

Lake Creek IFIM

Appendix G

Lake Creek Drainage Areas And Monthly Inflow For Instream Flow Study Sites

**LAKE CREEK DRAINAGE AREAS
AND
MONTHLY INFLOW FOR
INSTREAM FLOW STUDY SITES**

Prepared for:

Energy Northwest

Presented to:

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1.0 INTRODUCTION

1.1 Accretion Calculation

USGS gage No's. 14225500 (lake outlet) and 1422600 (Lake Creek above mouth) have 17 years of overlapping data. The years of overlapping data include water years 1912, 1914, and 1963-1977. Using daily average flow data, the daily inflow (cfs) between the upper (14225500) and lower (1422600) gages was calculated. Average monthly inflow (cfs) was then calculated for every month during the period of record when both gages were recording data (Table 1). To avoid possible data inconsistencies the data for water year 1912 was not included in the final monthly average calculation for inflow between the two gages.

Table 1. Average monthly inflow from Packwood Lake outlet downstream to lower gage at the old Route 12 bridge.

Average Inflow (cfs)												
WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1912	-4.7	37.8	13.9	52.3	55.4	6.2	0.8	-4.2	36.3	11.5	3.4	3.0
1914	11.8	21.8	18.6	50.7	25.1	36.7	42.8	41.4	26.7	22.2	10.3	12.3
1963	11.7	25.8	29.4	23.0	39.8	26.5	36.4	20.3	13.5	8.8	5.1	6.5
1964	5.9	26.7	26.6	47.1	35.4	29.0	37.6	30.3	26.0	17.1	12.9	8.6
1965	12.3	21.9	79.4	87.3	52.3	28.7	23.8	26.3	21.8	14.9	9.0	6.7
1966	5.8	8.7	13.5	29.0	20.2	37.2	34.8	25.1	18.9	12.7	8.5	5.9
1967	4.8	10.4	39.8	64.1	43.1	24.3	16.0	18.4	19.4	14.1	8.2	6.1
1968	11.9	21.2	38.9	39.2	62.1	36.0	26.8	15.7	14.3	9.6	8.0	9.4
1969	19.3	38.5	47.4	55.4	22.8	29.5	33.1	26.6	24.4	13.4	8.6	7.3
1970	8.9	11.6	22.4	62.2	47.1	30.0	27.2	17.9	15.0	10.2	6.6	5.6
1971	6.1	19.1	30.2	67.6	55.4	33.6	36.2	41.5	32.5	22.0	11.2	8.8
1972	9.0	21.6	37.9	66.4	79.7	99.7	50.3	48.2	42.7	26.1	14.9	13.7
1973	9.7	16.0	54.9	47.1	23.9	19.2	14.5	13.5	12.1	9.6	7.4	6.9
1974	6.8	34.4	56.8	82.5	49.8	43.4	46.7	44.2	52.5	26.0	14.5	9.3
1975	6.7	15.0	44.6	85.5	47.2	41.6	23.2	27.1	24.5	13.0	11.5	8.6
1976	8.7	30.8	92.8	67.3	36.4	29.7	37.5	35.7	27.2	18.7	12.9	9.2
1977	7.6	11.6	12.4	15.5	15.7	23.6	22.7	19.6	18.0	11.4	8.7	12.2
Avg	8.4	21.9	38.8	55.4	41.8	33.8	30.0	26.3	25.0	15.4	9.5	8.2
Avg-1912	9.2	20.9	40.4	55.6	41.0	35.5	31.9	28.2	24.3	15.6	9.9	8.6

Using the information in Table 1, inflow to Lake Creek per square mile was calculated. The USGS quantifies the drainage area at gage 14225500 (lake outlet) as 19.2 square miles, and at gage 14226000 (Lake Creek above mouth) as 26.5 square miles meaning that the effective drainage area between the two gages is 7.3 square miles. The monthly average inflow to Lake Creek (cfs) per square mile of drainage area is shown in Table 2. Again, the data for water year 1912 was excluded from the final calculation. Knowing the inflow per square mile of drainage area for any month allows for estimation of flow at any point on Lake Creek in a given month if both the drainage area at that point and the flow at the upper gage (14225500) are known.

Table 2. Average inflow to Lake Creek below Packwood Lake, per mile² of drainage.

Average Inflow to Lake Creek (cfs) per Square Mile of Drainage Area												
WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1912	-0.6	5.2	1.9	7.2	7.6	0.8	0.1	-0.6	5.0	1.6	0.5	0.4
1914	1.6	3.0	2.5	6.9	3.4	5.0	5.9	5.7	3.7	3.0	1.4	1.7
1963	1.6	3.5	4.0	3.2	5.5	3.6	5.0	2.8	1.8	1.2	0.7	0.9
1964	0.8	3.7	3.6	6.5	4.8	4.0	5.2	4.2	3.6	2.3	1.8	1.2
1965	1.7	3.0	10.9	12.0	7.2	3.9	3.3	3.6	3.0	2.0	1.2	0.9
1966	0.8	1.2	1.8	4.0	2.8	5.1	4.8	3.4	2.6	1.7	1.2	0.8
1967	0.7	1.4	5.5	8.8	5.9	3.3	2.2	2.5	2.7	1.9	1.1	0.8
1968	1.6	2.9	5.3	5.4	8.5	4.9	3.7	2.2	2.0	1.3	1.1	1.3
1969	2.6	5.3	6.5	7.6	3.1	4.0	4.5	3.6	3.3	1.8	1.2	1.0
1970	1.2	1.6	3.1	8.5	6.5	4.1	3.7	2.5	2.1	1.4	0.9	0.8
1971	0.8	2.6	4.1	9.3	7.6	4.6	5.0	5.7	4.5	3.0	1.5	1.2
1972	1.2	3.0	5.2	9.1	10.9	13.7	6.9	6.6	5.8	3.6	2.0	1.9
1973	1.3	2.2	7.5	6.5	3.3	2.6	2.0	1.8	1.7	1.3	1.0	0.9
1974	0.9	4.7	7.8	11.3	6.8	5.9	6.4	6.1	7.2	3.6	2.0	1.3
1975	0.9	2.1	6.1	11.7	6.5	5.7	3.2	3.7	3.4	1.8	1.6	1.2
1976	1.2	4.2	12.7	9.2	5.0	4.1	5.1	4.9	3.7	2.6	1.8	1.3
1977	1.0	1.6	1.7	2.1	2.2	3.2	3.1	2.7	2.5	1.6	1.2	1.7
Avg	1.1	3.0	5.3	7.6	5.7	4.6	4.1	3.6	3.4	2.1	1.3	1.1
Avg-1912	1.3	2.9	5.5	7.6	5.6	4.9	4.4	3.9	3.3	2.1	1.4	1.2

Figure 1 shows the location of IFIM study sites and transects, with the drainages delineated. Table 3 indicates the drainage area for each study site and transect grouping. Table 4 summarizes monthly inflow calculations to each study site and transect grouping. These calculations (excluding data from 1912) are used in the instream flow report to calculate inflow for all study sites and transects.

Study Site	Transects	Sq Miles
4	All	0.00
3	All	0.84
2	2-8	4.70
2	1	4.76
1	5-9	7.30
1	1-4	7.38

Table 4. Lake Creek Inflow (from USGS concurrent gages below Packwood Lake and at old HWY 12 bridge).							
		SS4	SS3	SS2-T2-8	SS2-T1	SS1-T5-9	SS1-T1-4
Month	cfs/mile ²	0	0.84	4.70	4.76	7.30	7.38
Jan	7.6	0	6.4	35.7	36.2	55.5	56.1
Feb	5.6	0	4.7	26.3	26.7	40.9	41.3
Mar	4.9	0	4.1	23.0	23.3	35.8	36.1
Apr	4.4	0	3.7	20.7	20.9	32.1	32.5
May	3.9	0	3.3	18.3	18.6	28.5	28.8
June	3.3	0	2.8	15.5	15.7	24.1	24.3
July	2.1	0	1.8	9.9	10.0	15.3	15.5
Aug	1.4	0	1.2	6.6	6.7	10.2	10.3
Sept	1.2	0	1.0	5.6	5.7	8.8	8.9
Oct	1.3	0	1.1	6.1	6.2	9.5	9.6
Nov	2.9	0	2.4	13.6	13.8	21.2	21.4
Dec	5.5	0	4.6	25.8	26.2	40.2	40.6
Annual	3.7	0	3.1	17.3	17.5	26.8	27.1

In their study plan request, WDOE requested that all tributaries and drainages to Lake Creek below the drop structure downstream to the confluence of Lake Creek with the Cowlitz River be delineated, with an estimate of drainage areas. Figure 2 reflects those delineations. Table 5 summarizes the drainage area (in miles²) of all delineated watersheds.

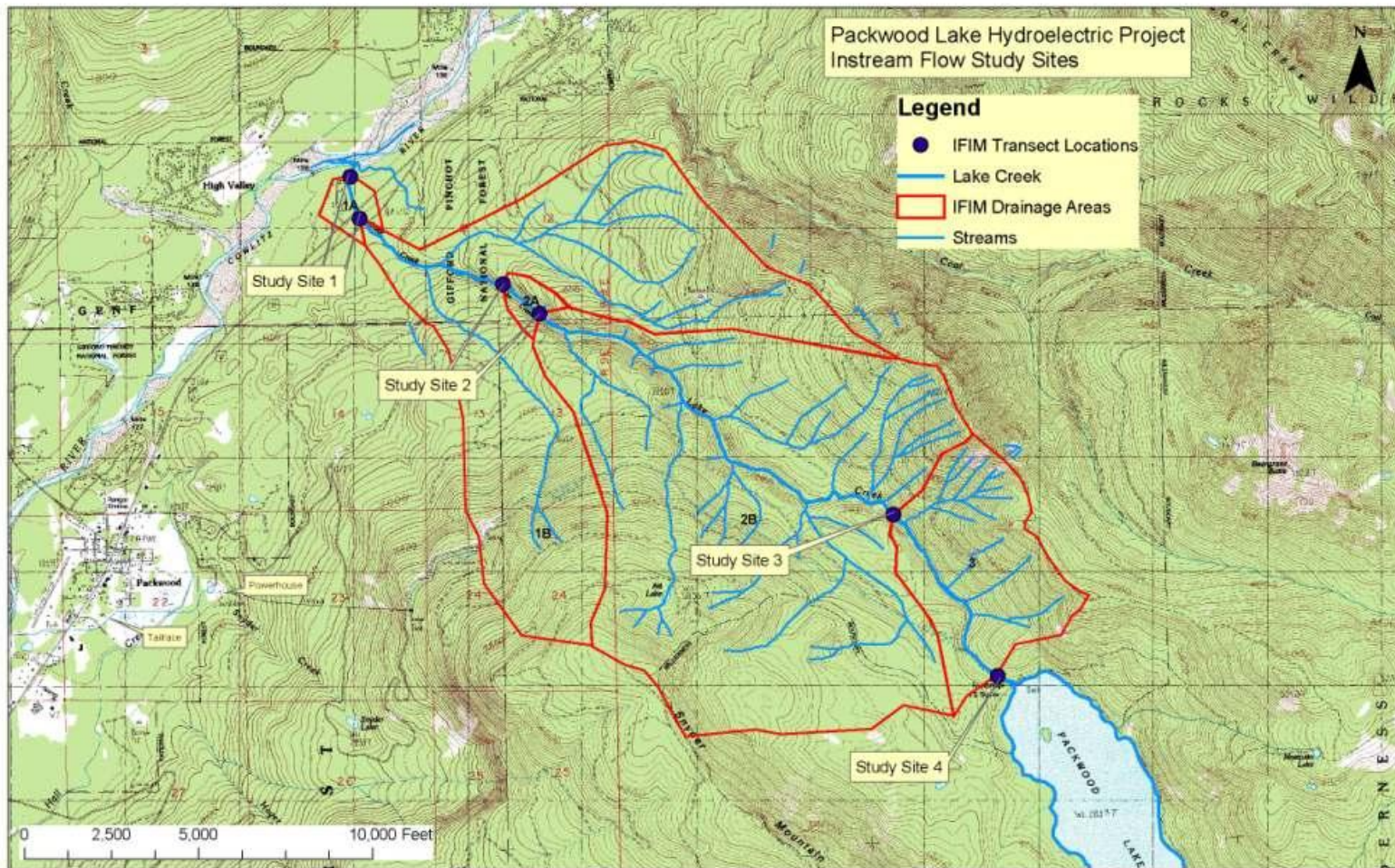


Figure 1. Lower Lake Creek watershed delineations, reflecting IFIM study sites and transects.

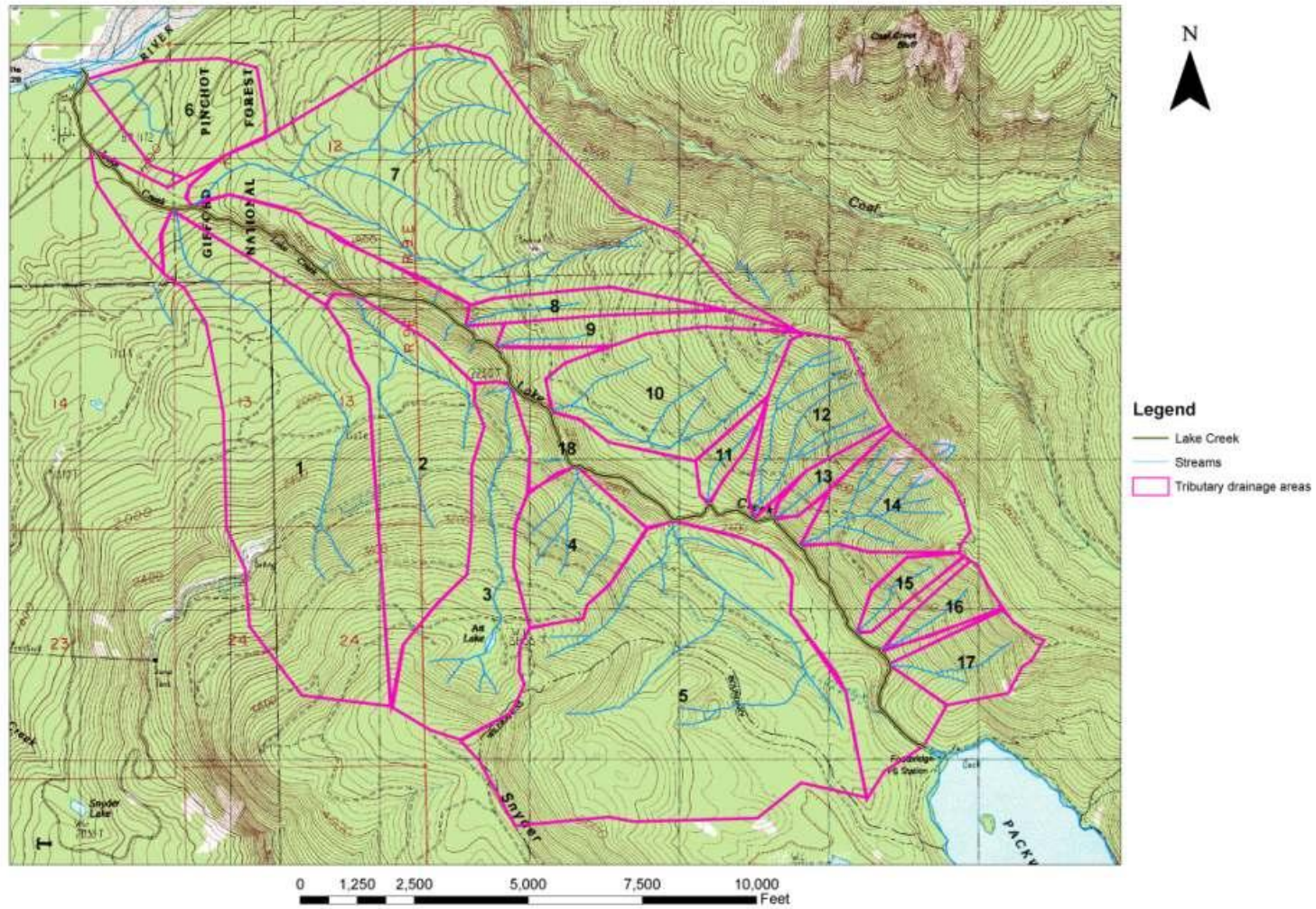


Figure 2. Delineation of drainages in lower Lake Creek from the Packwood Lake outlet to the confluence with the Cowlitz River.

Table 5. Lake Creek Tributaries Drainage Areas (mi sq.)	
ID	Sq Miles
18	1.079
17	0.137
16	0.070
15	0.054
14	0.223
13	0.048
12	0.232
11	0.043
10	0.379
9	0.105
8	0.093
7	1.209
6	0.251
5	1.384
4	0.238
3	0.433
2	0.507
1	1.062