
WELCOME TO THE
BRADY
FARMING COMMUNITY
WHEAT
PUMPKINS
HAY
CORN
PEAS

Sediment :

- *silt, clay and fine sands*
- *makes up the nutrient rich soil in which we grow crops*
- *easily becomes suspended in water*

Bedload :

- *gravel*
- *made up of various sized rocks and coarse sand*

Questions about the Lower Chehalis River Valley

- How deep are the soils?

- What does this tell us about how long these soils have been there?

- How much deeper does the gravel go before hitting bedrock?

Questions about the Lower Chehalis River Valley

- Predominantly, which way do the banks slope?
- **How does river erosion effect the frequency of flooding and fish**?
- How does soil filter water in comparison to gravel?
- **Which one acts more like a sponge? Gravel or soil?**

Questions about the Lower Chehalis River Valley

- **What does the EPA consider the #1 source of water pollution by volume?**
- How many dump truck loads of dirt goes into the river with each acre that erodes?
- **How many acres of soil have gone into the Chehalis river downstream of the Satsop bridges in the last 30 years?**
- As gravel and dirt fills in the tidal reach of the Chehalis river, what effect do you see with water temperatures and oxygen levels?

Questions about the Lower Chehalis River Valley

- Did you know, we are loosing soil to erosion up to **20 times faster** than the earth can replenish it?

- Does soil erosion add to rise in sea level?

- **How has soil erosion effected water acidity?**

- Have we lost the ability to sequester carbon with the increase in soil erosion?

Questions about the Lower Chehalis River Valley

- What has been the biggest reason for the loss of trees and buffer zones along the lower reaches of the rivers?

- **How has soil washing into the river influenced the Salmon?**

- Are deep holes in the river good habitat for Chinook Salmon?

- **Has the DOE ever fined someone for adding sediment to a stream?**

- How has sediment coming down the Mississippi and Amazon rivers influenced marine life, there?

Questions about the Lower Chehalis River Valley

- What is the material being dredged from the main shipping channel of the inner Grays Harbor? The Westport Marina?
- **What is the yearly cost of dredging this material?**
- Where does the Corp of Engineers put the dredged materials?
- **How has the sediment effected the oyster beds on the harbor?**

Gravel Transport, Gravel Harvesting, and Channel-Bed Degradation in Rivers Draining the Southern Olympic Mountains, Washington, U.S.A.

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ABSTRACT / The potential for gravel extraction to adversely affect anadromous fish habitat in three gravel-bed rivers of southwestern Washington, U.S.A., prompted the need to determine sustainable rates of gravel removal. This was accomplished by evaluating the components of a long-term sediment mass balance for the three rivers. Average annual gravel transport was determined by three independent methods. The closely agreeing results indicate that annual bedload supply decreases downstream through deposition and storage in response to declining gradient and from attrition during transport, as confirmed by laboratory experiments. A survey of gravel-bar harvesting operations indicates that the annual replenishment rate has been exceeded for up to three decades, often by more than tenfold. Analysis of data from nine stream gauging stations over a 55-yr period indicates degradation of about 0.03 m/yr in these reaches and suggests that bed degradation has produced the difference between the replenishment rates and the volumes of gravel harvested from the river beds and bars.

Introduction

Gravel is extracted from the low-water beds or bars of many perennial rivers, although it is seldom done in a planned manner that takes into account the potential, inadvertent effects of extraction on river morphology or sediment transport. Where regulated at all, restrictions commonly address the season and style of removal, but seldom the quantity. One reason that river-basin planners seldom take into account the potential adverse effects associated with gravel harvesting may be because the effects are not well documented in the published literature. These effects, recently reviewed by Collins and Dunne (1987), include: changes to bed elevations and morphology, which affect aquatic habitat, in-channel structures, floodplain land uses, and riparian habitat; and changes to river banks and channel patterns. Another reason may be that many environmental scientists and planners believe that evaluations of potential changes must necessarily be expensive and take many years to complete. However, in many, if not most, cases the necessary information can be developed rapidly and inexpensively, making use of basic principles of fluvial geomorphology, existing data, and judicious collection of additional data (Collins and Dunne 1987).

Typical of rivers draining the mountainous Pacific Northwest, the Humptulips, Wynoochee, and Satsop rivers of Washington state enter zones of rapidly declining gradient and widespread deposition of gravel bars as the rivers emerge from the southern Olympic Mountains (Fig. 1). Such depositional zones are characterized by rapid bar formation and channel shifting (Dunne 1988) and, in the rivers studied, are sites of gravel extraction and also provide habitat for anadromous fish. The possibility that this habitat could be depleted by gravel harvesting brought about the need to determine the rate at which gravel could be harvested without diminishing the long-term availability of gravel for spawning redds. It was necessary to determine the long-term flux of gravel rapidly and inexpensively.

The purpose of this article is to report the results of a study that makes use of widely applicable methods to determine the approximate, long-term bed material flux for specific reaches of the three rivers. The article also contributes to the small body of literature on gravel harvesting effects. Bed degradation associated with gravel extraction has been documented in one perennial river (Page and Heerdegen 1985), and in several arid-land, intermittent sand-bedded channels (Bull and Scott 1974). Several additional unpublished case histories are reviewed by Collins and Dunne (1987).

Approach of the Study

Sediment entering a reach is either transported through the reach, deposited and stored for some period of interest, broken down to smaller particles during storage or transport, or is removed by gravel harvesting. To account for these different components of the long-term bedload mass balance, the following

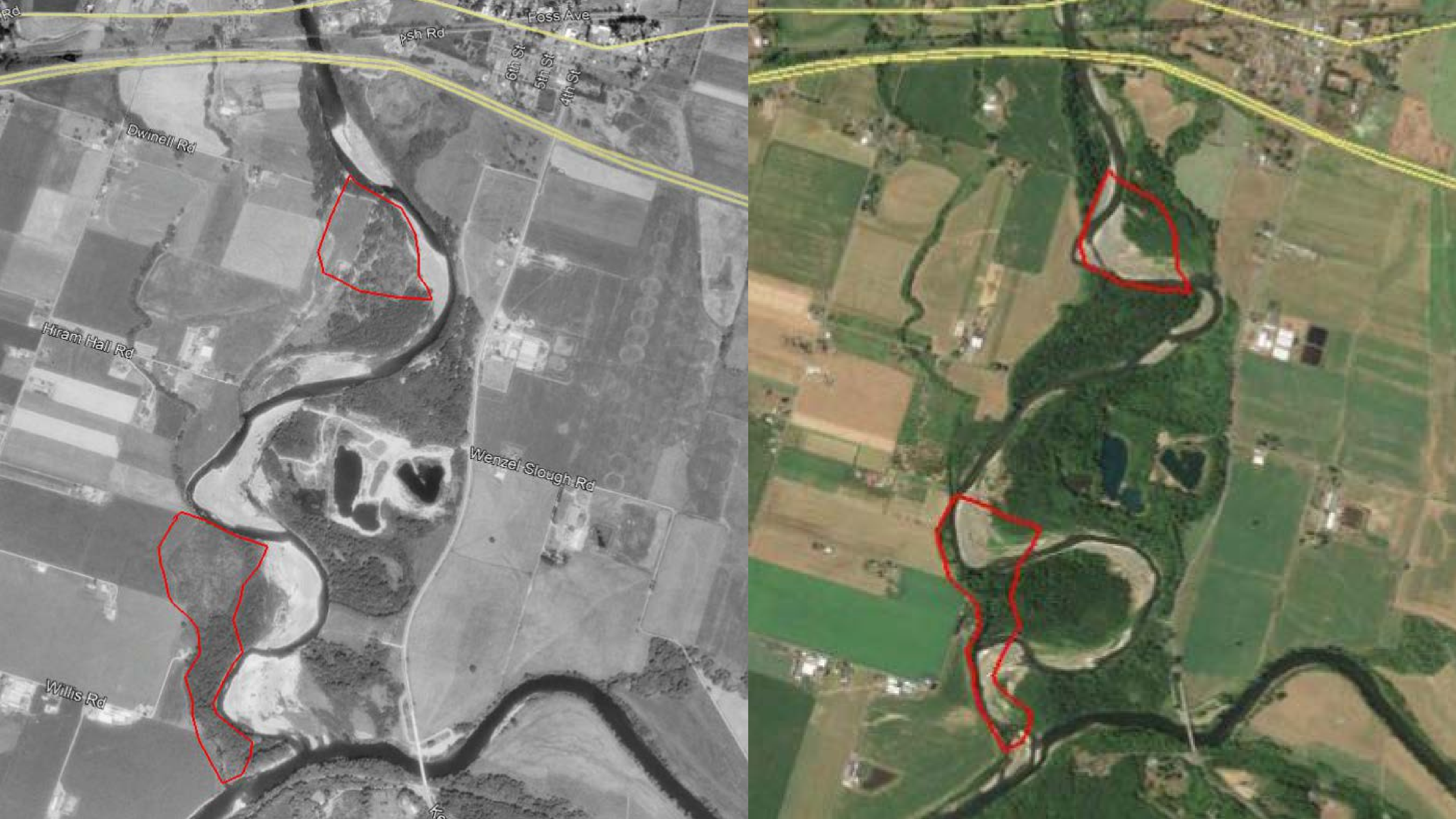
Environ Geol Water Sci Vol. 13, No. 3, 213–224

Satsop Year

Legend
Feature 1
Monte Elma Rd
Monte Brady Rd
Olympic Hwy
Foss Ave
6th St
5th St
4th St
Oneill Rd
12
Dwinell Rd
Hiram Hall Rd
Foster Rd
Wenzel Slough Rd
Willis Rd

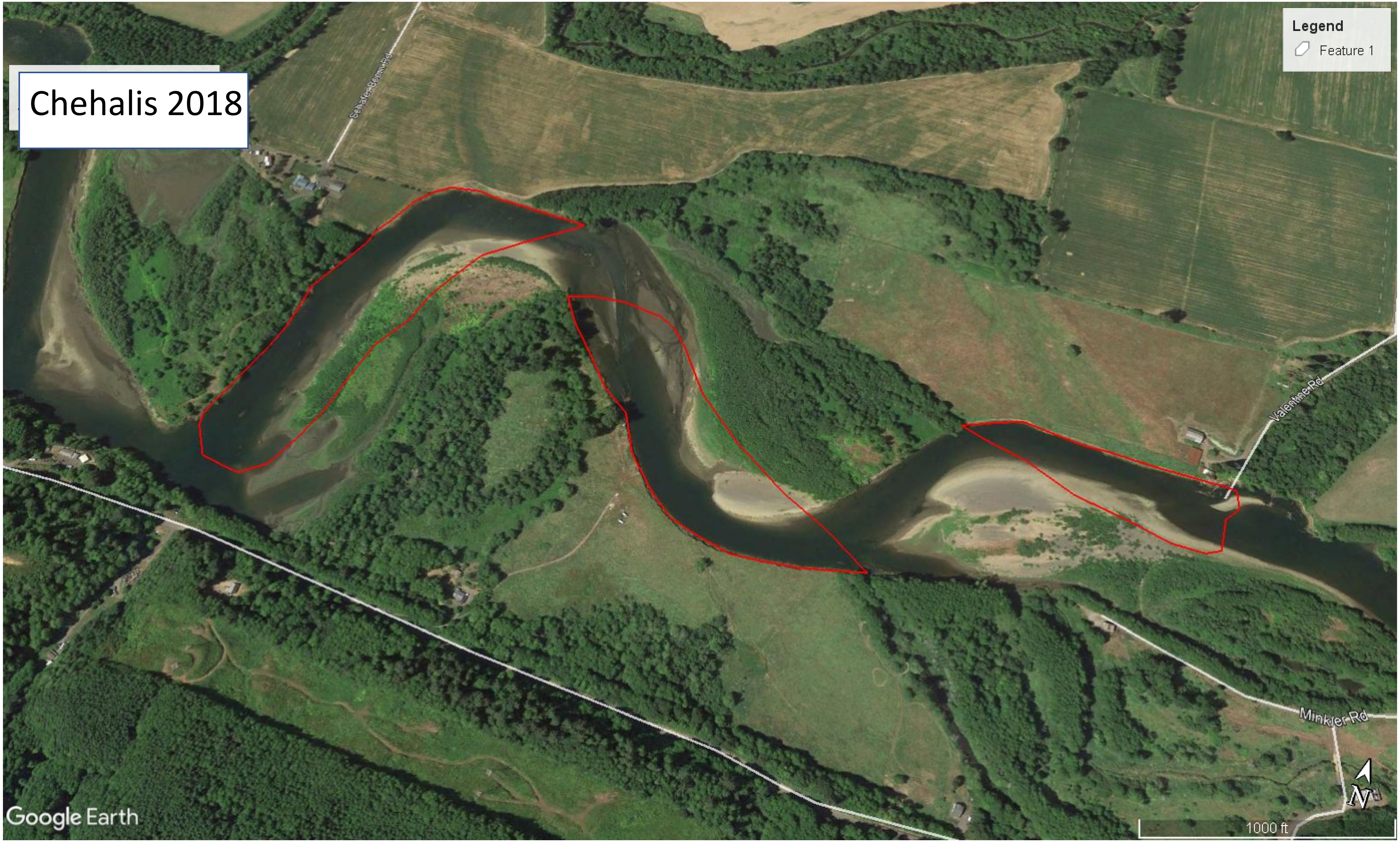
Satsop 2017


Legend
Feature 1
Monte Elma Rd
Olympic Hwy
12
Google Earth
Image Landsat / Copernicus
1 mi
N


Foss Ave
6th St
5th St
4th St
Dwinell Rd
Hiram Hall Rd
Wenzel Slough Rd
Willis Rd

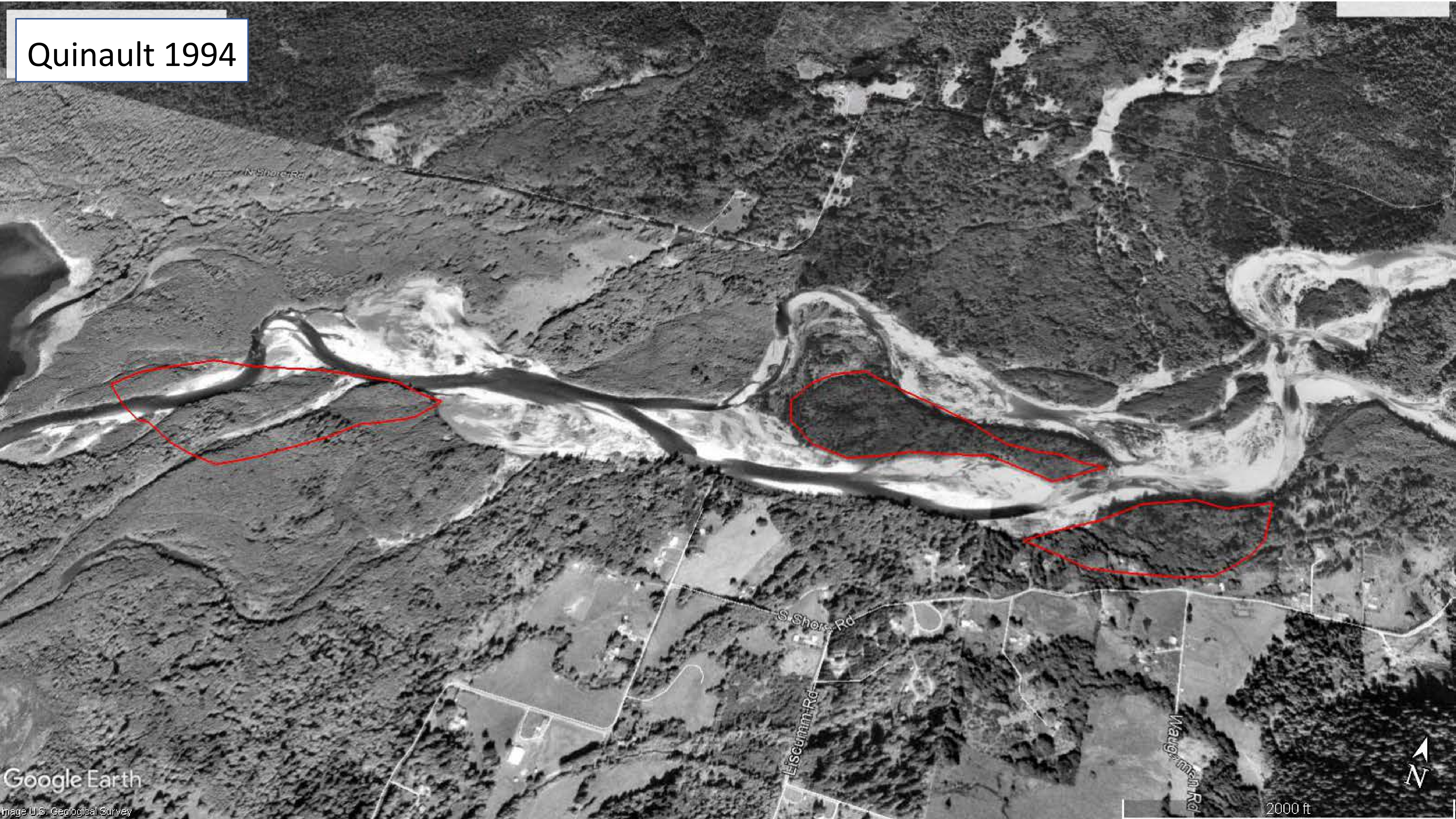

Wynoochee
Legend
Feature 1
Google Earth
400 ft
N

Chehalis 1991


Chehalis 2018
Legend
Feature 1
Valentine Rd
Minkler Rd
Google Earth
1000 ft
N

Grays Harbor

Quinault 1994



Quinault 2016
N-Shore-Rd
S-Shore-Rd
Google Earth
2000 ft
N

Quinault Lake 2006

Before Fill

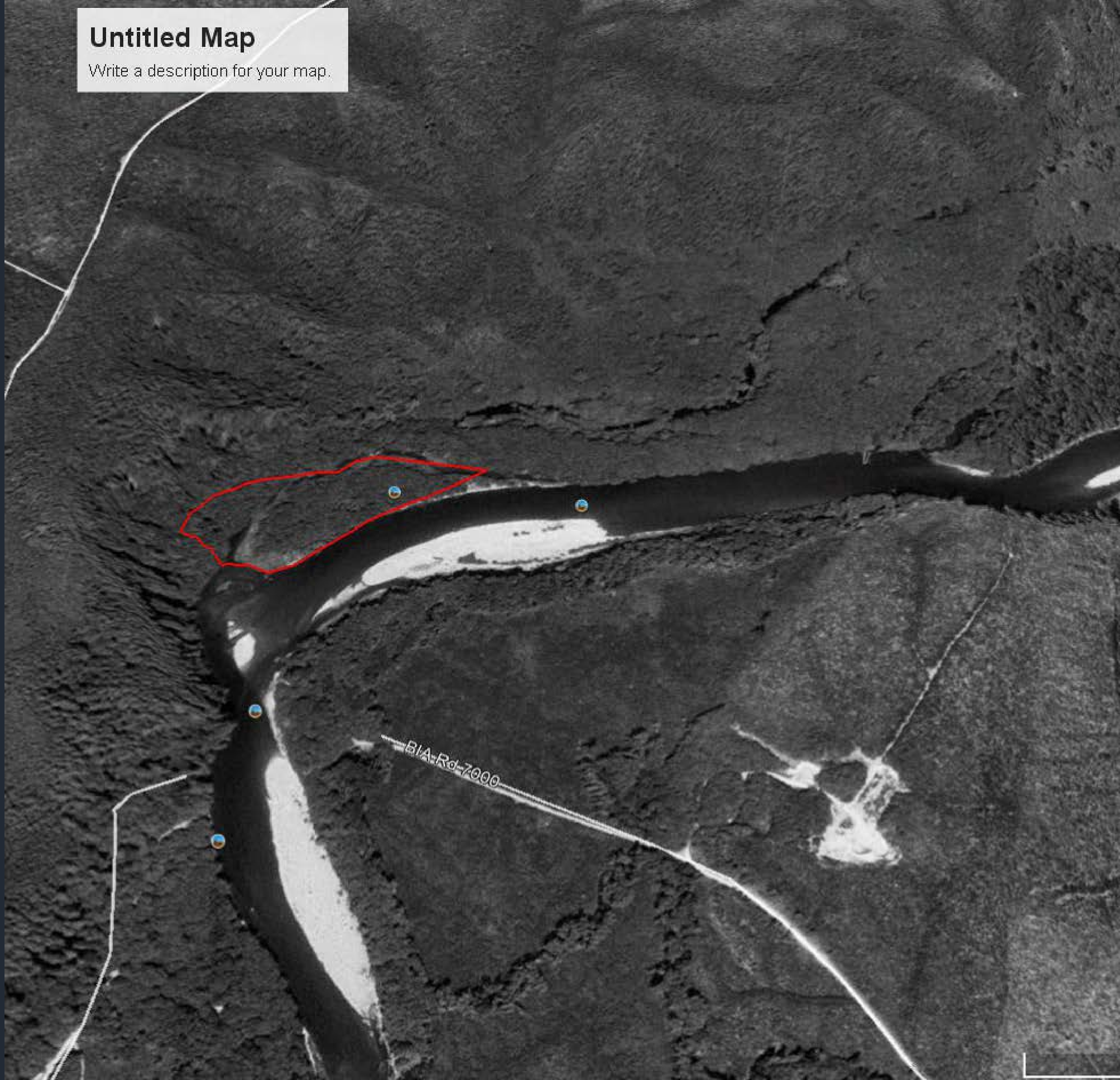
Quinault Lake 2016

After Fill


300

5

Chow Chow 1994



Chow Chow 2016


1994
BIA-Rd-7000

2016
BIA-Rd-7000


Write a description for your map.
OSO 2006
Google Earth
N

OSO 2013

10:37:22

10:41:53

10:44 first 911 call


OSO 2016
Google Earth
500 ft
N

Skokomish

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Differentiating the effects of logging, river engineering, and hydropower dams on flooding in the Skokomish River, Washington, USA

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ABSTRACT

A decades-long, progressive loss of channel capacity in the Skokomish River, a 622 km^2 basin draining the southeast Olympic Mountains of Washington State, has caused increasing flooding with severe consequences to endangered salmon runs, infrastructure, and private property. To differentiate among multiple potential drivers of the capacity loss, we analyze the geomorphic evidence for the potential effects of: flow regulation by two dams constituting the Cushman Hydroelectric Project, which began regulating flow in the river's North Fork in 1925 and diverting water out of the basin in 1930; sediment production from mid-twentieth century logging in the river's South Fork basin; and twentieth century river engineering in the mainstem. Bankfull channel capacity in the mainstem has steadily declined since about 1940 from 370 $m^3 s^{-1}$ to <100 $m^3 s^{-1}$ due partly to the narrowing of the Skokomish River, which in 2015 was only 45% as wide as it was in 1938. The capacity loss is also due to sediment filling the channel, with nearly 2 m of aggradation measured at a stream gauge since 1965. Comparison of channel cross sections surveyed in 1994, 2007, and 2016 show that about 20,000 $m^3 yr^{-1}$ (34,000 $Mg yr^{-1}$) of sediment is accumulating in the Skokomish River. The nature, timing, and spatial pattern of this channel narrowing and shallowing are consistent with the response expected from the Cushman Project, which exports water out of basin and thus substantially reduces downstream flows, but, because the dams were built below a natural lake, does not reduce the sediment supply. While sediment yield from the South Fork is high, accounting for about three-fourths of the total sediment supplied to the Skokomish River, it is dominated by the progressive widening of the channel and recruitment by lateral fluvial erosion of glacial sediments in alluvial terraces; landslides associated with logging in the South Fork basin produced a small amount of sediment relative both to the sediment produced by channel widening in the upper South Fork and to the rate of aggradation in the mainstem Skokomish River. The naturally-high sediment load from the South Fork and the flow reduction in the North Fork result in the unusual effect of flooding having increased downstream of the dams despite substantial reductions to peak flows. This case study illustrates how a watershed-scale analysis of multiple land uses and flow management and their interaction with the basin's geology and geomorphology can make use of geomorphic evidence to differentiate among the possible drivers of channel change and associated flooding.


CAT
CARR
U.S. ARMY

P. Bullock, in Encyclopedia of Soils in the Environment, 2005

Soil Erosion:

Soil erosion is the movement and transport of soil by various agents, particularly water, wind, and mass movement; hence climate is a key factor**. It has been recognized as a major problem since the 1930s and, although there has been some 70 years of research into the causes and processes, it is still increasing and of growing concern.** Global rates of soil erosion have been exceeding those of new soil formation by 10- and 20-fold on most continents of the world in the last few decades. The increase in soil erosion to date is strongly linked with the clearance of natural vegetation, to enable land to be used for arable agriculture, and the use of farming practices unsuited to the land on which they are practiced. This, combined with climatic variation and extreme weather events, has created ideal conditions for soil erosion. The main climatic factors influencing soil erosion are rainfall (amount, frequency, duration, and intensity), and wind (direction, strength, and frequency of high-intensity winds), coupled with drying-out of the soil. Land use, soil type, and topography are the other key factors.

Soil erosion by water is more widespread and its impact greater than that by wind. Climate change is likely to affect soil erosion by water through its effect on rainfall intensity, soil erodibility, vegetative cover, and patterns of land use. **General circulation models predict for many areas seasonally more intense drying, coupled with increased amounts and intensity of precipitation at other times, conditions that could lead to large increases in rates of erosion by water.**

What is a Watershed?

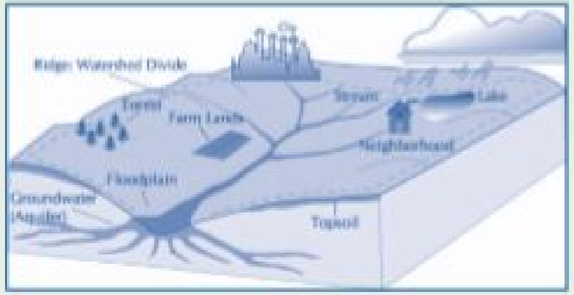
A watershed is an area of land that drains to a common point, such as a nearby creek, stream, river or lake. Every small watershed drains to a larger watershed that eventually flows to the ocean.

Watersheds support a wide variety of plants and wildlife and provide many outdoor recreation opportunities. Protecting the health of our watersheds preserves and enhances the quality of life for Kansas City area residents.

What is Stormwater Runoff?

Stormwater is water from rain or melting snow. It flows from rooftops, over paved streets, sidewalks and parking lots, across bare soil, and through lawns and storm drains. As it flows, runoff collects and transports soil, pet waste, salt, pesticides, fertilizer, oil and grease, litter and other pollutants. This water drains directly into nearby creeks, streams and rivers, without receiving treatment at sewage plants.

Polluted stormwater contaminates local waterways. It can harm plants, fish and wildlife, while degrading the quality of water.



A typical watershed system

MARC

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**For more information,
visit www.marc.org/Enviroment/Water
or call 816/474-4240.**

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Winter Watershed Tip

What is Sediment Pollution?

Help keep excess sediment out of our creeks, streams and rivers

Clean Water. Healthy Life.

What is sediment?

Sediment is the loose sand, clay, silt and other soil particles that settle at the bottom of a body of water. Sediment can come from soil erosion or from the decomposition of plants and animals. Wind, water and ice help carry these particles to rivers, lakes and streams.

Facts about Sediment

- The Environmental Protection Agency lists sediment as the most common pollutant in rivers, streams, lakes and reservoirs.
- While natural erosion produces nearly 30 percent of the total sediment in the United States, accelerated erosion from human use of land accounts for the remaining 70 percent.
- The most concentrated sediment releases come from construction activities, including relatively minor home-building projects such as room additions and swimming pools.
- Sediment pollution causes $16 billion in environmental damage annually.

What's the problem?

Sediment entering stormwater degrades the quality of water for drinking, wildlife and the land surrounding streams in the following ways:

- Sediment fills up storm drains and catch basins to carry water away from roads and homes, which increases the potential for flooding.
- Water polluted with sediment becomes cloudy, preventing animals from seeing food.
- Murky water prevents natural vegetation from growing in water.
- Sediment in stream beds disrupts the natural food chain by destroying the habitat where the smallest stream organisms live and causing massive declines in fish populations.
- Sediment increases the cost of treating drinking water and can result in odor and taste problems.
- Sediment can clog fish gills, reducing resistence to disease, lowering growth rates, and affecting fish egg and larvae development.
- Nutrients transported by sediment can activate blue-green algae that release toxins and can make swimmers sick.
- Sediment deposits in rivers can alter the flow of water and reduce water depth, which makes navigation and recreational use more difficult.

What can you do?

- Sweep sidewalks and driveways instead of hosing them off. Washing these areas results in sediment and other pollutants running off into streams, rivers and lakes.
- Use weed-free mulch when reseeding bare spots on your lawn, and use a straw erosion control blanket if restarting or tilling a lawn.

- Notify local government officials when you see sediment entering streets or streams near a construction site.
- Put compost or weed-free mulch on your garden to help keep soil from washing away.
- Avoid mowing within 10 to 25 feet from the edge of a stream or creek. This will create a safe buffer zone that will help minimize erosion and naturally filter stormwater runoff that may contain sediment.
- Either wash your car at a commercial car wash or on a surface that absorbs water, such as grass or gravel.

For more information about erosion and sediment control, visit www.marc.org/Environment/Water or call 816/474-4240.