/B	GA/F		
Merlin	*Falco columbarius*	GA/B	P/F	GA/F	P/F
Gyrfalcon	*Falco rusticolus*		GA/F		
Peregrine Falcon	*Falco peregrinus*		GA/F	GA/B	P/F
Ring-Necked Pheasant	*Phasianus colchicus*	GA/F		GA/B	
Ruffed Grouse	*Bonasa umbellus*	CA/B			
Blue Grouse	*Dendragapus obscurus*	CA/B			
Wild Turkey	*Meleagris gallopavo*	GA/B		GA/B	
Mountain Quail	*Oreortyx pictus*	GA/B		P/B	
California Quail	*Callipepla californica*	GA/B		GA/B	
American Coot	*Fulica americana*		CA/B	GA/B	
Sandhill Crane	*Grus canadensis*		CA/B		
Killdeer	***Charadrius vociferus***		**GA/B**	**GA/B**	**GA/F**
Willet	*Catoptrophorus semipalmatus*		CA/B		
Spotted Sandpiper	*Actitis macularia*		GA/B		

WILDLIFE SPECIES Note: Species in bold letters were observed directly or indirectly onsite.		ASSOCIATION WITH HABITAT TYPE			
Common Name	**Scientific Name**	**Upland Forest, Shrub**	**Wetland**	**Urban Environment**	**Riparian**
Upland Sandpiper	*Bartramia longicauda*		GA/B		
Western Sandpiper	*Calidris mauri*		CA/F		
Least Sandpiper	*Calidris minutilla*		CA/F		
Baird's Sandpiper	*Calidris bairdii*		CA/F		
Pectoral Sandpiper	*Calidris melanotos*		CA/F		
Dunlin	*Calidris alpina*		CA/F		
Ruff	*Philomachus pugnax*				GA/F
Heermann's Gull	*Larus heermanni*			GA/F	GA/F
Mew Gull	*Larus canus*			GA/F	
Ring-Billed Gull	*Larus delawarensis*			GA/F	
California Gull	*Larus californicus*			GA/F	GA/F
Herring Gull	*Larus argentatus*			GA/F	GA/F
Western Gull	*Larus occidentalis*			GA/B	GA/F
Glaucous-Winged Gull	*Larus glaucescens*			GA/B	GA/F
Glaucous Gull	*Larus hyperboreus*			GA/B	GA/F
Common Tern	*Sterna hirundo*		CA/F		
Forster's Tern	*Sterna forsteri*		CA/F		
Black Tern	*Chlidonias niger*		CA/B		
Marbled Murrelet	*Brachyramphus marmoratus*	CA/R			P/F
Rock Dove	*Columba livia*			CA/B	P/F
Band-Tailed Pigeon	*Columba fasciata*	CA/B		GA/B	
Mourning Dove	***Zenaida macroura***	**GA/B**		**GA/B**	**GA/B**
Barn Owl	*Tyto alba*		GA/F	GA/B	P/F
Western Screech-Owl	*Otus kennicottii*			GA/B	
Great Horned Owl	*Bubo virginianus*			GA/B	
Snowy Owl	*Nyctea scandiaca*			P/F	
Northern Pygmy-owl	*Glaucidium gnoma*	CA/B		P/F	
Spotted Owl	*Strix occidentalis*	CA/B			
Barred Owl	*Strix varia*	CA/B		P/B	
Great Gray Owl	*Strix nebulosa*	P/B			
Long-Eared Owl	*Asio otus*	P/B	GA/F		
Short-Eared Owl	*Asio flammeus*		GA/F		
Common Nighthawk	*Chordeiles minor*	GA/B	GA/F	GA/B	GA/B
Common Poorwill	*Phalaenoptilus nuttallii*	P/F			
Black Swift	*Cypseloides niger*	GA/F	P/F	GA/B	GA/B
Vaux's Swift	*Chaetura vauxi*	GA/B	GA/F	GA/B	GA/B
White-Throated Swift	*Aeronautes saxatalis*		GA/F		
Black-Chinned Hummingbird	*Archilochus alexandri*		GA/F		
Anna's Hummingbird	***Calypte anna***	**CA/B**		**GA/B**	**GA/B**
Calliope Hummingbird	*Stellula calliope*				
Rufous Hummingbird	*Selasphorus rufus*	GA/B	P/F	GA/B	GA/B
Allen's Hummingbird	*Selasphorus sasin*	GA/B		GA/B	GA/B
Belted Kingfisher	***Ceryle alcyon***				**GA/F**

WILDLIFE SPECIES Note: Species in bold letters were observed directly or indirectly onsite.		ASSOCIATION WITH HABITAT TYPE			
Common Name	**Scientific Name**	**Upland Forest, Shrub**	**Wetland**	**Urban Environment**	**Riparian**
Lewis's Woodpecker	*Melanerpes lewis*			GA/B	
Acorn Woodpecker	*Melanerpes formicivorus*			GA/B	
Williamson's Sapsucker	*Sphyrapicus thyroideus*			GA/B	
Red-breasted Sapsucker	*Sphyrapicus ruber*	GA/B			
Downy Woodpecker	*Picoides pubescens*	GA/B			CA/F
Hairy Woodpecker	*Picoides villosus*	GA/B		GA/B	GA/F
White-Headed Woodpecker	*Picoides albolarvatus*			P/B	
Northern Flicker	*Colaptes auratus*	GA/B		GA/B	GA/F
Pileated Woodpecker	***Dryocopus pileatus***			**GA/B**	**GA/F**
Olive-Sided Flycatcher	*Contopus cooperi*	CA/B		GA/B	GA/F
Western Wood-pewee	*Contopus sordidulus*	GA/B		GA/B	
Willow Flycatcher	*Empidonax traillii*	GA/B		GA/B	
Hammond's Flycatcher	*Empidonax hammondii*	GA/B			
Black Phoebe	*Sayornis nigricans*	P/F		GA/B	
Say's Phoebe	*Sayornis saya*			GA/B	
Ash-Throated Flycatcher	*Myiarchus cinerascens*			GA/B	
Western Kingbird	*Tyrannus verticalis*			GA/B	
Eastern Kingbird	*Tyrannus tyrannus*		GA/F	GA/B	
Yellow-Throated Vireo	*Vireo flavifrons*			GA/B	GA/F
Cassin's Vireo	*Vireo cassinii*	GA/B		GA/B	
Hutton's Vireo	*Vireo huttoni*	GA/B		P/B	
Warbling Vireo	*Vireo gilvus*	GA/B		P/B	
Red-eyed Vireo	*Vireo olivaceus*	P/B			
Gray Jay	***Perisoreus canadensis***	**GA/B**			
Steller's Jay	***Cyanocitta stelleri***	**GA/B**		**GA/B**	**GA/F**
Blue Jay	*Cyanocitta cristata*			GA/B	
Western Scrub-Jay	*Aphelocoma californica*	P/B		GA/B	
Pinyon Jay	*Gymnorhinus cyanocephalus*			GA/B	
Black-Billed Magpie	*Pica hudsonia*			GA/B	
American Crow	*Corvus brachyrhynchos*	GA/B	P/F	GA/B	GA/F
Northwestern Crow	***Corvus caurinus***	**GA/B**		**GA/B**	**GA/F**
Common Raven	*Corvus corax*	GA/B	P/F	GA/B	GA/F
Sky Lark	*Alauda arvensis*			P/B	
Horned Lark	*Eremophila alpestris*			GA/B	
Purple Martin	*Progne subis*	GA/B	GA/F	GA/B	GA/F
Tree Swallow	*Tachycineta bicolor*	P/B	CA/F	GA/B	
Violet-Green Swallow	*Tachycineta thalassina*	GA/B	GA/F	GA/B	
Northern Rough-Winged Swallow	*Stelgidopteryx serripennis*	GA/F	CA/F	P/B	
Bank Swallow	*Riparia riparia*		GA/F	P/B	GA/F
Cliff Swallow	*Petrochelidon pyrrhonota*	GA/B	GA/F	GA/B	GA/F
Barn Swallow	*Hirundo rustica*	GA/B	CA/F	GA/B	GA/F
Black-Capped Chickadee	***Poecile atricapilla***	**GA/B**	**P/F**	**GA/B**	**GA/F**
Chestnut-Backed Chickadee	*Poecile rufescens*	GA/B		GA/B	

WILDLIFE SPECIES **Note: Species in bold letters were observed directly or indirectly onsite.**		**ASSOCIATION WITH HABITAT TYPE**			
Common Name	**Scientific Name**	**Upland Forest, Shrub**	**Wetland**	**Urban Environment**	**Riparian**
Bushtit	*Psaltriparus minimus*	GA/B		GA/B	GA/F
Red-Breasted Nuthatch	*Sitta canadensis*	GA/B		GA/B	
White-Breasted Nuthatch	*Sitta carolinensis*			GA/B	
Pygmy Nuthatch	*Sitta pygmaea*				
Brown Creeper	*Certhia americana*	GA/B			
Bewick's Wren	*Thryomanes bewickii*	GA/B	P/F	GA/B	GA/F
House Wren	*Troglodytes aedon*	GA/B		GA/B	
Winter Wren	*Troglodytes troglodytes*	CA/B		GA/B	
Marsh Wren	***Cistothorus palustris***		**CA/B**	**GA/B**	**P/F**
Golden-Crowned Kinglet	*Regulus satrapa*	GA/B			
Ruby-Crowned Kinglet	*Regulus calendula*	GA/F			
Townsend's Solitaire	*Myadestes townsendi*	GA/B		P/F	
Swainson's Thrush	*Catharus ustulatus*	GA/B			
Hermit Thrush	*Catharus guttatus*	GA/B			
American Robin	*Turdus migratorius*	GA/B	GA/F	GA/B	P/F
Gray Catbird	*Dumetella carolinensis*			P/B	
Northern Mockingbird	*Mimus polyglottos*			GA/F	
European Starling	*Sturnus vulgaris*	GA/B			P/F
Bohemian Waxwing	*Bombycilla garrulus*			GA/F	
Orange-Crowned Warbler	*Vermivora celata*	GA/B			
Nashville Warbler	*Vermivora ruficapilla*	GA/B			
Yellow Warbler	*Dendroica petechia*			P/B	
Black-Throated Blue Warbler	*Dendroica caerulescens*			P/B	
Yellow-Rumped Warbler	*Dendroica coronata*			GA/B	
Townsend's Warbler	*Dendroica townsendi*			GA/F	
Wilson's Warbler	*Wilsonia pusilla*	CA/B			
Western Tanager	*Piranga ludoviciana*	CA/B			
Spotted Towhee	*Pipilo maculatus*	GA/B		GA/F	GA/F
American Tree Sparrow	*Spizella arborea*				GA/F
Chipping Sparrow	*Spizella passerina*			P/B	
Clay-Colored Sparrow	*Spizella pallida*			P/B	
Song Sparrow	*Melospiza melodia*	GA/B	GA/B	P/B	
Lincoln's Sparrow	*Melospiza lincolnii*		CA/B	P/B	
Swamp Sparrow	*Melospiza georgiana*		CA/F		
White-Throated Sparrow	*Zonotrichia albicollis*	GA/B			
White-Crowned Sparrow	*Zonotrichia leucophrys*	GA/B			
Golden-Crowned Sparrow	*Zonotrichia atricapilla*	GA/B			
Dark-Eyed Junco	*Junco hyemalis*	GA/B			
Lazuli Bunting	*Passerina amoena*	GA/B			
Red-Winged Blackbird	*Agelaius phoeniceus*		CA/B		CA/F
Western Meadowlark	*Sturnella neglecta*		P/F		
Yellow-Headed Blackbird	*Xanthocephalus xanthocephalus*		CA/B		
Great-Tailed Grackle	*Quiscalus mexicanus*			GA/F	

WILDLIFE SPECIES **Note: Species in bold letters were observed directly or indirectly onsite.**		**ASSOCIATION WITH HABITAT TYPE**			
Common Name	**Scientific Name**	**Upland Forest, Shrub**	**Wetland**	**Urban Environment**	**Riparian**
Brown-Headed Cowbird	*Molothrus ater*				CA/F
Purple Finch	*Carpodacus purpureus*	GA/B		GA/F	
Cassin's Finch	*Carpodacus cassinii*				
House Finch	*Carpodacus mexicanus*	GA/B		GA/F	
Red Crossbill	*Loxia curvirostra*	GA/B			
White-Winged Crossbill	*Loxia leucoptera*	P/F			
Pine Siskin	*Carduelis pinus*	GA/B		GA/F	
Lesser Goldfinch	*Carduelis psaltria*	P/F			
American Goldfinch	*Carduelis tristis*	GA/B			GA/F
Evening Grosbeak	*Coccothraustes vespertinus*	GA/B		GA/F	
House Sparrow	*Passer domesticus*			GA/F	GA/F

Adapted from the CD Matrix provided in Johnson, D.H. and T.A. O'Neil. 2001. Wildlife-Habitat Relationships in Oregon and Washington. Oregon State University Press. Corvallis.

Definitions:
CA – Closely Associated – A species is widely known to depend on a habitat for part of or all its life history requirements.
GA – Generally Associated – A species exhibits a high degree of adaptability and may be supported by a number of habitats.
P – Present – A species demonstrates occasional use of a habitat.
B – Breeds and feeds.
F – Feeds only.
R – Reproduces only.
O – Other, such as roosting, resting, hibernating, or cover.

Appendix F

Forest Sample Plot Data Sheets

Appendix G

2009 Pierce County Noxious Weed List

THE 2009 PIERCE COUNTY NOXIOUS WEED LIST

CLASS A WEEDS – Eradication of these species required by law throughout Washington State

Common name	***Scientific name***
buffalobur	*Solanum rostratum*
common crupina	*Crupina vulgaris*
cordgrass, dense flower	*Spartina densiflora*
cordgrass, salt meadow	*Spartina patens*
cordgrass, smooth	*Spartina alterniflora*
dyers woad	*Isatis tinctoria*
eggleaf spurge	*Euphorbia oblongata*
false brome	*Brachyopodium sylvaticum*
floating primrose willow	*Ludwigia peploides*
flowering rush	*Butomus umbellatus*
garlic mustard	*Alliaria petiolata*
giant hogweed	*Heracleum mantegazzianum*
goatsrue	*Galega officinalis*
hawkweed, European	*Hieracium sabaudum*
hawkweed, yellow devil	*Heracium floribundum*
hydrilla	*Hydrilla verticillata*
johnsongrass	*Sorghum halepense*
knapweed, bighead	*Centaurea macrocephala*
knapweed, Vochin	*Centaurea nigrescens*
kudzu	*Pueraria Montana var. lobata*
meadow clary	*Salvia pratensis*
purple starthistle	*Centaurea calcitrapa*
reed sweetgrass	*Glyceria maxima*
ricefield bulrush	*Shoenoplectus mucronatus*
sage, clary	*Salvia sclarea*
sage, Mediterranean	*Salvia aethiopsis*
shiny geranium	*Geranium lucidum*
silverleaf nightshade	*Solanum elaeagnifolium*
Spanish broom	*Spartium junceum*
spurge flax	*Thymelaea passerine*
Syrian bean-caper	*Zygophyllum fabago*
Texas blueweed	*Helianthus ciliaris*
thistle, Italian	*Carduus pycnocephalus*
thistle, milk	*Silybum marianum*
thistle, slenderflower	*Carduus tenuiflorus*
variable-leaf milfoil	*Myriophyllum heterophyllum*
velvetleaf	*Abutilon theophrasti*
wild four o'clock	*Mirabilis nyctaginea*

CLASS B WEEDS – Control of these species is required by law in Pierce County

Common name	***Scientific name***
Australian fieldcress	*Rorippa austriaca*
blackgrass	*Alopecurus myosuroides*
blueweed	*Echium vulgare*
bugloss, annual	*Anchusa arvensis*
bugloss, common	*Anchusa officinalis*
camelthorn	*Alhagi maurorum*

Common name	***Scientific name***
common fennel	*Foeniculum vulgare*
common reed	*Phragmites australis (non-native genotypes)*
Dalmatian toadflax	*Linaria dalmatica*
Eurasian watermilfoil	*Myriophyllum spicatum*
fanwort	*Cabomba caroliniana*
gorse	*Ulex europaeus*
grass-leaved arowhead	*Sagittaria graminea*
hawkweed, common	*Hieracium, lachenalii*
hawkweed, mouse ear	*Hieracium pilosella*
hawkweed, non-native	*Hieracium spp.*
hawkweed, orange	*Hieracium aurantiacum*
hawkweed, oxtongue	*Picris hieraciodes*
hawkweed, polar	*Hieracium atratum*
hawkweed, queen-devil	*Hieracium glomeratum*
hawkweed, smooth	*Hieracium laevigatum*
hawkweed, yellow	*Hieracium caespitosum*
hoary alyssum	*Berteroa incana*
indigobush	*Amorpha fruticosa*
knapweed, black	*Centaurea nigra*
knapweed, brown	*Centaurea jacea*
knapweed, diffuse	*Centaurea diffusa*
knapweed, meadow	*Centaurea jacea x nigra*
knapweed, Russian	*Acroptilon repens*
knapweed, spotted	*Centaurea stoebe*
kochia	*Kochia scoparia*
lawnweed	*Solvia sessilis*
lepyrodicilis	*Lepyrodiclis holosteoides*
longspine sandbur	*Cenchrus longispinus*
loosestrife, garden	*Lysimachia vulgaris*
loosestrife, purple	*Lythrum salicaria*
loosestrife, wand	*Lythrum virgatum*
parrotfeather	*Myriophyllum aquaticum*
perennial pepperweed	*Lepidium latifolium*
perennial sowthistle policeman's helmet	*Sonchus arvensis* *Impatiens glandulifera*
poison hemlock	*Conium maculatum*
rush skeletonweed	*Chondrilla juncea*
saltcedar	*Tamarix ramosissima*
spurge, leafy	*Uphorbia esula*
sulfur cinquefoil	*Potentilla recta*
swainsonpea	*Sphaerophysa salsula*
tansy ragwort	*Senecio jacobaea*
thistle, musk	*Carduus nutans*
thistle, plumeless	*Carduus acanthoides*
thistle, Scotch	*Onopordum acanthium*
water primrose	*Ludwigia hexapetala*
white bryony	*Bryonia alba*
wild chervil	*Anthriscus sylvestris*
yellow floating heart	*Nymphoides peltata*
yellow nutsedge	*Cyperus esculentus*
yellow starthistle	*Centaurea solstitialis*

NON-REGULATED NOXIOUS WEEDS – These are class B and C weeds that we highly recommend you control on your property due to the environmental and economic damage caused by their spread; but control is not legally required in Pierce County.

Common name	***Scientific name***
baby's breath	*Gypsophilia paniculata*
blackberry, evergreen	*Rubus laciniatus*
blackberry, Himalayan	*Rubus armeniacus*
Brazilian elodea	*Egeria densa*
butterfly bush	*Buddleja davidii*
cockle, white	*Silene latifolia ssp. Alba*
cocklebur, spiny	*Xanthium spinosum*
common tansy	*Tanacetum vulgare*
cress, hoary	*Cardaria draba*
dodder, smoothseed alfalfa	*Cuscuta approximata*
ivy, Atlantic	*Hedera hibernica*
ivy, English *(three cultivars only)*	*Hedera helix 'Baltica', 'Pittsburgh', 'Star'*
field bindweed	*Convulvulus arvensis*
fragrant waterlily	*Nymphaea odorata*
goatgrass, jointed	*Aegilops cylindrical*
groundsel, common	*Senecio vulgaris*
herb Robert	*Geranium robertianum*
knotweed, Bohemian	*Polygonum bohemicum*
knotweed, giant	Polygonum sachalinese
knotweed, Himalayan	*Polygonum polystachyum*
knotweed, Japanese	*Polygonum cuspidatum*
mayweed, scentless	*Matricaria perforata*
old man's beard	*Clematis vitalba*
pondweed, curly-leaf	*Potamogeton crispus*
reed canarygrass	*Phalaris arundinacea*
rye, cereal	*Secale cereale*
Scotch broom	*Cytisus scoparius*
Spikeweed	*Hemizxonia pungens*
St. Johnswort, common	*Hypericum perforatum*
thistle, bull	*Cirsium vulgare*
thistle, Canada	*Cirsium arvense*
whitetop, hairy	*Cardaria pubescens*
willow-herb, hairy	*Epilobium hirsutum*
wormwood, absinth	*Artemisia absinthium*
yellow archangel	*Lamiastrum galeobdolon*
yellow flag iris	*Iris pseudacorus*
yellow toadflax	*Linaria vulgaris*

Appendix H

Restoration Plant Specifications

First Creek Restoration Plant Specifications

The X denotes appropriate species to be planted in a specified restoration area.

Restoration Number		R-1	R-2	R-3	R-4	R-5	R-6	R-7	R-8	R-9	R-10	R-11	R-12		R-13	R-14
Minimum Number of Trees		53	53	1613	54	296	657	7	34	524	430	108	27		7	134
Common Name	**Scientific Name**												S	W		
Vine Maple	*Acer circinatum*				X	X		X		X		X	X			X
Big Leaf Maple	*Acer macrophyllum*				X	X		X		X		X	X			X
Red Alder	*Alnus rubra*															X
Madrona	*Arbutus menziesii*	X	X	X												
Black Hawthorn	*Crataegus douglasii*						X		X		X			X		
Paper Birch	*Betula papyrifera*						X		X		X			X		
Pacific Dogwood	*Cornus nuttallii*	X	X	X	X	X		X		X		X	X			X
Oregon Ash	*Fraxinus latifolia*						X		X		X			X		
Western Crabapple	*Malus (pyrus) fusca*				X	X	X	X	X	X	X	X	X	X		X
Black Cottonwood	*Populus balsamifera*													X		
Bitter Cherry	*Prunus emarginata*	X	X	X	X	X		X		X		X	X			X
Quaking Aspen	*Populus tremuloides*						X		X		X			X		
Douglas Fir	*Pseudotsuga menziesii*	X	X	X	X	X		X		X		X	X			X
Garry Oak	*Quercus garryana*	X	X	X												
Cascara	*Rhamnus purshiana*	X	X	X	X	X		X		X		X	X			X
Pacific Willow	*Salix lucida*						X		X		X			X		X
Scouler's Willow	*Salix scouleriana*						X		X		X			X		X
Western Red Cedar	*Thuja plicata*						X		X		X			X		X
Western Hemlock	*Tsuga heterophylla*	X					X		X		X		X	X		X
Minimum Number of Shrubs		170	204	8168	272	1497	3328	34	170	2654	2178	545	136		34	681
Serviceberry	*Amelanchier alnifolia*	X	X	X	X	X		X		X		X	X			X
Red-osier Dogwood	*Cornus sericea*						X		X		X			X		X
Beaked Hazelnut	*Corylus cornuta*	X	X	X	X	X		X		X		X	X			X
Salal	*Gaultheria shallon*	X	X	X	X	X		X		X		X	X			X
Oceanspray	*Holodiscus discolor*	X	X	X	X	X		X		X		X	X			X
Western Honeysuckle	*Lonicera ciliosa*	X	X	X	X	X		X		X		X	X			X
Twinberry	*Lonicera invlucrata*	X	X	X	X	X		X		X		X	X			X
Tall Oregon Grape	*Mahonia aquifolium*	X	X	X	X	X		X		X		X	X			X
Creeping Oregon Grape	*Mahonia nervosa*	X	X	X	X	X		X		X		X	X			X
Indian Plum	*Oemleria cerasiformis*	X	X	X	X	X		X		X		X	X			X
Lowbush Penstemon	*Penstemon fruticosus*	X	X	X	X	X		X		X		X	X			X
Mock Orange	*Philadelphus lewisii*	X	X	X	X	X		X		X		X	X			X

First Creek Restoration Plant Specifications

The X denotes appropriate species to be planted in a specified restoration area.

Restoration Number		R-1	R-2	R-3	R-4	R-5	R-6	R-7	R-8	R-9	R-10	R-11	R-12		R-13	R-14
Pacific Ninebark	*Physocarpus capitatus*						X		X		X			X		
Pacific Rhododendron	*Rhododendron macrophylum*	X	X	X												
Black Gooseberry	*Ribes lacustre*						X		X		X			X		X
Red Flowering Current	*Ribes sanguineum*	X	X	X	X	X		X		X		X	X			X
Bald Hip Rose	*Rosa gymnocarpa*	X	X	X	X	X	X	X	X	X	X	X	X	X		X
Nootka Rose	*Rosa nutkana*	X	X	X	X	X	X	X	X	X	X	X	X	X		X
Clustered Rose	*Rosa pisocarpa*	X	X	X	X	X	X	X	X	X	X	X	X	X		X
Thimbleberry	*Rubus parviflorus*	X	X	X	X	X		X		X		X	X			X
Salmonberry	*Rubus spectabilis*						X		X		X			X		
Trailing Blackberry	*Rubus ursinus*	X	X	X	X	X		X		X		X	X			X
Red Elderberry	*Sambucus racemosa*	X	X	X	X	X		X		X		X	X			X
Snowberry	*Symphoricarpos albus*	X	X	X	X	X		X		X		X	X			X
Evergreen Huckleberry	*Vaccinium ovatum*	X	X	X												
Ferns and herbaceous species as available (check sun and shade tolerances)																
Yarrow	*Achillea millefolium*															
Vanilla Leaf	*Achlys triphylla*															
Pearly Everlasting	*Anaphalis margaritacea*															
Red Columbine	*Anuilegia formosa*															
Wild Ginger	*Asarum caudatum*															
Aster	*Aster spp.*															
Lady Fern	*Athyrium filix-femina*															
Deer Fern	*Blechnum spicant*															
Cammas	*Camassia spp.*															
Harebell	*Campanula rotundifolia*															
Miner's Lettuce	*Claytonia perfoliata*															
Spring Beauty	*Claytonia sibirica*															
Dwarf Dogwood	*Cornus canadensis*															
Bleeding Heart	*Decentra formosa*															
Fairybells	*Disporum hookeri*															
Shooting Star	*Dodecatheon hendersonii*															
Willowherb	*Epilobiam watsonii*															

First Creek Restoration Plant Specifications The X denotes appropriate species to be planted in a specified restoration area.															
Restoration Number		R-1	R-2	R-3	R-4	R-5	R-6	R-7	R-8	R-9	R-10	R-11	R-12	R-13	R-14
Fawn Lily	*Erythronioum spp.*														
Strawberry	*Fragaria spp.*														
Large Leaf Avens	*Geum macrophylum*														
Tiger Lily	*Lilium columbianum*														
Big Leaf Lupine	*Lupinus polyphyllus*														
Skunk Cabbage	*Lysichiton amerianum*														
False Lily of the Valley	*Maianthemum dilatatum*														
False Solomon's Seal	*Maianthemum racemosum*														
Sword Fern	*Polystichum munitum*														
Wood Sorrel	*Oxalis oregana*														
Wapato, Arrowhead	*Sagittaria latifolia*														
Goldenrod	*Solidago canidensis*														
Cooley's Hedge Nettle	*Stachy's cooleyae*														
Twisted Stalk	*Streptopus amplexifolius*														
Fringecup	*Tellima grandiflora*														
Foamflower	*Tiarella trifoliata*														
Piggy-back Plant	*Tolmiea menziesii*														
Broad-leaved Starflower	*Trientalis latifolia*														
Western Trillium	*Trillium ovatum*														
Blue Violet	*Viola adunca*														
Yellow Wood Violet	*Viola glabella*														
Evergreen Violet	*Viola sempervirens*														
Note: S=slope, W=wetland.															