Project Brief:

Small Forestland Owner Parcel Identification and County GIS Data Compilation for Washington State WRIAs 23 & 49

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Executive Summary

Washington's non-industrial private forestlands represent over half of the total private forestland in the State. Lower in elevation than industrial forestlands, these parcels are often found in the spawning regions of many of Washington State's salmon streams and present an excellent opportunity for cost-share and assistance programs aimed at habitat access and restoration. The Washington State Departments of Fish & Wildlife and Natural Resources have teamed with many local fish enhancement groups to identify existing fish blockages and habitat enhancement opportunities. What is unknown is where the non-industrial lands that qualify for assistance programs are located. A Geographic Information System (GIS) based approach to locating Non-Industrial Private Forestlands (NIPF) using county assessor tax roles, GIS parcels, Landsat satellite imagery, and aerial photography has been developed to assist in the prioritization and identification of habitat enhancement opportunities on NIPF lands. This approach identifies certain and probable non-industrial lands and allows local fish enhancement groups to prioritize work and contact individual landowners.

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Introduction

Restoration of Washington's threatened and endangered salmon runs can be assisted by focusing restoration efforts in areas where the most habitats can be created for the least cost. The Washington State Department of Fish & Wildlife and the Department of Natural Resources as well as many local fish enhancement groups have come together to locate and survey many of the State's salmon streams. These surveys have produced Geographic Information System (GIS) layers that show the location, condition and fish passage status of dams, culverts, and fishways around the state. This information, combined with knowledge of who owns the land, can help local groups and funding agencies to identify target restoration areas. Currently, there are many assistance programs targeted specifically at Non-Industrial Private Forestlands and Small Forest Land Owners.

Many of the financial assistance programs are targeted only at Small Forest Landowners. However, the definition of small forest land owners (SFLO) makes it difficult to identify them without door-to-door surveys. The State of Washington's harvest-based definition of a small forest landowner created in the Salmon Recovery Act, defines small forest landowners as those who harvest less than two million board feet on an annual basis. [RCW 76.13.120(2)(c)]. A previous acreage-based definition considers non-industrial forests and woodlands (NIPF) as "those suburban acreages and rural lands supporting or capable of supporting trees and other flora and fauna associated with a forest ecosystem, comprised of total individual land ownerships of less than five thousand acres and not directly associated with a wood processing or handling facilities" [RCW 76.13.010(4)]. The currently available generalized information on harvests is not detailed enough to locate or identify small forest land owners. Therefore, the acreage-based definition of non-industrial private forests will be used to identify these ownerships.

Identification of these NIPF lands is based on two assumptions: land uses taxed as forestland meet the NIPF definition, and forested lands that have non-conflicting land uses likely meet the NIPF definition. County assessor tax roles and GIS parcels (where available) were used to identify the parcels that have land uses taxed as forestland. Landsat satellite imagery was classified into forest and non-forest categories to identify forested parcels. Those parcels were then intersected with non-conflicting land use parcels to identify those parcels that were mostly forested and had non-conflicting land uses. These additional forested parcels could be considered as probable NIPF lands.

In this brief project summary, we describe the data used in this analysis, the methods used to determine non-industrial private forestlands, and give some general statistics about these NIPF lands.

Data

WRIA 23

Of the 6 counties (Cowlitz, Grays Harbor, Lewis, Pacific, Thurston, and Wahkiakum) in Water Resource Inventory Area (WRIA) 23 only Cowlitz, Grays Harbor, Lewis, and Thurston had publicly available GIS parcel data, Figure 1. The portions of the WRIA that fall outside of Thurston County were analyzed for the Lower Columbia Fish Recovery Board in the summer of 2004. Project data for Cowlitz, Grays Harbor, and Lewis Counties can be acquired from the LCFRB and were not analyzed as part of this project.
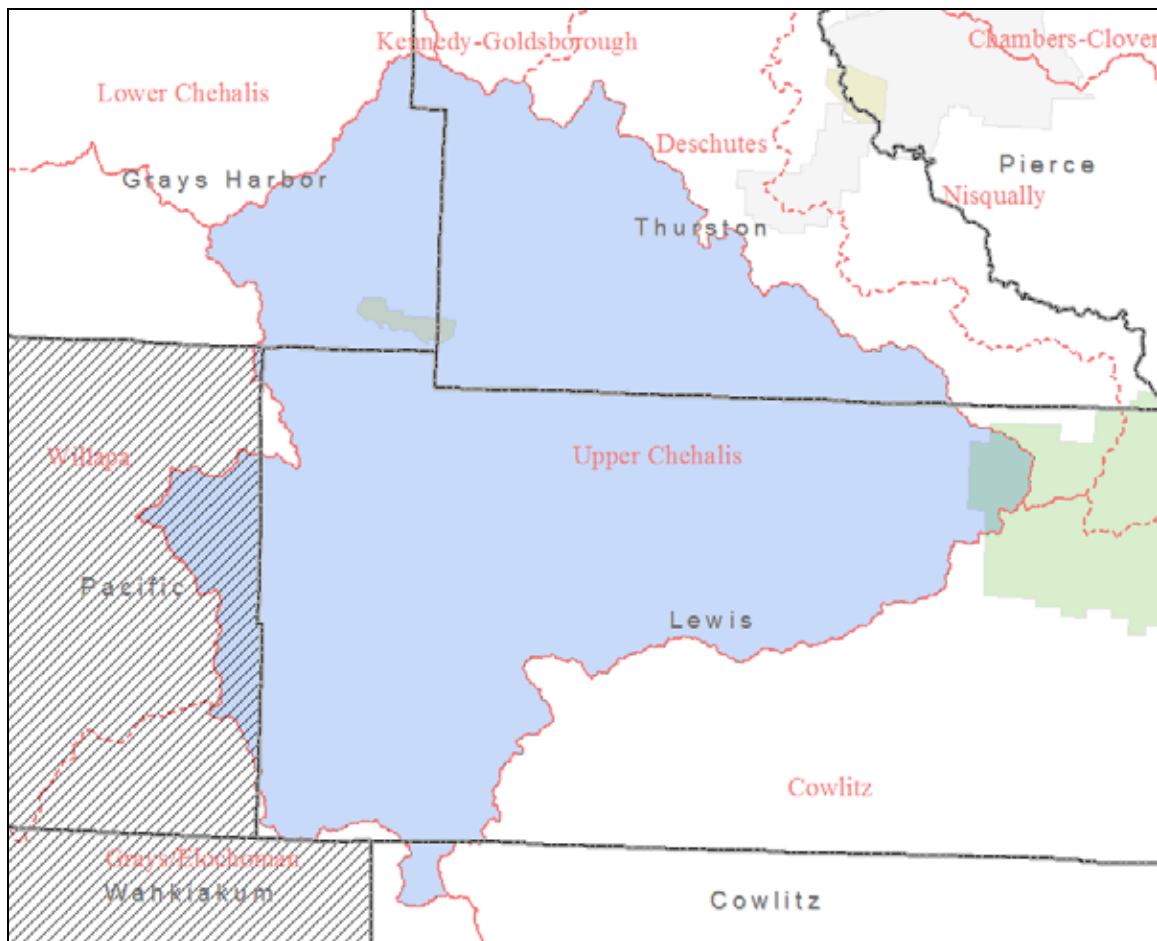
Figure 1 - Counties where GIS data was collected are shown without hatching.

WRIA 49

Water Resource Inventory Area 49 falls completely within Okanogan County, Figure 2. Countywide Parcel data was acquired from Okanogan County in 2004 which allowed for a seamless analysis of WRIA 49.
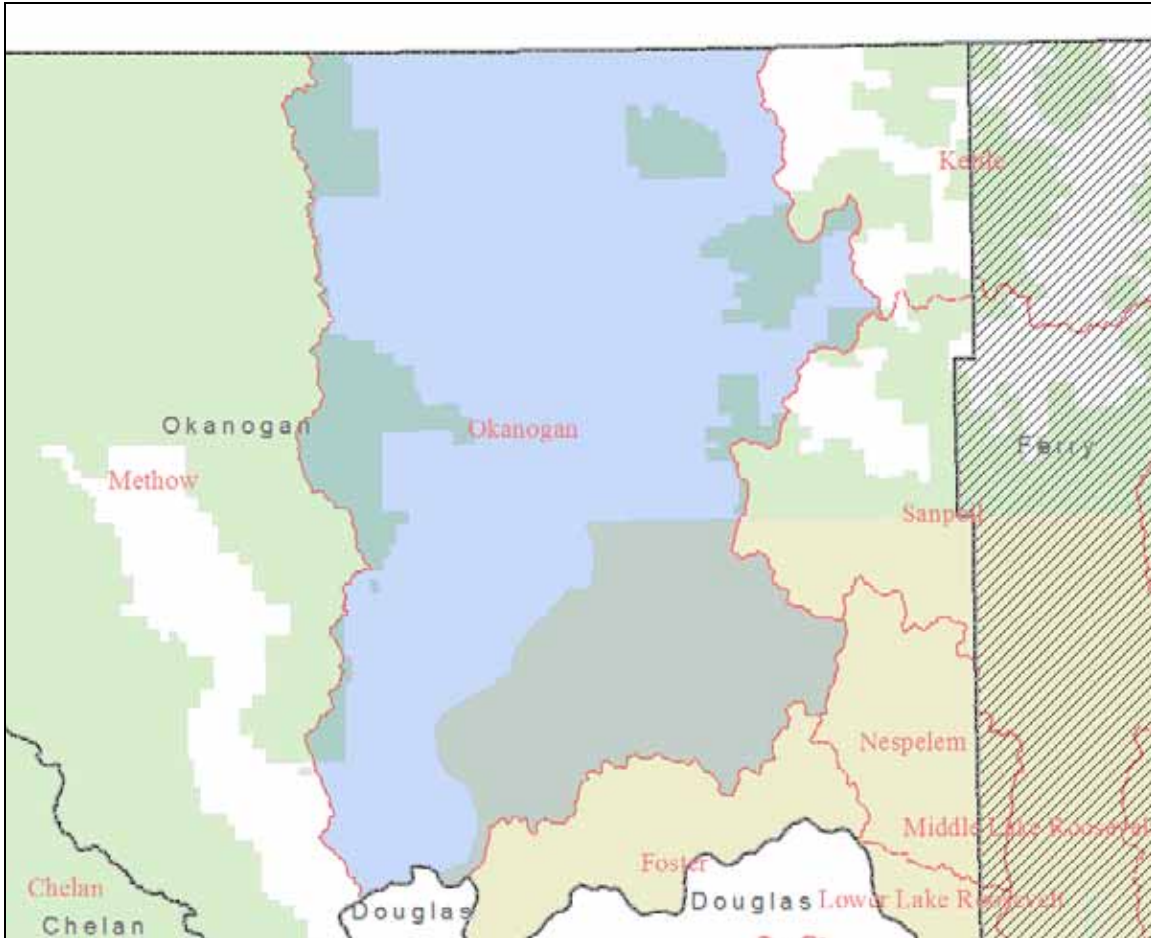
Figure 2 - WRIA 49 falls completely within Okanogan County.

Landsat data used for the analysis was acquired as part of the Washington State Remote Sensing Consortium 2000 Landsat purchase. All three of the scenes used for the analysis were acquired in the summer of 2000, see Table 1. The images are mostly cloud-free but there were a few areas where clouds obscured the land.

Table 1 - Acquisition dates of Landsat 7 Thematic Mapper satellite imagery.

Path	Row	Date
45	26	August 17, 2000
46	27	July 7, 2000
46	28	July 7, 2000

Orthographically corrected digital aerial photography used to create training datasets for the forest classification was acquired form the US Geological Survey and the US Forest Service. Image acquisition dates for the ortho-photography range from 1996 to 2001.

Analysis

Non-industrial private forestlands are identified using two methods. The first method uses only the county assessor's tax roles to identify parcels that have land uses taxed as forestland. The second method uses Landsat imagery to construct a forestland layer which is compared with non-conflicting land use parcels in the county assessor's tax roles. Both methods rely on local knowledge of the forest industry to eliminate those forest enterprises that are not non-industrial.

County assessors typically follow a land use tax scheme that is closely related to the State's land use coding scheme. Although there are some variations, the land uses that are typically found relating to forestland are: 87 - Classified forest land, 88 - Designated forest land, 92 - Noncommercial forest, 94 - Open space land, and 95 - Timberland. According to county assessors, these tax designations indicate that a parcel is being managed as forestland or is protected under a conservation agreement. Owners like Weyerhaeuser, Boise Cascade, Longview Fibre and others with more than 5000 acres are taxed as forestland but obviously not considered NIPF and are removed from the NIPF land base. This method yields a very high confidence that the identified parcels are indeed non-industrial private forests that cover the spectrum from habitat reserves and conservation areas to intensively managed, productive forestland. The tax designated non-industrial parcels can be identified in the datasets and maps as "SFLO" and the industrial parcels as "Industrial". In addition, obvious public ownerships like city, state, and federal lands are identified as "Public".

Identification of NIPF parcels that are not taxed as forestland requires additional analysis based on land cover. The land cover analysis utilized ERDAS Imagine 8.7 image processing software and Landsat 7 Enhanced Thematic Mapper satellite imagery. The satellite images are first converted to reflectance to remove atmospheric effects and then topographically normalized to remove the effects of topographic shading in the imagery. Orthographically corrected aerial photographs are visually interpreted to create training datasets for image classification. In most instances, the dates of the aerial photography preceded the Landsat imagery, and therefore, each photo plot was checked for consistency with the Landsat data.
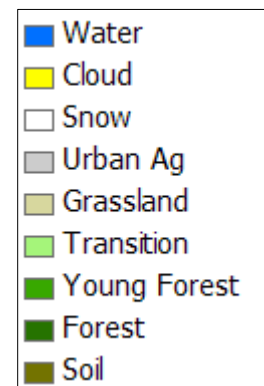
Figure 3 - Landsat classifications

Using the digital orthophoto training data, the images are classified into nine basic classes, see Figure 3 and Figure 4 and aggregated into forest/non-forest categories. Some land cover classes are more difficult to identify correctly than others. Recent harvest activity is very hard to distinguish from bare soils and some agricultural lands. Due to the difficulty in segregating recent harvests from other bare soils, all bare soils and recent harvests were assumed to be non-forest land. Therefore some recently harvested and replanted lands will not be identified as potential non-industrial lands. In a few areas clouds obscured earth's surface and land cover could not be identified. Some potentially

forested parcels may have been excluded from the analysis because of the cloud cover. A photographic accuracy assessment of the nine classes using random points shows that over 90% of the pixels are classified correctly. When aggregated into forest/non-forest, the accuracy is better than 96%.
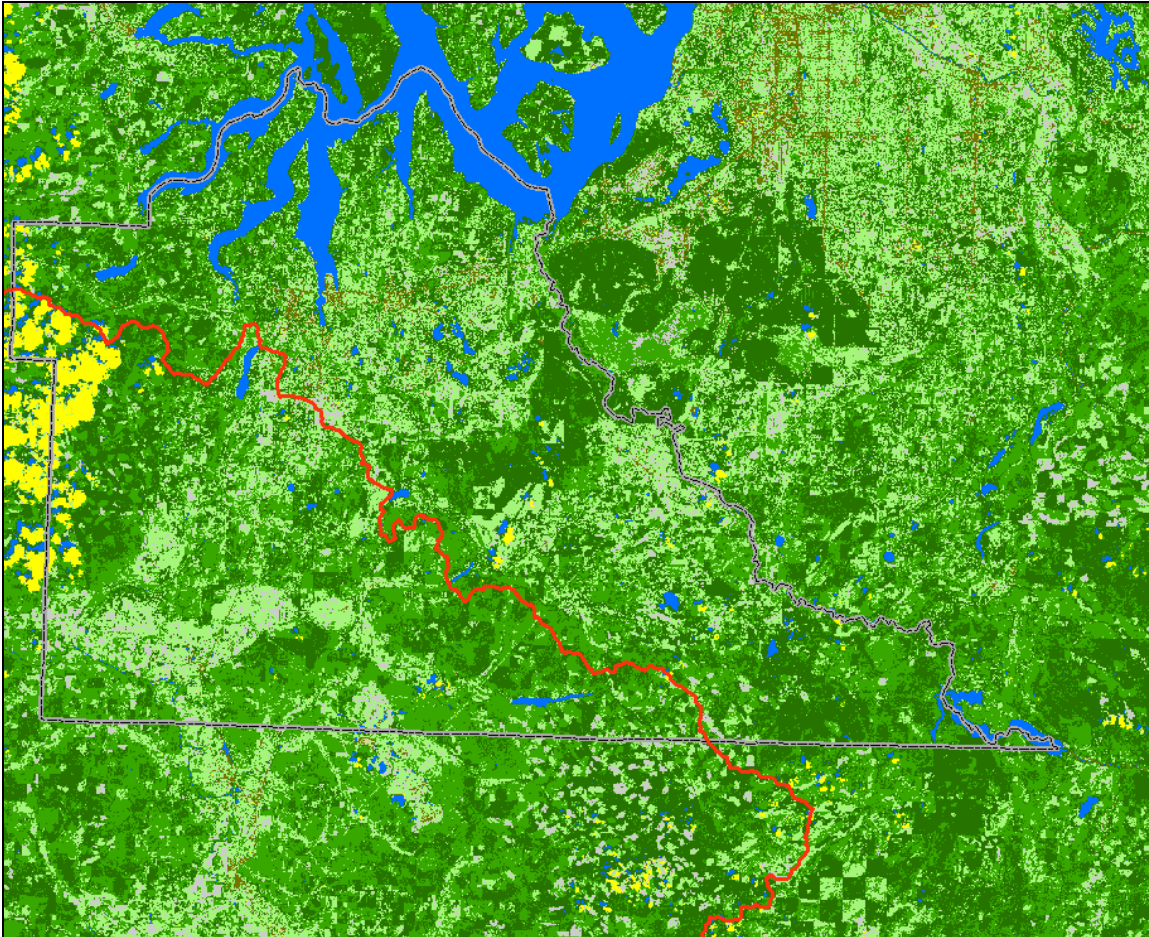
Figure 4 - Nine class Landsat imagery classification for Thurston County

It is known from Washington State University surveys and from discussions with landowners that somewhere around half of Washington's non-industrial private forests are not in forest tax classifications. These parcels typically have land uses that do not conflict with forestry but little data exists on what land uses are likely. Previous analyses have focused on assessor land use codes of: 89 – Other resource protection, 91 – Undeveloped land, and 99 – Other undeveloped land. For this analysis all forested parcels were considered as potential non-industrial lands to ensure that all potential recipients of forestland assistance programs were identified. Overlaying the forest/non-forest layer on the parcels enables the calculation of forest acres by parcel and the percent forest. For this analysis we considered any parcel that had at least 5 acres of forestland to be a potential non-industrial private forest and are identified in the datasets as "Possible SFLO – minimum of 5 forest acres". In addition, parcels with at least 1 acre of forestland were identified as potentially eligible for fish passage program funding as shown in the datasets as "Possible FPP – minimum of 1 forest acre".

Table 2 - Owner types identified in the analysis and the associated codes used in the datasets.

Owner Type Status Codes	
CODE	**DESCRIPTION**
0	Unknown
1	SFLO
3	Industrial
4	Public
5	Possible SFLO - minimum of 5 forest acres
6	Possible FPP - minimum of 1 forest acre

Counties store assessor parcel data in many different formats including ArcSDE, Geodatabases, Coverages and Shapefiles. In addition to storing the data in different formats, every County uses different attributes with diverse values. These differences make inter-county analyses difficult and inconsistent. To assist end uses of the data with their analyses, a single cross-county format was created. This cross-county format includes information like the owner name and address, the parcel size, land use, location and taxes.

Results

Parcels

Combining assessor tax roles with remote sensing techniques yielded two to four times as many candidate 5 acre and larger non-industrial private forests compared to using assessors tax roles alone. Table 3 and Table 4 show the number and acres of parcels by owner type for Thurston and Okanogan counties. The SFLO owner type parcels are the parcels that are identified by using the assessors land use tax codes. The industrial parcels are those that are owned by identified industrial corporations using the owner name in the assessor's data. Public parcels are those identified as city, county, state or federal lands. The possible SFLO parcels are those that are not taxed as forestlands but have at least 5 acres of forest. The possible FPP parcels are those that are not taxed as forestland but have at least 1 acre of forest. Additional tabular statistics can be found in the Appendix.

Table 3 - Number of parcels and acres by owner type for all parcels sizes in Thurston County.

Thurston County Parcels and Acres by Owner Type		
Description	**# of Parcels**	**Acres**
Unknown	74350	63643.97
SFLO	1518	54179.53
Industrial	839	87890.32
Public	3279	109094.96
Possible SFLO - minimum of 5 forest acres	5769	102917.98
Possible FPP - minimum of 1 forest acre	11040	43171.52

Table 4 - Number of parcels and acres by owner type for all parcels sizes in Okanogan County.

Okanogan County Parcels and Acres by Owner Type		
Description	**# of Parcels**	**Acres**
Unknown	32201	477064.35
SFLO	2093	67830.12
Industrial	1069	132922.80
Public	7977	1583740.78
Possible SFLO - minimum of 5 forest acres	5297	225603.62
Possible FPP - minimum of 1 forest acre	3337	47990.39

In addition to the identified SFLO lands that are taxed as forestland, previous analyses have identified possible SFLO lands as forested parcels that have assessor land use codes of: 89 – Other resource protection, 91 – Undeveloped land, and 99 – Other undeveloped land. The statistics in Table 3 and Table 4 include all parcels regardless of the assessor land use code. Table 5 and Table 6 list the number of parcels and the corresponding acres for parcels that are either taxed as forestland by the county assessor, or have a minimum amount of forestland and a non conflicting land use code.

Table 5 - Thurston County parcels that are taxed as forestland, or have land use codes 89, 91, or 99.

Thurston County Non-Conflicting Parcels and Acreages by Owner Type		
Description	**# of Parcels**	**Acres**
SFLO	1518	54179.53
Possible SFLO - minimum of 5 forest acres	2000	36246.91
Possible FPP - minimum of 1 forest acre	2778	10297.41

Table 6 - Okanogan County parcels that are taxed as forestland, or have land use codes 89, 91, or 99.

Okanogan County Non-Conflicting Parcels and Acreages by Owner Type		
Description	**# of Parcels**	**Acres**
SFLO	2093	67830.12
Possible SFLO - minimum of 5 forest acres	1670	37750.08
Possible FPP - minimum of 1 forest acre	1247	9151.82

Barriers

Barrier information from the Washington State Department of Fish and Wildlife for WRIAs within Thurston and Okanogan Counties were overlaid on the parcels to determine how many parcels are on non-industrial lands. The inventoried in-stream features include culverts, dams and fishways. Statistics for each type of in-stream feature and the fish passage barrier status can be found in the following tables.

Table 7 – Thurston County culvert barrier status by owner type.

Thurston County Culvert Barrier Status by Owner Type				
Description	Yes	No	Unk	No Data
Unknown	23	81	1	118
SFLO	13	21	2	16
Industrial	7	6	2	8
Public	28	24	12	27
Possible SFLO - minimum of 5 forest acres	61	77	2	69
Possible FPP - minimum of 1 forest acre	23	68	3	50

Table 8 – Thurston County dam barrier status by owner type.

Thurston County Dam Barrier Status by Owner Type		
Description	Yes	No Data
SFLO		1
Public	1	
Possible SFLO - minimum of 5 forest acres	3	
Possible FPP - minimum of 1 forest acre	1	

Table 9 – Thurston County fishway barrier status by owner type.

Thurston County Fishway Barrier Status by Owner Type			
Description	Yes	No	Unk
Unknown	1	3	
SFLO		1	1
Industrial		1	
Public		4	
Possible SFLO - minimum of 5 forest acres		5	
Possible FPP - minimum of 1 forest acre		2	

Table 10 - Okanogan County culvert barrier status by owner type.

Okanogan County Culvert Barrier Status by Owner Type				
Description	Yes	No	Unk	No Data
Unknown	77	11	8	64
SFLO	6	1		4
Industrial	2	2	5	3
Public	113	13	8	204
Possible SFLO - minimum of 5 forest acres	20	8	3	23
Possible FPP - minimum of 1 forest acre	18	3		14

Table 11 - Okanogan County dam barrier status by owner type.

Okanogan County Dam Barrier Status by Owner Type				
Description	**Yes**	**No**	**Unk**	**No Data**
Unknown	30	6	1	
SFLO	2			
Industrial	3			
Public	35	23		12
Possible SFLO - minimum of 5 forest acres	10	6		
Possible FPP - minimum of 1 forest acre	6	2		

Table 12 - Okanogan County fishway barrier status by owner type.

Okanogan County Fishway Barrier Status by Owner Type	
Description	**Yes**
Public	1
Possible FPP - minimum of 1 forest acre	1

Streams

Stream data from the Washington State Department of Natural Resources was overlaid on the parcels to determine the stream and shoreline lengths associated with the different owner types. The DNR classifies stream segments into multiple hydrology line types: interior, shoreline, perimeter, stream, and stream/perimeter. The nature of the classifications makes it difficult to identify how much stream length is on each type of ownership. The DNR hydro data steward should be able to provide some insights into the usefulness of the data on different types of streams, see Table 13 and Table 14. Stream statistics were also generated by DNR water types as shown in

Table 13 - Thurston County stream miles by DNR hydro line type.

Thurston County Stream Miles by Owner and Water Type					
OWNERTYPE	**INTERIOR**	**M/E SHORELN**	**PERIMETER**	**STREAM**	**STREAM/PERIM**
Unknown	6.92	41.64	76.52	79.21	0.48
SFLO	38.00	4.74	109.32	297.92	0.42
Industrial	22.23	0.44	67.16	847.49	1.06
Public	51.66	20.12	149.07	582.27	1.46
Possible SFLO	59.64	15.81	234.89	386.19	3.10
Possible FPP	13.16	21.85	64.60	115.15	0.33

Table 14 - Okanogan County stream miles by DNR hydro line type.

OWNERTYPE	INTERIOR	PERIMETER	STREAM	STREAM/PERIM
Unknown	123.61	452.79	2644.89	12.79
SFLO	7.92	29.38	402.11	0.29
Industrial	12.51	61.51	841.85	0.57
Public	294.25	793.47	9244.81	11.19
Possible SFLO	72.72	270.62	1256.90	6.62
Possible FPP	35.74	96.80	275.03	1.93

Table 15 - Thurston County stream miles by DNR water type code.

Thurston County Stream Miles by Owner and DNR Stream Type

OWNERTYPE	TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE 5	UNCLASSIFIED
Unknown	87.87	4.48	22.73	13.27	7.52	68.89
SFLO	58.77	20.80	52.15	35.13	99.85	183.70
Industrial	52.32	13.47	88.82	76.20	294.39	413.18
Public	141.71	24.43	142.64	76.90	191.99	226.90
Possible SFLO	170.49	35.23	127.44	64.27	71.92	230.27
Possible FPP	66.51	8.68	36.47	18.39	15.76	69.28

Table 16 - Okanogan County stream miles by DNR water type code.

Okanogan County Stream Miles by Owner and DNR Stream Type

OWNERTYPE	TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE 5	UNCLASSIFIED
Unknown	262.95	27.56	130.47	257.71	494.97	2060.44
SFLO	5.08	7.13	44.87	47.39	110.70	224.53
Industrial	6.08	3.23	37.18	43.36	184.86	641.74
Public	519.78	63.08	443.27	769.66	1913.82	6634.13
Possible SFLO	153.31	44.46	153.72	136.32	338.98	780.08
Possible FPP	81.53	5.09	33.30	33.71	51.93	203.95

Maps & Datasets

Map sets produced for the project show the location and identification information for all of the in-stream structures in the WDFW database overlaid on the known and possible SFLO and FPP parcels. These map sets, see Figure 5, and the associated reports and spreadsheets can be used to locate individual blockages and the parcels that they are on. With this information, interested groups can contact individual landowners about the fish passage barrier on their property. More information about the maps and associated reports can be found in the appendix.

Figure 5 - Example map sheet.

Conclusion & Recommendations

Utilizing county assessor tax roles is an effective way to identify Washington State Non-Industrial Private Forests. However, many of Washington's NIPF are not taxed as forestland. Often, owners are not aware of the tax benefits associated with a forest tax classification or their parcel is too small to realize the benefit. It is estimated from surveys that there are likely twice as many non-industrial private forests in Washington State as can be identified solely from county assessor tax information. Identification of these parcels and their owners can be assisted by using remote sensing techniques (to identify forestland) in combination with county assessor tax information. Assuming that large forested parcels with non-conflicting land uses are likely non-industrial private forestlands yields almost twice as many potential non-industrial private forests and is much closer to the numbers that surveys have estimated.

Validation of this method of identifying non-industrial private forests requires on-the-ground surveys of land owners. The outreach efforts of local fisheries enhancement groups can help to verify the validity of this approach. Future efforts to identify NIPF using remote sensing and assessor tax roles could benefit from information gained from these local groups.