Protecting and Restoring the Waters of the Dungeness

A Watershed-Based Plan Prepared in Compliance with
Section 319 of the Clean Water Act

Jamestown S'Klallam Tribe
Sequim, WA
July 2007

S'Klallam ancestor Lizzy Fleming & friend on the Dungeness River in 1919.
Jamestown Tribal Photo Archives

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Unless otherwise noted, map diagrams in this document were produced using the Jamestown S'Klallam Tribal GIS with data from the following sources:

- Irrigation Ditches - Montgomery Water Group – 1998
- Roads/Urban Growth Areas/Parcels/Forest cover/Septics/LIDAR – Clallam County 2006
- Streams – WA Dept. of Fish & Wildlife SSHIAP 2007
- Watershed boundary – WA Dept. of Ecology 2004
- Shellfish areas - WA Dept. of Health
- Major Riparian structures in the Dungeness - U.S. Bureau of Reclamation

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* Required elements marked with *

APPENDICES

FIGURES AND TABLES

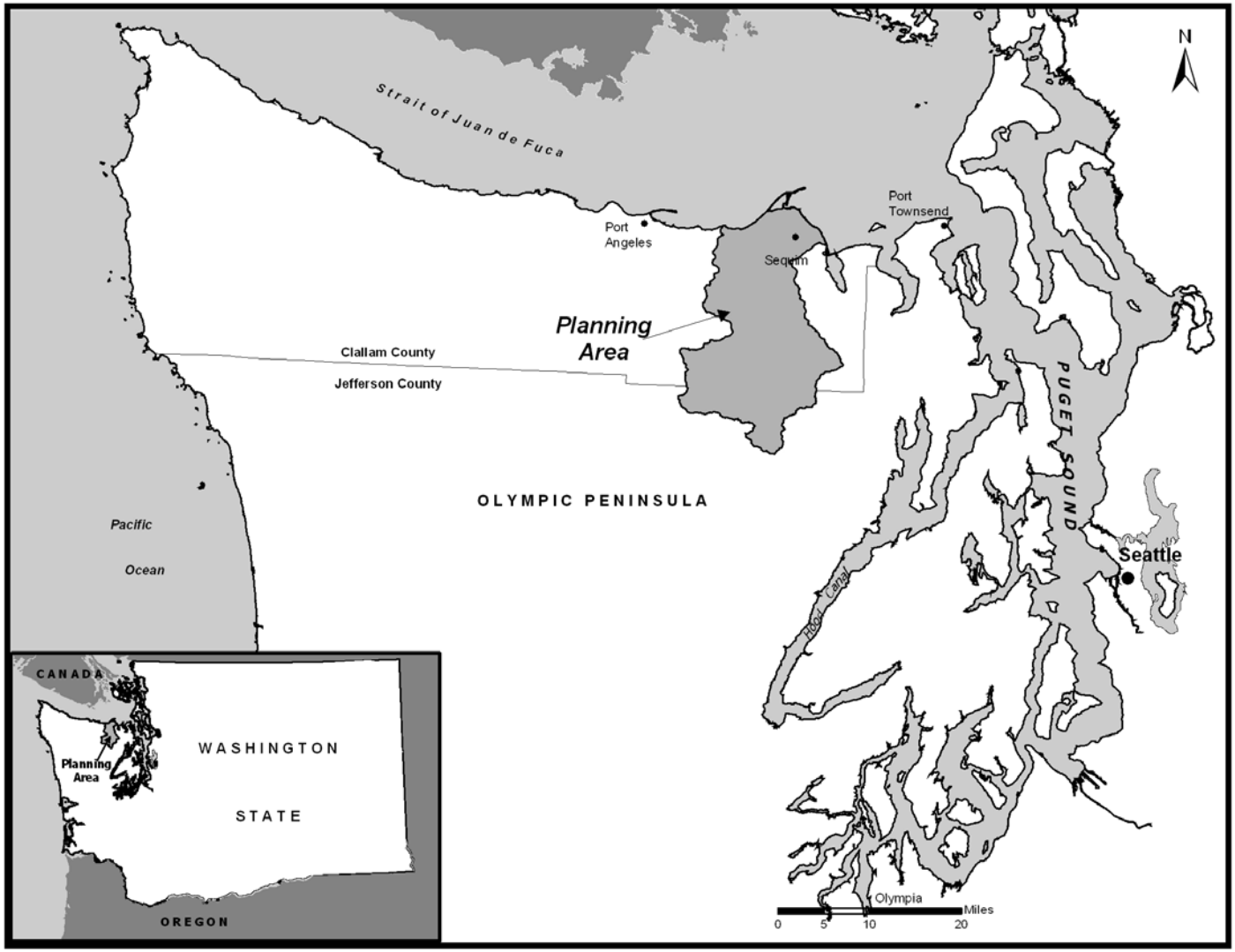


Figure i-1: General Location of the Dungeness Watershed, Washington State

INTRODUCTION: Purpose and Scope

Located on the north coast of the Olympic Peninsula (Figure i-1), the Dungeness watershed has always been the home of the Jamestown S'Klallam Tribe, providing abundant resources from its forests, rivers, tidelands and marine waters. Following early white settlement, the Dungeness band of S'Klallams pooled $500 in gold coin in 1874 to purchase 200 acres of land along Dungeness Bay, to remain in their ancestral homeland and avoid moving to a reservation. They named their community after their leader known as Lord James Balch. Today many citizens of the Jamestown S'Klallam Tribe still reside in the Dungeness watershed. The Tribe owns riparian property along the Dungeness River at three locations from the river mouth to river mile 7, and a small tideland area in Dungeness Bay. Tribal citizens harvest fish and shellfish from Dungeness Bay for ceremonial, subsistence and commercial purposes. Waters originating in the upper Dungeness watershed and associated tributaries, and estuarine/marine waters along the Strait of Juan de Fuca directly affect these tribal lands and waters, and are the subject of this plan.

The purpose of this plan is to characterize the Dungeness Watershed area highlighting the causes and sources of non-point source pollution. The plan has been developed with the intent of complying with the guidelines associated with Section 319 of the Clean Water Act as administered by the Environmental Protection Agency (http://www.epa.gov/owow/nps/cwact.html). The plan describes watershed area goals along with management measures for protecting water quality and restoring impaired water bodies. A secondary purpose of this plan is to integrate management measures for non-point source pollution with the protection and remedial actions recommended in other watershed management plans for the Dungeness.

> ***Non-point Source Pollution:*** *Pollution which cannot be traced back to a single origin or source, such as stormwater, water runoff from urban streets and parking lots, failed septic systems, and agricultural runoff of fertilizer, pesticides or animal wastes.*

Considerable watershed planning has already occurred in the Dungeness Watershed area during the past two decades related to water quantity, water quality, salmon recovery, forest management, flood management, and other watershed issues. Many management measures to improve water quality and habitat conditions have already been identified, and many projects have already been implemented or are in advanced planning stages. This plan thus draws from each of these previous planning efforts and the large body of technical studies that already exist, rather than conducting an independent watershed planning process.

Non-point source pollution in the Dungeness Watershed became a major focus of study following the downgrading of several commercial shellfish beds in Dungeness Bay in the 1990s. Increasing levels of fecal coliform bacteria were measured near the mouth of the Dungeness River and in Matriotti Creek, a lower river tributary. Two Total Maximum Daily Loading (TMDL) analyses of the Dungeness, one for fresh waters entering the Bay and a second for the Bay, for fecal coliform were conducted by the Washington Department of Ecology in 2002 and 2004. Concurrently, other studies of

water circulation in Dungeness Bay were commissioned by the Jamestown S'Klallam Tribe to augment the TMDL analysis. The shellfish area downgrades and source studies led to the formation of a Clean Water District by Clallam County, and a clean up plan was prepared by the County, Tribe, and other watershed partners. Non-point source pollution remains the subject of water quality work in the watershed. There are no point sources of pollution such as municipal or industrial facilities that discharge directly into a water body in this watershed.

The area covered by this plan (figure i-2) includes the Dungeness River watershed and the westerly adjacent watersheds of Siebert and McDonald Creeks, along with the marine waters of Dungeness Bay. The Dungeness, Siebert and McDonald are all independent drainages to the Strait of Juan de Fuca originating in the Olympic Mountains and foothills. The Dungeness River, and Siebert and McDonald Creeks, are directly connected hydrologically as Dungeness River water is transferred to these creeks via the Sequim-Dungeness valley irrigation system. Estuarine areas of Siebert and McDonald are utilized by migrating populations of Dungeness-origin salmon and other fish populations. Other small independent drainages to the east of the Dungeness River mouth including Meadowbrook, Cooper, Cassalery and Gierin Creeks are highly connected to the Dungeness estuary/nearshore environment, and are also included in this plan.

Further east, Bell, Johnson and Jimmycomelately Creeks are also closely related to the Dungeness hydrologically, geologically and biologically. However, these watersheds are not included in this plan as they are tributaries to Sequim Bay and will be the subject of a separate plan, to be completed in 2007-9.

Total Maximum Daily Load Analysis: *The Federal Clean Water Act requires a TMDL Analysis for water bodies that do not meet water quality standards. The Washington Department of Ecology maintains the list of such water bodies (known as the 303(d) list) for Washington State. A TMDL evaluation begins with a water quality technical study to determine the loading capacity of the water body to absorb pollutants and still meet water quality standards. The study also evaluates the likely sources of pollutants and the amount of pollutants that need to be reduced to reach that capacity. (Adapted from Sergeant, 2004)*

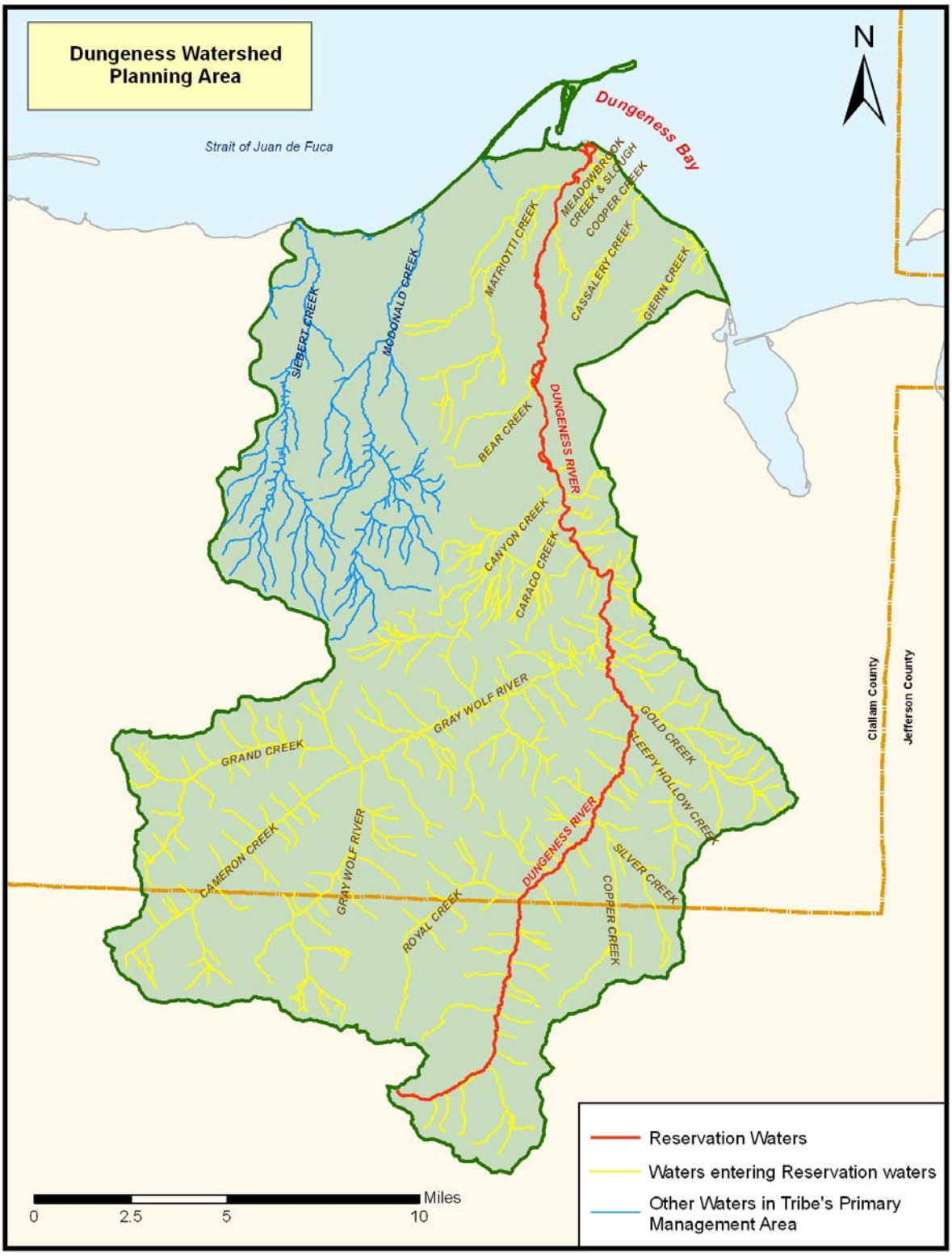


Figure i-2: Dungeness Watershed Planning Area Boundary

1. Overview of the Dungeness Watershed

Originating in the Olympic Mountains of Washington State, the Dungeness River and its main tributary, the Gray Wolf, drain a 270-square-mile watershed of steep mountains, deep forested canyons, and a broad open valley. With headwaters at 6,400 feet in Olympic National Park, the steep, 32-mile course of the Dungeness flows almost due north before emptying into the Strait of Juan de Fuca at sea level. The lower ten miles flow through a broad alluvial valley, which is characterized by a mixed use of small forested parcels, agriculture, and increasingly, a mix of rural/urban residential development in proximity to the City of Sequim. Characteristics of the Dungeness Watershed including climate, geology, hydrology, soils, biotic communities, land use and demographics are described more fully in several planning documents including the WRIA 18 Watershed Plan (Entrix, 2005). The excerpts provided here are intended as an introduction to the Dungeness Watershed and its key terrestrial, aquatic and human communities.

Precipitation and Streamflow

While the Dungeness watershed drains over 172,000 acres, it is located in the arid "rainshadow" of the Olympic Mountains, receiving only a fraction of the precipitation typical of other western Washington rivers and streams. Average annual precipitation in the upper watershed is approximately 63 inches, while the Sequim area experiences only 16 inches. Roughly 75 percent of annual precipitation occurs during the October to March period, thus the late summer streamflow is highly dependent on annual snowpack.

Streamflow has been measured at river mile 11.8 by the USGS for over 80 years. Typical late summer streamflows average less than 200 cubic feet per second (cfs), while average winter flows in December through February are approximately 400 cfs. Peak sustained flows occur during snowmelt in June and July. Instantaneous peak flows have been measured in excess of 7,500 cfs, with a record flow of 7,610 cfs on January 6, 2002, resulting in extensive flooding in portions of the lower 10 miles. River basin hydrology has been dramatically altered by an irrigation system initiated in 1896, and an estimated 173 miles of canals and ditches spread Dungeness River water throughout the lower watershed area. (Newberry, 2003)

Plant, Fish and Wildlife Communities

The Dungeness Basin is predominantly in the Western Hemlock forest zone, with small portions of the upper basin in the alpine zone (Kruckeberg, 1991). The dominant forest tree species include Douglas fir, Western hemlock, and Western red cedar. Forest lands in the mid to upper basin host various terrestrial wildlife species typical of the Pacific Northwest, such as black-tailed deer, Roosevelt elk, black bear and cougar. Bird species vary by the successional stage of the forest and include numerous species of owls, hawks, woodpeckers, flycatchers, warblers, sparrows and other species. Protected bird species include the Northern spotted owl, marbled murrelet, and bald eagle.

Seven species of Pacific salmonids utilize the Dungeness watershed for all or a portion of their life cycle -- Chinook, coho, chum, pink, steelhead, cutthroat trout, and bull trout. Chinook and summer chum salmon, steelhead, and bull trout are presently listed as threatened species under the Federal Endangered Species Act. The early-timed upper river stock of pink salmon is considered depressed while the lower river stock of pink is critical (WDFW et al., 1993).

The Washington Department of Fish and Wildlife has operated a hatchery on the Dungeness River at RM 10.5 since 1902 and a smaller satellite facility at Hurd Creek near Dungeness RM 2.9 since 1960. For several decades, hatchery operations were primarily oriented to the production of coho for commercial and recreational harvest. Since 1990, hatchery programs, while still supplying harvestable coho, have focused on the restoration of critical stocks in the eastern Strait of Juan de Fuca.

Dungeness Bay is formed by Dungeness Spit, the longest natural sand spit in the United States, and is the site of the Dungeness National Wildlife Refuge. In addition to numerous species of shorebirds and migratory waterfowl, Dungeness Bay and environs provide habitat for multiple species of fish and shellfish. Shellfish including native littleneck clams, oysters, Dungeness crab, butter clams, geoduck, and other species have been harvested for subsistence for centuries by tribal communities, and commercially harvested by native and non-Indian fishermen for approximately 150 years.

Human Communities

Evidence of human civilization in the Dungeness dates back as far as 11,000 years ago, with a projectile found embedded in the bone of a mastodon (Kirk and Doherty, 2007). At the time of European contact in the late 1700s, 13 permanent villages existed along the shores and bays of the Strait of Juan de Fuca, plus numerous camps as the native population moved around to take advantage of the availability of seasonal food sources at traditional fishing, hunting and gathering sites. It has been estimated that the population of S'Klallam Indians in the Dungeness watershed ranged from 400 to 2100 prior to white settlement (Lichatowich, 1992). Extensive white settlement began following the completion of the Treaty of Point No Point in 1855, which was intended to settle land claims with the resident bands of S'Klallams. Although the S'Klallams were instructed to relocate to a distant reservation along Hood Canal, many tribal families

continued to reside in their traditional homelands on the Strait of Juan de Fuca. Today, many tribal citizens still live in the Dungeness Watershed, and exercise rights to hunting, fishing, and gathering as reserved in the treaty.

Settlers to the Dungeness valley rapidly exerted major changes in the watershed landscape, with the removal of forest cover, construction of an irrigation system, construction of bridges and dikes, and the draining and diking of tidal areas near the river mouth to create farmland. Hatchery practices from 1902 to the 1960s altered the genetic composition and spatial distribution of Dungeness salmon. While portions of the upper watershed were protected within Olympic National Park, other areas of federal and state forest land were managed for extensive timber harvest. Land use change has been concentrated in the river corridor below river mile 11, where the steep gradient from the Olympic Mountains flattens into suitable terrain for farming and residential use. Figure 1-1 highlights the change in land cover since European contact. Today an estimated 20,000 people[a] make their home in the Dungeness Watershed, and growth in and around the City of Sequim continues at a dramatic rate due to the mild, relatively dry climate and beautiful scenery.

Siebert and McDonald Creeks

Both Siebert and McDonald Creeks are independent stream systems that originate in the Olympic Mountains and drain to the Strait of Juan de Fuca. Dungeness River flow is discharged into both creeks via the irrigation system. Siebert Creek is the westernmost stream influenced directly by Dungeness irrigation flows. Beginning at an elevation of 3,800 feet, Siebert Creek is 12.4 miles long and drains a watershed area of 19.5 square miles. With the exception of the east fork, Siebert Creek is generally characterized as having good fish habitat and water quality. The Siebert Creek estuary remains in essentially historic condition although threatened by proposed timber harvest and development. McDonald Creek originates on the northeast flank of Blue Mountain at an elevation of approximately 4,700 feet and is 13.6 miles long. McDonald Creek has been impacted by many of the same factors affecting the Dungeness, including timber harvest in the upper watershed, irrigation use, road crossings, and residential development. (Entrix, 2005)

[a] 2000 Census data derived from Entrix, 2005, with 2% growth rate calculated.

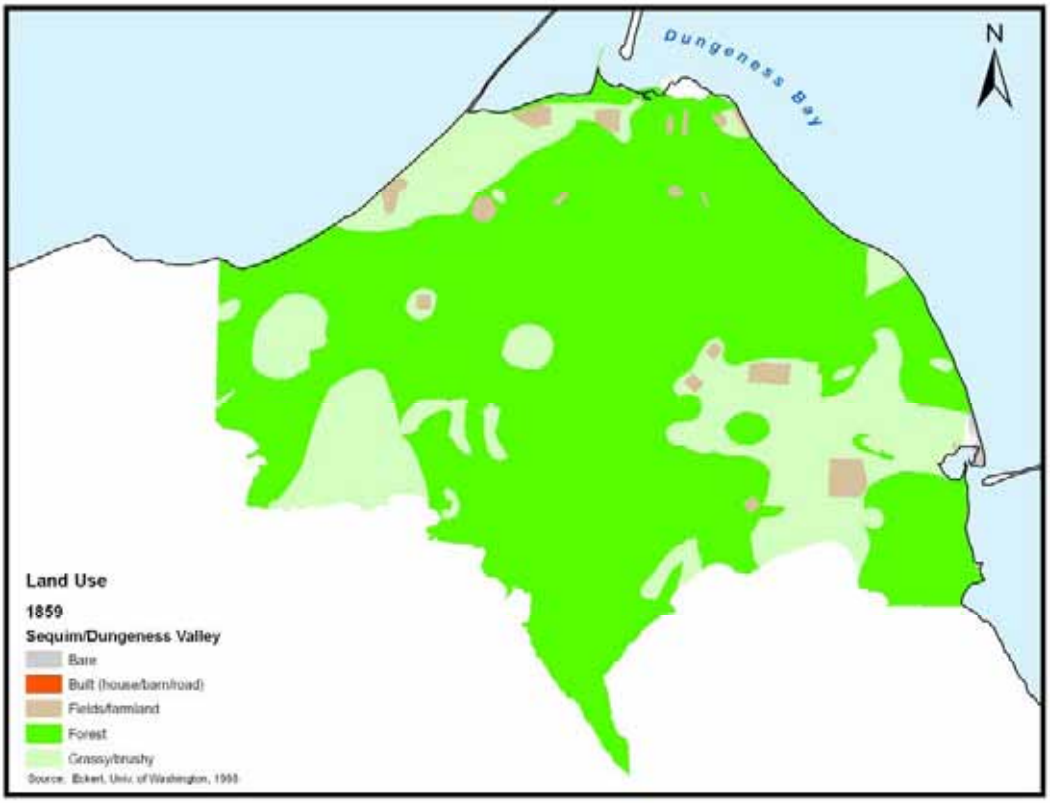
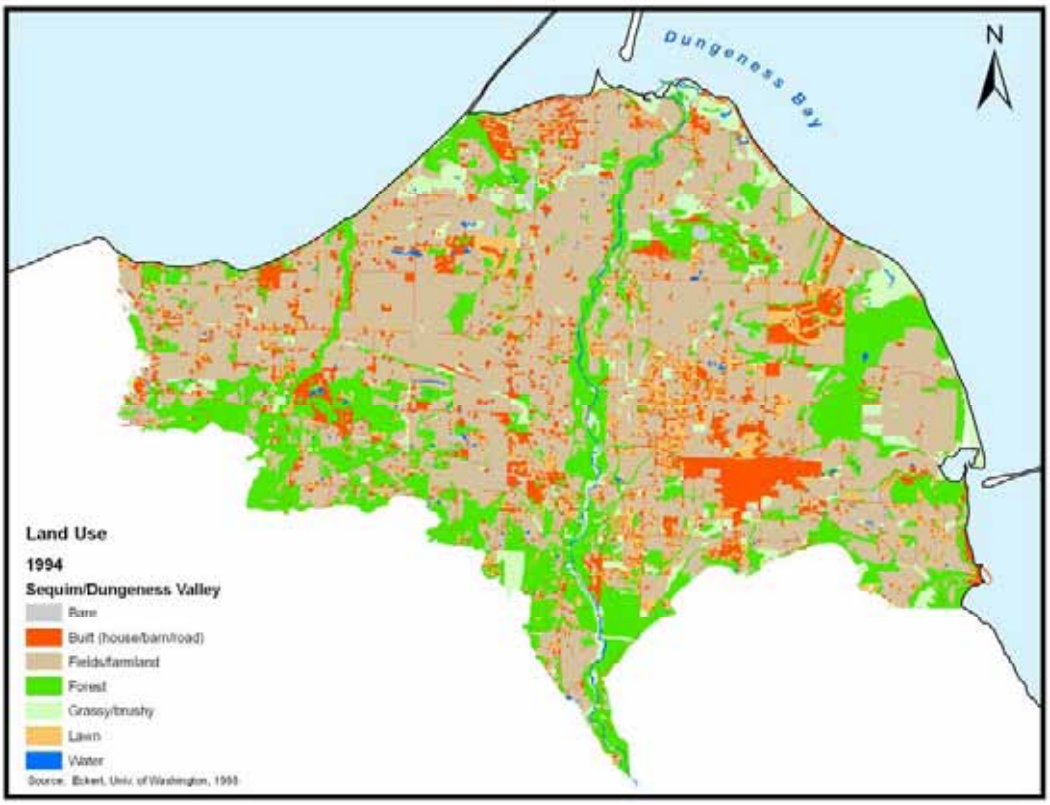


Figure 1-1 (a and b): Land use in the Sequim-Dungeness Valley 1859 and 1994 (Eckert, 1998)



2. Watershed Community Collaboration: History of Watershed Planning in the Dungeness (1988-2007)

2.1 The Dungeness River Management Team

The Dungeness watershed has been subject to multiple processes of watershed planning since 1988, addressing water quantity, water quality, flood control, forest management, salmon recovery and other critical watershed issues. Nationally recognized for cooperative resolution of these issues, the watershed council, known as the Dungeness River Management Team (DRMT), has operated since the late 1980s. The DRMT was initially organized and appointed by the Clallam County Board of Commissioners, and was reorganized in a joint resolution by the County and the Jamestown S'Klallam Tribe in 1995; staff activities are supported by both governments. The DRMT has no official decision-making or enforcement authorities in the Dungeness watershed; all research, restoration and enforcement activities remain under the jurisdiction of the various federal, state, local, and tribal governments. The DRMT functions as an important, ongoing forum for communication, coordination and sharing of resources in the watershed.

> ***Watershed planning**: an assessment of natural resource conditions and competing demands for resource use and protection within a hydrological basin, prepared with the active participation of residents and other parties with interests and management authority in the watershed.*

Dungeness River Management Team 2007

Voting:
City of Sequim
Clallam County
Dungeness-Quilcene Planning Group
Jamestown S'Klallam Tribe
North Olympic Land Trust
Protect the Peninsula's Future
Riverside Property Owners (2 geographical areas)
Sequim-Dungeness Agricultural Water Users Association
Sports Fishers
Washington Department of Ecology / Puget Sound Action Team
Washington Department of Fish and Wildlife

Advisory:
American Water Resources Association
Clallam Conservation District
Dungeness National Wildlife Refuge / US Fish and Wildlife Service
US Forest Service

Early activities of the DRMT included problem definition, data gathering, and education and involvement of governmental agencies, riparian landowners, and citizens' organizations. These discussions helped to frame several technical studies related to instream flow, water consumption, water quality, riparian conditions, channel morphology, circulation patterns in Dungeness Bay, sanitary surveys, salmon status, habitat utilization, groundwater characterization, and other important inventories and

assessments. Numerous agencies were involved in leading and funding these projects including Clallam County, Jamestown S'Klallam Tribe, Clallam Conservation District, US Environmental Protection Agency, US Forest Service, US Geological Survey, US Fish and Wildlife Service, Natural Resource Conservation Service; and the Washington State Departments of Ecology, Fish & Wildlife, Agriculture, Health, and Natural Resources.

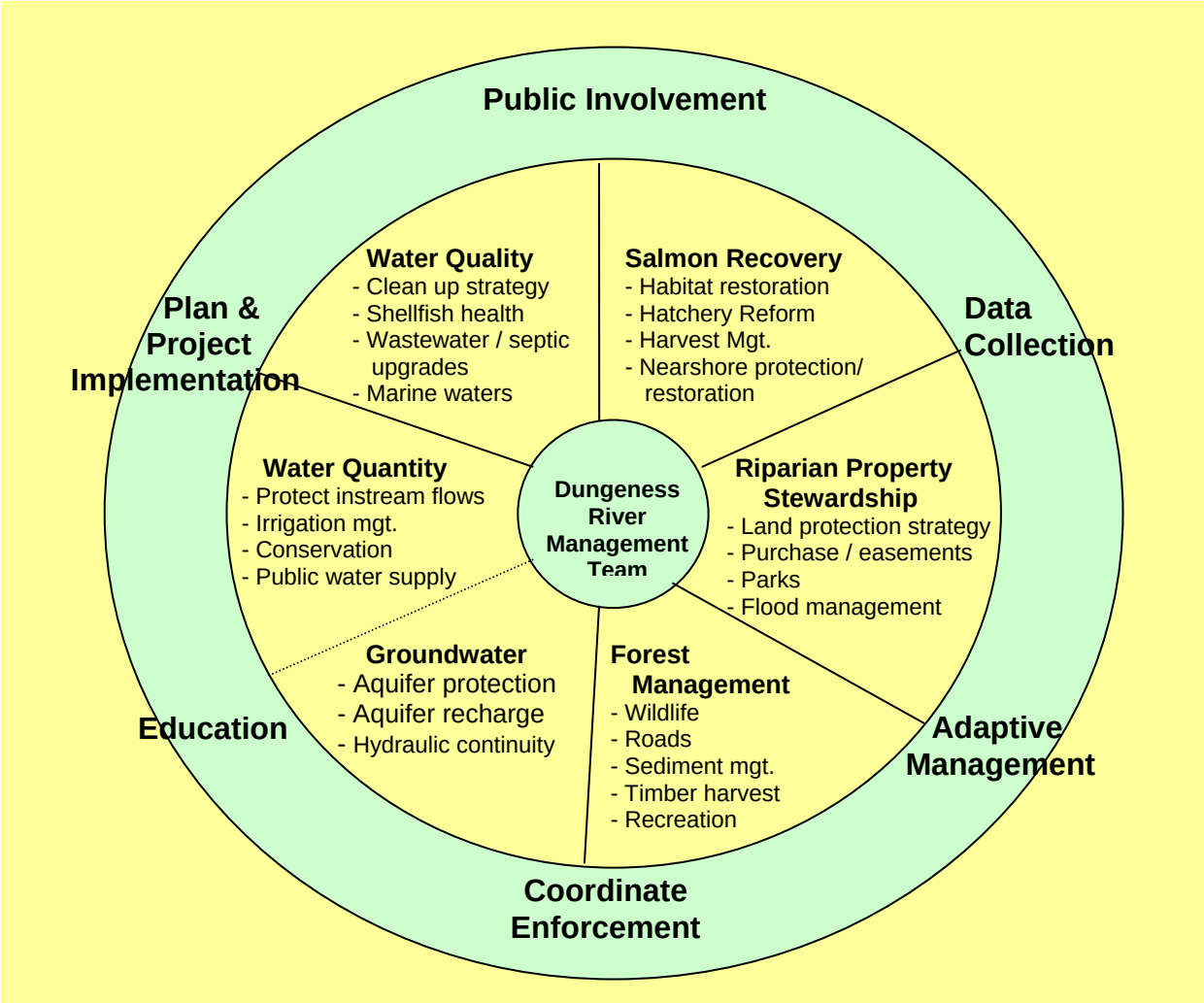


Figure 2-1: Activities of the Dungeness River Management Team

Two standing committees work closely with the DRMT: the River Restoration Work Group consists of federal, state, tribal and county fisheries biologists and planners, along with riverside property owners, and has prepared specific recommendations for long term habitat restoration and protection projects and strategies; the Clean Water Work Group is a work group of federal, state, county and tribal representatives, shellfish growers, and citizen advisors, and is focused on the implementation of water quality clean-up plans for Dungeness Bay, Sequim Bay and tributaries. Other, ad hoc committees have been formed by the DRMT for flood control, educational projects, groundwater analysis, pesticide/herbicide use and other subjects. The DRMT and sub-committees coordinate data collection, monitoring, public education and other watershed activities, and provide adaptive management oversight for the watershed.

2.2 Previous Major Watershed Plans

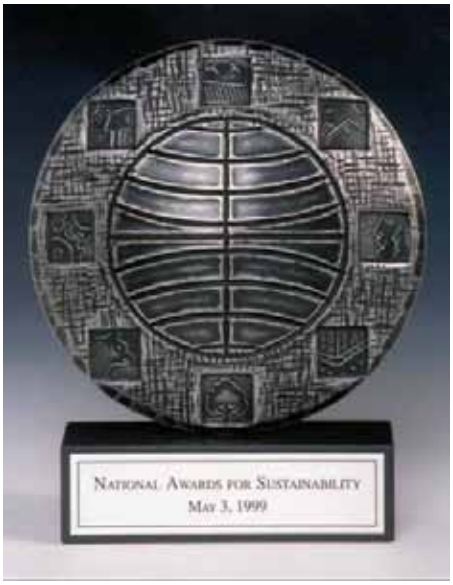
Appendix A contains a bibliography of plans, studies, and restoration and education projects that have been prepared and implemented in the Dungeness watershed area since 1989. Some of the major watershed-based plans include the following:

Dungeness Comprehensive Flood Control Management Plan, 1990 (Kramer, Chin and Mayo for Clallam County Public Works). The Dungeness River Management Team served as the advisory body for the flood control plan, which identified structural and non-structural approaches to flood control, and provided consideration to habitat as well as property protection. The plan was updated by Clallam County in 2003.

Dungeness River Area Watershed Management Plan, 1993 (Clallam County Department of Community Development and the Dungeness Watershed Management Committee): The Dungeness Area Plan was developed from 1991-1993 to identify water quality problems and their impact on existing and future beneficial uses in eastern Clallam County. The process was conducted by a committee of citizen representatives and governmental entities including the Jamestown S'Klallam Tribe. Technical support was provided by the inter-agency Puget Sound Cooperative River Basin Team and a detailed watershed characterization was prepared. The planning process found that non-point source pollution threatened future water use for recreation, wildlife, fish and shellfish, and domestic water supply. A series of collaborative actions was recommended, and many actions targeting data-collection, problem remediation, and education related to non-point source pollution have been implemented. Additionally, characterization of Dungeness area groundwater resources has been actively pursued.

Dungeness-Quilcene Water Resources Management Plan, 1994 (Dungeness-Quilcene Regional Planning Group). While the 1993 Watershed Management Plan described above emphasized water quality, the concurrent "DQ plan" focused primarily on water quantity issues. The DQ plan was one of two pilot water resource management plans authorized by the Washington State Legislature following the 1991 Chelan Agreement. Active participation was drawn together from state, local, and tribal governments; and caucuses representing agricultural water users, business, environmental organizations, and recreational users. The Jamestown S'Klallam Tribe served as the coordinating entity for the project. In the Dungeness portion of the planning area, landmark agreements were achieved regarding agricultural water use, and the voluntary reduction of consumption below adjudicated water rights; these were later formalized in a ***Trust Water Rights Memorandum of Understanding*** between the irrigation district/company boards and the Washington Department of Ecology in 1998. In recognition that instream flows were not the only impairment to fisheries habitat in the watershed, the Jamestown S'Klallam Tribe and other participating governments and organizations agreed to work toward habitat

restoration concurrently with water conservation efforts. The DQ plan consolidated positive working arrangements among the agricultural users, Tribe, Clallam County, Washington Department of Ecology, and other key watershed parties for resource use and conflict resolution.



The Sequim-Dungeness Agricultural Water Users and the Jamestown S'Klallam Tribe have been jointly recognized for their cooperative efforts in water conservation with an award from the President's Council on Community Sustainability and Renew America, as well as the Washington State Governor's Environmental Excellence Award.

Comprehensive Water Conservation Plan, 1999 (Montgomery Water Group for the Sequim-Dungeness Valley Agricultural Water Users Association). The water conservation plan was a direct follow-up to the Dungeness-Quilcene plan, and provided detailed options for infrastructure and managerial improvements to reduce Dungeness River diversions, along with cost estimates and cost/benefit analysis. A considerable portion of the conservation plan has been implemented by the water users between 1999 and 2007. Following the listing of Chinook salmon and other Dungeness salmonids species as threatened in 1999, a ***Comprehensive Irrigation District Management Program (CIDMP)*** (HDR, 2006) was prepared to ensure that irrigation activities were compliant with both the Endangered Species Act and the Clean Water Act. The CIDMP was prepared from 2003 to 2006 and submitted to the National Marine Fisheries Service in December, 2006. The CIDMP included several additional infrastructure and managerial recommendations to improve water conservation and fish passage.

Dungeness Salmon Recovery Planning Notebook, 2004-2005 (Jamestown S'Klallam Tribe for the Dungeness River Management Team). Data collection for salmon recovery in the Dungeness Watershed began in the late 1980s with instream flow studies, habitat inventory and assessment, and analysis of sediment movement and channel morphology. Watershed-scale recommendations for habitat protection and restoration were outlined in several documents including:

- ***Recommended Restoration Projects for the Dungeness River*** *(Dungeness River Restoration Work Group, 1997)*

- ***Recommended Land Protection Strategies for the Dungeness River Riparian Area*** *(Hals/ DRRWG, 2003)*
- ***Dungeness Watershed Analysis*** (US Forest Service,1995; update 2002)
- ***Limiting Factors Analysis*** (Washington Conservation Commission, 1995)
- ***Restoring the Dungeness*** (Newberry/Jamestown S'Klallam Tribe, 2003)

In 2003, the Shared Strategy for Puget Sound requested comprehensive salmon recovery plans from all Puget Sound watershed areas to integrate into a regional recovery plan. In the Dungeness, the existing plans and additional recommendations were compiled into a Salmon Recovery Planning Notebook, and submitted to the Shared Strategy and National Marine Fisheries Service in 2004. Updates were submitted in 2005.

Elwha-Dungeness (Water Resource Inventory Area 18) Watershed Plan, 2005 (Entrix, Inc. for the Dungeness River Management Team and the Elwha-Morse Management Team). The WRIA 18 Watershed Plan was produced under the Washington State enabling legislation, the Watershed Management Act of 1998. The Act calls for locally-based watershed planning to assess the status of water resources and how to address competing demands for water within each WRIA. Initiating governments for WRIA 18 watershed planning are Clallam County, the Jamestown and Lower Elwha S'Klallam Tribes, City of Port Angeles, and Agnew Irrigation District (largest regional water purveyor). The Dungeness watershed portion of the WRIA 18 plan built heavily on previous efforts including the 1994 Dungeness-Quilcene Plan and the 1993 Dungeness Area Watershed Plan. The WRIA 18 Plan includes a more detailed watershed characterization, and recommendations are presented in eight general categories: water quantity, water quality, habitat, instream flows, stormwater, land use and management, education and outreach, and watershed management. The WRIA 18 Plan was adopted by the initiating governments in 2004, and has proceeded to revision, implementation and rule-making phases.

2.3 Jamestown S'Klallam Tribal Comprehensive Plan

The mission of the Jamestown S'Klallam Natural Resources Department is, "*to protect treaty rights to the natural resources of the Point No Point Treaty Area for the benefit of Jamestown S'Klallam Tribal members and future descendants. In this capacity, the Department is charged with ensuring the orderly harvest of fish, shellfish and wildlife resources, providing opportunities for tribal members to derive subsistence and/or livelihood from the harvest of these resources, increasing opportunity through restoration, enhancement and scientific study and reversing the decline of these resources resulting from environmental degradation."* (Jamestown S'Klallam Tribal Comprehensive Plan, 1994). Tribal comprehensive plans were completed in 1985 and 1994. Since the 1994 plan, the Tribal Council has conducted an annual review of each department's goals and annual work plans, described further in section 4.1.

3. Causes and Sources of Non-Point Source Pollution

3.0 Introduction

Numerous water bodies in the Dungeness Watershed area are included on the 303(d) list of impaired water bodies (Table 3-1). Problems include low dissolved oxygen, fecal coliform contamination, loss of habitat, and the presence of heavy metals. Water bodies which do not meet standards include the marine waters of Dungeness Bay and the eastern Strait of Juan de Fuca, Dungeness River and tributaries, and independent drainages to the Strait including Siebert, McDonald, Casselary, Cooper, Meadowbrook and Gierin Creeks:

Table 3-1: Summary of Washington State's Water Quality Assessment [303(d)] List for the Dungeness Watershed Area (Categories 2-5) (from WA Dept. of Ecology website, 2007)

Water Body Name	Pollution Parameter	Category	Listing Description
Freshwater Bodies			
Cassalery Creek	Dissolved Oxygen	5	SK data 2000-2001
	Fecal Coliform	5	CC data, 1991; SK data 2000-2001
	Bioassessment	2	SK Benthic Index of Biological Indicators shows degraded biological conditions
	Dissolved Oxygen	2	SK data 2001
Siebert Creek (west fork)	Dissolved Oxygen	5	SK 2001-2002
Siebert Creek	Bioassessment	2	SK 2001-2002 BIBI
Matriotti Creek	Fecal Coliform	4A	CC, JST, Ecology data 1991-2002
Meadowbrook Creek	Fecal Coliform	4A,2	CC, JST, Ecology data 1991-2002
Meadowbrook Slough	Fecal Coliform	4A	CC, JST, Ecology data 1991-2002
Dungeness River	Instream Flow	4C	USFWS, JST data 1987-2000; was on list 1998 for this parameter until reclassified.
	Fecal Coliform	4C	CC, JST, Ecology data 1991-2002 specific to river mouth area
	Bioassessment	2	Plotnikoff & Wiseman 2002[a]
	Mercury	2	Ecology single sample 2003
	Thalium	2	EPA station at Sequim water intake, single sample.
Marine Water Bodies			
Dungeness Bay	Fecal Coliform	5,2	JST, Ecology data 1999-2002
	Fish Habitat	4C	WDFW 2000-2001 ulvoid macroalgae impairment to shellfish and surf smelt spawning
Strait of Juan de Fuca (East)	Fecal Coliform	5	WA Dept of Health, 2001

303(d) list categories: Category 5= Polluted waters that require a TMDL; Category 4a= Polluted water bodies that have a TMDL; Category 4C=Water bodies impaired by a non-pollutant; Category 2=Waters of concern; Category 1=Meets standards
SK=Streamkeepers; CC=Clallam County; JST=Jamestown S'Klallam Tribe; Ecology=WA Dept of Ecology

[a] Study found biological degradation of aquatic life based on River Invertebrate Predication and Classification System. Insufficient evidence to show impairment due to pollutant.

- **Marine waters of Dungeness Bay and the Eastern Strait of Juan de Fuca:** The Washington Department of Health (DOH) monitors marine water quality (temperature, salinity, fecal coliform bacteria) at 19 monitoring stations in the inner and outer portions of Dungeness Bay. In 1997, DOH reported levels of fecal coliform bacteria in Dungeness Bay near the mouth of the Dungeness River which exceeded the federal standard for commercial shellfish harvest. The Tribe and other local partners initiated an intensive monitoring program of both fresh and marine waters to try to identify the sources of the bacteria. The monitoring revealed that bacterial contamination was widespread throughout the lower Dungeness watershed.

  The Tribe, the County, the Conservation District and other watershed stakeholders jointly developed a plan to address pollution sources called the Dungeness Bay Shellfish Closure Prevention Response Strategy. Although the partners began implementing the plan, bacteria levels continued to rise, and in 1998 the area near the mouth of the River was formally closed to shellfish harvest (Figure 3-1). Under the 1994 *Puget Sound Water Quality Management Plan*, DOH is required to initiate a closure response process following the downgrade of a shellfish harvest area. DOH convenes a Response Team consisting of state and local agencies, tribes, impacted shellfish harvesters and other interests. The Response Team identifies a lead agency and then the Team works together to develop and implement a strategy to restore water quality in the affected area. Clallam County agreed to act as the lead entity to form a Shellfish Protection District and develop a response plan. The WA Department of Ecology (Ecology) provided expert technical assistance to the on-going monitoring effort, and in 1999 commenced a fecal coliform bacteria TMDL study of the Dungeness River, Matriotti Creek, and several other tributaries that flow into the Dungeness Bay area. The Tribe and County continued active involvement in the monitoring effort in both fresh and marine waters, and helped develop and guide the TMDL.

  In 2000 a much larger area of the Bay, extending from the mouth of the Dungeness into the inner Bay, was downgraded to Prohibited for shellfish harvest by the DOH. Another area inside the inner bay was closed to harvest in 2001. The TMDL for the River and Matriotti Creek was completed in 2002 (Sargeant, 2002). Ecology then initiated a fecal coliform bacteria TMDL of Dungeness Bay (Sargeant, 2004). Ecology's analysis of bacteria in the Bay was supplemented by a comprehensive study of circulation patterns in the bay and the potential for marine sources of bacteria, commissioned by the Jamestown S'Klallam Tribe (Rensel, 2003).

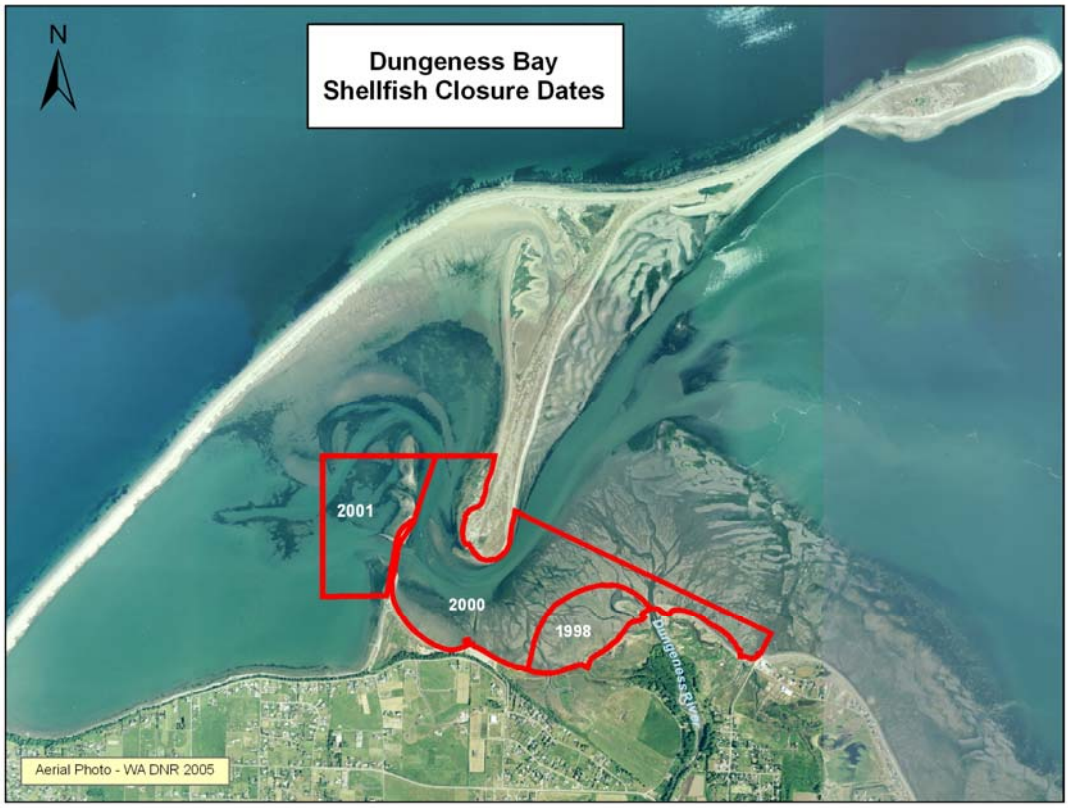
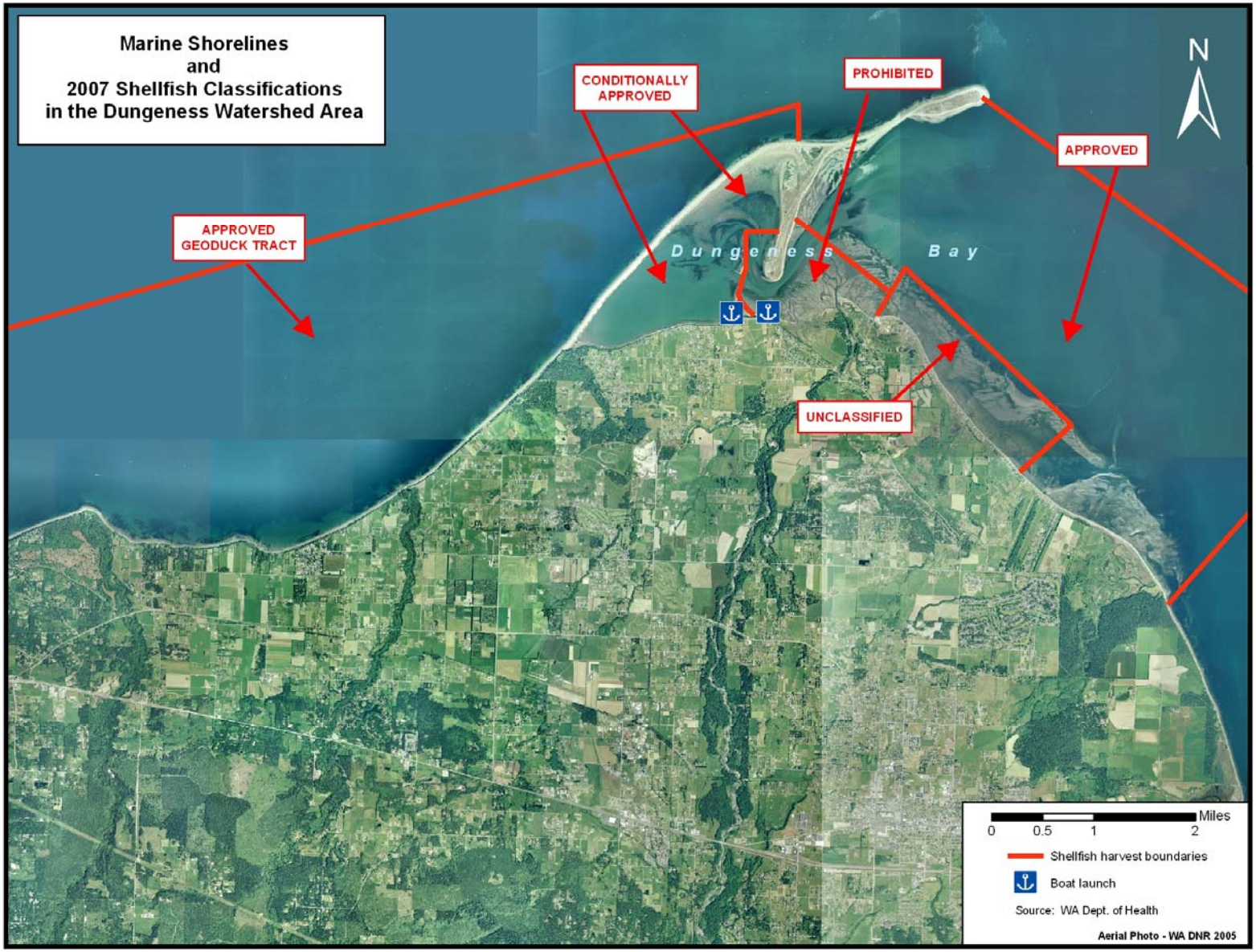


Figure 3-1: Shellfish harvest closures in Dungeness Bay 1998-2001

Instead of forming a Shellfish Protection District, Clallam County opted for a more comprehensive Clean Water District which could address a wide variety of water quality pollution in the watershed. The Response Team was renamed the Clean Water Workgroup and made a standing committee of the DRMT. The Clean Water Workgroup expanded the Dungeness Bay Shellfish Closure Prevention Response Strategy and used it as the basis to develop A Clean Water Strategy for Addressing Bacteria Pollution in the Dungeness Bay and Watershed and a Water Cleanup Detailed Implementation Plan (DIP) in 2004 (Streeter and Hempleman, 2004).

Figure 3-2 displays the marine shorelines of the Dungeness Watershed and the 2007 shellfish harvest classifications. The marine waters east of the Dungeness River include areas not currently certified by the WA Dept. of Health and the Jamestown Beach area, which is classified as Approved for shellfish harvest. This area is monitored six times per year by DOH, in cooperation with the Jamestown S'Klallam Tribe. The Three Crabs Road is considered an area of concern. The marine waters west of Dungeness Spit are monitored and certified by WA DOH for tribal and state geoduck harvest. Maintaining marine water quality along the entire watershed nearshore area is a primary Tribal goal.


Marine Shorelines
and
2007 Shellfish Classifications
in the Dungeness Watershed Area
CONDITIONALLY APPROVED
PROHIBITED
APPROVED
APPROVED GEODUCK TRACT
UNCLASSIFIED
Dungeness Bay
N
Miles
0 0.5 1 2
Shellfish harvest boundaries
Boat launch
Source: WA Dept. of Health
Aerial Photo - WA DNR 2005

- **Dungeness River and Tributaries**

  The Dungeness River and Matriotti Creek are included on the 303(d) list as impaired water bodies for fecal coliform contamination, instream flows and associated temperatures, and loss of fish habitat. The estuarine interface between the Dungeness River and Dungeness Bay is heavily diked and normal sediment transport processes in the lower river and bay have been disrupted, contributing to poor circulation and pollutant retention. Historically, the Dungeness River system has been heavily impacted by agriculture; forestry; construction of roads, bridges and dikes; and the loss of riparian vegetation. In recent decades, urbanization impacts have been added to the mix of non-point source pollution impacts.

- **Independent drainages to the Strait of Juan de Fuca**

  Several small streams adjacent to the Dungeness are linked hydrologically and biologically to the Dungeness River system. Siebert, McDonald, Cassalery, Cooper, Meadowbrook and Gierin Creek are all receiving waters for irrigation water withdrawn from the Dungeness River. Additionally, the pocket estuaries associated with these systems are important migration corridors and nearshore rearing areas for Dungeness salmon. Shoreline armoring, dredging and fill, and the placement of tidegates have substantially impaired the function of these pocket estuary systems. Housing developments along the marine shorelines are known to contribute fecal coliform contamination from failing septic systems and stormwater. Meadowbrook Creek and Slough and Cassalery Creek are included on the 303(d) list due to low dissolved oxygen and fecal coliform contamination. Siebert and McDonald Creeks have been impacted by timber harvest, road construction, and shoreline riparian development. Siebert is listed due to low dissolved oxygen in the west fork.

  Causes and sources of pollution in the Dungeness Watershed area include most of the eight major categories of non-point source pollution in the waterways of the United States identified by the Environmental Protection Agency: Agriculture; Forestry; Hydromodification/Habitat Alteration; Marinas and Boating; Roads, Highways and Bridges; Urbanization; and Wetland/Riparian Management; with sub-categories specific to each.[a] Of the EPA's major categories, all but one (mining) are relevant to the Dungeness Watershed. The history of collaborative watershed planning in the Dungeness region has resulted in an extensive collection of data regarding the sources and trends of pollution in each of these categories.

[a] http://www.epa.gov/cgi-bin/epaprintonly.cgi

photo: http://faculty.washington.edu/edford/forest.html

3.1 Forestry

Upland portions of the Dungeness Watershed above River Mile 11.8 are entirely under Federal jurisdiction either in Olympic National Park or Olympic National Forest (Figure 3-3). The Dungeness is identified as a Tier 1 Key Watershed in the Federal Forest Plan based on the presence of important aquatic and terrestrial species (FEMAT, 1993). The extent to which human activities have accelerated slides, erosion and channel instability has been studied for almost two decades. A Watershed Analysis of the Dungeness was completed by the Forest Service in 1996, which identified the need for additional study of sedimentation and road impacts to aquatic resources. The Sedimentation Analysis was completed in 2001-2 using airphoto analysis, road inventory and field reconnaissance for the watershed above river mile 10.8. Basin-wide sediment yields are high, with natural values associated with a legacy of unstable soils and landforms from glacial movement.

"The mass wasting inventory and the road inventory identified 556 sites in the Dungeness Watershed with either existing or potential for landslides or large scale surface erosion. The mass wasting inventory identified 444 erosion features either currently existing or that have occurred within the last several hundred years. The road inventory identified 139 sites with existing landslides with surface erosion during recovery or potential landslides. This is ample evidence that mass wasting, particularly, has a large potential to influence the sediment regime in the Dungeness Watershed….. Of the 444 erosion features observed in the mass wasting inventory, 396 features are currently active in the watershed." (USDA Forest Service/Olympic National Forest 2002)

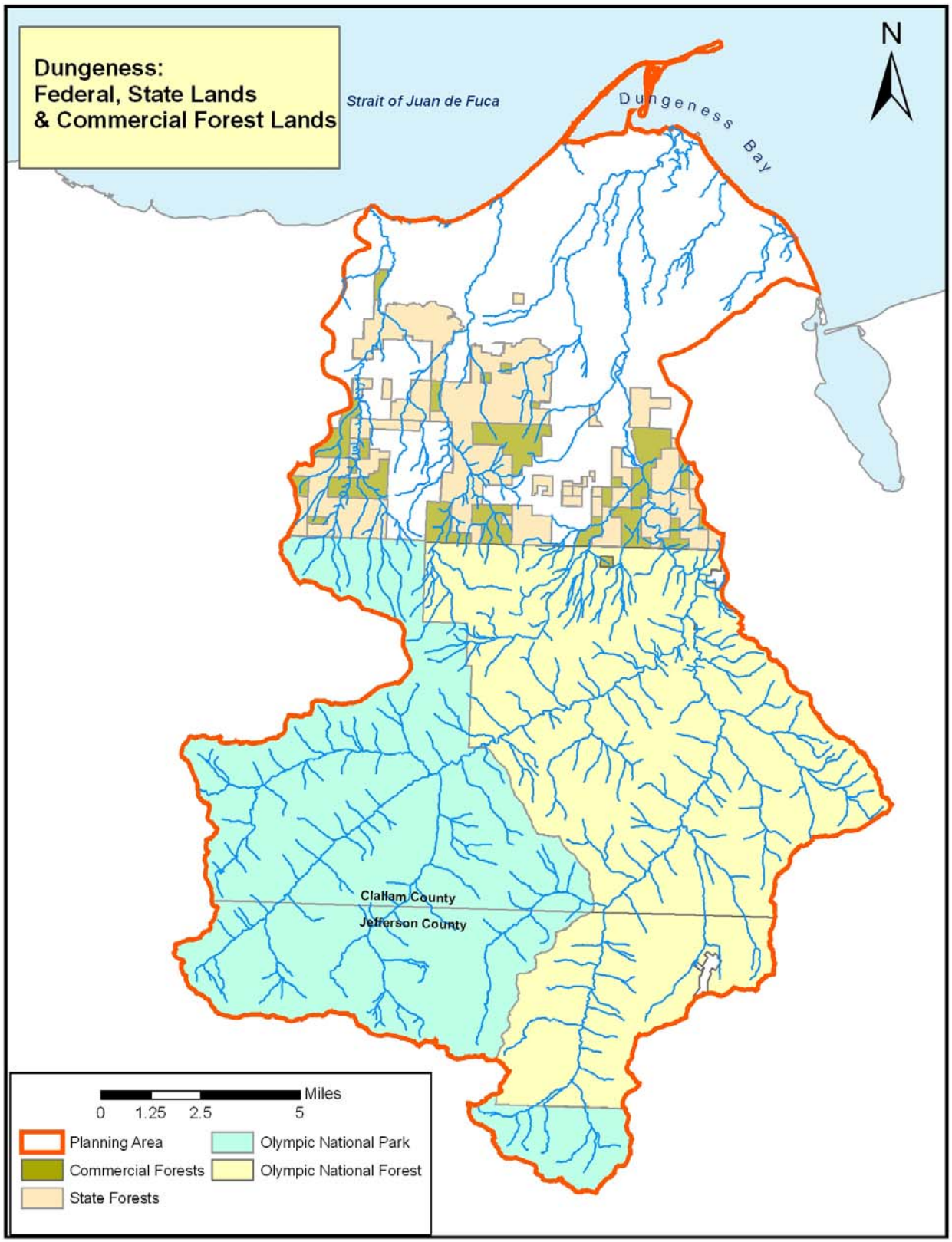


Figure 3-3: Federal, state and commercial timberlands in the Dungeness Watershed Area

Four sub-watersheds in the Dungeness analysis area stood out as having high densities of landslide features -- Eddy Creek, Gold Creek, Canyon Creek, and Silver Creek, with Eddy Creek significantly higher than the others. The analysis stated that these sub-watersheds were characterized by naturally unstable landforms, and "*they also have experienced more recent historical wildfires and have received some of the higher intensity forest management activities of the watershed*" (table 3-2).

Table 3-2: Mass wasting events in the Dungeness Watershed analysis area by subwatershed. (USDA Forest Service/Olympic National Forest, 2002)

Subwatershed	Drainage area (mi^2)	Number of mass wasting features – all events	Density of features – all events (number/ mi^2)	Density of features – natural events (number/ mi^2)
Lower Dungeness River Subbasin Area (21.6 mi^2)				
Canyon Creek	7.8	36	4.6	2.5
Caraco Creek	3.0	5	1.7	0.3
Dungeness River Below Gray Wolf River	7.0	9	1.3	1.0
Pats Creek	3.8	4	1.1	0.5
Mid-Dungeness River Subbasin Area (34.7 mi^2)				
Bungalow/Skookum	4.8	6	1.3	0.6
Eddy Creek	5.0	38	7.6	5.2
Gold Creek	8.9	37	4.2	2.1
Mueller Creek	7.4	23	3.1	1.7
Silver Creek	4.3	19	4.4	2.8
Sleepy Hollow	4.3	17	3.9	2.6
Dungeness River – Wilderness Subbasin (37.1 mi^2)				
Copper Creek	5.7	8	1.4	1.4
Heather/Home Creek	8.6	13	1.5	1.5
Milk/Ghoul Creek	8.6	29	3.4	3.4
Royal Creek	10.6	28	2.6	2.6
Still Creek	3.5	7	2.0	2.0
Gray Wolf River Subbasin (76.2 mi^2)				
Cameron Creek	18.1	45	2.5	2.5
Divide Creek	5.8	17	2.9	2.9
Grand Creek	15.5	35	2.3	2.3
Gray Wolf River Lower	6.8	17	2.5	1.5
Gray Wolf River Upper	18.0	27	1.5	1.5
Slab Camp Creek	4.7	11	2.3	1.1
Slide Creek	7.3	13	1.8	1.8

3.1.1 Harvesting, Residue Management

In addition to identifying the location and density of landslide features in the Dungeness, the Forest Service sediment analysis also specified whether the

sites were associated with harvest activity or were natural slides. *"Of the existing features inventoried, 14 percent were associated with vegetation removal, either clearcut harvest or fire and salvage. Twenty-five percent were associated with roads, 61 percent were interpreted to be naturally occurring, and less than 1 percent were of unknown origin,"* (Table 3-3).

Table 3-3: All erosion features by erosion process type and land use or land condition. (USDA Forest Service/Olympic National Forest, 2002)

	Number of features inventoried*					
	Shallow rapid landslides					
Land use or condition	Debris slides	Debris flows	Snow avalanches and debris torrents	Surface erosion	Deep-seated	Streambank erosion
Clearcut	29	1	-	2	-	2
Wildfire (within last 150 years)	15	9	1	-	-	1
Natural (includes historical fire disturbance as well as other causes)	56	81	96	-	34	-
Roads	38	11	-	56	6	-
Unknown	-	2	-	-	-	

The USFS analysis concluded that a high portion of sediment delivery to streams was the result of natural erosional processes, but that management actions had exacerbated sediment input with substantive impacts in specific subwatersheds. Harvest in the Dungeness has substantially declined following the completion of the Federal Forest Plan, and several watersheds are exhibiting decreasing sediment input as they recover from earlier harvest. The USFS analysis also prepared a Watershed Improvement Needs (WIN) inventory to identify and prioritize remediation projects in the upper watershed. These management measures, which include replanting, slope stabilization, upgrading stream crossings, and road decommissioning, are described further in section 5.

3.1.2 Logging Road Construction/Maintenance

Road construction within the Dungeness Watershed began sometime prior to 1939 in association with timber harvest activities. Timber harvest on USDA Forest Service lands was greatest during the 1960s through 1990s. Forest management since the early 1990s has shifted toward a decline in permanent road construction and utilization of temporary roads and has emphasized reduction in the miles of road network.

In the Dungeness Watershed, there are approximately 108 miles of classified and 16 miles of unclassified Forest Service roads (Table 3-4). Classified roads are those determined to be needed for long-term motor vehicle access, while unclassified roads are unplanned, temporary, and abandoned roads and tracks that have not been decommissioned. Sub-watersheds with the greatest road

density include Gold Creek, Eddy Creek, and Caraco Creek, which have road densities of 2.8, 3.3, and 3.5 miles per square mile, respectively. The road inventory included a rating of aquatic risk for each subwatershed (Figure 3-4).

Table 3-4: Length and density of USDA Forest Service roads in the Dungeness Watershed, by subwatershed. (USDA Forest Service/Olympic National Forest, 2002)

Subwatershed	Forest Service classified roads (miles)	Forest Service unclassified roads (miles)	Forest Service road density (miles/square mile)
Slab Camp Creek	2.3	0.7	0.5
Gray Wolf River Lower	7.6	0.5	1.1
Mueller Creek	5.6	0.7	0.7
Silver Creek	3.0	0.9	0.7
Bungalow/Skookum Creek	6.1	0.5	1.3
Sleepy Hollow Creek	4.8	0.7	1.1
Gold Creek	24.8	4.7	2.8
Eddy Creek	16.0	1.8	3.3
Canyon Creek	11.7	1.7	1.5
Pats Creek	5.6	1.6	1.4
Caraco Creek	10.9	1.1	3.5
Dungeness River Below Gray Wolf River	9.3	1.0	1.3
Total	**107.7**	**15.8**	**Average1.6**

3.1.3 Forest Practices on Non-Federal Lands

State-owned lands in the upper Dungeness, Siebert and McDonald Creek have not undergone an analysis of sedimentation comparable to the US Forest Service analysis. State-owned timber lands are managed for timber production and multiple recreational uses, and forest practices are governed by a Habitat Conservation Plan approved by the US Fish and Wildlife Service and National Marine Fisheries Service. The Washington Department of Natural Resources has proposed the designation of an off-road vehicle park in the Burnt Hill area of the upper Dungeness Watershed. A declaration of no significant impact for this action was withdrawn by WDNR in 2006 following objections by adjacent residents and agencies related to erosion, chemical contamination from illegal dumping, fire hazard, noise, and wildlife disruption.

Private commercial forest lands are subject to the Washington State Forest and Fish Act and a programmatic habitat conservation plan related to forest practices. Timber harvest is generally evaluated on a case by case basis under the Forest and Fish rules.

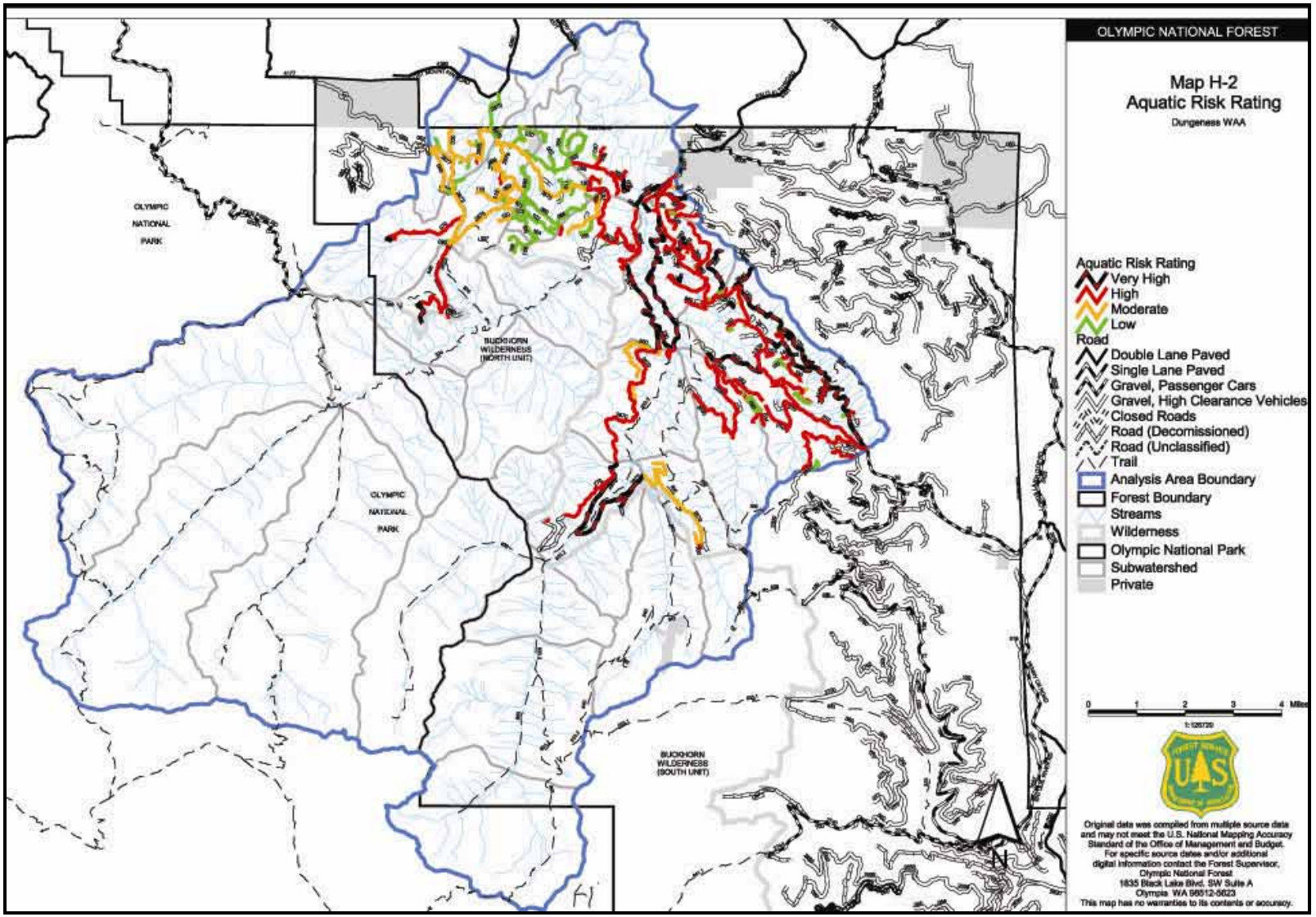


Figure 3-4: Ratings of Aquatic Risk for Roads in the upper Dungeness Watershed, Olympic National Forest (USDA Forest Service/ Olympic National Forest, 2002)

3.2 Agriculture

Agriculture in the Sequim-Dungeness Valley began in the middle of the 19th century. Early settlers rapidly removed tree cover and built extensive systems of dikes and levees along the rivers and marine shorelines to drain land that would be flat enough to farm. The dry summers in the rainshadow of the Olympic Mountains created demand for irrigation and the first water rights for irrigation in the Dungeness were issued by the State of Washington in 1896. An extensive system of main canals and secondary irrigation ditches was constructed throughout the valley (figure 3-5). The irrigation system in the Sequim-Dungeness Valley has been cumulatively estimated to be 173 miles long (Montgomery Water Group, 1999). The Water Use Coordinator for the Sequim-Dungeness Valley Water Users Association estimates an additional 150 miles of conveyance to the end users. Estimates of historic peak acreage under irrigation range from 8,800 to 14,000 acres (Entrix, 2005), but irrigated acreage in the valley is now estimated to be between 5,000 and 5,500 acres. This irrigated acreage includes the remaining commercial farms, as well as smaller “hobby” farms, and parcels which have undergone residential development. In addition to the hydrological modification of the valley (described further in Section 3.3), the irrigation ditches have been a conduit for the transfer of bacteria and other contaminants into the fresh water bodies of the Dungeness Valley as well as the marine waters of Dungeness Bay. The irrigation canals and ditches are commingled with small creeks and roadside ditches, thus the system distributes bacteria, pesticides and stormwater runoff throughout the valley.

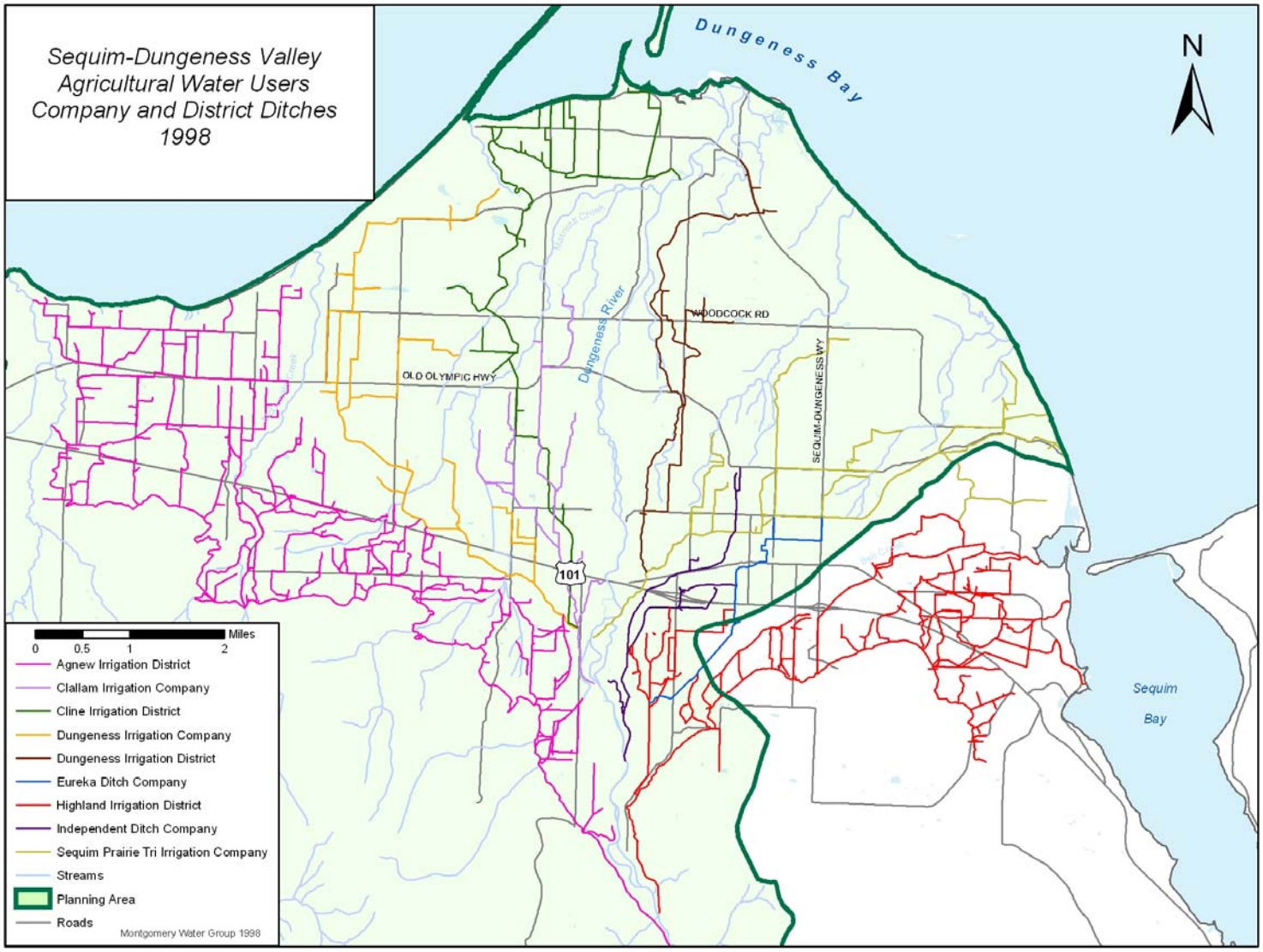


Figure 3-5: Dungeness Irrigation Ditches

The Agriculture category in EPA's non-point source classification system contains three sub-categories relevant to the Dungeness watershed: irrigated crop production, animal operations, and aquaculture. Of the three, animal operations present the most significant risk to water quality and human health in the Dungeness Watershed. The Clallam Conservation District conducted a comprehensive farm inventory in 2006 utilizing air photos and visual inspection of farms from the road. Of the 125 farms in Clallam County that were rated as having a medium or high potential to impact surface water quality, 23 were located in the Dungeness drainage covering 495 acres.

3.2.1 Irrigated Crop Production: The focus of the Conservation District inventory was on livestock. Non-livestock production farms such as those producing hay, lavender, and vegetables were also inventoried but were not rated for their potential to impact water quality. Potential causes and sources of pollutants from irrigated crop production include pesticide, herbicide and fertilizer application. Monitoring data suggest that nutrient sources are a growing problem but a full assessment is needed.

In 2003 limited testing was conducted of McDonald Creek sediments for the presence of chlorinated and organophosphorus pesticides. The Creek was selected as a control site for a study of urban sediment contaminants by Battelle Marine Science Laboratory. No pesticides were detected in any of the samples (Brandenberger, et al. 2003).

3.2.2 Animal Operations: The primary objective of the Conservation District farm inventory was to rate livestock-keeping operations in terms of need for technical assistance to address potential water quality concerns. Any property keeping livestock (including horses and llamas) was designated as a "farm." Farms were rated as high priority, *"if livestock had access to waterways and/or if observed farm management practices clearly appeared to impact nearby waterways. For example, a farm was considered high priority if livestock manure was piled near a stream and it was apparent that the pile posed a pollution risk (even if livestock were fenced out of the stream area). If livestock had access to a waterway the farm was automatically designated as high priority unless it was apparent that the livestock had a negligible impact on the waterway."* Seasonal variation in the potential for pollution was considered in the inventory method, and the presence of proper techniques for pasture management was also noted. Table 3-5 contains the results for the Dungeness watershed for the high priority farms and the type of best management practice needed. The Conservation District maintains a detailed map of the farms where technical assistance is needed to implement solutions such as rotating composting, fencing, watering stations and other best management practices.

Table 3-5: Farm Inventory Results for the Dungeness Bay Drainage (Clallam Conservation District, 2006)

Total Number of High Priority Farms	**23**
Total Acreage of High Priority Farms	**495**
Estimated Feet of Exclusion Fencing[1] Needed	18,550
Estimated Number of Stream Crossings Needed	6
Estimated Number of Manure Storage Structures Needed	7
Estimated Number of Heavy Use Protection Areas Needed	5

1 - Exclusion fencing is used to restrict livestock from streams, ditches, ponds, and other waterways.

3.2.3 Aquaculture: Aquaculture in the Dungeness is limited to shellfish cultivation and harvest along the marine shorelines of Dungeness Bay. These activities are not identified as a cause of pollution to the marine waters, however they are highly dependent on water quality in upland and marine areas in order to produce shellfish meeting state and federal health certification standards. Species cultivated include Pacific oysters, Olympia oysters, manila clams and geoducks. These species supplement native little necks, horse clams and other species harvested for non-native recreational and tribal commercial, ceremonial and subsistence harvest. Protection of human health from the consumption of shellfish contaminated with fecal coliform bacteria is a major goal of this plan.

3.3 Hydromodification/ Habitat Alteration

Agriculture and urbanization have resulted in vast changes to the Dungeness area landscape. The irrigation system has altered the hydrology throughout the watershed area as it reduces surface water flow at the source, and provides artificial recharge to area groundwater, streams and wetlands. Urban and residential growth in eastern Clallam County relies almost entirely on groundwater sources that are hydraulically linked with the Dungeness River. In the past 150 years, the river channel has been altered by dikes, dredging, streambank structures and bridge crossings that affect streamflow, the transport of sediment, and recruitment of large woody debris. Estuarine areas and marine shorelines have been impacted by the placement of tidal gates, dikes and bank structures that have reduced large areas of saltmarsh habitat. Sediment from upper watershed timber harvest and the diking of the lower Dungeness River has disrupted normal sediment transport processes and water circulation in Dungeness Bay. Most of the studies available on the habitat alteration of the lower Dungeness River area have been completed in the context of salmonid restoration or the protection of water quality for shellfish harvest. In the upper watershed, habitat analysis has largely focused on the northern spotted owl and other particular species of concern. Overall analysis of the watershed area for wildlife corridors and larger ecosystem function are subjects for future research.

The EPA category of Hydromodification and other Habitat Alteration has several sub-categories relevant to the Dungeness watershed area including flow regulation/modification, groundwater withdrawal, and channel modification. Additionally, the close relationship between stream channel conditions and nearshore/estuarine areas for this watershed are of particular concern for water quality and aquatic species.

3.3.1 Flow Regulation/Modification

By the early 1920s, competition for water in the late summer among the users of the Dungeness irrigation system was serious enough to merit formal adjudication. The 1924 adjudication of Dungeness water rights allocated the potential for 581 cubic feet per second (cfs) of surface water to be withdrawn from the Dungeness River to irrigate a potential 26,000 acres. Actual instream flow of the river in the late summer averages 185 cfs, thus the adjudication allowed for the river to be severely over-appropriated. Although irrigators managed water withdrawals to avoid drying up the river, instream flow measurements in the late 1980s recorded that as much as 82 percent of the flow was being withdrawn (Seiter, et al., 2000).

Federal case water law has backed the rights of indigenous tribes to water supply to support their community. The Jamestown S'Klallam and other western Washington tribes assert that their treaties reserved water resources and instream flows that support fisheries. An Instream Flow Incremental Methodology study by US Fish and Wildlife Service (Wampler and Hiss, 1991) indicated that usable fish habitat was severely impaired by low flows. Concern over the status of Chinook salmon and other species led to a series of discussions in the early 1990s between the Sequim-Dungeness Water Users Association, Washington Department of Ecology, and the Jamestown S'Klallam Tribe, as well as the preparation of the 1994 Dungeness-Quilcene Plan (Seiter, et al., 2000). Conservation actions, efficiency improvements, and drought response resulted in significant reductions in water withdrawals from the Dungeness River (figure 3-6).

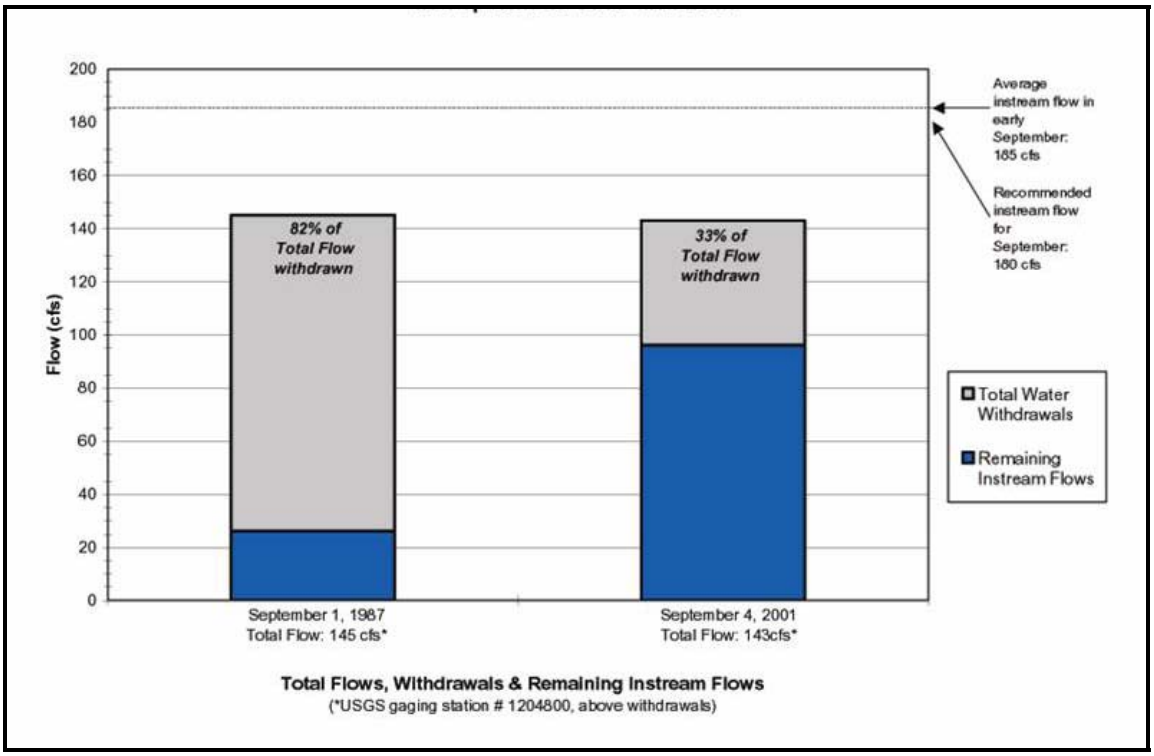


Figure 3-6: Comparison of Water Withdrawals from the Dungeness River in September 1987 and 2001 (Jamestown S'Klallam Tribe Natural Resources Dept.)

A trust water rights agreement was established in a 1998 memorandum of understanding between the Washington Department of Ecology and the Dungeness Water Users Association with the intent of providing a mechanism for water users to conserve water without placing their water rights in jeopardy. The trust water rights agreement established several important water use parameters including limiting withdrawals to no more than 50% of the river flow, as well as maximum acreage and diversion amounts. Additionally, water conserved by the irrigation districts was placed into trust, with 2/3 applied to instream flow and 1/3 to future agriculture. More information on water rights and current uses is contained in the WRIA 18 watershed plan (Entrix, 2005).

Seasonal low flows in the Dungeness, exacerbated by water withdrawals, lack of cover, and braided channel conditions, contribute to temperature and dissolved oxygen problems. A hydrology study of the Dungeness in 1994 by Orsborne and Ralph documented extensive portions of the lower Dungeness where temperatures routinely approach the maximum preferred range for salmon, particularly for spawning and rearing. A study of Dungeness side channels conducted by the US Bureau of Reclamation in 2002-2003 (Daraio, et al., 2003) documented sustained high temperatures in August and September above the preferred range as flow levels dropped. For example, Figure 3-7 shows the temperature and flow data for the Dawley side channel located on Tribal trust land at RM 7.0, an extremely important side channel for juvenile pink and Chinook salmon.

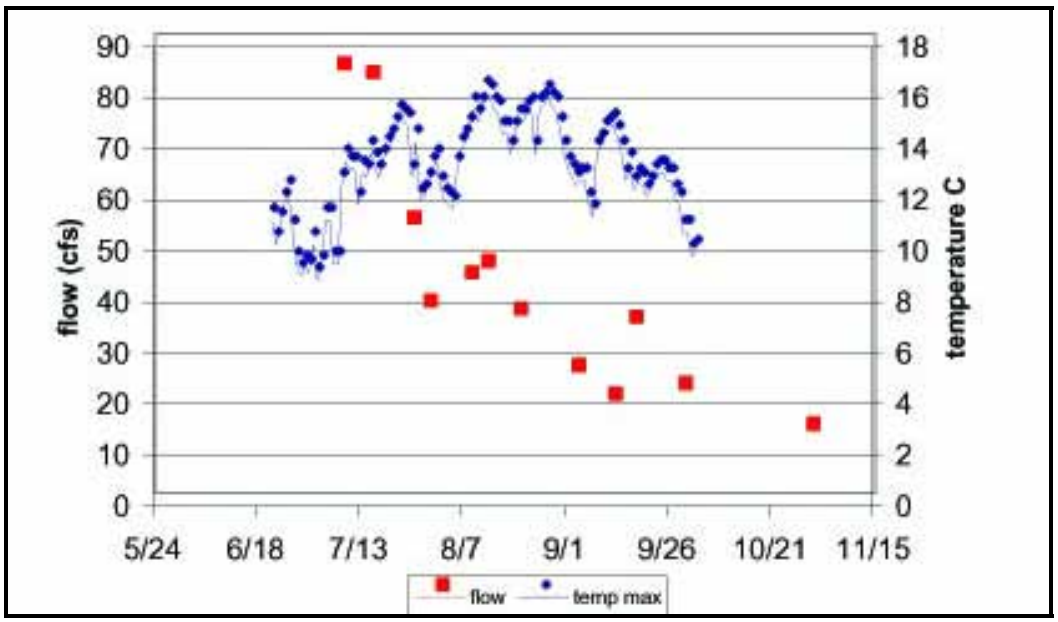


Figure 3-7: Flow and maximum daily temperature in the Dawley side channel (Daraio, et al., 2003)

3.3.2 Groundwater Withdrawal: The relationship between surface and groundwater in the Dungeness Watershed has been characterized in several studies prepared by the US Geological Survey and consultants to the Jamestown S'Klallam Tribe, Washington Department of Ecology, City of Sequim, and Clallam County, and are summarized in the WRIA 18 Watershed Plan. These studies have attempted to address water management questions related to surface water flows, the irrigation system, withdrawals for domestic water supplies, and the shallow/mid level aquifers in the lower watershed. The reports were also used by Clallam County in preparing Critical Aquifer Recharge designations for the County's Critical Areas Ordinance and Comprehensive Plan (figure 3-8).

Major Groundwater Studies in the Dungeness prepared by the US Geological Survey:

Drost, B.W. 1986. Water Resources of Clallam County, WA

Thomas, B., et al. 1999. Hydrogeological Assessment of the Sequim-Dungeness Area. This study updated the earlier Drost study with a detailed characterization of groundwater and estimates of a total water budget.

Simonds, F.W. and K. Sinclair, 2002. Surface Water-Ground Water Interactions Along the Dungeness River and Vertical Hydraulic Conductivity of Streambed Sediments Surface Water-Ground Water Interactions Along the Dungeness River and Vertical Hydraulic Conductivity of Streambed Sediments

Gray and Osborne, 2000. City of Sequim Water System Comprehensive Plan.

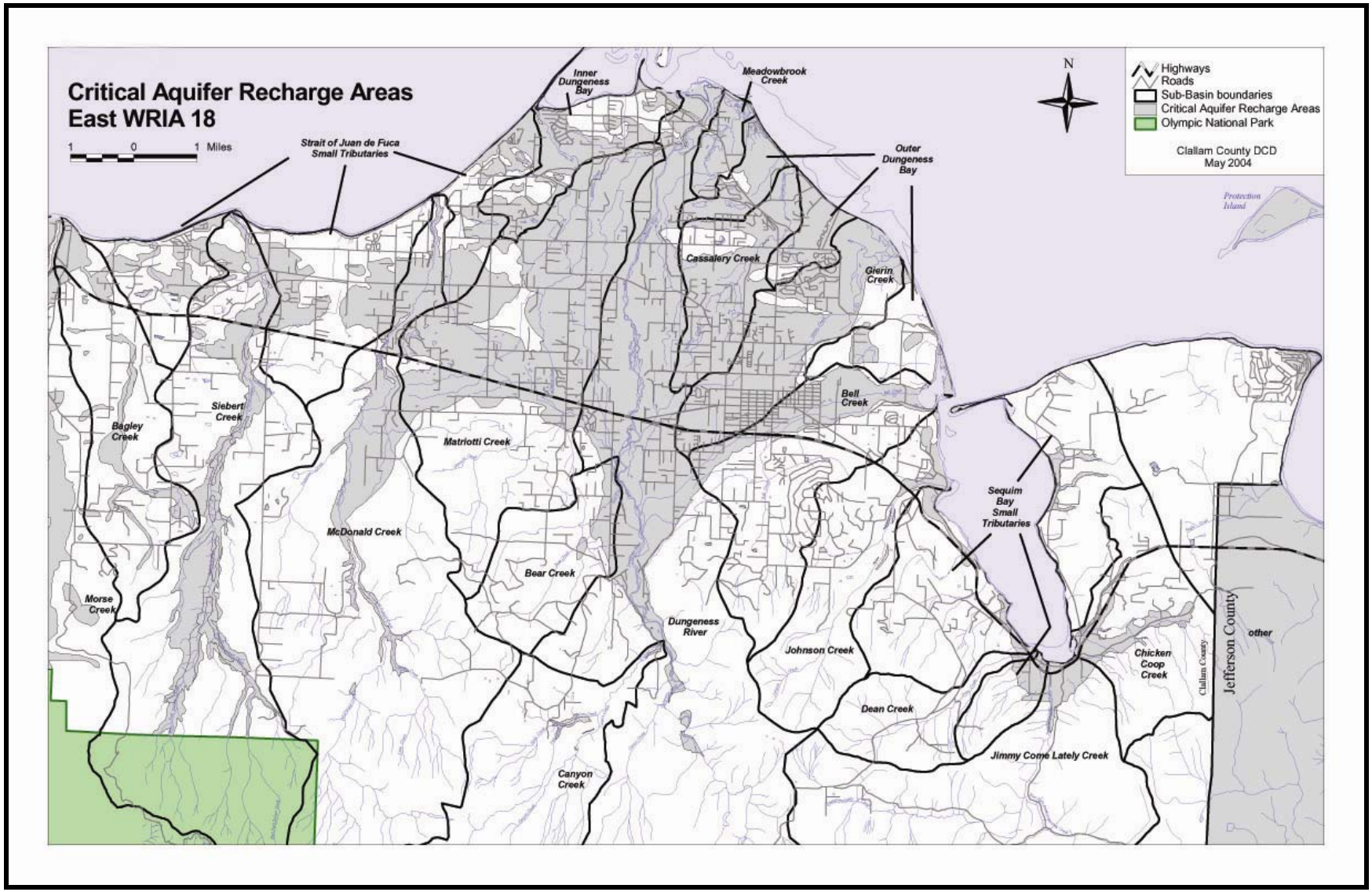


Figure 3-8: Critical aquifer recharge map

Groundwater is the principal source of municipal and residential water supplies in the Dungeness watershed. Approximately 4,000 wells are located in the Dungeness watershed area serving an estimated 9,000 residential units (Table 3-6). This represents a dramatic increase from the 200 wells which were present in 1970. Most of the wells are "exempt" wells serving single family homes. These wells are exempt from the requirement of obtaining a water right from the State of Washington, and are limited to a withdrawal of up to 5,000 gallons per day. Actual average daily withdrawal from exempt wells is estimated to be 350 gpd, however the wells are not metered and precise estimates of groundwater withdrawals from exempt wells in the watershed are not available. Exempt wells are expressed as a concern in several watershed planning documents for their potential to reduce groundwater discharge to area rivers, streams and wetlands. The wellheads may be potential sources of contamination to area aquifers; and many of these wells are shallow and thus vulnerable to non-point source contamination or hydrological modification.

Subbasin	Number of existing wells	Distribution of Well Depths					
		0-50'	51-100'	101-150'	151-250'	251-500'	500-1000'
Bear Creek	169	15%	33%	17%	18%	14%	4%
Canyon Creek	2	0	0	0	0	100%	0
Cassalery Creek	589	37%	47%	14%	2%	1%	0
Dungeness Bay Inner	184	2%	48%	33%	11%	4%	2%
Dungeness Bay Outer	91	22%	36%	27%	10%	3%	1%
Dungeness River	1039	23%	48%	19%	6%	3%	1%
Gierin Creek	273	25%	49%	13%	12%	2%	0
Matriotti Creek	678	17%	54%	16%	10%	4%	1%
McDonald Creek.	309	10%	30%	35%	21%	3%	2%
Meadowbrook Creek	23	39%	30%	17%	13%	0	0
Siebert Creek	71	8%	34%	27%	20%	10%	1%
Strait small tribs	298	4%	33%	43%	14%	6%	0
Total	3726						

Table 3-6: Number of existing wells and depths by subbasin in the Dungeness Watershed area. (Entrix, 2005 based on 2002 data from Clallam County Department of Community Development)

The US Geological Survey (Thomas, 1999) estimated that 41% of the groundwater withdrawal for the Dungeness area was for public water supply and 26% from exempt wells. Figure 3-9 shows the distribution and density of exempt wells in the Dungeness watershed area.

Class A group water systems are also scattered throughout the watershed (figure 3-10). Other uses of groundwater are commercial/ industrial facilities and golf courses.

Groundwater hydrology has also been studied at length to evaluate the potential impact of the Comprehensive Water Conservation Plan for the irrigation system on aquifer levels (Montgomery, 1999). A simulated groundwater model for the lower Dungeness watershed was developed in 2002 during the preparation of an Environmental Impact Statement for the water conservation plan (Foster-Wheeler, 2003). The model is currently being updated and modified to assess the potential for aquifer storage and recovery for potential water sources associated with regional growth, and a report is anticipated from Clallam County and the Washington Department of Ecology in 2008.

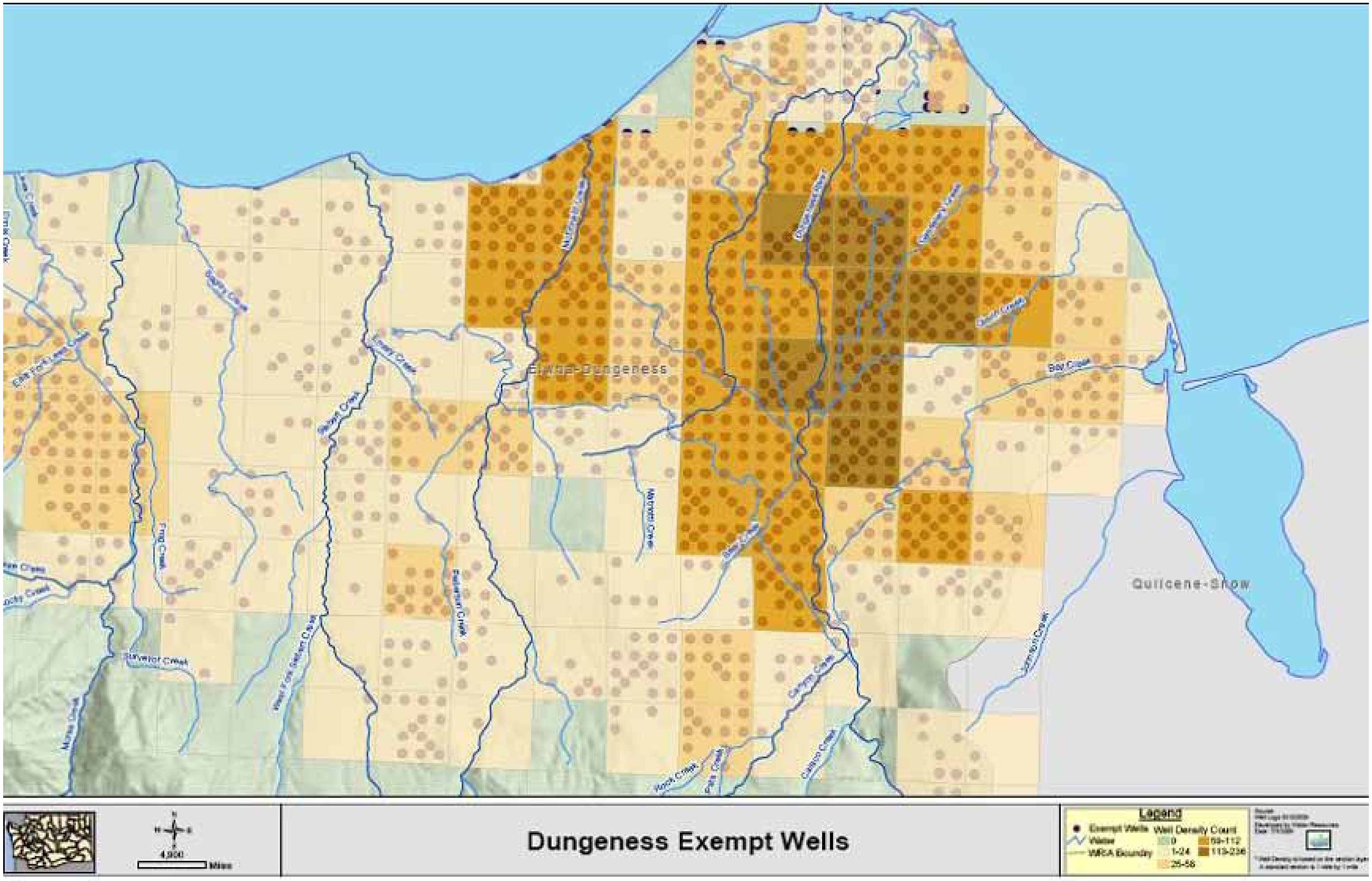


Figure 3-9: Density of exempt wells in the Dungeness watershed area. (WA Dept. of Ecology)

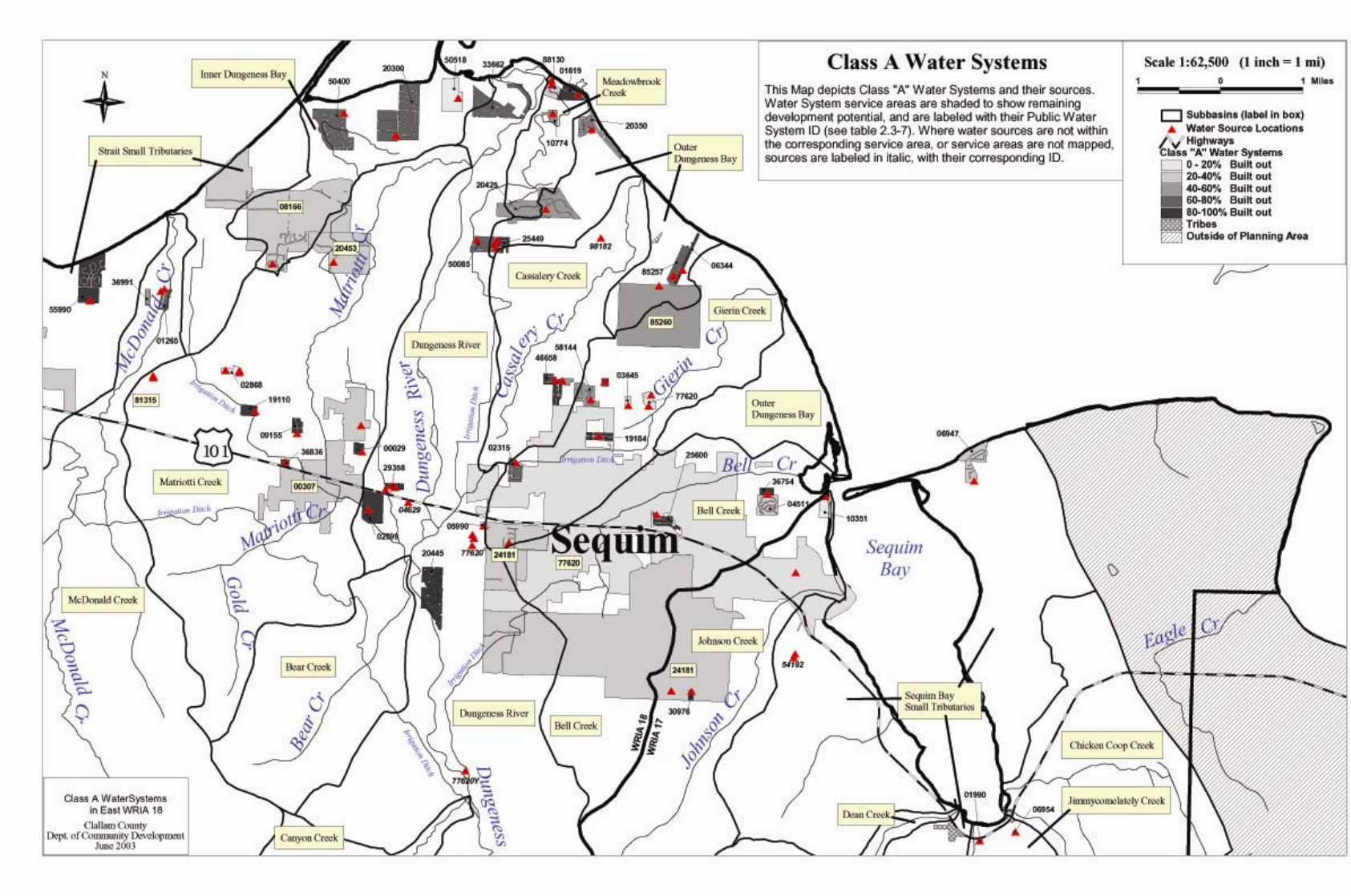


Figure 3-10: Class A water systems

3.3.3 Channel modification

River channels shift naturally, and can have dramatic impacts on houses and structures built close to the river when flood events occur (photo). In addition to property damage, flood events spread nutrient and bacterial pollution and exacerbate sedimentation problems. Historically, flood prevention along the river often consisted of the construction of dikes and other shoreline structures. These structures have had a profound impact on the channel structure and the processes of channel formation. The US Bureau of Reclamation (BOR) summarized several studies related to the impact of channel morphology on fish habitat and cited six primary human activities that have altered the Dungeness River: construction of levees, clearing of riparian vegetation, construction of bridges, gravel extraction, and water diversions. BOR completed a comprehensive analysis of historic river channels in the Dungeness for the Jamestown S'Klallam Tribe to identify opportunities and constraints in restoring fish habitat in the lower river (Bountry et al. 2002). Figure 3-11displays a sample of the highly unstable reach located near the Dungeness Meadows dike at River Mile 7.6-8.2.

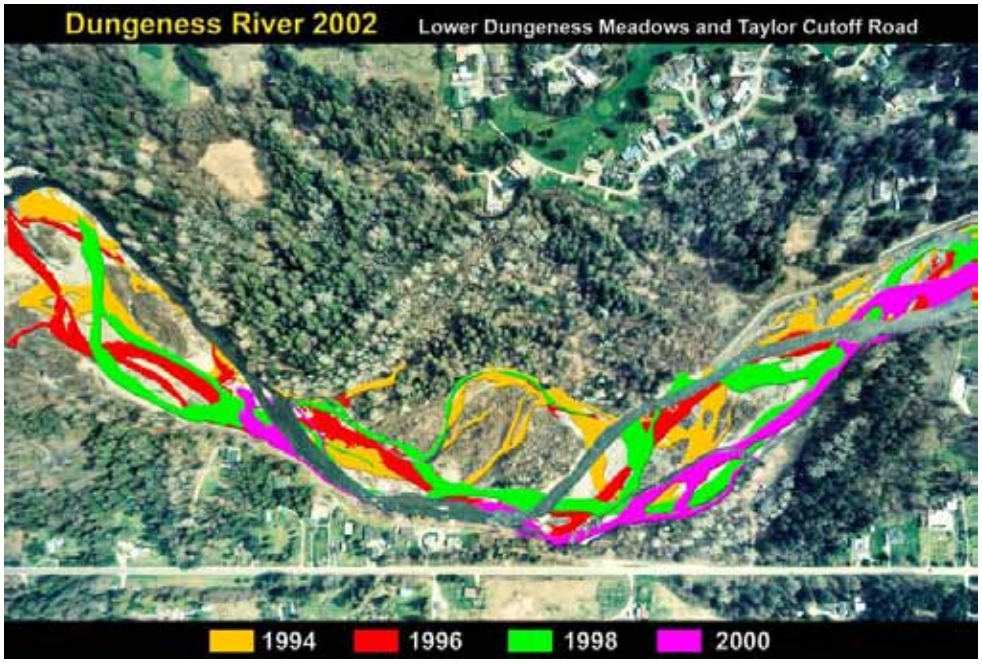


Figure 3-11: Variation of mainstem channels of the Dungeness River near the Dungeness Meadows dike from 1994 to 2000. (R. Johnson, adapted from Bountry, 2002)

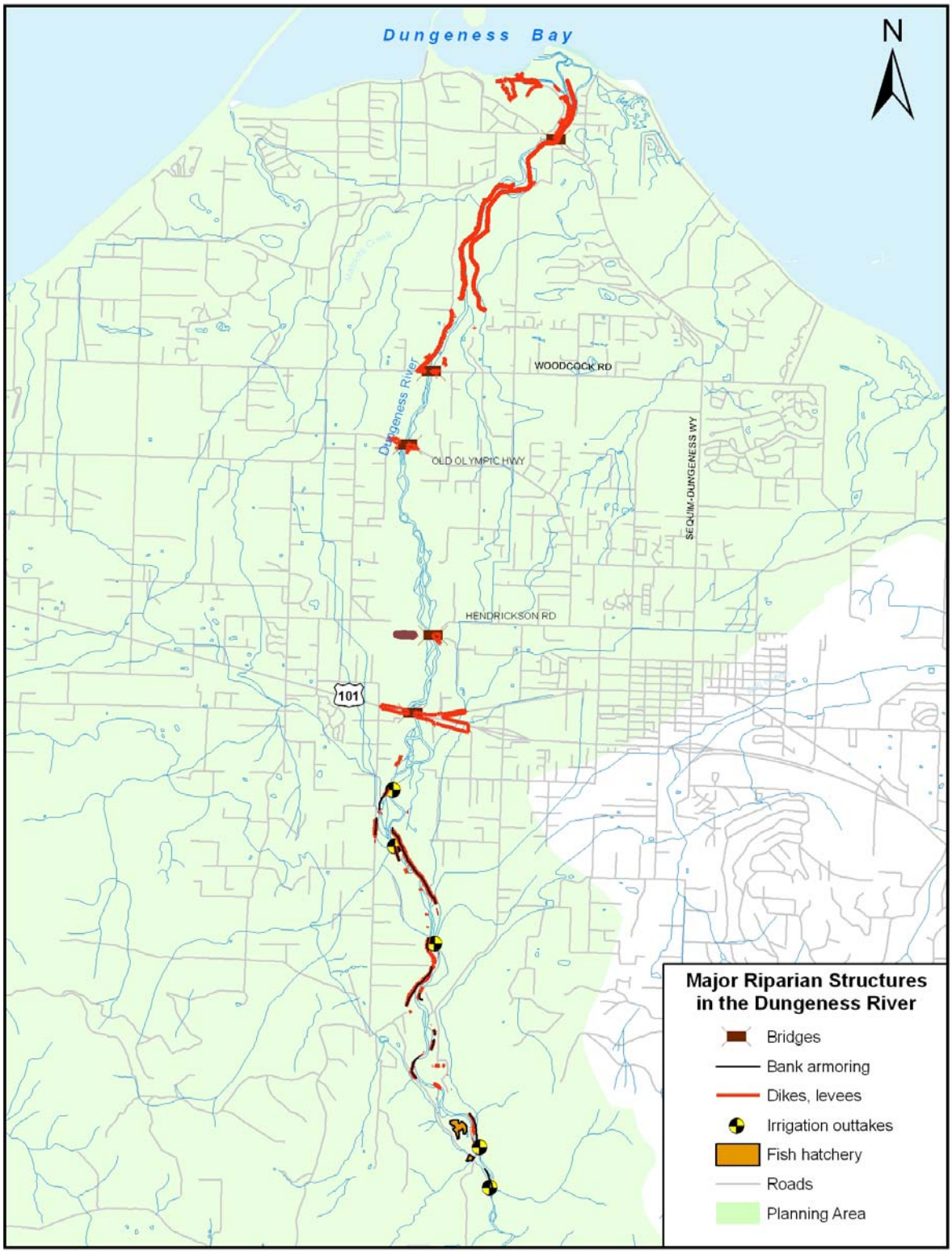


Figure 3-12 Major riparian structures on the Dungeness River.

3.3.3.1 Construction of levees: Levees in the Dungeness have been identified as the greatest single factor altering physical river processes. Levees cut off access to side channel habitat for salmonids, act as constrictions which increase the velocity and depth of flood flows, reduce the recruitment of woody debris and corresponding channel complexity, and reduce groundwater contribution to the stream. Additionally, levees can increase downstream erosion and scouring by increasing velocity and modifying the direction of flow, adding more sedimentation to the system. Six major levees occur along the banks of the lower 10 miles of the Dungeness (Figure 3-12) (Table 3-7), and smaller levees occur throughout the lower watershed.

Levee	River Mile	Bank	Description/Year Built
Kinkade Levee	9.6-9.9	East	Originally 1940, reconstructed 1971
Haller Dike	8.57-8.87	West	Private levee replaced and set back by County in 1997
Dungeness Meadows Levee	7.5-8.1	East	1960s, extended approximately 1990
Army Corps of Engineers Levee	2.6 to near mouth	East	1961
Olympic Game Farm Levee	2.1-1.0	West	Originally 1900s, expanded 1960s
River's End Levee	0.8 to near mouth	West	Private levee

Table 3-7: Major levees in the Dungeness River (Entrix, 2005; Bountry, 2002)

3.3.3.2 Clearing of riparian vegetation: Loss of riparian vegetation reduces bank slope stability, increases sedimentation to the river, reduces the ability of riparian areas to filter nutrients and other pollutants, removes shade thereby increasing stream temperatures, and reduces the production of macroinvertebrates used as food supplies by salmonids. The loss of riparian vegetation may impair the recruitment of large woody debris for decades, inhibiting the formation of side channels, pools and other habitat requirements for aquatic species. The Dungeness River Restoration Work Group, consisting primarily of regional habitat biologists and planners, prepared the study *Recommended Land Protection Strategies for the Dungeness* (Hals, et al. 2003) and identified key areas in the lower river where the loss of riparian vegetation is a factor impairing habitat. Major sites include restoration of the Dungeness estuarine delta, the lower river floodplain at the site of the Beebe dike, tributary systems such as Matriotti Creek, areas targeted for dike removal and/or setback, and reforestation of riparian parcels along the Dungeness River below Canyon Creek. Table 3-8 contains information on the locations of unvegetated sections of the river.

Table 3-8: Dungeness River reaches without riparian vegetation in 2003 (within 50' of channel meander hazard mapped by Clallam County). Source: Hals, 2004 from aerial photographs taken 4-14-03 and 5-6-03 for Jamestown S'Klallam Tribe

Reference Landmarks	Approximate West Bank Unvegetated Reaches	Approximate East Bank Unvegetated Reaches
River Mouth (RM 0.0)	RM 0.7 – RM 0.9	
Schoolhouse Br. (RM 1.0)	RM 1.0 – RM 1.25	RM 0.9 – RM 1.9
	RM 2.75 – RM 3.25	RM 2.8 – RM 3.0
Woodcock Rd. (RM 3.25)	RM 3.45 – RM 3.54	
Old Oly. Hwy. (RM 3.8)	RM 3.8 – RM 3.85	
Railroad Bridge (RM 5.6)	RM 4.95 – RM 5.5	RM 6.22 – RM 6.75
Hwy. 101 (RM 6.4)	RM 6.5 – RM 6.8	
	RM 7.3 – RM 7.5	
	RM 7.85 – RM 7.9	RM 7.95 – RM 8.2
Powerline Crossing (RM 8.8)	RM 8.9 – RM 9.3	
	RM 9.5 – RM 9.65	
Canyon Creek (RM 10.8)	RM 10.6 – RM 10.8	

3.3.3.3 Construction of highway and railroad bridges: See section 3.5

3.3.3.4 Construction of riverbank protection structures: Numerous small riverbank protection projects occur along the Dungeness River, such as rip rap and bulkhead structures constructed by riverfront property owners. While these interfere with large woody debris recruitment and channel migration, their impacts are generally at a smaller scale than the large dikes and levees.

3.3.3.5 Gravel extraction: Gravel extraction occurred along the lower Dungeness until the mid-1990s; these activities were for commercial gravel-mining purposes, and to compensate for aggradation caused by levees and other channel modifications. Gravel "traps" consisting of intensive mining sites in the river channel were excavated in the early 1990s upstream from the Highway 101 bridge specifically to address aggradation issues. Problems associated with gravel extraction include channel avulsion, headcut erosion in the channel, sedimentation, and fish mortality.

3.3.3.6 Water diversions: There are five principal water diversions for the Dungeness irrigation system located between river mile 11.1 and 6.9 (figure 3-11). Each of the diversions is maintained by the water users and includes a diversion structure, canal/pipe, fish screen, and bypass channel to return fish to the river. The lateral and vertical instability of the Dungeness mainstem channel has prompted the water users to actively modify channel structures in some locations as needed to ensure a water supply during low flows.

The City of Sequim maintains an infiltration water outtake from the Dungeness River at Kinkade Island. However, it is currently used primarily as a back up system for groundwater sources due to sedimentation and maintenance issues.

3.3.4 Dungeness Bay/Estuary/Nearshore

In addition to the modification of the Dungeness River channel, areas at and near the river mouth have been drastically modified from their historic configurations, with significant impacts to water circulation, water quality, and the condition of habitat for salmonids, shellfish, and other aquatic plants and animals. Shoreline hardening is a significant problem along the marine shoreline. In some cases aging structures are made of creosote treated wood, automobile tires and other materials with a potential to pollute the water. Inappropriate development of former sandspits, such as along Three Crabs Road, has exacerbated this problem.

Two major studies have been conducted to evaluate the changes to the Dungeness delta and the impact on the nearshore area. The 2005 analysis by the University of Washington, *Historical geomorphology and ecology of the Dungeness River delta and nearshore environments from the Dungeness Spit to Washington Harbor,* (Collins) depicted the historic conditions of the Dungeness delta/ nearshore landscape prior to major human modification following white settlement in the mid-19th century. The purpose of the study is to provide a historical reference condition for restoration of the river delta. Landforms at the mouth of the Dungeness have been irreversibly changed due to sediment deposition and the elimination of historic distributary channels cut off by river levees and saltmarsh dikes. Restoration of nearshore processes at the mouth of the Dungeness and pocket estuaries to the east are considered to be critical to salmonid recovery. Figure 3-13 shows the channel locations of the river mouth at selected years between 1855 and 2003 based on historical survey maps and airphotos.

Another major study of change in the condition of Dungeness Bay was conducted by Rensel -- *Dungeness Bay Bathymetry, Circulation and Fecal Coliform Studies: Phase 2,* (2003) as part of the TMDL analysis for the Bay. Concerns by the Tribe and others related to water quality and shellfish harvest closures in Dungeness Bay prompted a more in-depth analysis of the circulation and bathymetry of the bay which was conducted from 2001 to 2003. Rensel compared the water volume of inner Dungeness Bay in 2000 with estimates from 1967, and estimated a decline in the water volume of the bay of 35% for areas below mean low tide. Intensive drogue surveys were used to determine the reflux rate of the bay--the amount of ebb tide water leaving the bay that returns on the following flood tide. The reflux rate was estimated to be 45% -- meaning that 45% of the water leaving the bay returns in a single tidal cycle. Such a high reflux rate results in a slow rate of flushing water (and associated pollutants) from the bay, thereby having significant effects on water quality.

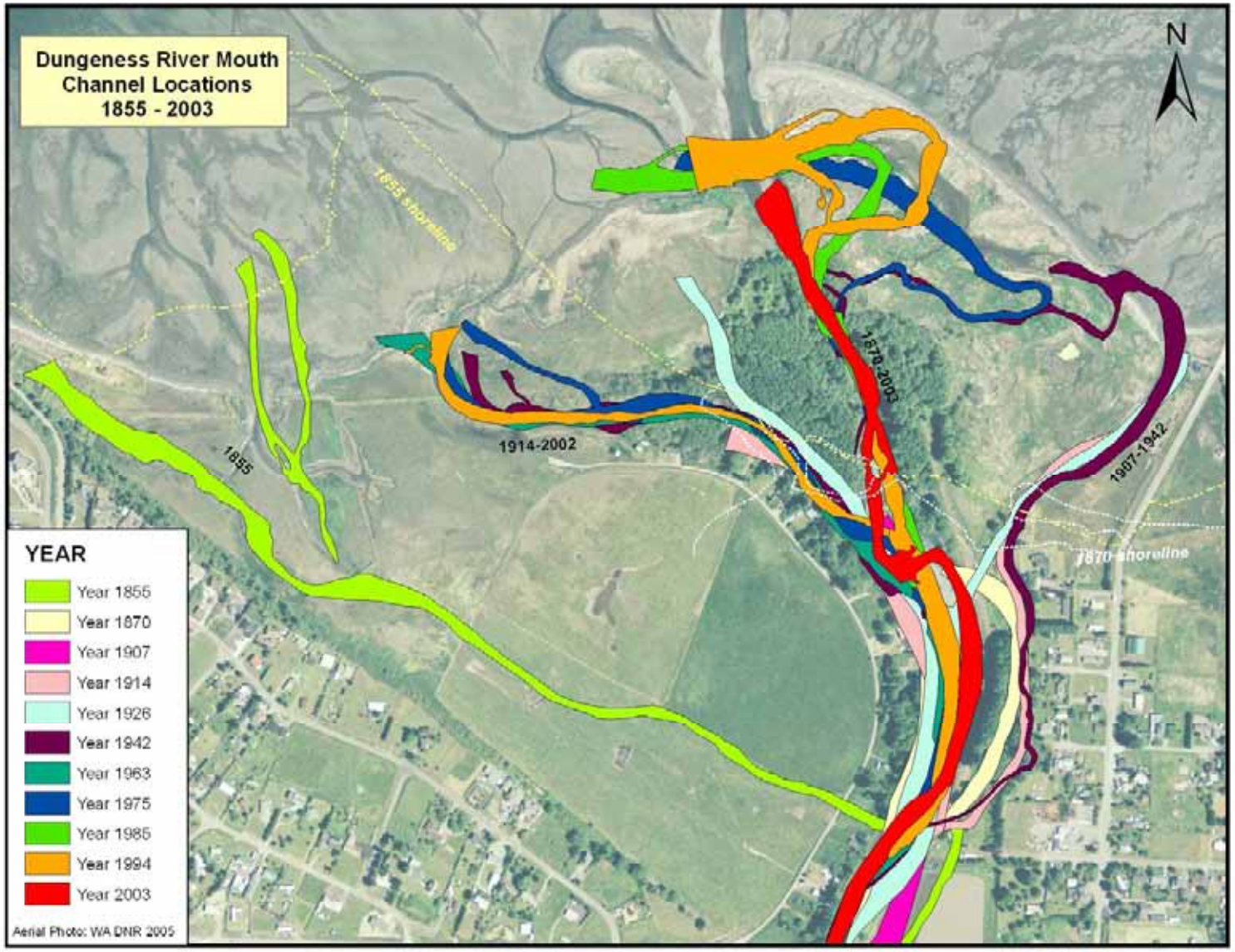


Figure 3-13: Dungeness River Mouth Channel Locations 1855-2003. (Collins/UW, 2005)

Ulvoid mat blooms have been observed in inner and outer Dungeness Bay, especially since 2002 when the Bay was listed on the 303d list for nitrification. The ulvoid mats are related to elevated nutrients in the water. These mats spread out in intertidal areas, generate significantly poor odor, kill shellfish and other invertebrates, and smother eelgrass. The eelgrass beds are important for ESA-listed species including Chinook, Hood Canal summer chum and bull trout, along with forage fish such as herring and surf smelt, and juvenile crab habitat.

Several small independent drainages are located immediately to the east of the Dungeness River that either served as historical distributaries of the river or were part of the estuary system. Meadowbrook Creek has been substantially modified by the ACOE dike which removed the outlet of flood flows from the river, and by shoreline development and the elimination of large woody debris. Additionally, Meadowbrook Creek from river mile 0.3 to 1.0 was straightened and altered decades ago to improve agricultural capacity. Two culverts were installed to provide livestock and equipment crossing of the creek. The culverts are 18” and 4’ in diameter by 8’ long and both restrict tidal flow. The damming effect of the culverts impacts water quality in multiple ways but primarily a) it reduces the creek’s ability to transport sediment and b) it contributes to the pervasive flooding in the adjacent residential area, compounding water quality degradation with increased stormwater contaminants. The Meadowbrook Creek bridge on Sequim-Dungeness Way also severely restricts tidal flux and floodplain function. County and private roads cross former wetland areas to serve residences on the shoreline, robbing the wetlands of pollution prevention and habitat function, and increasing flooding with its own associated pollution sources (Figure 3-14).

When the ACOE dike was constructed, a flood gate was located along the east bank of the Dungeness at approximately RM 0.7 to provide stockwater. This water forms Meadowbrook Slough and empties into the mouth of Meadowbrook Creek. No longer farmed, the area has a number of septic systems and is subject to chronic elevated fecal coliform levels.

Cooper, Cassalery and Gierin Creeks are other independent drainages entering the Strait of Juan de Fuca between the Dungeness River and Sequim Bay, and are highly influenced by the Dungeness irrigation system. Saltmarsh estuarine conditions at the mouths of each of these creeks has been substantially modified by tidegates, blocking culverts, straightening, and channelization associated with farming and housing development (Collins, 2005).

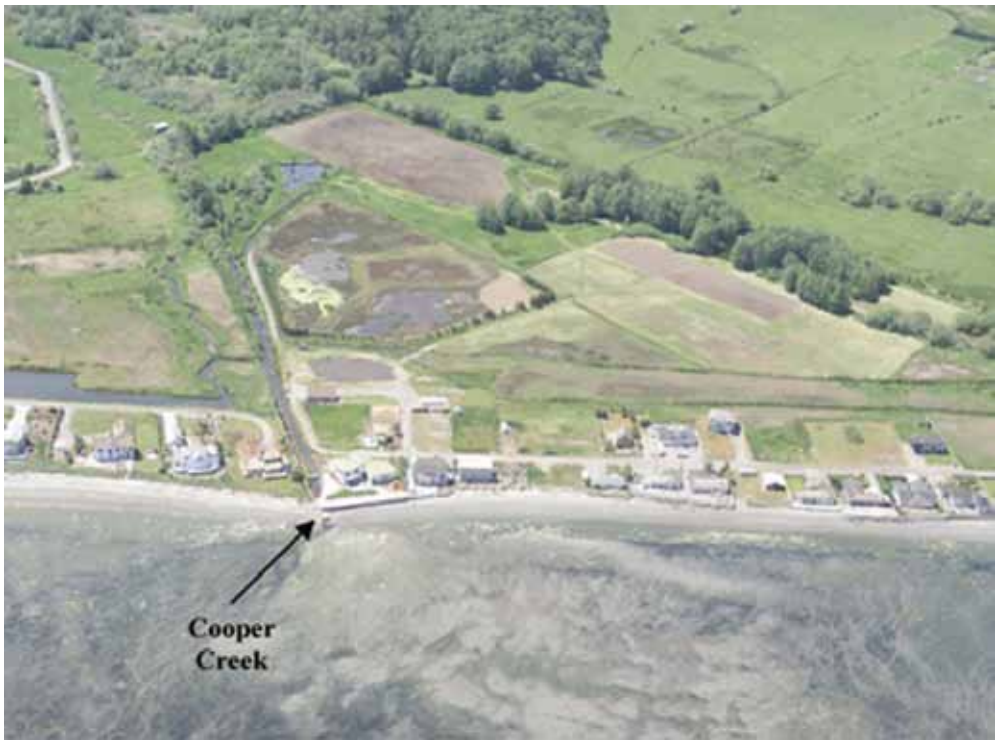


Figure 3-14 a and b: Shoreline development at the mouths of Meadowbrook Creek and Cooper Creek have dramatically modified shoreline processes and hydrology, and operate on septic systems that contribute contaminants to Dungeness Bay.

3.3.5 Hydromodification and Habitat Alteration of Siebert and McDonald Creeks

Modification of Siebert Creek is primarily associated with highway crossings of SR101 and the Old Olympic Highway, and associated riprap and bank armoring. Eroding streambanks are seen downstream of these alterations. Additionally, a logging road on the east fork has been identified as a source of sedimentation. Land use in the Siebert Creek watershed is largely comprised of commercial forest land and small woodlots. Siebert Creek is the most westerly creek that receives irrigation tailwaters from the Dungeness system.

A comprehensive watershed assessment was conducted by the Siebert Creek Technical Committee in 2004. The assessment documented sediment sources through a photo-analysis and field surveys were conducted of salmonid use, pools and riffles, vegetative cover, streamflow, and large woody debris (Shreffler, et al., 2004). Additionally, volunteers from the Pacific Woodrush group, a local non-profit organization dedicated to Siebert Creek, collected temperature data at 6 sites between June and October 2001 to 2003. Although no lethal temperatures were observed for salmon during the sampling, Siebert Creek did violate temperature standards for Class AA waters numerous times, particularly in 2003. (Table 3-9).

The mouth of Siebert Creek is generally in historic conditions, however the steep topography of the lower watershed and high wave action have generally precluded the formation of a larger estuary. Temporary berms formed by sand/gravel deposition during low flow periods inhibit salmonid migration.

Table 3-9: Water Temperature Data at 6 monitoring sites for Siebert Creek in 2003 (Shreffler, et al. 2004). Values > Class AA standard are in **bold**.

Site	Month	Max Temp	Total Days Exceeding Class AA C° Water Quality Std,
1	June	14.93	0
	July	**16.20**	1
	August	13.68	0
2	June	11.67	0
	July	13.99	0
	August	13.38	0
3	June	14.73	0
	July	**16.64**	3
	August	14.57	0
4	June	**16.12**	1
	July	**18.34**	12
	August	**16.43**	3
5	June	15.18	0
	July	**16.35**	1
	August	14.59	0
6	June	12.94	0
	July	14.68	0
	August	13.23	0

McDonald Creek exhibits many of the same habitat modifications as the Dungeness River. The creek has been impacted by timber harvest on US Forest Service lands in the 1980s and associated sediment input and bank erosion. The creek itself is used for conveyance of irrigation water, as up to 5 cfs of Dungeness irrigation water is discharged into the creek at river mile 5.0 and withdrawn at RM 2.0 with potential impacts on the homing ability of Dungeness and McDonald Creek salmonids, as well as distribution of pollutants (Entrix, 2005). Large portions of the upper watershed in the Lost Mountain and Blue Mountain areas have been converted from forest land to residential development. Much of the stream is severely depleted of large woody debris. Specific habitat conditions are described in the Limiting Factors Analysis for WRIA 18 (Haring, 1999). Estuarine areas are likely similar to historic conditions, but as in Siebert Creek, topography and wave action preclude the formation of any significantly large estuary, and temporary berms may inhibit fish migration. (Entrix, 2005)

3.4 Marinas and Recreational Boating (including vessel discharge, pumpouts, and shoreline dredging)

There are no marinas, vessel pumpout facilities or vessel maintenance facilities located in the Dungeness watershed area. Two public boat launches are located along Dungeness Bay on the west side of the Dungeness River (Figure 3-2). Both are managed by Clallam County as county parks. Recreational boating occurs year round in Dungeness Bay along with seasonal commercial and recreational fishing operations and shellfish harvest. Marine debris, especially of lost crab pots, is a significant problem in the bay (Clallam Marine Resource Committee). There are no data about fuel spill problems in the Bay. There is negligible use of this shallow Bay by boats with heads and there are no live-aboard boats.

3.5 Roads, Highways and Bridges

Five highway and railroad bridges span the lower Dungeness River (figure 3-12 and table 3-10). In some instances the bridges constrict the active river channel, their associated levees cut off access to side channels and the floodplain, and some inhibit sediment transport through the river system. The Burlingame Bridge was replaced in 1999 and the new, longer span allows the river to access historic channel and floodplain areas. Recommended restoration projects for the river system generally call for similar consideration of flood plain function in future bridge replacement projects.

The Railroad Bridge is owned by the Tribe as part of Railroad Bridge Park. The bridge was built in 1914-1915 and is an iron and wood truss structure with creosote-treated wood. Railroad traffic ceased in 1985 and the right of way, including the bridge, is now a non-motorized trail from Port Townsend to the Pacific. The western approach trestle to the bridge crosses several side channels but provides significant flood plain capacity. The eastern approach trestle was breached in a flood in 1962, and was replaced with a 150 foot dike. This dike was modified in 1995. Water quality pollution is of especial concern in this area, as Railroad Bridge Park is popular and the river is heavily used by fishers, waders, and swimmers. This section of the river is also a documented spawning area for Chinook salmon.

Table 3-10: Bridges along the lower Dungeness River

Bridge	River Mile	Span (ft)
Schoolhouse Bridge	0.7	200
Woodcock Bridge (aka Ward Bridge)	3.3	405
Burlingame Bridge on Old Olympic Highway	4.0	430
Railroad Bridge (including approach trestle)	5.7	1005
Highway 101 Bridge	6.4	590

Runoff from area roads has been cited as a concern for potential contaminants such as metals and hydrocarbons. A 2003 study of stormwater impacts on sediment quality in selected urbanizing Clallam County streams by the Battelle Marine Sciences Laboratory found that the levels of metals and hydrocarbons were slightly elevated in stream sediments at sites located downstream of the Highway 101 crossing. Additionally, "*Metals in stormwater impacted road sediment deposits were notably higher in cadmium, copper, zinc, lead and petroleum hydrocarbons than stream sediments, indicating that roads and vehicles could be an important source of pollutants within the developed area."* (Brandenberger, et al. 2003).

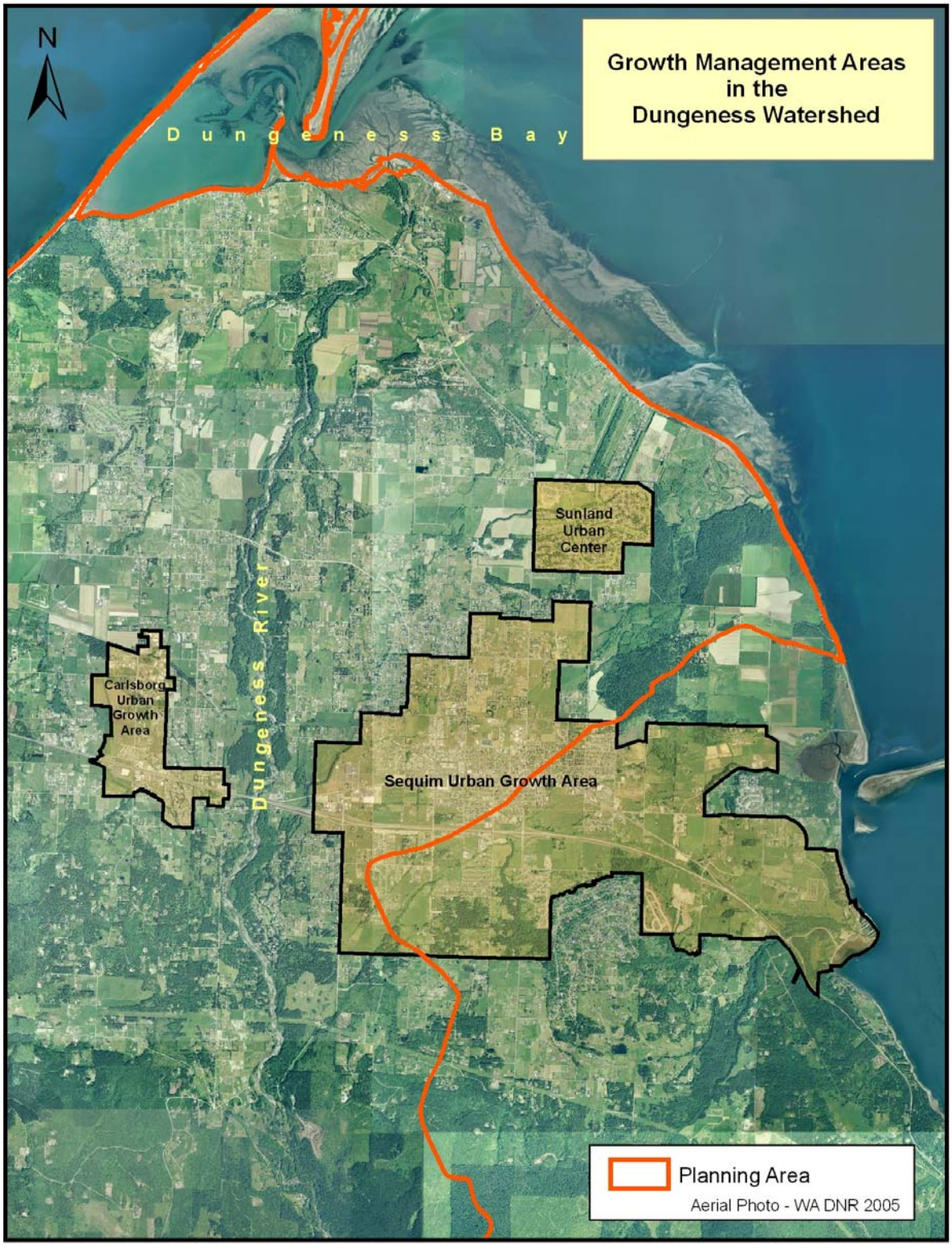
3.6 Urbanization

Estimates of the growth rate in eastern Clallam County vary from 1.62 to 2.8% per year (Entrix, 2005). A significant portion of the growth in the watershed consists of residential development for retirement homes. Associated with this development has been a marked expansion in commercial shopping centers in the City of Sequim since 2003. Urban residential and commercial growth creates demand for additional water supplies, elevates the need for wastewater treatment, adds impervious surfaces, and increases the runoff of non-point source pollutants from parking lots, golf courses, lawn and yard maintenance, and domestic pet waste.

Photo: The Sequim elk herd grazes near new housing development. (Sage, Point No Point Treaty Council)

3.6.1 Municipal / Residential Development

Urban Growth Areas (UGA) have been designated for the City of Sequim and the village of Carlsborg (figure 3-15). The Sunland Development north of the Sequim UGA is designated as an urban center. Although the Clallam County Comprehensive Plan has provisions for the protection of agriculture in the Sequim-Dungeness valley, many farms have been removed from agricultural production and converted to residential parcels. The loss of a critical mass of farmland to sustain a viable agricultural community is a major concern expressed in several plans (e.g. Entrix, 2005). Similarly, small forested lots have been converted to residential use throughout the foothills area of the Dungeness and in the McDonald and Siebert watersheds.


N
Growth Management Areas
in the
Dungeness Watershed
Dungeness Bay
Sunland
Urban
Center
Dungeness River
Carlsborg
Urban
Growth
Area
Sequim Urban Growth Area
Planning Area
Aerial Photo - WA DNR 2005

Clallam County prepared buildout estimates for the Dungeness watershed area as part of their updates to the County Comprehensive Plan in 2002 (Figure 3-16 and Table 3-11). County GIS data indicated that approximately 9,152 residential units are located in the watershed area (Siebert to Gierin) as of 2002. Full buildout scenarios were also calculated at existing zoning, and total potential residential units were estimated to be 20,383. A maximum scenario using clustering and transferable development rights would entail a total of 24,458 residential units in the watershed area.

Table 3-11: Existing and Potential Buildout of Residential Units in the Dungeness Watershed Area by Subbasin (Adapted from Entrix, 2005; based on buildout analysis by Clallam County Department of Community Development, 2002)

Subbasin	Number of existing residential units	Total potential residential units at full buildout with existing zoning	Maximum potential residential units with clustering and transferable development rights
Bear Creek	163	434	434
Canyon Creek	39	111	111
Cassalery Creek	788	1314	1493
Dungeness Bay Inner	689	1549	1549
Dungeness Bay Outer	570	1378	1572
Dungeness River	1625	3212	3652
Gierin Creek	1941	4281	7181
Matriotti Creek	1274	3374	3374
McDonald Creek	439	1084	1084
Meadowbrook Creek	128	354	354
Siebert Creek	350	962	1213
Strait small tribs	1146	2330	2441
Total	9152	20383	24458

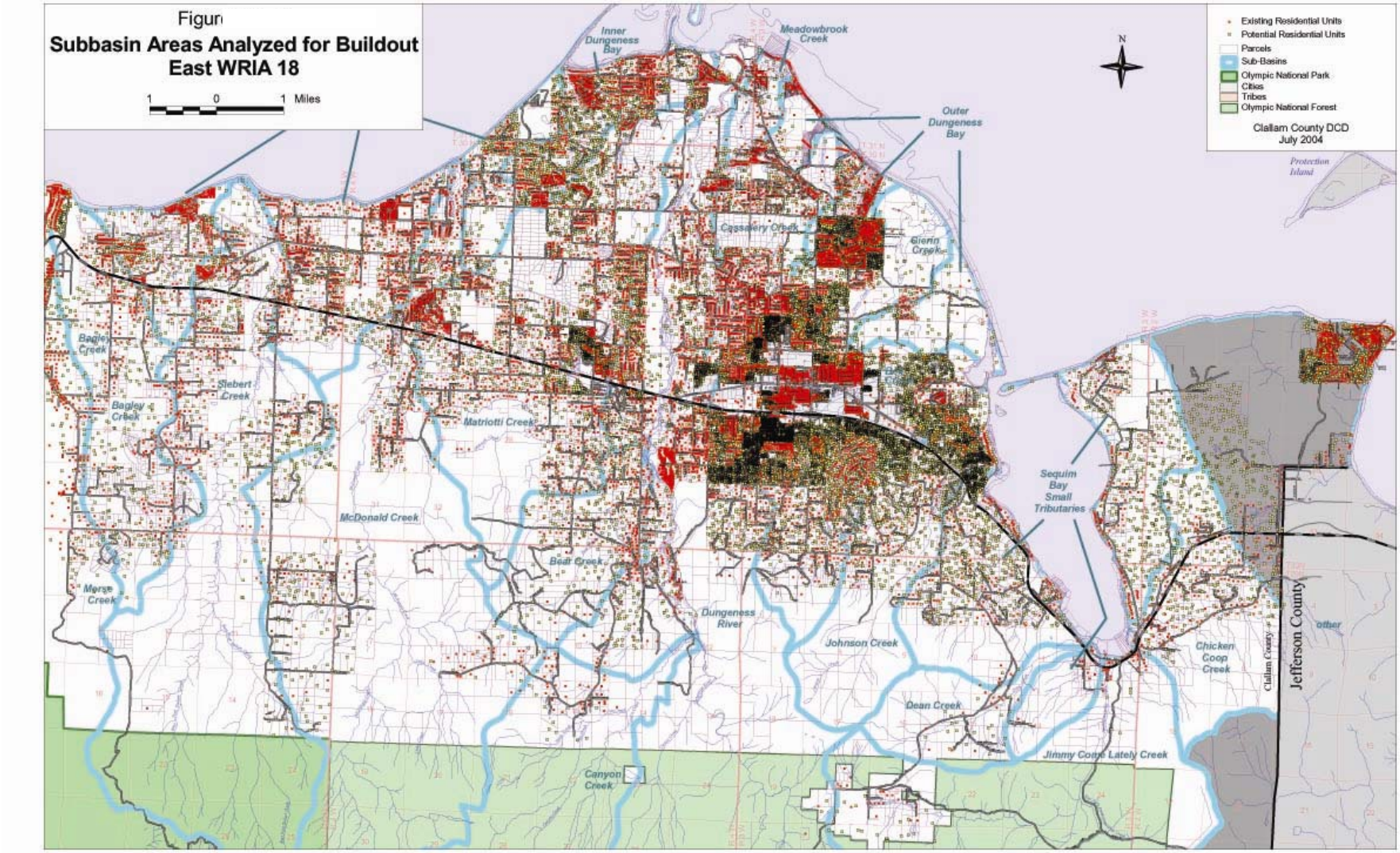


Figure 3-16: Estimated buildout in eastern Clallam County

Due to the course soils in the lower watershed area near Sequim, the underlying aquifers are susceptible to contamination. Potential issues associated with groundwater pollution are listed in the 1994 Sequim-Dungeness Groundwater Protection Strategy, and include nitrates, pesticides, stormwater, underground storage tanks, seawater intrusion, well construction and abandonment, and the lowering of the shallow aquifer. Clallam County evaluated nitrate concentrations by sampling over 300 wells in 1992 and identified areas of elevated levels at Carlsborg, northeast Sequim, and the west end of Woodcock Road. Thomas (1999) further evaluated nitrate levels and estimated the relative causes and sources of contamination (figure 3-17).

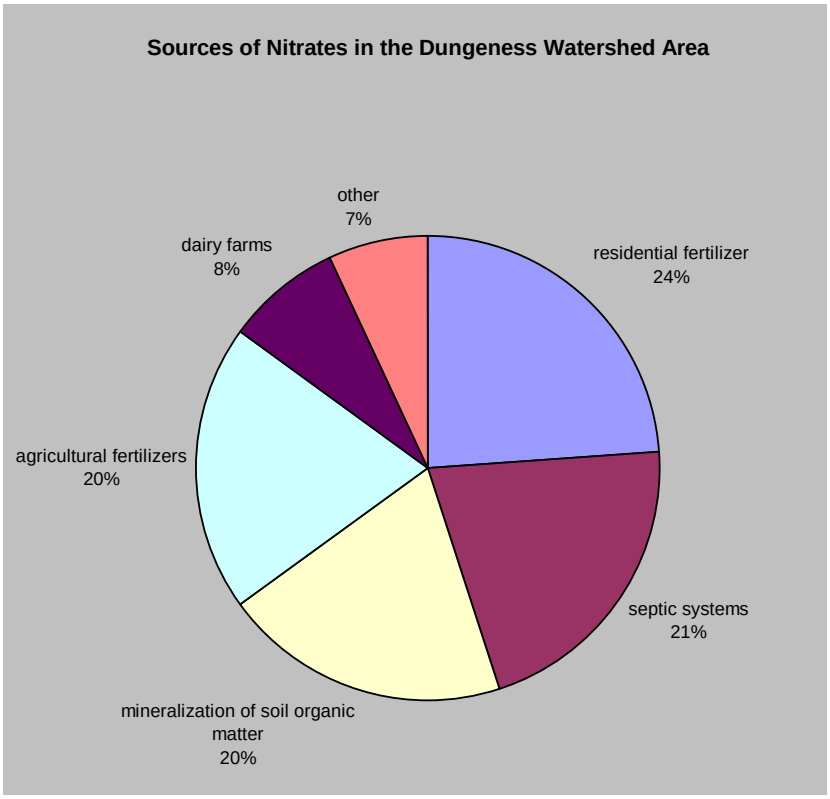


Figure 3-17: Sources of Nitrates in the Dungeness Watershed Area (Adapted from Thomas, 1999) (Note: The term soil organic matter is generally used to represent the organic constituents in the soil, including undecayed plant and animal tissues, their partial decomposition products, and the soil biomass.)

3.6.2 Wastewater Treatment

Wastewater treatment for the City of Sequim is a tertiary treatment and wastewater re-use facility located in the Bell Creek/Sequim Bay watershed. Within the Dungeness watershed area, there are several small community treatment systems but the vast majority of homes are on individual on-site septic systems.

Individual septic systems require appropriate design, installation, and homeowner maintenance to avoid emitting bacterial and viral contaminants into surface and groundwater bodies. Past monitoring efforts by the Clallam County Departments of Health and Community Development identified a number of individual septic systems that were failing, and clusters of failing systems have been found at Carlsborg. Septic systems are a major focus of management measures described in the Clean Water Strategy, with measures for education, training, inspection and remediation. In the TMDL study area, which includes the River, Mattriotti Creek, Meadowbrook Creek, and the Marine Drive, Three Crabs Road, and Golden Sands development along Dungeness Bay, an extensive monitoring effort is being conducted. Septics of Concern were identified through County records (Figure 3-18a and b). Using this data base as a starting point, a dedicated County position was created with EPA grant funds. The Operations and Maintenance Specialist, conducting site visits, dye testing, and other investigations, has identified a number of failing systems requiring repair or replacement. Some are direct discharges into surface water. For individuals, repair and replacement cost share through the EPA grant are part of the program. However in some areas such as Three Crabs and Golden Sands, much more expensive community treatment systems may be required

In the rest of the watershed, further investigation is needed. The state-mandated inspection program may aid in data gathering. Areas with pervasive problems will require a feasibility study and large capital investment. The County is currently conducting a feasibility study for a community treatment system to replace individual septics in Carlsborg, and it has increased septic permit fees for new construction sufficiently to cover the cost of continuing the full-time Operations and Maintenance Specialist

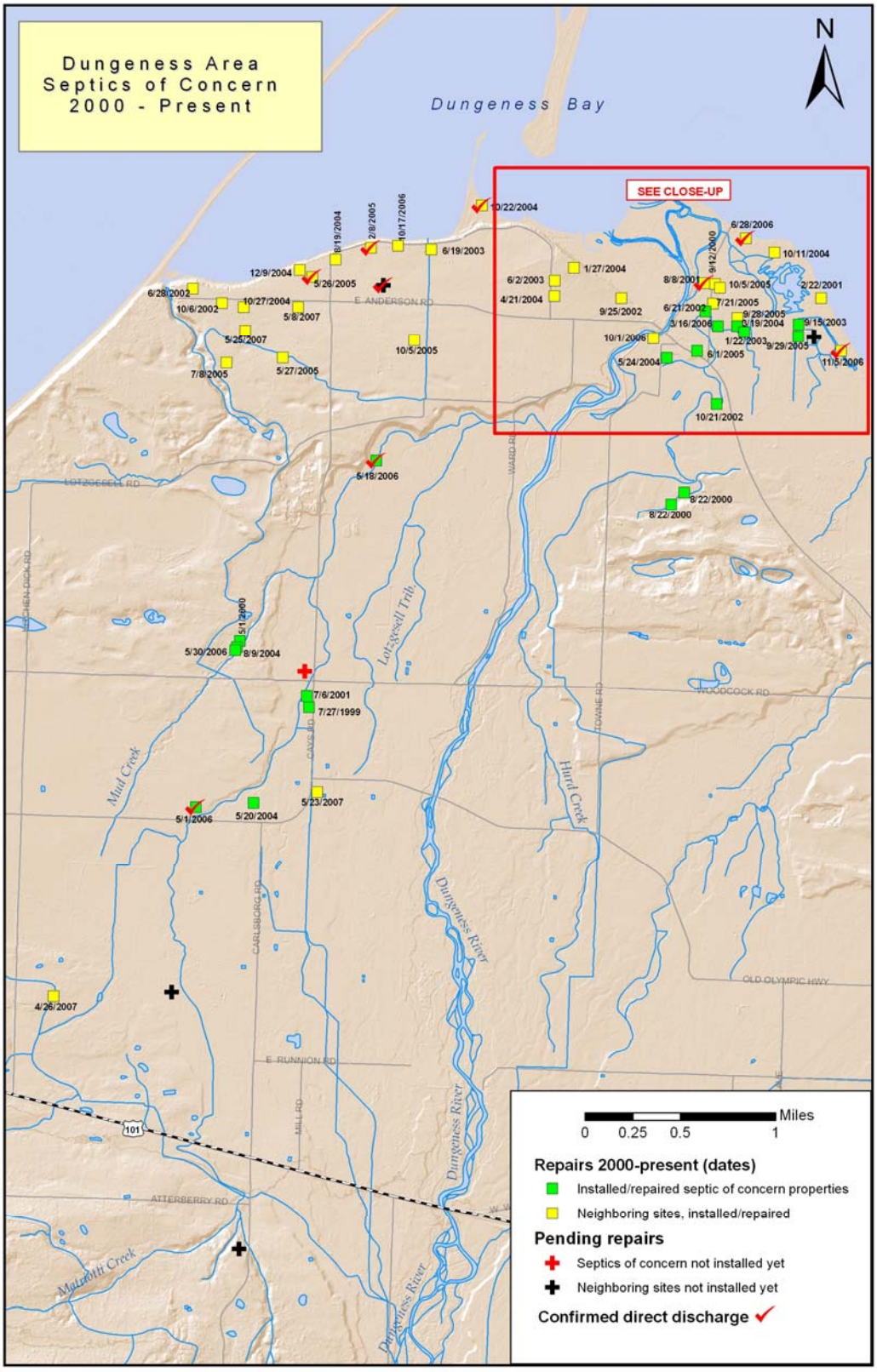
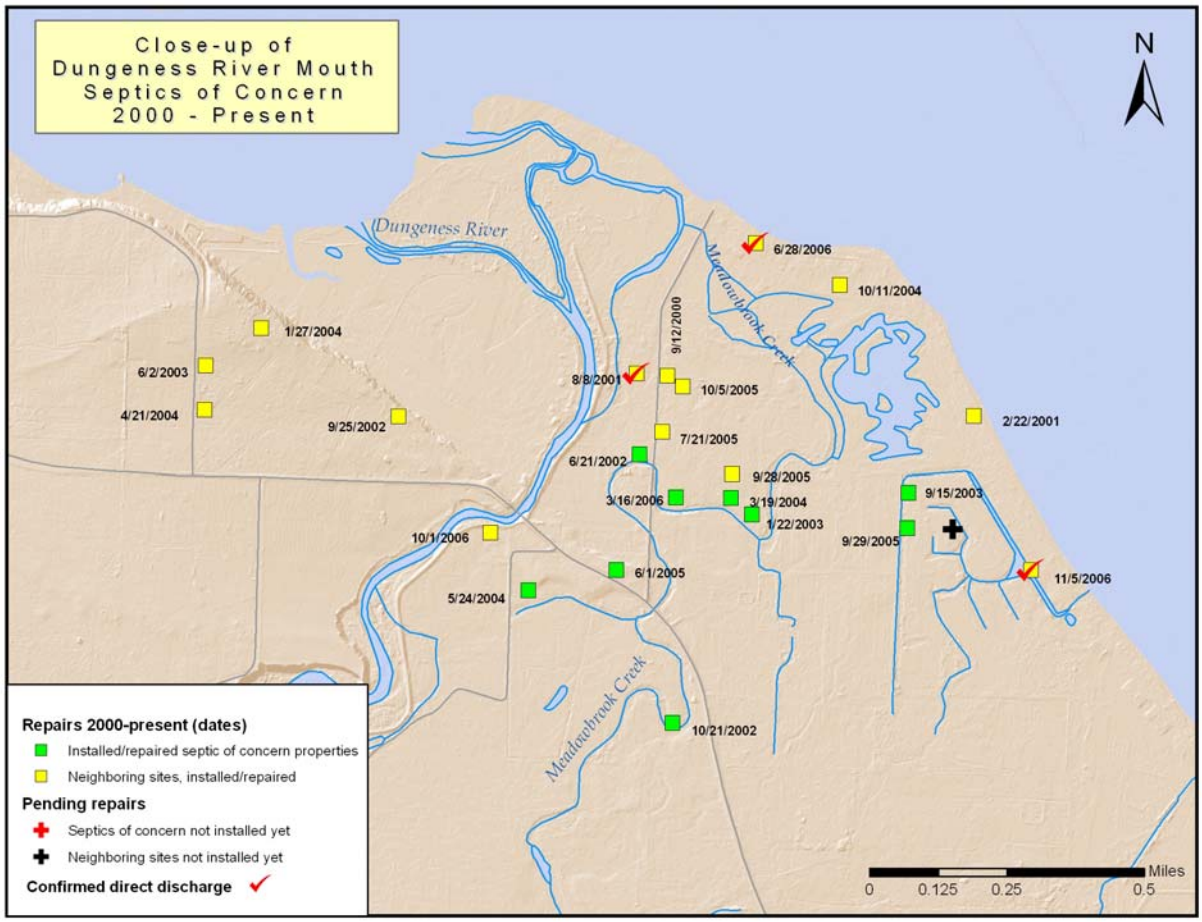


Figure 3-18a: Identified septic contaminant sources 2000-2006Clallam Co Department of Environmental Health



3.6.3 Golf Courses

The growing retirement community in the Sequim-Dungeness Valley has created an increased demand for golf courses. Three golf courses are located in the area (Figure 3-19). The 1994 Dungeness-Quilcene plan called for the adoption of best management practice guidelines for golf courses due to the potential impacts of water consumption and the use of pesticides and herbicides. This recommendation remains to be implemented. The Tribe recently purchased one of these golf courses. Hazardous waste contamination was discovered on the property and is being remediated (Phase II Assessment, K Burgess, 2007.) Many aspects of this golf course, including wastewater treatment, runoff, water consumption, and landscape/greens management, will need further research and the application of best management practices.

3.6.4 Impervious surfaces / stormwater runoff

Figure 3-20 contains a map of the impervious surfaces of the Dungeness watershed area from the 1995 Washington Department of Ecology report, *"Western Washington Land Cover Change Analysis: Final Report."*

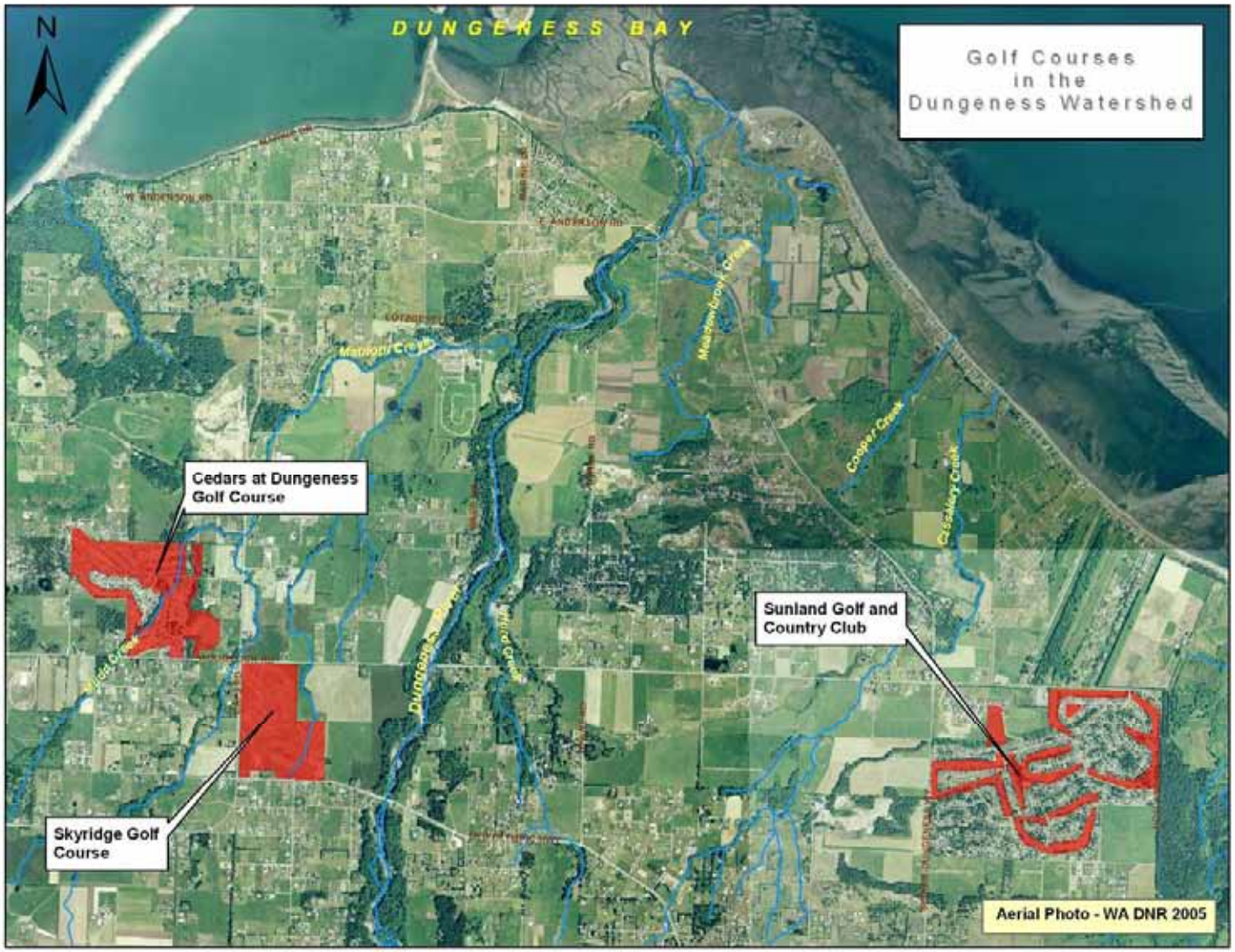


Figure 3-19: Golf courses in the Dungeness Watershed

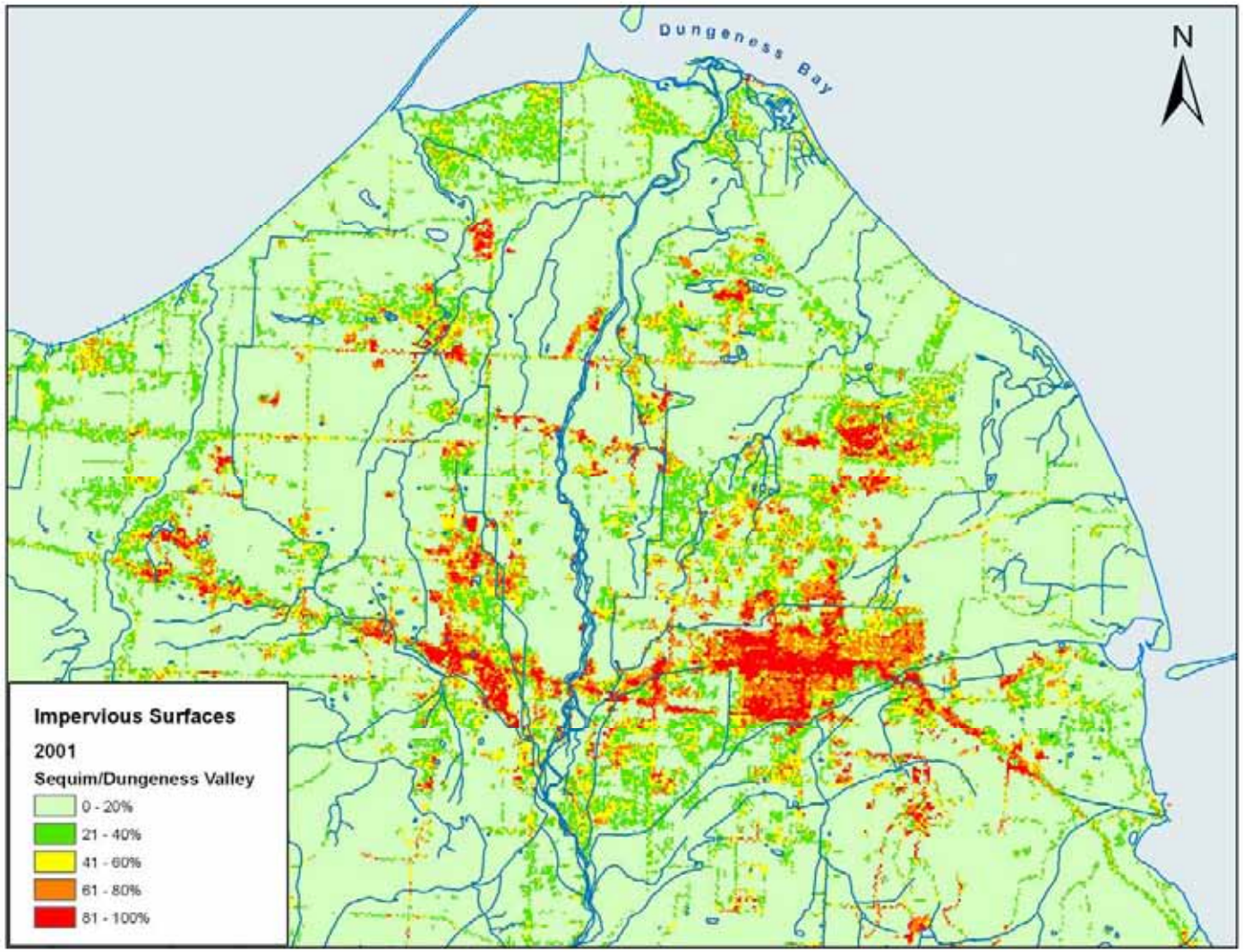


Figure 3-20: Impervious Surfaces in the Sequim-Dungeness Valley
(Washington Department of Ecology, 2005)

3.6.5 Individual landowner management, yard maintenance

The conversion of agricultural and forest land to residential development has resulted in increasing numbers of individual landowners that are unfamiliar with proper stewardship techniques for the region. Impacts resulting from yards and small farms and woodlots include excessive water consumption for landscaping, nutrient loading from fertilizer and manure, pesticide/herbicide use, clearing of riparian vegetation, introduction or proliferation of invasive ornamentals plants, and blockage of fish passage. Clallam Conservation District has developed programs to provide individual technical assistance to the owners of woodlots, small farms and urbanized lands to develop stewardship plans, conserve water, inhibit animal access to waterways, and preserve open space, agricultural and farm lands. The Tribe is also providing technical assistance on invasive plants and appropriate riparian plantings to land owners along the Dungeness River (see section 3.7.2).

3.6.6 Domestic pet waste

In 2006 the Jamestown S'Klallam Tribe, working with ten volunteers, instituted a six month program to observe pet waste amounts at seven locations adjacent to surface waters affecting Dungeness Bay. Approximately 700 piles of fresh pet waste were observed in less than six months. The observations suggest that pet waste is a likely significant contributor to bacterial pollution. For example, at Dungeness Landing, a County park adjacent to the Bay, 23 fresh piles of pet waste were found at one time. Additionally, there are landowners who feed wildlife and conservation owners who plant rye to attract wildlife, thereby increasing bacterial input to surface waters above natural levels.

3.7 Wetland/ Riparian

3.7.1 Wetlands

Wetlands have been the subject of several inventories in the lower Dungeness watershed, and comprise an estimated 4,574 acres, many consisting of small ponds (DWMC 1993). An updated wetland inventory in 1995 by Clallam County enumerated a total of 353 regulated wetlands and 174 artificially created wetlands -- primarily ponds associated with irrigation ditches, gravel pits, and residential landscaping. Clallam County also prepared an *Assessment of Wetland Functions and Wetland Management Guidance for the Lower Dungeness River Area and Sequim Bay Watersheds* in 1995 defining the hydrological characteristics of different wetland types, potential for indigenous species and habitat diversity, risk of impairment, and management measures. Ten percent of all wetlands were in designated urban growth areas or high intensity rural zones. Wetlands associated with irrigation canals are described in the Comprehensive Water Conservation Plan (Montgomery, 1999). The report indicates that some of the artificial wetlands unintentionally created or expanded by irrigation would be lost following conservation implementation. The 1994 Dungeness Quilcene Plan specifically consulted regional biologists over the wetlands-water conservation issue, and determined that the artificial wetlands generally did not provide functions and values for fish and wildlife species that would merit the intentional loss of water from the Dungeness River via the irrigation system. The impact of irrigation conservation on wetlands in the Dungeness region was further analyzed in a 2002 Environmental Impact Statement on the water conservation plan (Foster-Wheeler). The US Forest Service reviews and maps wetlands and riparian reserve areas in the upper Dungeness watershed.

3.7.2 Removal of Riparian Vegetation / Invasive Plant Species

The impact of the loss of riparian vegetation on habitat and water quality has been discussed in section 3.3.3.2. Please refer to Table 3-8 for details on denuded areas along the Dungeness River. Associated with the loss of native riparian vegetation, is the introduction of invasive plant species. Noxious species identified in the lower Dungeness include Herb Robert, Japanese knotweed, Scotch broom, Reed canary grass, butterfly bush, Himalayan blackberry, Canadian thistle, and poison Hemlock. These species interfere with native plant species and exacerbate the loss of forested areas that are essential for large woody debris recruitment. Of particular concern are recent outbreaks of Japanese knotweed *(Polygonum cuspidatum)* which were originally introduced to the United States as ornamental species for landscaping or erosion control. The knotweed proliferates aggressively along riparian shorelines, eliminating native shrubs and tree seedlings, and is extremely difficult and expensive to eradicate (Figure 3-21).

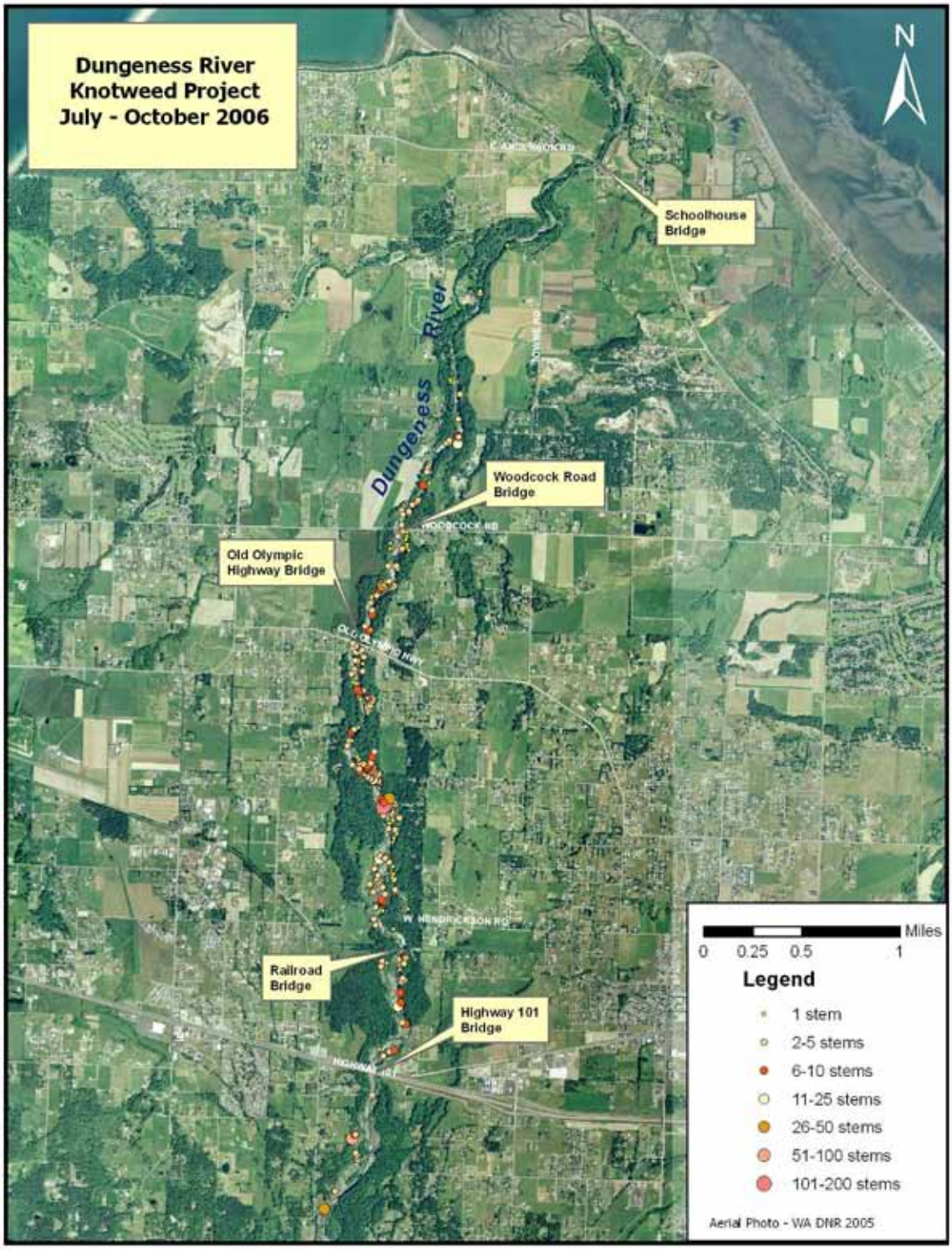


Figure 3-21: Knotweed infestations along the Dungeness River in 2006 (Jamestown S'Klallam Tribe Natural Resources Dept.)

3.7.3 Drainage and fill

As noted in section 3.3.4, marine shorelines of Dungeness Bay and smaller estuarine areas to the east have been dramatically modified by drainage, tidal dikes, and fill which were originally constructed to create farmland in the late 19th century. Due to the flat landscape and favorable scenery along Dungeness Bay, these areas have recently been the focus of considerable residential development, with corresponding pressure to maintain or expand drainage and fill throughout the alluvial plain near the Dungeness mouth. Clallam County has not adopted a clearing, grading and fill ordinance.

3.8 Other Sources

3.8.1 Wildlife

Although the lower watershed is rapidly converting from rural to suburban and urban, there are still significant undeveloped areas which provide habitat for many species of wildlife including deer, elk, cougar, bear and coyote, in addition to smaller mammals. The upper watershed is forested with terrestrial wildlife species typical of late successional forests in the Pacific Northwest, particularly in Olympic National Forest, Olympic National Park and the Buckhorn Wilderness.

The Olympic Game Farm, located at River Mile 1.8, has a large collection of exotic animals for public display, including bears, elk, bison, cougars, and lions. Mattriotti Creek, the largest tributary to the river, crosses through the Game Farm and enters the river. A herd of donkeys grazes along the west bank with direct access to the river.

Most of the inner Dungeness Bay is a national wildlife refuge for migratory waterfowl and shore birds. Marine mammals and birds have long been considered to be a contributing factor to fecal coliform contamination in Dungeness Bay. Rensel (2003) observed large numbers of gulls congregating at the Dungeness River mouth during low-tide periods during the day, especially during the late spring and summer. Sampling above and below bird groups near the mouth of the Dungeness River resulted in seven out of nine samples with significantly higher downstream than upstream fecal coliform geometric means (Rensel, 2003).

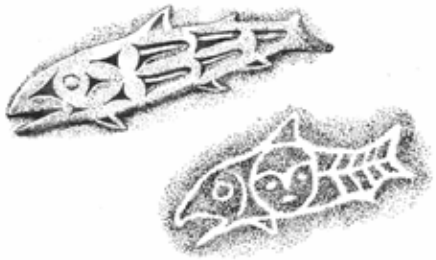
Marine mammals are present in the Bay seasonally, especially at haulouts on Cline Spit and at the end of Dungeness Spit near the lighthouse. An examination of marine water quality data has not indicated a significant impact of seal presence on water quality (Sergeant, 2004). The relative contribution and amounts of bacterial contamination by different wildlife species in Dungeness Bay is presently the subject of a comprehensive source identification study by Battelle National Marine Lab and the Jamestown S'Klallam Tribe as part of a Targeted Watershed Initiative Grant from the EPA.

4. Summary of Watershed-Based Goals

4.1 Broad Watershed Goals

Goals for the Dungeness watershed have been developed by each of the agencies and governmental entities that are involved in management of watershed resources. The cooperative effort to protect and restore the watershed has resulted in substantial convergence of these broad watershed goals between the tribal community and other partners. Long-standing watershed goals have been developed by the Jamestown S'Klallam Tribe and the Dungeness River Management Team.

Excerpts from the 1994 Jamestown S'Klallam Tribal Comprehensive Plan:



NATURAL RESOURCES AND PLANNING GOALS:

- *Protect, restore and enhance the ecosystems which have historically supported populations of fish and wildlife for countless tribal generations*
- *Provide the necessary planning strategies and tools to meet the challenges of future growth*.

SUB-GOALS AND LONG RANGE PLANS (RELEVANT TO NON-POINT SOURCE POLLUTION):

Water Quality:

- Implement completed nonpoint watershed plans
- Monitor and document water quality to protect fish and wildlife habitat and shellfish beds
- Ensure that shellfish resources meet requirements for health certification or safe subsistence harvest.
- Monitor and protect drinking water

Water Quantity:

- Protect in-stream flows for fish
- Encourage water conservation by local irrigators and other entities
- Implement the Dungeness-Quilcene Water Resource Management Plan

Restoration and Habitat Protection:

- Restore fish and shellfish resources to sustainable, and ultimately harvestable, levels
- Complete comprehensive recovery plans for all threatened stocks of fish in the Dungeness River and eastern Strait of Juan de Fuca tributaries
- Implement cooperative projects with local, state and federal agencies to restore ESA listed and other threatened stocks
- Review timber harvest, gravel extraction, shoreline activities and other construction conducted in the Tribe's primary area.
- Implement an ecosystem restoration initiative for the Dungeness Watershed in cooperation with federal, state and local agencies and in compliance with the Federal Northwest Forest Plan. The initiative includes components covering channel stabilization, habitat recovery, riparian re-vegetation and critical stock protection and restoration.

Land Management and Future Growth:

- Institute strategies for developing Tribal lands, identifying potential development problems and opportunities.
- Establish methods for Tribal compliance with land use planning policies as lands are developed for programs, services, and business opportunities.

Environmental Education:

- Make presentations to inform the public and promote ecosystem protection Conduct special education projects
- Contract with Conservation Districts, Clallam County and others to work with farmers and landowners on water conservation and water quality
- Operate the natural history interpretive center on the Dungeness River

GOALS OF THE DUNGENESS RIVER MANAGEMENT TEAM:

Goal 1: Prevent loss of life and property from flooding.

Goal 2: Work toward restoration of riparian and aquatic ecosystems within the Dungeness River watershed and estuary to mutually benefit wild and native salmonids and human residents.

Goal 3: Protect and enhance water quality and quantity in the Dungeness River Watershed Planning Area to support all beneficial uses, including an adequate clean water supply for current and future human needs and a higher productive capacity of fish and wildlife habitats.

Goal 4: Encourage cooperation, coordination and management among all levels of government and citizenship in protecting ground and surface water quality and quantity.

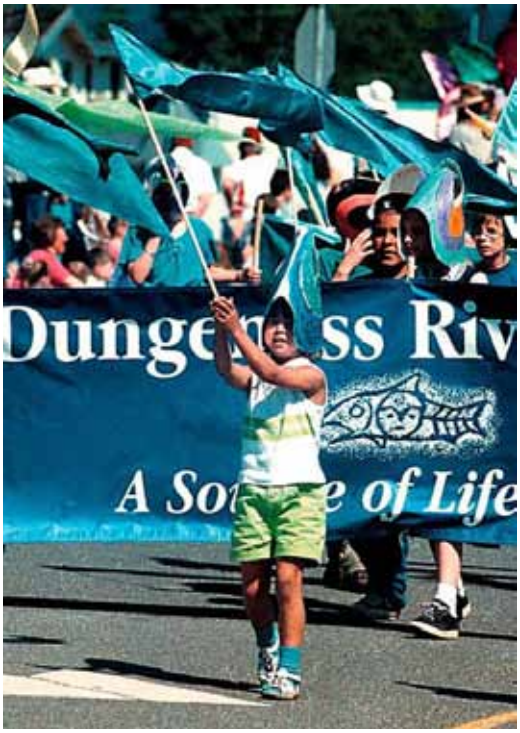
Goal 5: Exchange information on technical studies, issues and projects occurring in the Dungeness River Watershed Planning Area.

Goal 6: Promote public participation and education about the watershed so as to develop and encourage a community stewardship ethic and help prevent / resolve conflict.

Goal 7: Support, promote and facilitate implementation of relevant management plans and strategies developed for this area and endorsed by the DRMT.

THE DRMT MISSION STATEMENT: *"To preserve and enhance the Dungeness River Watershed Planning Area through an ecosystem approach to restore its physical and biological health."*

The DRMT vision for the watershed: "Farms, forests, fish and friends sharing a home together."



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4.2 Quantitative Watershed Goals and Planning Targets

4.2.1 Water Quality Standards and Pollutant Reduction Goals

4.2.1.1 Dungeness River, Bay and Tributaries: Clallam County and the Washington Department of Ecology prepared a Clean Water Strategy in 2004 in response to the contamination of Dungeness Bay and the closure of much of the bay to shellfish harvest (Streeter and Hempleman, 2004). General goals of the Strategy are as follows:

- *To protect public health.*
- *To identify and correct sources of bacterial contamination associated with human activities in order to restore and maintain water quality in the freshwater ditches, streams and river; and in marine waters within Dungeness Bay.*
- *To re-open closed shellfish beds to continue to harvest shellfish for commercial, subsistence and recreational purposes and to protect habitat for shellfish and other wildlife species.*
- *To encourage water clean-up actions through public outreach that emphasizes innovative ways to reach new audiences and energizes existing audiences to reduce pollution in the watershed.*

The TMDL study of Dungeness Bay identified the following water quality criteria (table 4-1) which are described in more detail in the full study (Sargeant, 2004).

Table 4-1: Washington State Water Quality Criteria for Fecal Coliform Bacteria (Ch. 173-201A WAC) and the National Shellfish Sanitation Standards for Shellfish Harvest* (Sargeant, 2004)

Fecal Coliform Bacteria	Class AA marine water	DOH shellfish harvest standard	Class A Fresh water	Class AA fresh water	TMDL target for Dungeness R. RM 3.2 to mouth (Sargeant, 2002)
Shall not exceed a geometric mean value of (number of colonies/100 mL)	14	14	100	50	13
With not more than 10% of samples exceeding (number of colonies/100 mL)	43	--	200	100	--
A 90th percentile not to exceed	--	43	--	--	43

The TMDL studies identified specific fecal coliform loading reduction factors necessary to meet water quality standards for Dungeness Bay marine sites, the Dungeness River and irrigation ditches. These are summarized in tables 4-2 through 4-5.

* As of June, 2007, Washington State's proposed change to use-based standards was still under review by the Federal Services. See section 4.2.1.3 for more information.

Table 4-2: Fecal coliform target reductions and concentrations for tributaries to Dungeness Bay (Hempleman, 2004)

Site	Study FC GMV*	Study 90th %ile	Target FC GMV*	Target 90th %ile	Required Change %
Dungeness River RM 0.1	15	47	13	43	-9
Meadowbrook Creek CM 0.2	33	243	14	100	-59
Cooper Creek	49	140	35	100	-28
Golden Sands Slough	109	565	19	100	-82
Irrigation Ditch 1	150	273	100	182	-33
Irrigation Ditch 2	153	1281	24	200	-84

* Geometric Mean Value

Table 4-3: Fecal coliform target reductions and concentrations for Dungeness River and Tributaries (Hempleman, 2004)

Site	Study FC GMV (#fc/100mL)	Study 90th %ile (#fc/100mL)	Target FC GMV (#fc/100mL)	Target 90th %ile (#fc/100mL)	Required Change %
Dungeness River RM 0.1	15	47	13	43	-9
Residual Reach RM 0.1-0.3			0	0	
Dungeness RM 0.3	13	61	9	43	-29
Dungeness RM 0.8	17	81	9	43	-47
Irrigation Ditch @Dungeness RM 1.0	83	239	60	170	-29
Matriotti Creek	279	783	60	170	-78
Hurd Creek	12	100	12	100	0
Dungeness RM 3.2	6	28	6	28	0

Table 4-4: Fecal coliform loading reductions necessary to meet water quality standards for Dungeness Bay marine sites and the Dungeness River during the critical period (Hempleman, 2004)

Sub-area	Critical period or season	# of sample events in season	# of samples in season	Geo-mean	90th %ile	FC reduction needed to meet standards	Limiting Criterion	Target value fc/100mL
3.2 -- Convergence zone	Nov-Feb	5	17	16	122	65%	90th percentile	43
4.1 - West inner bay	Nov-Feb	5	35	24	64	41%	Geometric mean	14
2 -- River mouth	March-July	8	58	20	107	60%	90th percentile	43
Dungeness RM 0.1	March-July	9	33	13	80	46%	90th percentile	43

Table 4-5: Fecal coliform reductions to meet Class AA freshwater standards for the ditches to the inner Bay, October 2001 - September 2002 (Hempleman, 2004)

Ditch Number	Number of sample events	Geometric Mean	90th percentile	FC reduction necessary to meet standards	Limiting criterion	Target value fc/100 mL
1	16	69	702	86%	90th %ile	100
2	7	11	805	88%	90th %ile	100
3	5	80	622	84%	90th %ile	100
4	14	78	2879	97%	90th %ile	100
5	8	18	149	33%	90th %ile	100
7	13	98	1874	95%	90th %ile	100

4.2.1.2 Siebert and McDonald Creeks:

Siebert Creek is classified as a Class AA water body. Nonpoint issues include sedimentation from a logging road on the East Fork, some vegetation removal, and an old landfill leachate and sedimentation at Emery Creek (DWMC 1993). Occasional monitoring from 1988 to 1999 indicated few fecal coliform concerns (Entrix, 2005). Concern over proposals by the Washington Department of Natural Resources and private timber land owners to undertake commercial logging in or near the riparian zone prompted local landowners and regional tribal and state biologists to conduct specific site analysis of the logging proposals. Additionally, several large major forested parcels were acquired using state and federal funds for conservation easements or acquisition. As noted in Section 3.3.5, Siebert Creek has not always met Class AA standards for temperature.

McDonald Creek is also classified as a Class AA water body. Nonpoint issues include an unstable channel and bank erosion, particularly from an unpermitted rechannelization attempt at a residential development called Solmar. Elevated bacteria from Agnew Ditch is also noted (DWMC 1993). Temperature monitoring from 1993-1999 indicated poor temperatures at several locations, and thresholds for salmonids were substantially exceeded at one site downstream of a large residential development (Bernthal and Rot, 1999 cited in Entrix, 2005).

4.2.1.3 State and Tribal Standards

The State of Washington entered into a required Tri-ennial review of its water quality standards in 1993. Ecology is the Department delegated to lead this effort. A decision was made to adopt use-based rather than numeric standards, as well as to reexamine temperature, dissolved oxygen and other parameters; resulting in a long review process that has not been completed as of May, 2007. Parts of the new standards have been approved by EPA. However due to a failure to adequately define the proposed uses, and at the urging of Tribes, including Jamestown, EPA rejected other parts. The Washington State Department of Fish and Wildlife, regional tribes, the US Fish and Wildlife Service and the National Marine Fisheries Service have revised the uses and where they

are to apply, and the Services are reviewing the final product. Once state standards are fully adopted by EPA, the Jamestown S'Klallam Tribe will need to examine its options for Tribal Water Quality Standards. The Tribe has reservation and trust lands in several widely scattered watersheds, closely interwoven with land and water bodies under the jurisdiction of the state. Adoption of state standards would be a logical step, but is not possible until the state has adoptable standards.

4.2.2 Water Quantity Goals

No minimum instream flow levels have been established by state rule for the Dungeness River. Adjudicated water rights exceed flow levels for much of the year; however, a trust water right agreement in 1998 effectively relinquished many of the unused "paper" water rights for the Dungeness. Water quantity goals for the Dungeness were discussed at length in the following forums:

- Preparation of the Dungeness-Quilcene Plan 1991-1994
- An IFIM study by the US Fish and Wildlife Service established a set of recommended instream flow levels (table 4-6) (Wampler and Hiss, 1993).
- Preparation of the WRIA 18 Plan 2002-2005 (Entrix, 2005)
- Comprehensive Irrigation District Management Plan (CIDMP) (HDR draft, 2005) preparation included a discussion of Instream flow "target" levels by the irrigators and the National Marine Fisheries Service and US Fish and Wildlife Services, the agencies with responsibility for ensuring recovery for listed species of salmonids. CIDMP discussions have not yet, however, resulted in any permits from the Services related to the Endangered Species Act which specify quantifiable target flows.
- Recently, studies of salmon utilization of side channel habitat by the Tribe, and flow studies of side channels by BOR (Daraio, et al., 2004) have prompted the Jamestown S'Klallam Tribe to question whether IFIM recommendations adequately considered side channel flows or flows needed in early August, and the Tribe has requested further analysis by the Washington Department of Ecology. Additionally, the Tribe and Ecology have discussed the levels needed for channel-forming flows.

Figure 4-1 summarizes the mean half-monthly flows of the Dungeness River, the recommendations of the IFIM study, flow levels that would be achieved following full implementation of the draft CIDMP in an average year scenario, and the flows necessary for side channel flow and channel formation.

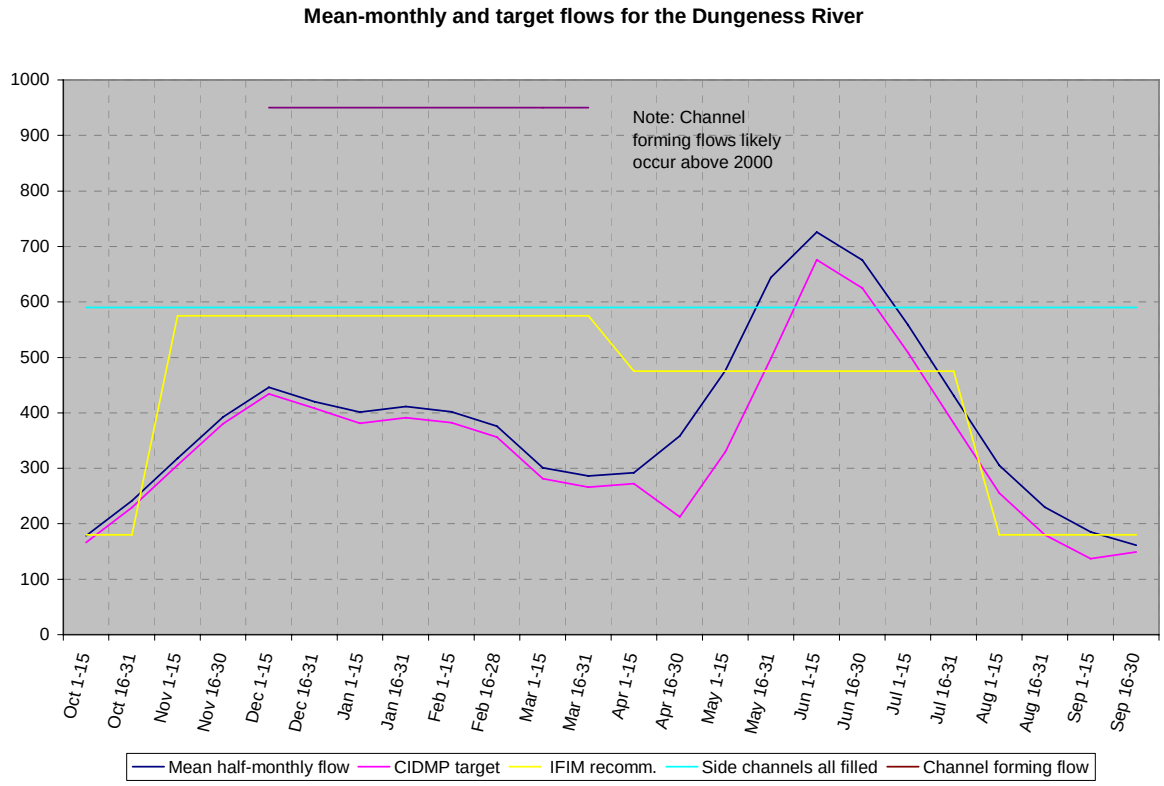


Figure 4-1: Dungeness River mean half-monthly flows, recommended IFIM instream flows, and additional target flows. (Sources: USGS gage data; Hiss and Wampler, 1993; Daraio, 2004; HDR, 2006 CIDMP).

Table 4-6: Recommended Instream Flow Levels for Dungeness Planning Area streams (Entrix, 2005) (Dungeness River based on IFIM (Hiss and Wampler, 1993); other creeks on Toe-width (Hiss, 1993)

Stream	Toe-width (ft) & location	Spawning and rearing flows (cfs)	Instream Flow Recommendations by Month (cfs)											
			J	F	M	A	M	J	J	A	S	O	N	D
Cassalery	5.7 Woodcock	Coho spawn 5 Steel spawn 12 Steel rear 2	5	3	12	12	8	8	2	2	2	2	5	5
Dungeness River	IFIM	combined	575	575	575	475	475	475	475	180	180	180	575	575
Gierin	9.1 at Holland Rd	Coho spawn 10 Steel spawn 20 Steel rear 4	10	7	20	20	13	13	4	4	4	4	10	10
Matriotti	11.8 at Lamar Lane	Coho spawn 14 Steel spawn 27 Chum spawn 29 Steel rear 5	14	10	27	27	18	18	5	5	5	5	13	13
McDonald	24.3 at Old Oly Hwy	Coho spawn 36 Steel spawn 63 Chum spawn 71 Steel rear 15	36	24	63	63	42	42	15	15	15	15	36	36
Meadowbrook	10.8 at Seq-Dunge Way	Coho spawn 12 Steel spawn 24 Chum spawn 26 Steel rear 5	12	8	24	24	16	16	5	5	5	5	12	12
Siebert	24.5 at Old Oly Hwy	Coho spawn 36 Steel spawn 63 Chum spawn 72 Steel rear 15	36	24	63	63	42	42	15	15	15	15	36	36

4.2.3 Salmon Recovery Goals and Planning Targets

Four species of salmonids in the Dungeness watershed are listed as threatened under the Endangered Species Act: Puget Sound Chinook salmon, Strait of Juan de Fuca/Hood Canal summer chum salmon, Puget Sound steelhead, and bull trout. The early and late-timed stocks of Dungeness River pink salmon are considered to be depressed and critical respectively in the State's 1993 Salmon and Steelhead Stock Inventory. The Jamestown S'Klallam Tribe and Clallam County, on behalf of the Dungeness River Management Team, submitted a Dungeness Salmon Recovery Notebook for the Puget Sound Salmon Recovery Plan (Shared Strategy, 2005) describing limiting factors, the watershed strategy for salmon recovery, recovery targets and cost estimates. Abundance and productivity targets for threatened Chinook salmon populations in Puget Sound have been developed by federal, state and tribal fisheries biologists and

endorsed by the Dungeness River Management Team. Planning targets are based on the four viable salmon population characteristics: abundance, productivity, diversity and spatial structure. The Ecosystem Diagnosis and Treatment (EDT) method (Mobrand Biometrics, Inc., 1996) was used to model the parameters for recovery of Puget Sound Chinook populations.

Table 4-7: Dungeness Chinook Escapement Planning Targets in Comparison With Mean Escapement 1987-2001 (Jamestown S'Klallam Tribe, 2003)

Escapement Planning Targets with Productivity in Parentheses		Mean Escapement (1987 - 2001)
4,700 (1.0*)	1,200 (3.0*)	123

**Note: Productivity is expressed as adults produced per spawner.*

The planning targets indicate a range of escapement and the associated productivities (or adult returns per spawner) that would constitute recovery. The range is needed to show that abundance and productivity are related, and even under recovery conditions, will tend to vary inversely (the productivity declines when the abundance increases and vice versa). Thus, the range of related target escapements and productivities shown represents the recovery goals.

Less information was available for bull trout recovery planning; however, USFWS developed abundance targets for each core recovery area on the Olympic Peninsula based on two factors. *"The first factor was the minimum number of adult spawners in a core area needed to avoid the deleterious effects from genetic drift. The team selected the high value of 1,000 spawning adults from the suggested range of 500 to 1,000 spawning adults. In addition, the amount of available suitable habitat was also considered. The recovered abundance level for Dungeness core area was determined to be at least 1,000 adult spawners. The recovery team emphasized that a more precise estimate of recovered abundance will be possible following availability of additional current abundance information. The second factor considered in developing recovered abundance targets was the size of local populations needed to address inbreeding concerns. Based on the guidance presented above, the Olympic Peninsula Recovery Team chose to base local population abundance on the higher value of the 50 to 100 spawners needed to avoid inbreeding depression."* (USFWS, 2004)

Quantitative goals for summer chum and steelhead in the Dungeness River and adjacent drainages remain to be developed, as population levels for these species are largely unknown. Pink salmon in the Dungeness are not Federally listed as threatened, as they are part of the larger Puget Sound pink salmon grouping, and quantitative goals have not been developed.

4.2.4 Shellfish harvest/human consumption goals

In December, 2006 the Puget Sound Partnership released goals for a healthy ecosystem in Puget Sound. This government - private sector task force, led by William Ruckelshaus, Billy Frank Jr., and Jay Manning, indicated that a primary goal for a healthy Puget Sound is that, *"Fish and shellfish are plentiful and safe*

for people to eat." Although it is difficult to translate this overarching goal into quantitative terms, the Clean Water Strategy for Dungeness Bay includes a goal to re-open all closed shellfish beds for commercial, subsistence and recreational harvest. Clallam County Department of Health and Washington DOH are responsible for preventing human illness from unsafe consumption of shellfish. The Tribe is equally concerned about the safety of shellfish for its harvesters and consumers, but has not to date conducted a shellfish consumption study for Dungeness Bay. When needed the EPA standard for tribal shellfish consumption of 54 grams per day is used as a goal.

4.2.5 Land Management Goals

Land management goals for Tribal properties are determined by the Comprehensive Plan and annual work plans for each Tribal department. State and local governments follow standards established by statute; Clallam County has standards for buffer widths, wetlands protection and other protective measures in the Critical Areas Ordinance. Federal and State forest lands are subject to standards in the Federal Forest Plan, WA Forest and Fish Act and relevant Habitat Conservation Plans. Due to an increase in Tribal trust land where development is proposed, the Tribe will be developing its own environmental standards for trust lands, where local and state jurisdiction does not apply. In general the Tribe mimics local and state land management standards, and meets all the requirements of the National Environmental Program Act (NEPA).

5. Non-Point Source Management Measures

5.0 Introduction

Management measures that address NPS causes and sources in the Dungeness watershed and the Siebert, and McDonald sub-watersheds, are specified in a wide range of plans that have been prepared by federal, tribal, state and local governments in partnership with involved citizens and private organizations. Each of these plans contains measures that will assist in protecting and restoring tribal reservation waters. In this section, the key initiatives that address non-point source pollution and other regional watershed issues are organized around the Tribal goal areas:

- **Water quality clean-up plans for marine waters and fresh waters,** including the Clean Water Strategy and Detailed Implementation Plan for addressing bacteria pollution in Dungeness Bay and Watershed, associated TMDL analyses, and a targeted watershed initiative project ;
- **Water conservation plans** targeting the recovery of instream flows to levels that will protect and enhance stream temperature and salmon productivity;
- **Salmon recovery action plans** to protect and restore habitat and critical stocks. These have been developed locally and submitted as part of the regional recovery plans for Puget Sound salmon and bull trout;
- **Regional land and watershed management plans** including the 2005 WRIA 18 watershed plan, applicable portions of the Federal Northwest Forest Plan, and other regulations and best management practices to promote stewardship on federal, state and private lands;
- **Property-specific Tribal plans** for land and water management;
- **Environmental education,** which is described in Section 6.

The solutions to NPS problems, like the problems themselves, are highly integrated, thus each discrete NPS pollutant sub-category is addressed in a number of plans. Table 5-1 provides a summary of the NPS categories and sub-categories, and the key plan documents describing measures to address each pollutant source.

NPS management measures are designed to meet goals such as providing opportunity for the safe harvest of shellfish for subsistence, ceremonial, and commercial use. Shellfish harvest is a high-participation activity for tribal families.

Table 5-1: Summary of Management Measures by NPS Categories/Sub-Categories

NPS Category	Sub-category	Key Planning & Management Documents	Description of Measures
Forestry	Harvest & Residue Management	Federal Forest Plan; USFS Watershed Analysis; USFS Sedimentation Analysis; WDNR HCP, WA Forest Practices	Federal Lands: Supplement to Watershed Analysis contains a Watershed Improvement Needs (WIN) inventory of measures to address sedimentation from erosion and road maintenance, and road decommissioning.
	Road Construction & Maintenance		State and Private Lands: Harvest Mgt measures subject to Habitat Conservation Plans, regulations of the WA Forest Practices Board, and the Washington Timber Fish and Wildlife Agreement.
Agriculture	Irrigated Crop Production	CCD Best Management Practices; Clean Water Strategy DIP Clallam County Critical Areas Ordinance, CIDMP	Clallam Conservation District (CCD) annual operation plan for outreach and implementation of best management practices for pasture management and animal operations. Irrigation ditch water quality improvements; bacterial source identification. Clallam County Critical Areas Ordinance for stream buffers. CIDMP includes pollutant reduction measure for irrigation system.
	Animal Operations		
	Aquaculture		Aquaculture practices relating to water quality are regulated by WA Dept of Health, the National Shellfish Sanitation Program, and Tribal ordinances.
Hydromodification & Habitat Alteration (freshwater, estuarine, and marine waters)	Flow Regulation & Modification	CIDMP, Water Conservation Plan, WRIA 18 Watershed Plan, Dungeness R. Comprehensive Flood Control Plan	CIDMP and Conservation Plan specify water conservation measures including irrigation ditch tight-lining, regulating reservoirs, efficient management, drought response. WRIA 18 plan provides water budget for entire region and comprehensive water use management recommendations.
	Groundwater Withdrawal	Sequim-Dungeness Groundwater Protection Strategy; WRIA 18 Plan	Recommendations include: additional study and modeling of groundwater resources, measurement of groundwater use, conservation measures, wellhead protection, increased reliance on community drinking water systems.
	Channel Modification	Puget Sound Chinook Plan--Dungeness Salmon Recovery Notebook and supporting documents*, Flood Plan	Measures to improve channel function and riparian productivity via constriction abatement (dike removal & setback), conservation easements, flood plain restoration, LWD placement, replacement of shoreline armoring, etc. Comp flood plan updated to coordinate with salmon habitat.
	Estuary/Nearshore/Marine	Clean Water Strategy; DIP; Salmon Recovery Notebook	Flood plain restoration; upland sediment source controls; purchase of saltmarsh habitat and conservation easements; removal of tidal constrictions and restoration of estuarine marsh; removal of shoreline armoring, removal of creosote and tire structures, trend analysis of circulation.
Marinas & Recreational Boating	Vessel discharge and shoreline dredging	Dungeness Watershed Area Mgt Plan	County shorelines mgt measures; info & outreach to vessel owners; pump-out stations.

Roads, Highways & Bridges	Construction		Dungeness Salmon Recovery Notebook and supporting docs*, Comp. Flood Plan		Recommendations regarding bridge placement and channel function, bridge lengthening or removal, construction monitoring.
	Runoff		Sequim-Dungeness Groundwater Protection Strategy; WRIA 18 Plan		Research on contaminants in streams and groundwater; waste disposal; use of LID measures to treat runoff
Urbanization	Municipal & Residential Development		Sequim & Clallam Comp Plans; WRIA 18 Plan; Tribal Comp Plan		Designation of critical areas, and areas for forest and agricultural land retention; City and County ordinances; development of Tribal ordinances.
	Wastewater Treatment		City of Sequim Wastewater Re-use Plan; Clean Water Strategy DIP		Waste water reuse; County septics O&M program (septic installation and inspection, identification of septics of concern and remediation, landowner education), construction of community wastewater systems.
	Golf Courses		DQ Plan, WRIA 18 plan		Recommended development of BMPs for golf course design and operation related to water quality and quantity.
	Impervious Surfaces & Stormwater Runoff		Clean Water Strategy DIP, WRIA 18 Plan,		Recommendations for use of low impact development techniques; adoption of a County stormwater ordinance; use of updated state stormwater manual.
	Landowner Mgt.		Clean Water Strategy DIP, WRIA 18 Plan		Outreach and technical assistance to individual landowners by CCD and Tribe; short courses at River Center
	Domestic Pet Waste		Clean Water Strategy DIP		Public outreach and education program, installation of pet waste stations, signage.
Wetland- Riparian (including freshwater, estuarine, and marine shorelines)	Wetlands		Clallam Critical Areas Component of Comp Plan		Maintain wetland inventory and regulatory protection.
	Riparian Vegetation		Recommended Land Protection Strategies; County noxious weed mgt plan; Dungeness Salmon Recovery Notebook		Recommendations for re-vegetation of shoreline and flood plain areas; removal of invasive species; outreach and technical assistance to individual landowners, short courses at River Center. Compliance with US Army Corps of Engineers maintenance requirements for COE dikes.
	Drainage & Fill		Draft stage		Adoption of Clearing and Grading Ordinance by Clallam Co
	Estuarine/nearshore/Marine		Clallam Critical Areas Component of Comp Plan		Shoreline protection; soft armoring; recommendations for re-vegetation of shoreline; public outreach and technical assistance to individual landowners, short courses at River Center.
			Northwest Straits Commission/Clallam County Marine Resource Committee		Marine debris removal; removal of creosote logs and structures; public outreach on nearshore functions and water quality
Other	Wildlife		Clean Water Strategy DIP		Source identification of wildlife contribution to fecal coliform loading; public outreach on feeding of wildlife.

* The Dungeness Salmon Recovery Notebook is a supplemental chapter of the Puget Sound Salmon Recovery Plan approved by NMFS. Supporting documents to the Dungeness Salmon Recovery Notebook include WRIA 18 Limiting Factors Analysis (WCC), Recommended Restoration Projects (DRRWG), Recommended Land Protection Strategies (DRRWG), BOR channel analysis; Restoring the Dungeness (JST)

5.1 Water Quality Clean-up Plans to Protect and Restore Marine and Fresh Waters of Dungeness Bay and the Dungeness Watershed

The Sequim-Dungeness Clean Water District was formed by the Board of Clallam County Commissioners in 2001 in response to water quality violations of federal and state bacterial standards in the lower Dungeness River, the Matriotti Creek tributary, adjacent creeks, and Dungeness Bay affecting shellfish harvest. A Clean Water Strategy and Detailed Implementation Plan (DIP) were developed by the Clean Water Work Group, comprised of the US Fish and Wildlife Service, Jamestown S'Klallam Tribe, Washington Departments of Ecology and Health, Puget Sound Action Team, Clallam County, Clallam Conservation District, the Sequim-Dungeness Agricultural Water Users Association and private citizens. They were published by the Washington Department of Ecology to implement the twoTMDL studies of the lower watershed and Dungeness Bay. Actions of the work group are coordinated with the Dungeness River Management Team, and the work group serves as the DRMT water quality sub-committee, as well as reporting to the Clallam County Board of Health.

GOALS OF THE CLEAN WATER STRATEGY:

- *To protect public health.*
- *To identify and correct sources of bacterial contamination associated with human activities in order to restore and maintain water quality in the freshwater ditches, streams and river; and in marine waters within Dungeness Bay.*
- *To re-open closed shellfish beds to continue to harvest shellfish for commercial, subsistence and recreational purposes and to protect habitat for shellfish and other wildlife species.*
- *To encourage water clean-up actions through public outreach that emphasized innovative ways to reach new audiences and energizes existing audiences to reduce pollution in the watershed.*

(Streeter and Hemplemen, 2004)

The Clean Water Strategy and DIP contain an action plan specifying recommended actions, priorities, status, agency roles and responsibilities and cost estimates. The approach includes continued investigation of pollution sources, on-site septic investigation and outreach, on-site septic system repair and replacement, farm planning with the use of best management practices, stormwater management, proper disposal of pet waste, modification of irrigation ditches to promote water conservation/quality, and overall outreach and education in the region. These are summarized in table 5-2 below; more information is contained in the Strategy/DIP.

A dye test reveals raw sewage flowing directly from the house to a stormwater drain discharging into marine water. In October, 2006 Clallam County reported that 149 site visits had resulted in 49 inspections by local designers, and 25 repairs. Six of the County inspections revealed direct discharge into surface water.

Table 5-2: SUMMARY OF NPS MANAGEMENT MEASURES IN THE CLEAN WATER STRATEGY AND DETAILED IMPLEMENTATION PLAN (adapted from Streeter and Hempleman, 2004)	
General Strategies	***Identified Actions***
Strategies to Address Human Waste	
Expansion of septics operation and maintenance programs	Assessment and monitoring
	Inspect septics of concern
	Followup repair, replacement
Purchase of land and conservation easements in sensitive areas.	River's End area targeted for restoration due to septic failures and critical salmon habitat.
	Land/easement purchase, building demolition, septic removal.
Conversion to community systems where appropriate	Identified areas are 3 Crabs Road, Golden Sands Development, Carlsborg
	Feasibility, design, implementation
Landowner Education	Septics 101 class on basic septic system maintenance.
	School water quality curriculum
	Talks and displays at River Center, displays at area festivals and events
Stormwater Management	
Sub-area plans for stormwater management	Focus areas are Marine Drive, 3 Crabs Area
	Restoration of hydrological function in Meadowbrook Creek
	Capital facilities, retrofits, standards for new development, and basic BMPs based on soil characteristics, topography, and development patterns.
Low Impact Development	CCD stormwater management manual for small-scale development (rural residential) in progress. The manual includes a series of pre-engineered stormwater management practices for builders, developers and citizens which can be installed without the aid of an engineer.
	The North Peninsula Builders Association has developed a Built Green Checklist
	Landowner education.
Agriculture and livestock waste	
Treatment of irrigation ditch tailwaters	Pilot projects completed, biofiltration, constructed wetlands. Marine Drive specifically identified for treatment.
Ditch piping	Reduction of bacterial contamination through piping of open ditches, based on priorities identified in CCD monitoring
Individual conservation plans and BMPs	CCD activities based on 2006 farm inventory.
Outreach and education	Workshops and presentations
	Brochures such as "Living on a Ditch"
	web page information
Enforcement	WA Dept of Ecology per MOU with Clallam County and Clallam Conservation District

Domestic animals and pet waste	
Public outreach	Waste disposal information via brochures, advertisements and presentations; signage
Installation of pet waste stations	Areas of high pet use adjacent to surface waters
Cleanup	Coordination of volunteer cleanup crews
Regulatory and Policy Approaches	
Stormwater ordinance or designation of stormwater sensitive areas	Revisions to draft; proceed to adoption (Clallam County)
Critical Areas	Update maps and regulatory constraints per Federal ESA listings and WA Legislature action
Review development regulations	Encourage use of LID, remove disincentives.
Establish Tribal regulations	Adopt ordinances to regulate activities on Tribal reservation/trust lands
Research and Monitoring	
Freshwater	Develop overall freshwater monitoring for wet season/storm events for streams, ditches
	Continued fresh water monitoring
	BMP effectiveness monitoring
	Data analysis of monitoring
	Microbial source identification
	Streamkeeper voluntary monitoring program
Marine and estuarine areas	Continued marine monitoring
	Beach and Beachwatcher voluntary monitoring programs
	Microbial source identification
	Additional research on Dungeness Bay (basic ecological studies, nutrients, circulation, fecal coliform assessment in water and sediment, wildlife usage)
	Feasibility for remediation of Meadowbrook/Cooper/Matriotti/Gierin creek estuaries
	Marine shoreline soft armoring techniques
General	Analysis of impervious surfaces
	GIS analysis, map fecal nutrient and temporal trends
Education and Outreach	
General outreach	Public workshops
	Newspaper reports
	Continuation of school age water quality classes and field trips
	Displays and activities in booths, fairs and festivals
	Permanent displays at River Center
	Web pages at Tribe and River Center

Some implementation actions have occurred in each of the strategies outlined above, but major areas remain unfunded. Previous funding from the EPA under the 319 program has enabled the Tribe to conduct marine and fresh water studies, participate in the development of the Clean Water Strategy/DIP, provide targeted public education, and implement water quality improvement projects on Tribal lands. From 2004-8 the Jamestown S'Klallam Tribe, Battelle Marine Science Laboratory, Clallam County, and the Clallam Conservation District have been carrying out the scope of work under an EPA-funded Targeted Watershed Initiative. Key elements of the project include:

- a Microbial Source Tracking study (MST), to more precisely define pollutant sources;
- innovative Best Management Practice (BMP) demonstrations (and market-based incentives for BMP implementation) related to water quality treatment, stormwater management, and septic maintenance; and
- an Effectiveness Study, to compare cost/benefit and effectiveness of the MST Study and BMP demonstrations
- Public outreach and education

Information about water quality protection measures for the Dungeness irrigation system are closely linked to water conservation, and are described in the following section.

5.2 Water Conservation

Most of the water rights to the Dungeness River are appurtenant to lands that have been under irrigated agriculture for over a century (table 5-3) and agriculture remains the largest consumptive water use in the Sequim-Dungeness valley. The Sequim-Dungeness Agricultural Water Users Association made a voluntary commitment to water conservation in the 1994 Dungeness-Quilcene Plan in order to improve instream flows for salmon populations. The water users have invested substantial amounts of time, financial resources, and effort toward the implementation of this commitment, and considerable reductions in diversions have occurred. In 1976, irrigation withdrawals were measured at 120 cubic feet per second (cfs) averaging 40% of the flow of the Dungeness River over the irrigation season. In 2000, average seasonal irrigation withdrawals were 52 cfs (13% of flow) (Foster-Wheeler, 2003). Additionally, the water users have worked closely with the Clallam Conservation District to improve conveyance and treatment of ditch tailwaters to minimize the discharge of pollutants into surface water bodies.

Table 5-3: Water Rights and Claims on the Dungeness River in cfs
(preliminary, based on Trust Water Rights MOU)
(table adapted from Entrix, 2005)

Dungeness River Agricultural Water Users	156.00
Other as decreed in 1924 adjudication (treated as relinquished in TWR MOU)	8.84
WDFW Fish Propagation (non-consumptive)	40.00
City of Sequim	1.40
Others	0.01
Water Claims	1.90
Total	**208.15**

Two major plans delineate specific management measures for irrigation water: the 1999 Comprehensive Water Conservation Plan (Montgomery) and the 2006nComprehensive Irrigation District Management Plan (HDR). The Water Conservation Plan was the subject of a contested Declaration of No Significant Impact and Final Environmental Impact Statement in 2003 under the WA State Environmental Policy Act. The suit arose due to controversy over the artificial enhancement of shallow aquifer ground water and small-stream flow due to irrigation conveyance system losses (Foster-Wheeler). Although the Water Conservation Plan was in and of itself a mitigation plan to minimize the impacts to threatened salmonids of continued diversion of Dungeness River water private landowners representing Graysmarsh LLC filed suit in state court requesting “mitigation” for the loss of artificial recharge to Gierin Creek and associated wetlands. This issue remains pending in court, and is the subject of additional study and discussions between the Water Users Association, Department of Ecology, and Graysmarsh LLC. The Jamestown S’Klallam Tribe has commented repeatedly to the Department of Ecology that the Tribe considers the continued delay in implementing the Water Conservation Plan to be impacting threatened species of salmon, since ongoing ditch leakage results in additional withdrawal of river water. A solution to this legal barrier to water conservation is needed.

The 2005 CIDMP was prepared in an effort to bring the management of the Dungeness irrigation system into compliance with both the Federal Endangered Species Act and the Federal Clean Water Act. The CIDMP document reviews impacts to salmonids and water quality in more depth than the earlier Conservation Plan, including suggested target flows and maximum withdrawal levels bi-weekly under different flow scenarios. The CIDMP also reviewed the structure of existing diversion facilities and their potential to harm salmonids species or impair water quality. Many of the management measures, such as piping open ditches, implementing tailwater reductions and treatments, and minimizing surface water withdrawals will improve both water quality and quantity throughout the irrigation system.

Management measures for the irrigation system are both structural (e.g., reducing ditch leakage, seepage losses and conveyance of pollutants through piping) and non-structural (e.g., measurement, efficiency, and drought response).

5.2.1 Non-structural water management recommendations for irrigation:

The Water Conservation Plan proposes a series of connected actions to improve the efficiency of the irrigation water delivery system in order to reduce diversions from the river, particularly during low flow periods:

- Improvements in measurement, gauging, and flow control can identify areas of continuing conveyance loss and inefficient use, providing data to target education or structural remedies.
- Maintenance of open ditches is designed to reduce conveyance loss from evapo-transpiration from vegetation in and encroaching on ditches.
- A Drought Response Plan has been prepared and allows for efficient and prioritized response to exceptionally dry conditions to meet mandated and target flow levels.

A telemetered weir on an irrigation ditch provides real-time data on Dungeness water withdrawals.

- Education and outreach to ditch users disseminated by ditch walkers and written publications available through the County and Conservation District.

5.2.2 Structural improvements to the irrigation system

Structural improvements to irrigation facilities for water conservation include:

- Replacing existing open ditches with pipelines to reduce seepage loss and prevent pollutants from entering the system (113 projects).
- Combining canal systems to reduce seepage loss (3 projects)
- Abandoning reaches of existing canal and replacing the water supply with ground water (1 project)
- Constructing re-regulating reservoirs either on-farm or in-line to reduce diversions and the amount of unused water that is discharged as tailwater (16 to 20 projects)
- Elimination of tailwater
- Investigating the use of treated wastewater from the City of Sequim as an alternative source of irrigation in specific locations.

Most of the projects are open ditch replacement with a total of 104,000 feet of pipe. An estimated 30.2 cfs of diversions would be eliminated from the Dungeness River if ditch piping were fully implemented. Total water savings from all structural measures combined was estimated at 38.4 cfs. Specific projects for each irrigation district, location, estimated water savings and engineering are located in the Conservation Plan.

While water savings and pollutant reductions from any single project will vary based on site conditions, a current demonstration piping project in the Carlsborg area to reroute and replace 30,000 feet of open ditch with 20,000 feet of buried pipeline is estimated to save 3.25 cubic feet per second of water (approximately twice the volume used by the City of Sequim) and prevent a geometric mean bacteria load of 36 fc/100mL from reaching the River.

5.2.3 Measures to reduce pollutant loading in the irrigation system

The CIDMP includes a list of pollutants associated with the irrigation system and the source of activity, along with management measures to address these parameters. These are summarized in Table 5-4:

Table 5-4: Potential Pollutant Loading Sources, Activities, and Management Measures Described in the Comprehensive Irrigation District Management Plan (HDR, 2006)

Pollutant Type	Irrigation-related activities	Management Measures
Fecal Coliform Pesticides Oil, grease and fuel Turbidity/sedimentation Temperature Nutrients	• Animal waste and fertilizers applied to fields, access to water bodies • Ditch maintenance with pesticides • Ditch maintenance with heavy equipment, ditches near roads • Maintenance of facilities, including high spring diversions • Water diversions • Tailwater returns • Loss of vegetation along ditches resulting in temperature elevation	• Conversion of open ditches to closed pipes • Integrated pest mgt plan, responsible herbicide use • Inspect and clean heavy equipment prior to use • Utilize refueling buffers • Perform maintenance during seasons when ditches are dry, where possible • Construct artificial wetlands for tailwater discharge • Educate property owners about conservation, pesticides • Animal exclusion fencing • Prohibit stormwater discharge to irrigation system

5.2.4 Regional Water Conservation Strategies

Water conservation measures for municipal and residential use are included in the recommendations of the 2005 WRIA 18 Water Resource Plan (Entrix) and emphasize efficiency and incentives for conservation. Principal recommendations for conservation include:

- Public education, both seasonal and on-going
- Regional water planning for all group water purveyors with conservation and efficiency strategies
- Improved measurement of water use
- Incorporation of efficiency into regional building codes, encouraging efficient appliances and materials
- Water shortage response planning
- Seasonal conservation
- Group A water system plans
- Water audits and leak detection monitoring
- Rates, rebates and incentives
- Efficient landscaping and design

5.2.5 Aquifer Storage and Recharge

Water conservation recommendations in the WRIA 18 Plan are largely dependent upon the use of groundwater for future water supply in the Sequim-

Dungeness area. However, groundwater is in hydraulic continuity with surface flows of the Dungeness River -- an over-appropriated system. State water law and concerns over the impact to instream flow for threatened species of salmon generally preclude the issuance of water rights for community groundwater systems, leading to a proliferation of single exempt wells. The wells are also in hydraulic continuity, but are exempt from the requirement to obtain a water right. To address this problem, the Department of Ecology and Clallam County are conducting feasibility studies for aquifer storage and recharge (ASR) in 2007-8. The purpose of the study is to determine whether seasonal flows in excess of instream flow needs for fisheries can be "spilled" through the irrigation system or other means to recharge the regional aquifer. The water stored in the aquifer would potentially be available for future water supply, encouraging the use of group water systems. ASR as a water management measure remains in the early stages of analysis in the Dungeness watershed and state-wide.

5.2.5 Wastewater reuse

The reuse of reclaimed wastewater was extensively studied by the City of Sequim and the city began implementing Class A treatment and re-use in 1998 (Gray and Osborne, 2003). The City uses its reclaimed water for irrigation, vehicle washing and other uses which otherwise would have come from groundwater in hydrologic continuity with surface water, or from direct withdrawal from the Dungeness River. In 2006 Clallam County began a feasibility study for a community wastewater system for the Carlsborg area. A treatment system using membrane filters which produces Class A water is under consideration. It is anticipated that production and use of such re-use of wastewater will become a more common practice in the watershed in future.

5.3 Dungeness Salmon Recovery Planning

The Jamestown S'Klallam Tribe is one of the three S'Klallam tribes that are successors in interest to the Treaty of Point-No-Point in 1855 that reserved the opportunity for hunting, gathering and fishing at usual and accustomed stations in the ceded territory. All three S'Klallam tribes retain treaty fishing rights in the Dungeness, however the Jamestown S'Klallam Tribe has primary tribal management authority of the area under the terms of the Point No Point Treaty Council Compact, and an exclusive harvest area inside Dungeness Bay.

Dwindling runs of Chinook and pink salmon in the Dungeness prompted the Tribe to initiate salmon recovery planning prior to threatened listings under the Endangered Species Act. Several key reports and plans were prepared, including "*Recommended Restoration Projects for the Dungeness River"* known locally as *'the Blue Book"* (Dungeness River Restoration Work Group, 1997), *"Salmon and Steelhead Limiting Factors, WRIA 18"* (Washington Conservation Commission, 1999) and "*Restoring the Dungeness"* (JST, 2003) which largely summarized the overall restoration strategy for the watershed. These documents and supplementary studies were combined into the "*Dungeness Salmon Recovery Notebook" (*JST and Clallam County, 2004; updated 2005) and were submitted to the National Marine Fisheries Service via the Puget Sound Salmon Recovery Plan prepared by Shared Strategy in 2005. Salmon recovery measures expressed in these documents are largely organized around 10 "Pillars of Restoration" developed by the habitat work group and affirmed by the Dungeness River Management Team.

TEN STRATEGIC RESTORATION ELEMENTS FOR THE DUNGENESS RIVER WATERSHED

1. *Restoration of the lower river floodplain and delta to river mile (RM) 2.6*
2. *Protection of existing functional habitat through land purchase*
3. *Floodplain restoration / constriction abatement*
4. *Water conservation / instream flow protection*
5. *Restoration of functional riparian and riverine habitat*
6. *Large woody debris placement*
7. *Nearshore habitat protection and restoration*
8. *Barrier removal*
9. *Stock recovery / rehabilitation*
10. *Sediment management / source control*

From "Restoring the Dungeness: An Overview of the Dungeness River Restoration Strategy" (Jamestown S'Klallam Tribe, 2003)

Associated with each of the ten elements are projects in each reach of the river, scientific studies, and public outreach components. Appendix C contains the detailed project list for Dungeness salmon recovery that was prepared by the Dungeness River Restoration Work Group and ranked by the Dungeness River Management Team. During the preparation of the Dungeness Salmon Recovery Notebook in 2004, the project list was evaluated using the Ecosystem Diagnostic Treatment computer simulation (Mobrand, 2004) to assess the biological importance to Chinook salmon. In 2005, the biological importance factor was further assessed for benefit to bull trout. Top rated projects included water conservation, and restoration of the river mouth/ estuary and lower river floodplain. These priorities also coincide closely with the management measures identified in the Clean Water Strategy. The Dungeness Salmon Recovery Planning Notebook was reviewed in 2004-5 by the Technical Recovery Team (TRT) of scientists appointed by the National Marine Fisheries Service as part of their overall review of the Puget Sound Salmon Recovery Plan. The TRT was in general agreement with the approach taken by Dungeness watershed partners; however they requested further work in integrating habitat recovery with hatchery strategies and harvest management. Hatchery/harvest/habitat integration has been a focus for salmon recovery planning in 2006-7, along with project implementation and monitoring.

Restoration of small "pocket" estuaries in the vicinity of the Dungeness River delta is part of the nearshore habitat protection and restoration strategy for the Dungeness watershed, including Meadowbrook, Casselary, Cooper, and Gierin Creeks. Salmon restoration strategies for Siebert and McDonald and the other Creeks are contained in the regional project list prepared by the North Olympic Peninsula Lead Entity Group for Salmon Recovery (NOPLEG) and the Limiting Factors Analysis for WRIA 18 (WCC). Projects for Siebert and McDonald Creeks

include land protection through acquisition or easement, and restoration of properly functioning riparian conditions through re-vegetation, large woody debris placement, culvert removal or reconfiguration, and removal of bank armoring. Recommendations also include exploring alternatives to the conveyance of irrigation water through McDonald Creek. Additionally, the creeks are being assessed for their salmon productivity through a cooperative smolt trapping project by the Jamestown S'Klallam Tribe and WDFW.

Dungeness Chinook male in the captive broodstock program and WDFW hatchery crew in 2004. (Photo: Chitwood, Jamestown S'Klallam Tribe)

A captive broodstock program for Chinook has been operated by WDFW and the Tribe to boost Chinook production by rearing a cycle of adult salmon in the hatchery and releasing the progeny in the upper watershed where they can imprint on areas where habitat quality is favorable. To monitor the Chinook population recovery, the Tribe and WDFW have also conducted annual surveys of the Chinook redds for the past 12 years to enter the location of the redds into GPS, and create a GIS map layer showing Chinook spawning. Figure 5-1 displays the data for the three most recent years available.

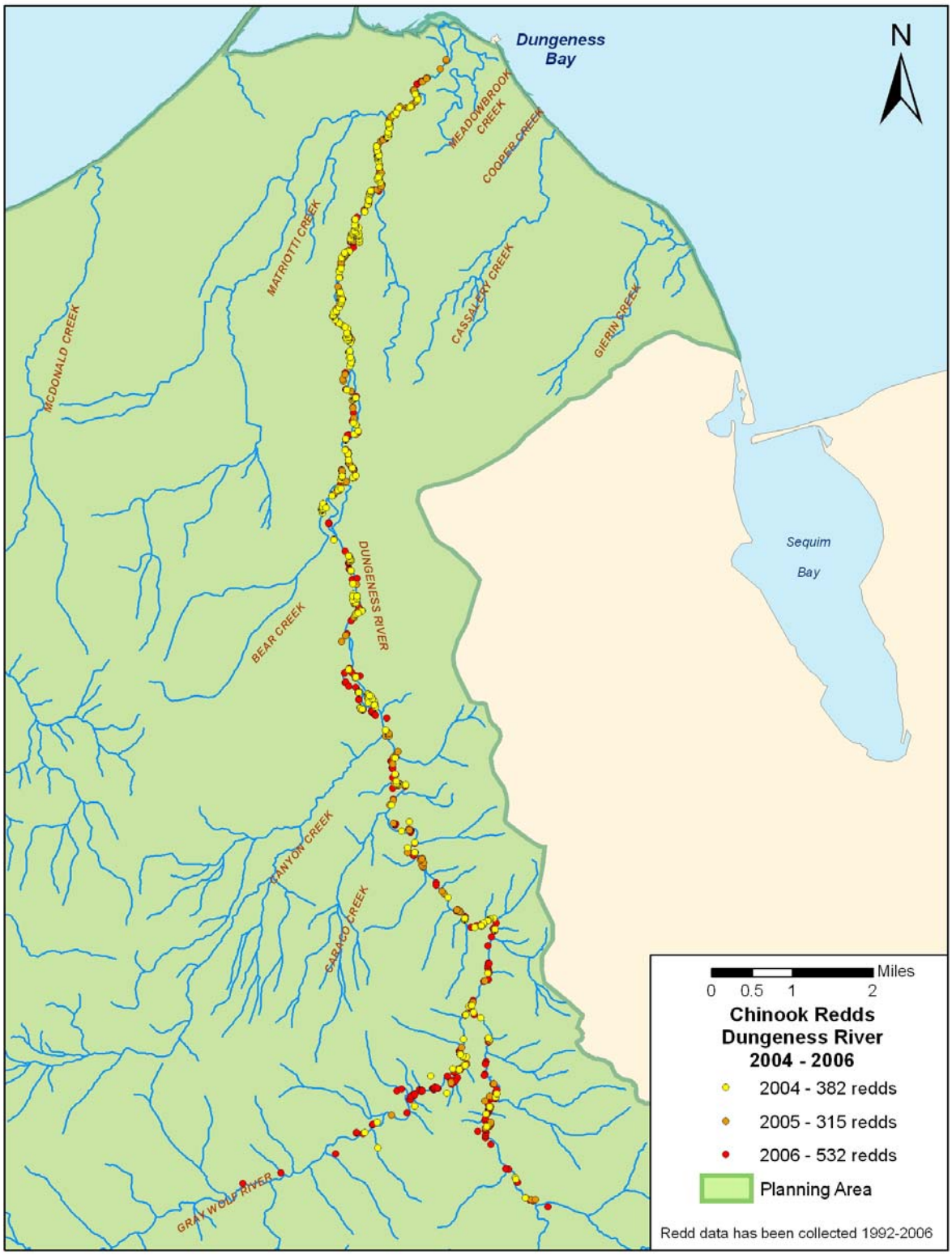


Figure 5-1: Location of Chinook redds 2004-2006

5.4 Regional Land and Water Management Plans & Initiatives

The upper Dungeness watershed is federally owned and managed by the National Park Service and USDA/Forest Service. Mid-elevation or foothills portions of the watershed are largely comprised of a mix of state and private commercial timberlands. Lands north (downstream) of river mile 11 are a mix of small private woodlots, farms, rural residential and urbanizing parcels. Land management strategies to protect and restore regional water bodies have been developed by and for each of these landowner types in the Dungeness area.

5.4.1 Federal Lands in the Upper Watershed:

Portions of the upper watershed, including most of the Gray Wolf River are contained in Olympic National Park. The east fork of the upper Dungeness is largely contained in Olympic National Forest. The Dungeness is a tier 1 key watershed under the Northwest Forest Plan and federal lands are managed to comply with the Aquatic Conservation Strategy of the Forest Plan. The Aquatic Conservation Strategy was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands. Watershed analysis forms one of the four components of this strategy, along with Riparian Reserves, establishment of Key Watersheds, and Watershed Restoration (FEMAT, 1993) (ROD, USDA Forest Service and USDI BLM 1994a). Standards and guidelines for the management of land to protect and enhance habitat for late-successional and old-growth forest-related species are included in the Forest Plan, and supersede management directions contained in the existing *Olympic National Forest Land and Resources Management Plan* (USDA Forest Service 1990) unless the existing plan is more restrictive or provides greater benefit to the species of concern.

A watershed analysis and supplement have been completed for the Dungeness, and a Watershed Improvement Needs inventory contains the management measures to remedy existing deficiencies identified in the forest. These were prioritized by an inter-agency team based on sub-watershed priority and opportunities for aquatic and terrestrial habitat restoration. The full matrix of restoration priorities is contained in the supplement to the Dungeness Watershed Analysis; table 5-5 below shows the restoration opportunities for the Slab Camp Creek sub-watershed as an example. The Forest Service reports that all but two of the high priority road improvement and culvert projects identified on the Watershed Inventory Needs list have been completed in the last 5 years (Hagerty, pers. comm.).

Table 5-5: Key Restoration Opportunities—Slab Camp Creek Subwatershed. (From US Forest Service 2002), Appendix R-1.

Resource area of concern	Altered process (hazard)	Affected habitat parameters	Restoration activity	Benefiting resources
TC channel segments on mainstem Gray Wolf River	Sediment delivery to stream	Spawning and rearing habitat	Stabilization, drainage, and upgrading stream crossings, FS Road 2875000, Segment 171	Aquatic species: ONTS, ONCL, ONKI, ONMYWI, ONMYSU, SACO, ONGO *
MC2 channel segment on tributary to Gray Wolf River	Sediment delivery to stream	Spawning and rearing habitat, channel complexity	Stabilization, drainage, and upgrading stream crossings, FS Road 2875000, Segment 171	Aquatic species: ONCL

***(various species of salmonids)**

5.4.2 State and Commercial Forest Lands

State trust forest lands are managed under the 1992 Forest Resource Plan, the Habitat Conservation Plan covering riparian species, and the State Forest Practices Code. WA Dept. of Natural Resources (WDNR) forest practices follow rules promulgated under the Forest and Fish Act and Timber-Fish-Wildlife (TFW) guidance.

Privately owned forest lands are managed under the WA Forest and Fish Act and updated forest practices rules to address water quality and riparian-dependent species habitat. On a site-specific basis, these rules consider risks associated with hydrologic changes (e.g. peak flows), wetlands, unstable land forms and cumulative timber harvest effects. The updated rules have been adopted as a Programmatic Habitat Conservation Plan under Endangered Species Act provisions and approved by NOAA Fisheries and the US Fish and Wildlife Service. The HCP is a 50-year agreement signed in 2006 which applies to 60,000 miles of Washington streams running through 9.3 million acres of forest land that provide habitat for more than 70 aquatic species, including salmon, many of them threatened or endangered. It covers 13 populations of salmon and steelhead.

Additional recommendations for state and commercial forest lands are included in the WRIA 18 plan to address issues such as:

- Improvement of forest practices to address long-term cumulative effects
- Reduction of impacts to watershed resources when forest lands are converted to residential use
- Reduction of sediment delivery to natural levels to the extent feasible
- Sediment pulses are avoided to prevent impacts to sensitive species and life stages
- Planning for road maintenance and abandonment as part of forest practices

- Off road vehicle use management to protect natural drainage, slopes, water quality and to minimize noise and disturbance of wildlife or habitat
- Need for technical assistance for small forest landowners

5.4.3 Local Land and Water Management Measures

The WRIA 18 plan contains a watershed characterization for the Elwha, Dungeness and independent drainages in east Clallam County along with regional and sub-basin recommendations. These detailed recommendations are organized around eight categories: water quantity, water quality, habitat, instream flows, stormwater, land use and management, education and outreach, and watershed management. Please refer to the Plan for additional information.

Due to the urbanizing nature of eastern Clallam County, a number of specific local measures have recently been emphasized by the Clallam Conservation District, Clallam County, Jamestown S'Klallam Tribe, WDFW and other watershed partners to address stormwater, animal management, yard/landscape management, noxious weed control, and other issues:

- Best management practices for **animal management and individual property management** have been developed by the Clallam Conservation District and the District provides outreach and technical assistance subject to funding. Best management practices for golf course facilities in the Sequim-Dungeness area have not yet been developed.
- **Stormwater management** in eastern Clallam County has been the subject of several activities to try to upgrade present development standards. Although the WA Department of Ecology has developed 2005 standards, Clallam County is currently operating out of the old, outdated Department of Ecology stormwater manual dated 1992. A stormwater ordinance was drafted by the County in 2003 but has not been adopted; additional funding is needed to update the draft and conduct a public review process for adoption. Puget Sound Action Team and Ecology have conducted several workshops on stormwater management and LID and have identified impediments to LID implementation. In 2007, Clallam Conservation District is completing an EPA-funded project to prepare a set of engineered standardized LID designs for small scale development that can be submitted with permit applications and building plans to encourage the use of LID best management practices. Completion of this project is a necessary step in the adoption of an updated county stormwater ordinance. The North Peninsula Builders Association has also developed a Built Green Checklist incorporating LID. Several pilot LID projects have been constructed by the Conservation District and the Tribe. The City of Sequim also has outdated stormwater management standards. A Tribal ordinance addressing stormwater is needed.

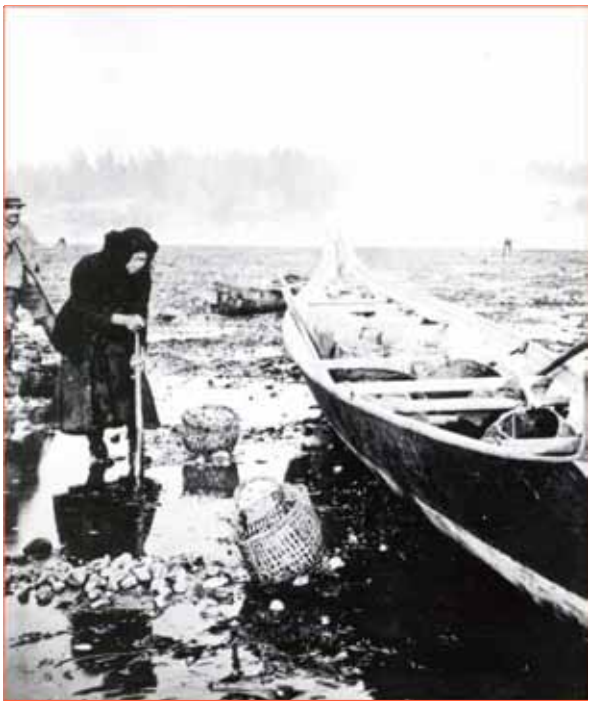
Effective eradication of Japanese knotweed requires labor-intensive injection of individual stems.

Clallam County operates a **Noxious Weed Control** Board to oversee inspection, notification, outreach, and weed removal activities throughout the county. Major invasive species in the Dungeness area include Scotch Broom, Robert's geranium, knotweed and butterfly bush. Knotweed and butterfly bush, which are escaped ornamentals used in landscaping, are particularly difficult to eradicate. A vigorous program has been implemented by the County, Conservation District, Jamestown S'Klallam Tribe and other partners in the last five years in an effort to halt the spread of these species. Eradication is extremely labor intensive and expensive -- knotweed for example is only effectively removed if individual stems are injected with an approved herbicide. Outreach to raise the awareness that butterfly bush is an invasive plant was funded by an EPA grant in 2005, along with a demonstration project to remove approximately 4-6 acres in the Dungeness channel migration zone. Research on the impact of butterfly bush, knotweed, and other alien species to proper successional growth in forested areas remains an unmet need.

Japanese knotweed infestation following treatment.

- **Re-vegetation** using appropriate native species has been proposed throughout the Dungeness watershed area, with an emphasis on riparian zones and other sensitive areas. The Clallam Conservation District and the Tribe provide outreach, technical assistance, and cost share to individual landowners, with good response to outreach in the last two years. Re-vegetation by the Jamestown S'Klallam Tribe in the lower 2.6 miles since 2004 has resulted in replanting 90 acres with a 75% success rate. Another 10 acres is scheduled for planting in 2007-9. The Conservation District operates a native plant sale in the county annually.

5.5 Tribal Land and Water Management



"Long before I was born, my people depended on the Dungeness River for their food, shelter and clothes. In many ways, we still do. This watershed has always been my home."

--- Elaine Grinnell, Tribal Elder

The Jamestown band of S'Klallams were signatories to the Point No Point Treaty in 1855. In order to avoid being sent to a reservation 90 miles away, the Jamestown S'Klallam purchased land near the Dungeness River and settled on it, establishing their own unique community. Their refusal to move to a distant reservation eventually caused the band to lose Federal recognition, which was regained in 1981 following a lengthy petition process. The Tribe then purchased properties on Sequim Bay to create a reservation with an administrative facility and community center that was generally accessible for groups of Tribal citizens who lived in Port Angeles, Sequim, the original Jamestown site on Dungeness Bay, and Port Townsend. Funds limited the amount of land purchased to 11 acres. Since that modest beginning, the Tribe's social, health, economic and natural resource programs, as well as its land-base, have grown significantly. Tribal holdings now exceed 402.94 acres, non-contiguous parcels scattered in numerous watersheds within the Tribe's Usual & Accustomed (U&A) treaty fishing area. These properties have been purchased by the Tribe and converted, piece by piece, into trust land. As of January 1, 2007 a total of 13.48 acres are in Reservation status, 86.70 in Trust status, and the balance are in fee-to-trust or fee-simple status.

The Tribe's ability to properly address water quality impacts and problems is limited by the dispersed nature of the land holdings and the diversity of the numerous watersheds in which they occur. The Tribe has a Water Quality Work Plan which continues to develop the Tribe's administrative and technical capacity to establish an integrated environmental management program for Tribal lands and waters, and to fulfill the requirements of the Clean Water Act, the Endangered Species Act, the Safe Drinking Water Act and other federal statutes. Long term goals are reviewed every five years, in concert with Tribal Comprehensive Plan revisions, and short term goals are reviewed annually, based on progress made on previous goals and newly emergent problems. The Tribe's NPS Assessment and NPS Management Plan were updated in 2003-2004, addressing Tribal NPS management measures across all reservation waters, waters entering reservation waters and non-reservation waters. The NPS plan is closely integrated with the Clean Water Strategy and other plans developed and implemented in conjunction with watershed partners.

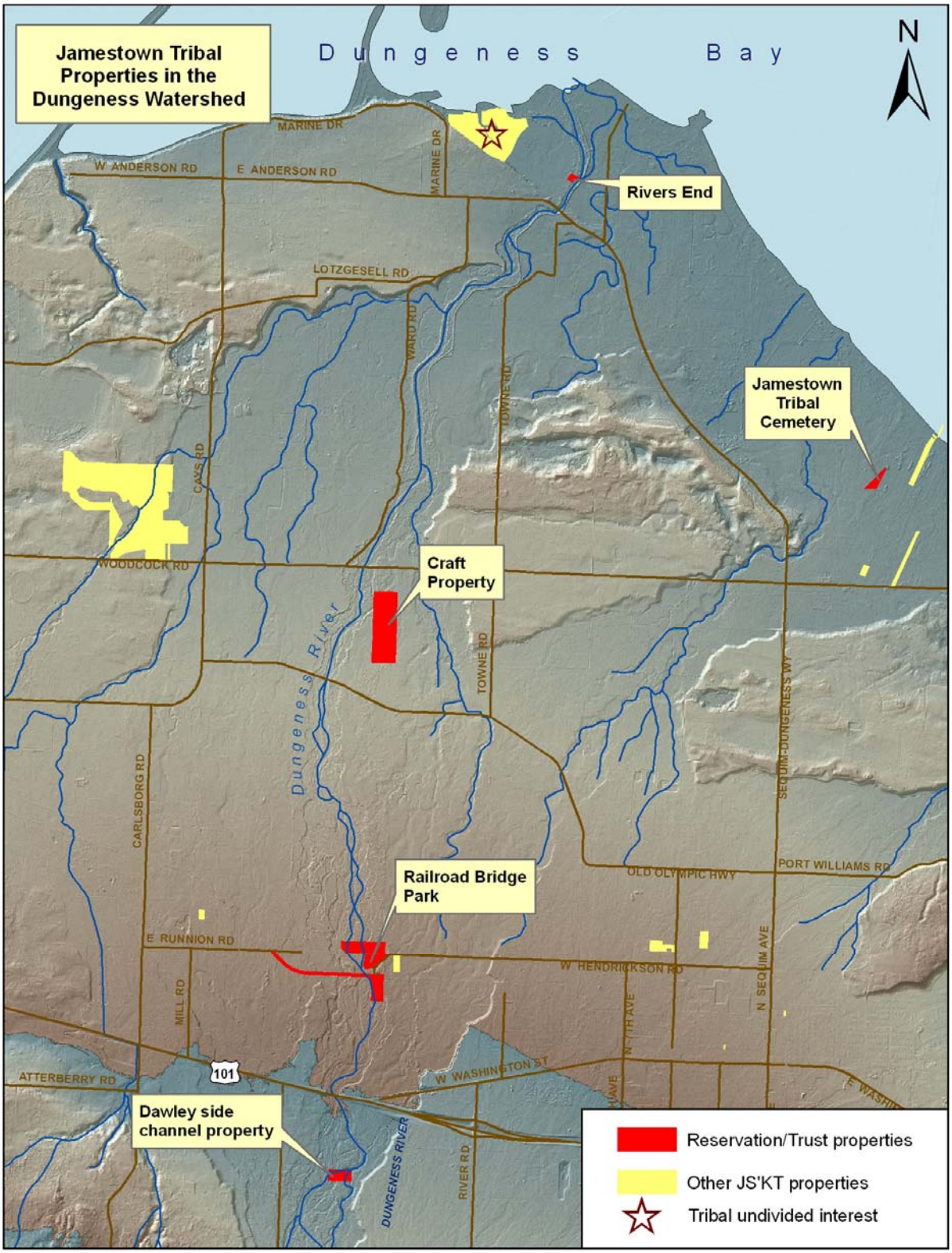


Figure 5-2: Jamestown S'Klallam Tribal properties in the Dungeness Watershed

5.5.1 Tribal Lands and Waters in the Dungeness Watershed Area

Tribal lands and associated waters in the Dungeness area include riparian parcels located at the mouth of the Dungeness River and upstream from Highway 101 which were acquired primarily for habitat protection and restoration; several parcels at RM 5.8 at the Railroad Bridge which is a public park and environmental education center; and other scattered parcels in the watershed (figure 5-2).

- **River's End Road**: Two parcels totaling .95 acre at the Dungeness River mouth were purchased by the Tribe for the protection and restoration of water quality and salmon habitat and are now in trust status. The purchase was made with a private foundation grant matched with funds from the Salmon Recovery Funding Board. They are within the estuarine zone of the Dungeness River/Bay. The parcels also include an undivided interest in another 40.23 acres that are communally owned by shoreline residents on River's End Road and the adjacent shoreline bluffs. Management of this property is part of an active restoration program for the river mouth consisting of dike removal and re-vegetation of saltmarsh/forest habitat for salmon restoration; and demolition of structures, de-commissioning of septic systems and other infrastructure for the protection of water quality.

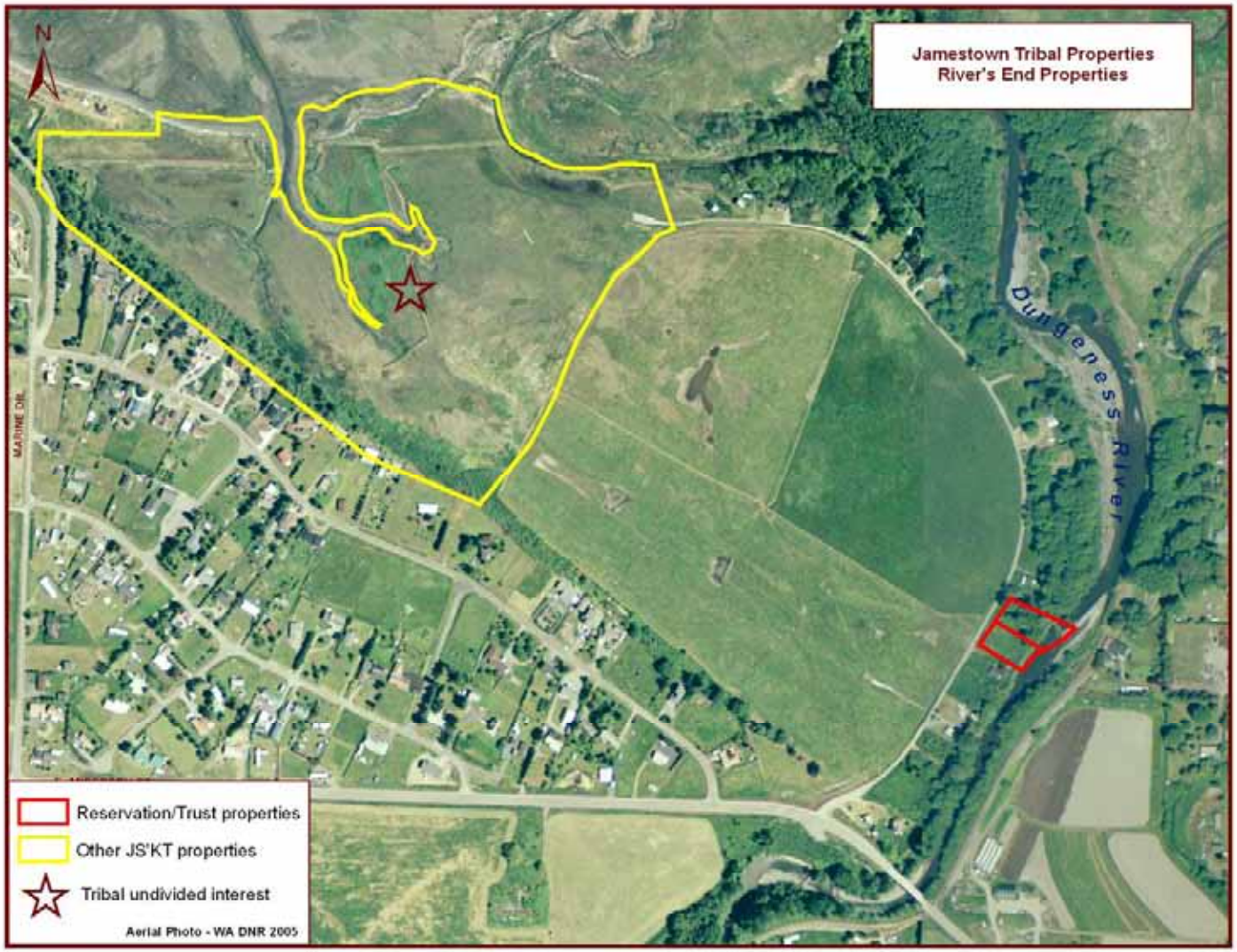


Figure 5-3: Tribal properties at River's End Road

- **Railroad Bridge Park and Dungeness River Audubon Center**: The Tribe assumed ownership of an abandoned railroad right-of-way, bridge, and some adjacent parcels as the governmental sponsor for a grant-funded citizen-led effort to preserve the historic bridge and riparian area. Management of the property, now totaling 26 acres, is focused on habitat protection, maintenance of the Olympic Discovery Trail which passes through the park, and the operation of the Dungeness River Audubon Center for environmental education programs and research. The land is in trust status. The Tribe has worked closely with adjacent landowners, and has made significant efforts to acquire and/or protect the mature riparian forest habitat that abuts the railroad bridge. This section of the river is also the focus of a large tribal salmon habitat restoration program consisting of re-vegetation and placement of large woody debris.

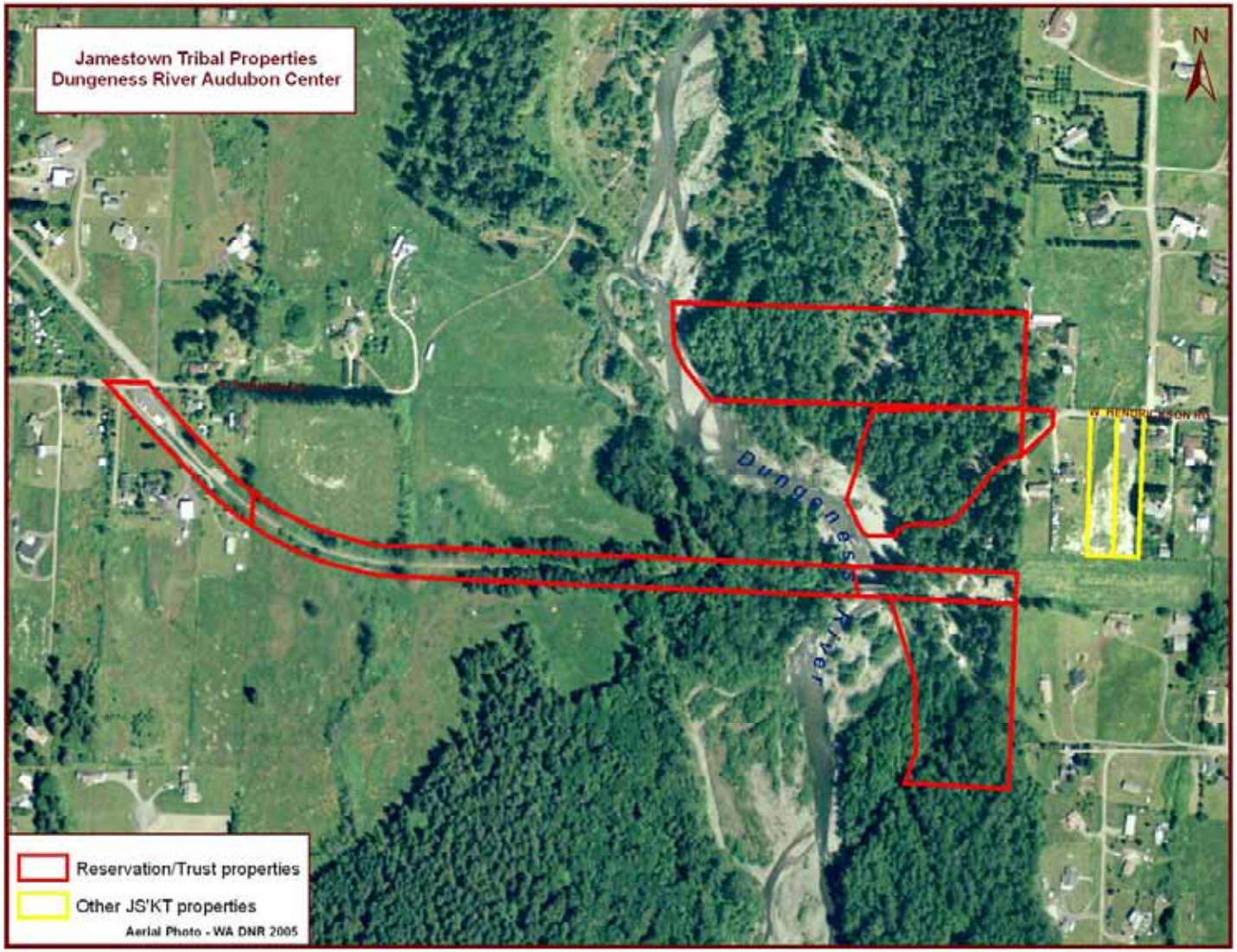


Figure 5-4: Tribal Properties at Railroad Bridge Park and the Dungeness River Audubon Center

- **Other lands acquired for habitat / water quality protection and restoration** include property located upstream from Highway 101 which was purchased by the Tribe and converted to trust status. The property is part of the Dawley side-channel complex in the Dungeness that is a major focus of land acquisition and conservation due to its high ecological value. Juvenile salmonids studies have shown this side channel to be the most productive area in the lower river for pink and Chinook salmon in early life stages, and preservation of water quality in this reach is extremely important.
- **Other tribal trust/reservation lands** in the watershed include the historic tribal cemetery in Jamestown, and the Craft property in the lower Dungeness located close to the River at RM 3.6. These and all other Tribal properties fall under the oversight of the Best Management Practices described in the Tribal NPS Plan.

5.5.2 Property-specific Tribal Land and Water Development Plans

Natural Resources: The Tribe anticipates the acquisition of additional properties or conservation easements (sometimes in conjunction with watershed partners) for the purpose of protecting and restoring habitat and water quality. Acquisition priorities, constraints, prescriptions, and assessed land values for the Dungeness are described in detail in *Recommended Land Protection Strategies for the Dungeness River* (Hals, 2002) developed by the Dungeness River Restoration Work Group. Restoration, re-vegetation and other habitat measures commonly follow acquisition, along with water quality and other monitoring and adaptive management.

Social/Health/Economic Development: Tribal properties for social and health services and economic development have also been purchased at several locations throughout the watershed. While the best management practices in the Tribal NPS documents provide general guidance, management plans specific to these properties to protect water quality will need to be developed. A particular identified need is the recent purchase by the Tribe of the “Cedars at Dungeness” golf course. The Dungeness Quilcene Plan and the WRIA 18 plan recommended the establishment of regional BMPs for golf course operation and maintenance to protect water quality and quantity, but these have not been implemented. Specific BMPs for the Tribal golf course will be needed regarding water consumption, use of pesticides and herbicides, well and septic system management, equipment maintenance, and other associated impacts.

Stormwater management: As with non-tribal development in the watershed, low-impact development techniques and other management measures are necessary to address stormwater and other potential NPS impacts. LID designs have been incorporated into parking areas at some tribal facilities, and the retrofit or new design of stormwater management will be needed for existing and planned facilities.

Governmental services: The Tribe has jurisdiction for regulating development and management of reservation and trust lands to ensure compliance with all Federal statutes. In the past, the Tribe has mirrored county standards for its developments, and identified a federal agency to complete the NEPA process, usually the federal agency contributing funding to the project. As the Tribe's trust land base grows, and some developments are conducted without federal financing, it will continue to be necessary for the Tribe to update or develop ordinances, policies and procedures to implement their jurisdictional responsibilities. In 2007, the Tribe is developing a comprehensive environmental ordinance specific to Tribal properties.

Since regaining federal recognition in 1981, the Jamestown S'Klallam Tribe has had considerable success in building a land and facilities base for tribal citizens, along with a host of programs for natural resource management, social and health services, and business development. Overall tribal goals reflect the drive toward increasing self-sufficiency and reduction of dependence on federal programs and services. The Tribe has a long-standing commitment to build and maintain community partnerships. These partnerships are a critical component in protecting and restoring watershed health in the Dungeness and the estimated costs for this goal will require support at all levels of government and the private sector.

6. Information and Education

6.1 Summary of Watershed Education and Outreach

6.1.1 Coordination of Public Information and Education

Although the Jamestown S'Klallam Tribe conducts much of its education and outreach program through the Dungeness River Audubon River Center (see Section 6.2), the Tribe also maintains a number of natural resource education programs for Tribal children, prepares displays for community events describing Tribal natural resource projects and programs, provides talks and presentations to conferences and workshops, and provides in-class and field trips for local school groups. The Tribe frequently assists other community organizations such as the Marine Resource Committee, Clallam Conservation District, Clallam County, WSU Cooperative Extension, Peninsula College and others with delivery of their educational programs. Educational outreach is an important management tool for the Tribe where waters entering the reservation are not under Tribal jurisdiction.

Along with the Tribe, Clallam County, and the Dungeness River Audubon Center, numerous other governmental and non-governmental organizations provide education and outreach related to marine and fresh water quality and habitat in the Dungeness Watershed Area. Some of the major organizations involved in public education and outreach include the following:

The Dungeness River Management Team is approaching its 20th anniversary in 2008. The longstanding watershed council serves as a clearinghouse for coordinating information and education efforts for participating governments, organizations, and the public at large. Continuation of a central watershed council to coordinate information with open, regular public meetings has been a recommendation in every major watershed plan. Open meetings are held monthly and announced on the internet and the Sequim Gazette newspaper. has been a principal facilitator of the group since its inception in the late 1980s, and maintains the DRMT website. The DRMT also works with the following standing committees and organizations to coordinate watershed information:

The Clean Water Work Group oversees public involvement and education efforts related to the implementation of the Clean Water Strategy DIP and addresses other water quality issues. The CWWG consists of a consortium of participating governments, shellfish growers, scientists, volunteer organizations, private citizens and tideland owners. The Tribe has been a principal facilitator of the group since 2005.

The Dungeness River Restoration Work Group consisting of local and regional biologists and planners meets as needed to coordinate research and

analysis of river restoration issues, and to provide technical ranking of salmon recovery projects.

The Clallam County Marine Resource Committee is a governmental and citizen committee appointed by the County to oversee projects and information related to the nearshore and marine waters of Clallam County. The MRC has provided public information on several projects including forage fish surveys, derelict gear, marine debris, and other subjects related to marine water quality and habitat.

The Clallam Conservation District provides public outreach relating to best management practices for forest, farm and urban land owners. This includes talks, tours, and publications on a wide variety of water-quality related topics such as pasture management, manure management and the use of native plants. Additionally, the Conservation District retains engineering and technical staff for the layout and design of specific restoration, animal management, and related projects and structures. The District also works closely with school groups.

Streamkeepers is a cadre of volunteer water quality and habitat monitors, sponsored and coordinated by Clallam County. Streamkeepers has a technical advisory group of data users who cooperate on data collection needs. Streamkeepers provides training to the volunteers, circulates its data widely, and maintains a newsletter and communicates frequently on water quality and habitat related issues to an extensive email-based communication network.

Beachwatchers: Washington State University Cooperative Extension has recently provided funds to Clallam County to train and deploy volunteer marine and nearshore stewards, and provide outreach to their neighbors and the general public.

6.1.2 Public Information and Involvement Methods

The WRIA 18 watershed plan provided a comprehensive list of the public involvement techniques that have been used and/or are recommended as follows:

- Establish and maintain a central clearinghouse for watershed information
- Continue to develop and implement school curricula for watershed health
- Conduct small demonstration projects for water quality protection, water conservation, habitat restoration etc.
- Provide outreach and one-on-one technical assistance for landowners through the WSU Cooperative Extension Service (yard and garden management), Clallam Conservation District (forest, agriculture and animal waste management), Clallam County Department of Health (septic installation and maintenance), Sequim-Dungeness Water Users Association

(conservation), and Jamestown S'Klallam Tribe and Washington Department of Fish and Wildlife (water quality and habitat restoration)
- Continue and expand volunteer programs such as the Streamkeepers, Baywatchers and Salmon volunteers to involve greater numbers of people in monitoring and restoring watershed health
- Publicize the benefits of conservation easements by the North Olympic Land Trust and other organizations
- Promote the formation of neighborhood and sub-basin groups
- Conduct seminars to provide information on local natural resources and ecological processes such as shellfish, fisheries and wildlife
- Expand interpretive information along the Olympic Discovery Trail; promote trail and recreation programs that are compatible with watershed health
- Conduct homeowner seminars covering topics such as wells and septic maintenance, pasture management, native landscaping, pesticide and herbicide use, and water conservation.
- Provide training to realtors, well drillers, septic installers and other professional organizations
- Periodically prepare publications on the status of watershed resources, such as brochures, booklets, newsletters, fact sheets, newspaper articles and posters.
- Prepare an annual milestones report of the DRMT.
- Provide direct mailings to watershed residents
- Conduct creative activities to celebrate the watershed including fairs and the bi-annual River Festival, entries in the irrigation festival parade, theatrical productions.

6.2 Dungeness River Audubon Center

The Dungeness River Audubon Center, located at the Dungeness Railroad Bridge (RM 5.8) provides an important site for environmental education and outdoor experiences within the Dungeness watershed and throughout the north Olympic Peninsula. The River Center is the first Audubon Center in Washington State, the first in the nation that is located on a salmon-bearing river, and the first center in the country with a tribal partner. Founding partners include the Jamestown S'Klallam Tribe, Olympic Peninsula Audubon Society, National Audubon Society, and the Rainshadow Natural Science Foundation (now the River Center Foundation). The River Center sponsors numerous water quality programs with area school groups, and regular events to educate the public about water quality, quantity, salmon and wildlife habitat and related aspects of the watershed. Highschool and college students conduct research through two scholarship programs. The River Center provides meeting space for a wide variety of local and state entities working on solutions to watershed problems. Permanent and rotating displays address water quality and habitat issues. River Center programs provide detailed learning opportunities about the physical characteristics, wildlife, and human use of the Dungeness watershed, including:

- Middle school and elementary school watershed education programs

- Annual events and festivals focusing on the environment of the Dungeness Watershed
- Adult education classes and presentations
- Field trip opportunities for pre-K through college classes and retiree groups
- Pre-K through college classroom visits by River Center instructors and docents
- Interpretive facilities, exhibits, and signs, both within the River Center and throughout Railroad Bridge Park on interpretive trails
- Internships for high school and community college students
- Docent and volunteer opportunities for all ages
- Speaker programs covering natural resources, natural history and human history
- Participation in community events, representing the interests of the Dungeness watershed, wildlife, and the environment.

In addition to the development and expansion of these important programs, long range goals include the acquisition of a contiguous 360 acre parcel. The property is presently undeveloped and provides excellent habitat for salmon and wildlife species, and an opportunity for unique public parklands along the lower Dungeness River. Other long range plans include improved satellite parking, and potential facilities expansion. This expansion would greatly increase the River Center partners' capacity for public outreach.

The River Center offers three sessions of an annual summer River Camp for ages 8- 11.

7. Cost Estimates and Sources of Funding

7.1 Cost Estimates of Identified NPS Management Measures

The cost estimates for implementing NPS management measures (Table7.1) come from a variety of sources, and contain a mix of short term and long term management actions. The Clean Water Strategy/Detailed Implementation Plan contains estimates for water quality management measures for the next 5 to 10 years. The Dungeness Salmon Recovery Planning Notebook has a short term 3-year list of restoration projects and a 10-year project list for the watershed. The Dungeness agriculture water users have retained engineers to complete very specific cost estimates for lining irrigation ditches and other projects to restore water quality and quantity over a 20 year period.

Each of the Jamestown Tribal natural resources sub-goals from the Tribal Comprehensive Plan -- water quality, water quantity, habitat, land management, and environmental education -- entail tribal staffing needs to participate in planning forums, design and implement projects, monitor results, and inform the tribal community and general public. Protection and restoration of tribal reservation and trust lands and waters will also require significant funding from other watershed partners. Table 7.1 contains the funding estimates for protecting and restoring the Dungeness watershed area as such estimates are available. These are broken out for each Tribal sub-goal, and divided into Tribal programs and programs identified for cooperating watershed partners.

7.2 Current and Future Needs

Governments at all levels are struggling to meet their financial obligations for the protection and restoration of the environment. Tribal governments are no exception and face particular challenges. Small tribes like the Jamestown S'Klallam are immensely affected by activities occurring off the reservation over which they have little or no control, but must monitor and respond as these actions directly affect reservation lands and waters. Additionally, the Tribe has few revenue sources of their own that can be dedicated to environmental management and NPS remediation. Although Tribal fishers are taxed on their commercial fishing activities, few Tribal fishermen are presently engaged in commercial fishing due to the poor status of most fisheries resources, and these funds are already dedicated to management, enforcement and legal expenses associated with the exercise of tribal treaty fishing rights. Other revenue sources support social services such as education and elders' programs to meet the needs of Tribal citizens.

Table 7.1 provides many long term estimates that would enable major steps in addressing NPS pollution in the watershed. Only a small short-term fraction of the needed funding is in hand for the implementation of the Clean Water Strategy/DIP, Water Conservation Plan/CIDMP, and Salmon Recovery Plans. Other areas of need

which are not in one of the existing plans, and where detailed cost estimates are not available include:

- Each newly purchased Tribal property requires professional assessments for wetland delineation, water supply capability, critical aquifer recharge, stormwater management, wastewater disposal, noxious weed removal, and re-vegetation. EPA Brownfields grants cover some assessments of hazardous waste and underground storage tanks, but these funds are granted only on an annual basis.
- Retrofitting of existing tribal properties to ameliorate NPS causes and sources is needed, as well as the development and implementation of best management practices.
- Land acquisition based on the Comprehensive Land Protection Strategy, based on market and funding availability. Acquisition will be necessary where other management measures are insufficient to long term habitat and water quality restoration, such as the setback of dikes, removal of structures and septic systems, and re-vegetation on river and marine shorelines.
- Integration of Tribal enforcement with NPS management to enhance program effectiveness. Tribal enforcement programs are presently limited to fisheries management, and current funding levels are inadequate for existing responsibilities, let alone expanded services.
- Identification of solutions to the loss of saltmarsh habitat and pocket estuaries along Dungeness Bay.
- Identification of solutions to legal and structural barriers to water conservation.
- Additional assessments of salmon productivity to determine if recovery efforts are working.
- Long term and stable funding for the operation of Environmental Education programs and the Dungeness River Audubon Center.
- The growing threat to species and habitat posed by the rapid proliferation of invasive vegetation and alien aquatic species.
- Assessment of the potential loss of tribal trust resources from climate change.

Table 7-1: OVERVIEW OF ESTIMATED COSTS

Notes on this table: Cost estimates are organized by Tribal sub-goal and were obtained from a variety of sources including the Tribal NPS Management Plan, Clean Water Strategy/DIP, Comprehensive Irrigation Water Conservation Plan, Salmon Recovery Plan, and partner organizations such as the Clallam Conservation District and Dungeness River Audubon Center. Some estimates represent ongoing program costs, while others are one-time project costs, thus they have not been added together to present a total annual or 5-year estimate. Where appropriate, the estimates have been separated for Tribal and partner NPS programs.

Activities by tribal goal:	**Estimated costs**	**Time frame**	**Comments**	**Funding Sources**
WATER QUALITY MANAGEMENT MEASURES				
Tribal NPS Programs				
Staff and office supplies to oversee monitoring of water and shellfish, septic programs, stormwater planning, revegetation and other BMPs for protecting and improving water quality. 4.75 FTE	$522,000	annual costs, ongoing	details in Tribal NPS plan; includes staff, office supplies, travel, training, overhead, and engineering/ tech consultation	EPA, BIA-OSG, Ecology, WDFW, Tribal funds
Projects for channel restoration, stormwater facilities, re-vegetation, agriculture BMPs, septic remediation	$325,000	annual costs, 5 year plan	project construction costs	
Public education programs	$30,000	annual, ongoing		EPA, Ecology, Foundations
Monitoring supplies, transportation, laboratory costs	$30,000	annual, ongoing		EPA, BIA-OSG, Ecology, WDFW, Tribal funds
Land acquisition where other water quality remediation is not feasible. (acquisition and removal of structures and septic systems)	$250,000	2-10 years		Land and Water Conservation Fund, RCFB, Private
Partner NPS Programs				
Clean Water Strategy				
Ongoing actions for septic inspection and education programs, public outreach, stormwater planning, livestock plans, monitoring, streamkeepers	$2,900,000	5 years	Clean Water Strategy/DIP has detailed breakout	Centennial Fund, EPA, Special Assessments, County Fees, WRIA 18 implementation funds, other

Implementation of projects for community septic systems, biofiltration projects, stormwater remediation, pet waste, microbial source tracking, remote sensing, GIS, and research.	Minimum combined estimate of $3,100,000	5 years	Clean Water Strategy/DIP	State and federal low interest loan programs, Targeted Watershed Initiative (in-hand),
Example partner program: Clallam Conservation District's technical assistance and construction programs for individual landowners -- includes design & engineering of BMPs.	Programs: urbanland 430,000 farmland 1,941,000 forestland 286,000 education 85,000	5 years	Conservation District 5 year work plan. Includes staff, cost share, overhead	WA Conservation Commission, Conservation Reserve Program, Envtl Quality Incentives Program, NRCS
WATER CONSERVATION AND MANAGEMENT				
Tribal Water Resource Programs				
Tribal staff and supplies to monitor irrigation withdrawals and instream flows, participate in water management forums, analyze data, groundwater planning, water conservation programs. 1.75 FTE & consultation from planner, engineer, and hydrologist	$225,000	annual, ongoing		Pacific Coast Salmon Recovery Fund (PCSRF), Self-governance
Partner Water Quantity Programs				
Irrigation Projects		20 yrs	CWCP/CIDMP has detailed breakout. Approximately $5 million of these have already been implemented	USDA, Salmon Recovery Funding Board (SRFB), Ecology low interest loans, assessments on water users
Agnew District	964,013			
Dungeness Company	2,878,225			
Cline District	2,945,843			
Clallam Company	918,847			
Dungeness District	1,289,438			
Seq-Prairie Tri Company	1,918,917			
Independent Canal	697,257			
Eureka Canal	3,801,197			
Highland District	1,355,676			
sub-total: irrigation	$ 16,769,413			
Other Water Conservation				
Atterbury Road Reservoir	$3,400,000	5 yrs	Montgomery estimate (engineer)	none identified

East side storage analysis& design	$270,000	5 yrs	CCD estimate	WA Dept of Ecology
Education and outreach	$50,000	2 yrs		PIE fund
Aquifer recharge analysis & design	$600,000	2 yrs	Clallam County estimate	
HABITAT RESTORATION/ PROTECTION AND SALMON RECOVERY				
Tribal Programs				
Timber Fish Wildlife, 1.25 FTE and equipment to monitor forest practices, invasive vegetation, restoration planning	$200,000	annual, ongoing	costs for staff, supplies, equipment, travel, vehicle O&M	State and Federal TFW
Coastal Salmon Program: 4.75 FTE for restoration planning, GIS, DRMT, spawning surveys, juvenile production studies, and construction of projects. Presently not fully funded.	$1,175,000	coincides with 10-yr salmon recovery list	annual projects vary, presently only funded at $200,000	PCSRF
Implementation of Federal court orders and recovery plans covering Harvest, Hatchery, & Habitat Management	$573,183 plus indirect	annual, ongoing	estimated min. annual budget for meeting legal fisheries mgt & enforcement responsibilities	Self-governance
Partner Salmon Recovery Programs				
Dungeness Salmon Recovery: 3 year list		3 yrs		
Rivers End Risk Assessment	$100,000			examples: WDFW and NRCS coastal wetlands funds, ALEA, USFWS & BIA jobs for the environment, SRFB, PCSRF
Rivers End Saltmarsh Recovery Ph 1	75,000			
Beebe land purchase	$1,000,000		includes some funding in hand	
ACOE dike setback	$7,500,000			
LWD placement	$2,175,000		source: Dungeness Salmon Recovery Notebook, Puget Sound Salmon Recovery Plan	
Tier 1 land purchase below RM 10	$4,295,000			
Restoration risk analysis	175,000			
Upper Haller dike setback	300,000			
Riparian reforestation	$150,000			
High priority water conservation	See water quant.			

sub-total 3 year list	$15,770,000		excludes water conservation	
Salmon Recovery: 10 year List	$41,000,000	10 yrs		
LAND MANAGEMENT PROGRAMS				
Tribal Programs				
Environmental Analysis of Tribal Development	$150,000	annual, ongoing		Tribal business funding, EPA, Ecology
Transportation Plan environmental compliance	$75,000	2 yrs		
Stormwater management planning and implementation, with LID	$125,000	2 yrs	planning and design costs only	
Golf Course BMP development & implementation	$125,000	2 yrs	planning and design costs only	
Wastewater treatment maintenance and upgrades	$10,000/year	5-10 yrs	maintenance; inspections, upgrades	
Partner Land Management Programs	est. not available			
ENVIRONMENTAL EDUCATION				
Tribal Programs				
Staff and supplies for classes, technical assistance, brochures and articles	$125,000	annual-ongoing		PCSRF, EPA, State programs, foundations
Partner Programs				
Operation of Dungeness River Audubon Center				
Operating costs: Staff, park maintenance, facility operations, supplies, newsletter & publications, phone, internet, etc.	$210,000	annual - ongoing	From Dungeness River Center Business Plan	fees for services, EPA and other public grants; Foundations, private donations
Land Acquisitions and Improvements	$3,600,000		Purchase of adjacent riparian acreage.	private/federal/state land programs
Facility and Site Improvements	$300,000			unidentified

8. Watershed Milestones and Schedule for Implementation

On a watershed basis, the progress for implementing NPS management measures will depend on the concerted effort of all watershed partners. The Jamestown S'Klallam Tribe and other partners have made substantial commitments of staff, funding and other resources for the past two decades to protect and restore watershed health. These commitments are anticipated to continue over the long term subject to available funding.

Table 8.1 describes in detail the milestones for implementation (outputs) as well as the criteria for evaluating success (outcomes). The table is organized around the Tribal natural resource sub-goals, and briefly summarized below.

Water Quality: Milestones include the number and location of septic systems upgraded or redesigned, irrigation ditches piped and tailwaters treated, stormwater management systems upgraded and designed, research projects completed, and the number of people reached through outreach efforts such as publications and classes.

Water Quantity: Major milestones are tied to the implementation of the Comprehensive Water Conservation Plan by the irrigation and agricultural community, along with the implementation of other recommendations of the WRIA 18 watershed plan. They include milestones such as number of miles of ditches upgraded or piped, and number of conservation measures designed and implemented.

Habitat Protection and Salmon Recovery: A short term and long term list of measures and milestones have been submitted to the National Marine Fisheries Service covering land acquisition, floodplain restoration, re-vegetation, sediment control and the implementation of recommendations by the Hatchery Science Review Group.

Management of Tribal Lands and Waters: Milestones are tied to the Comprehensive Land Protection Strategy which was completed by the Dungeness River Restoration Work Group (Hals, et al., 2003) and the upgrading of tribal social and business facilities to protect water quality and conserve water.

Education and Outreach: The Dungeness River Management Team publishes an annual "Milestones Report" on the implementation actions by the Tribe and other watershed partners. Other important milestones include the continuation, expansion, and fiscal self-sufficiency of the Dungeness River Audubon Center.

Partners listed in Table 8-1: Jamestown S'Klallam Tribe, Clallam County, City of Sequim, Clallam Conservation District, Sequim-Dungeness Agricultural Water Users Association, Clallam County Marine Resources Committee, Clallam County Public Utility District, WSU Cooperative Extension Service, Washington Dept of Fish and Wildlife, Washington Department of Ecology, Dungeness River Audubon Center, North Olympic Land Trust, US Forest Service, US Fish and Wildlife Service, US Army Corps of Engineers, Environmental Protection Agency, National Marine Fisheries Service, Battelle Marine Laboratory

TABLE 8-1: MILESTONES FOR IMPLEMENTATION & MEASURABLE CRITERIA FOR EVALUATING PROGRESS

Notes: This table has been organized around Jamestown S'Klallam Tribal natural resources sub-goals, shown in the shaded areas, and the NPS categories addressed. Under each goal the table summarizes management strategies, milestones for implementation, anticipated timing (subject to funding), key watershed partners, how our outputs will be measured, and the criteria to be used to evaluate progress. There is a considerable amount of overlap between Tribal goals, and the management strategies may address more than one source of NPS pollution. Thus some of the major milestones and evaluation criteria may apply to more than one goal and NPS category. More information on how the management strategies relate to NPS categories and sub-categories is in table ___.

TRIBAL SUB-GOAL: Ensure water quality that protects fish and wildlife resources and provides safe food and water.

NPS Categories Addressed: Agriculture, Hydromodification & Habitat Alteration, Urbanization, Marinas & Vessels

NPS MANAGEMENT STRATEGY	MILESTONES FOR IMPLEMENTATION	TIMING	KEY PARTNERS	MEASUREABLE OUTPUTS	MEASURABLE CRITERIA FOR EVALUATING PROGRESS (Outcomes)
Human Waste Management	Support County programs for septic O&M, septic inspection and remediation	ongoing	County	# septic systems pumped database tracking of septic O&M # systems inspected and repaired # classes Septics 101	Reductions in fecal coliform loading to Matriotti Creek, Dungeness River & Bay: achieve 80% of required reduction by 2010, meet water quality standards by 2012
	Suppport the development of community systems for areas of concern	5 yrs	County	Feasibility studies completed for 3 systems, and at least one to design & construction phase.	
	Buyout remaining parcels at Rivers End and decommission septic systems	3 yrs	Tribe, County, WDFW, NOLT	Parcels purchased and septics decommissioned.	
Stormwater Management	Treatment of irrigation ditch tailwaters	5 years	CCD, WUA	Installed treatment sites	Achieve net reductions in nitrates for Carlsborg and other elevated areas; achieve net reductions in bacteria; achieve public health standards
	Piping of irrigation ditches	20 years	WUA	# feet ditch lined	
	Increase use of LID methods	5 yrs	Tribe, County, CCD	County approval of LID techniques	

Stormwater Management	Reduce stormwater impacts	1.5 yrs	County, Tribe	County approval of upgraded stormwater manual; County Roads Dept install LID in roadside ditches	No increase in metals or hydrocarbons for baseline streams.
		5 yrs	Tribe	Retrofit tribal facilities	
	Raise public awareness	5 yrs	volunteers	Signage program at stormwater drains	
Animal Waste Management	Implement pet waste program	1 yr	Tribe, EPA, volunteers	mailings and posters distributed	Reductions in fecal coliform loading per TMDLs
		2 yrs	County parks	install pet waste stations	
	Reduce domestic animal waste	5 yrs	CCD	Complete farm plans with BMPs	
	Enforce animal waste violations	ongoing	Ecology	Last resort after outreach and technical assistance.	
Monitoring	Shellfish sampling	ongoing	Tribe, DOH	bi-weekly for intertidal harvest during PSP season; weekly for geoduck harvest	Safe consumption of shellfish by tribal citizens and general public
	Marine waters	ongoing	Tribe, DOH	Monthly sampling	Achievement of certified shellfish beds in Dungeness Bay by 2012
	Freshwater	ongoing	Streamkeepers Baywatchers, Tribe, County	monthly sampling; quarterly for some parameters	Safe wading/swimming for tribal citizens and general public; attain temperature/DO targets for fish bearing streams
	Complete annual data analysis	annual	Clean Water Work Group	Annual review of results	Adaptive mgt of strategies based on results.
	Achieve capacity to monitor all nine parameters required under CWA Section 106		Tribe	trained staff, all equipment available, funding for staff, materials, transportation, lab costs	Attain water quality standards for all nine parameters

Research	Microbial source identification	1 yr	Tribe, Battelle, Ecology, County	Identification of controllable sources of bacterial contamination.	Adaptive mgt of strategies based on results.
	Evaluate D Bay for nutrients and wildlife contribution	5 yrs	Tribe, Ecology, DOE, WDFW	to be developed	
	Evaluate culture methods for oysters, clams etc	ongoing	Tribe, volunteers	Shellfish gardens completed	
	GIS analysis and remote sensing	ongoing	Tribe, CCD, County	annual airphotos, updated maps	
	Evaluate effectiveness of BMPs	ongoing	Tribe, County, CCD	progress reports	Adjustment of BMPs to achieve water quality standards
	Investigate restoration of pocket estuaries at Meadowbrook, Cooper, Casselary, Gierin Creeks	5 yrs	CCD, Tribe, WDFW	complete feasibility analysis and identify restoration options	
Regulatory	Upgrade city and county ordinances	1 to 5 years	County, Ecology	Adopt stormwater manual	Improved water quality(bacteria, nutrients, chemicals)
			MRC, City	Designate nearshore critical areas	Revisions to CAO
			County, Tribe, CCD	Identify barriers to improved water quality in ordinances	Updated ordinances leading to improved water quality
	Develop/update Tribal ordinances	1 to 5 years	Tribe	Improve jurisdictional control over tribal waters	Updated/new ordinances leading to improved water quality
Education and Outreach	Public workshops on water quality issues	annual	County, CCD, River Center, Tribe	# Workshops conducted; # individuals attending	Behavior change leading to improved water quality; participant feedback
	Prepare written material for public outreach	annual	County, CCD, Tribe	Newspaper articles and mailings; annual milestones report of DRMT; # publications distributed	

Education and Outreach		bi-annual	all partners	Dungeness River Festival; attendance and participation	Behavior change leading to improved water quality; participant feedback
	Booths, fairs and festivals	annual	variable	booths, exhibits, fairs -- attendance and participation	
		5 years	River Center	Permanent displays at River Center	
	Design and implementation of interpretive displays	5 years	River Center, Tribe, WDFW, County parks	Interpretive trail signs	
	Information for recreational boaters	1-5 years	WDFW, County parks, Tribe	Interpretive signs and brochures for boaters at launch sites.	Behavior change or continued stewardship by vessel owners.
	In-class and in-field school programs	on-going	River Center; Tribe; CCD; County	# of students reached;# of accompanying adults reached	Evaluate student understanding of watershed processes and impacts from actions; participant feedback; teacher feedback.

TRIBAL SUB-GOAL: Protect instream flows and encourage water conservation.					
NPS Categories Addressed: Agriculture, Hydromodification & Habitat Alteration, Urbanization					
NPS MANAGEMENT STRATEGY	**MILESTONES FOR IMPLEMENTATION**	**TIMING**	**KEY PARTNERS**	**MEASUREABLE OUTPUTS**	**MEASURABLE CRITERIA FOR EVALUATING PROGRESS (Outcomes)**
Irrigation System Conservation and Efficiency	Implementation of Irrigation Conservation Plan	5 years	WUA	complete non-structural recommendations	5 years: Meet or exceed targets >100 cfs Aug-Oct in 7 out of 10 years and side channel targets > 575 cfs November to July
		5-20 yrs	WUA	design and construct storage	20 years: Meet IFIM or toe width recommend. for all streams in late summer 8 out of 10 years. Ensure that water management will provide adequate flows for mainstem and side channel habitat availability.
		as needed	WUA, Ecology	implement drought response	
	Complete CIDMP	3 yrs	WUA, Ecology, USFWS, NMFS, Tribe	Determine set of target flow levels attainable and necessary for recovery.	
	Identify legal barriers to water conservation	5 yrs	Tribe, WUA, Ecology	proposals completed for changes to irrigation by-laws, rule or state law	
		3 yrs	Sequim, County, Ecology	Review City and County ordinances for water conservation	Long term: Evaluate productivity and assess whether flow levels are leading to recovery.
Domestic Water Supplies - Conservation and Efficiency	Identify options for public domestic water supply	2 yrs	Ecology, County, Tribe, WUA	Complete aquifer recharge analysis	Increase proportion of residents on public water supply versus single domestic wells.
				Complete estimates of water use from exempt wells in watershed	
		3 yrs	County, Ecology	Review County ordinances for water conservation	Revised building and land use requirements to promote water quality and

Domestic Water Supplies - Conservation and Efficiency	Residential and business conservation	ongoing	Sequim, County, PUD	New construction and retrofit for water conservation (interior/exterior)		Conservation and efficiency measures in place.
	Water re-use	ongoing	Sequim	Use of treated wastewater for additional uses.		Expanded use of waste water leading to improved water quality and reduced reliance on new surface and ground water sources.
Protection of Instream Flows	Re-evaluate instream flow recommendations from IFIM	2 yrs	Tribe, Ecology, Services	Complete scope of work		Improved estimates of the relationship of flow and salmon habitat availability
	Complete instream flow setting	3 yrs	Ecology	Rule drafted and adopted		Improved ability to provide long term education and enforcement.
	Conservation outreach and education	ongoing	Ecology, County, Tribe, WUA, PUD, CCD	# Public workshops and presentations; publications; demonstration projects; farm plans completed		Improved individual stewardship for water conservation on farms and residences.

TRIBAL SUB-GOAL: Protect and restore habitat for salmon and other fish and shellfish species to achieve sustainable, harvestable levels. **NPS Categories Addressed: Hydromodification & Habitat Alteration; Forestry; Agriculture; Urbanization; Wetlands-Riparian; Roads, Highways & Bridges**					
NPS MANAGEMENT STRATEGY	**MILESTONES FOR IMPLEMENTATION**	**TIMING**	**KEY PARTNERS**	**MEASUREABLE OUTPUTS**	**MEASURABLE CRITERIA FOR EVALUATING PROGRESS (Outcomes)**
Restoration of the Lower River Delta to RM 2.6	Buyout remaining parcels at Rivers End, remove structures and revegetate.	3 yrs	Tribe, County, WDFW, NOLT	Parcels purchased and structures removed.	Increase in # of juvenile salmonids out-migrating
	Saltmarsh recovery	3 yrs	Tribe, USFWS, ACOE, WDFW	Complete risk assessment of channel migration Acres revegetated Tidal structures removed	
	Expansion of flood plain in diked reach	3-10 yrs	Tribe, USFWS, ACOE, County, WDFW	# Acres of habitat conserved Analysis of ACOE dike setback Dike setback, # acres floodplain restored	Achievement of min. planning targets and ranges for Chinook for at least 3 consecutive years by 2020
	Other Tier 1 Land Acquisition	3-10 yrs	Tribe, County, WDFW, NOLT	Parcels purchased and structures removed; # acres habitat restored	
Protection of Existing Habitat through Land Acquisition RM 2.6-11.3	Tier 1 Land purchase / easements	3-10 yrs	Tribe, County, WDFW, NOLT	Parcels purchased and structures removed.	Increase in # acres properly functioning riparian and flood plain habitat.
Floodplain Restoration / Constriction Abatement	Upper Haller Dike Setback	3-10 yrs	County, WDFW	Dike setback	Increase in # acres properly functioning riparian and flood plain habitat.
Water Conservation:	See water conservation section				improved water temperatures

Restoration of Functional Riparian and Riverine Habitat	Riparian reforestation	1-10 yrs	CCD, Tribe, WDFW	acres revegetated	Increase in # acres properly functioning riparian and flood plain habitat.
	Noxious weed removal	1-3 yrs	County, Tribe, CCD, EPA	acres treated	
Large Woody Debris Placement	LWD placement at RR reach	1-3 yrs	Tribe	River miles of LWD placed	
	Engineering for other areas	5 yrs	Tribe	Plans completed	
Nearshore Habitat Protection and Restoration	Removal of shoreline armoring	2-10 yrs		length of armoring removed	Improved marine water circulation for water quality protection and nearshore habitat.
	Review of shoreline codes	2-5 yrs	County, Ecology		
	Also see water quality research measures				
Stock Recovery and Rehabilitation	Completion of Chinook rebuilding program	1-10 yrs	WDFW, Tribe	completion of captive brood program	See Chinook planning targets above.
	Analysis of salmon productivity	ongoing	WDFW, Tribe	GPS and map annual Chinook redds	
				Evaluate juvenile production with smolt traps	
	Evaluate status of additional species	5 yrs	WDFW, Tribe	stream surveys and other assessments of bull trout, chum, pink, steelhead	
	Implement recommendations of Hatchery Science Review Group	1-15 yrs	WDFW, Tribe	hatchery water treatment upgraded, removal of riparian armoring and other recommendations	Integration of hatchery management with habitat and harvest recovery plan
	Education and Outreach	ongoing	WDFW, Tribe	Annual reports to DRMT and community on stock status; integrate info with enforcement	

Barrier Removal	Remediation of Canyon Creek	5 yrs	WDFW	removal of passage barrier	
	Culvert upgrades / replacement	1-5 yrs	USFS	implementation of remaining sites on Watershed Needs Inventory	Reduced sediment input
	Improve irrigation diversion structures	1-5 yrs	WUA	upgrade irrigation outtakes	Improved fish passage
Sediment management and source control	Remediation of mass-wasting and road sedimentation in upper watershed	1-5 yrs	USFS	implementation of remaining sites on Watershed Needs Inventory	
	Upgrade construction practices	5 yrs	County	Clearing and Grading Ordinance	
TRIBAL SUB-GOAL: Manage Tribal properties to retain water quality and habitat values while fostering social & economic development.					
NPS Categories Addressed: Hydromodification & Habitat Alteration; Urbanization; Wetlands & Riparian; Roads, Highways & Bridges					
NPS MANAGEMENT STRATEGY	**MILESTONES FOR IMPLEMENTATION**	**TIMING**	**KEY PARTNERS**	**MEASUREABLE OUTPUTS**	**MEASURABLE CRITERIA FOR EVALUATING PROGRESS (Outcomes)**
Management of Tribal properties	Protect and restore habitat on designated conservation properties	ongoing	Tribe	Tribal properties retain habitat values and species diversity	Increase acreage in protected status
				Revegetation of River's End parcels	
				Acquire additional habitat parcels	
	Mgt. of Railroad Bridge Park	ongoing	Tribe, River Center, County	Improved trails	Expansion of Railroad Bridge Park
				Move parking further from River	
				Expand land area for Park	

Management of Tribal Properties	Tribal social & economic development properties	1-5 yrs	Tribe	Ordinances updated/adopted to provide jurisdictional authority to protect water quality and habitat Design and implement BMP for golf course facilities. Implement LID on tribal properties	Tribal properties meet current standards for water quality, BMPs and stormwater by 2012
Management of Federal, County, State and Private Lands	see measures in water quality and salmon recovery				
	technical assistance to landowners	ongoing	Tribe, CCD, WSU, County	Individual homeowners contacted with technical assistance for farm / forest/ pasture management	Behavior change leading to improved water quality; participant feedback
TRIBAL SUB-GOAL: Support environmental education **NPS Categories Addressed: All**					
NPS MANAGEMENT STRATEGY	**MILESTONES FOR IMPLEMENTATION**	**TIMING**	**KEY PARTNERS**	**MEASUREABLE OUTPUTS**	**MEASURABLE CRITERIA FOR EVALUATING PROGRESS (Outcomes)**
Also see environmental education measures in other sections of this table.					
Operation of Dungeness River Center	Support operations of the River Center for education and communication of watershed, community and school organizations.	ongoing	River Center staff, Tribe; partners	Expand revenue sources for ongoing operation Upgrade facilities and programs Conduct school classes and field trips	River Center is 80% self-sustaining by 2010

9. Criteria for Evaluating Progress

Criteria for evaluating progress are also summarized in Table 8.1 and are organized by Tribal sub-goal as follows:

Water Quality: Interim criteria have been developed as part of the TMDLs for the Lower Dungeness River/ Matriotti Creek and Dungeness Bay. Over the long term, it is the Tribe's intent that bacteria levels are reduced sufficiently that all shellfish beds in the Dungeness area are certifiable. The Detailed Implementation Plan contains tables of the required reductions in fecal coliform concentrations for tributaries to Dungeness Bay, marine sites, Dungeness River, and irrigation ditches to the inner Bay. The interim targets of the Clean Water Workgroup are:

- Achieve target bacteria reductions in the *Dungeness River and Matriotti Creek Fecal Coliform Bacteria Total Maximum Daily Load Study* (Sergeant, 2002).
- For the *Dungeness Bay Fecal Coliform Bacteria Daily Load Study* (Sergeant, 2004), the targets are as follows:
    - Approximately 80% of required reduction by 2010
    - Achievement of standards and restored shellfish harvest by 2012

In addition to the interim targets based on fecal coliform concentrations, it is the goal of the Clean Water Work Group to meet all other water quality standards by 2012 and maintain them thereafter. These include all the parameters required under the Clean Water Act Section 106 program.

Water Quantity: An Instream Flow Incremental Methodology study for the Dungeness River and recommendations for instream flows was completed by US Fish and Wildlife Service in the early 1990s along with Toe-Width method recommendations for other streams in the watershed area (citations). The IFIM monthly criteria for cubic feet per second remain an important benchmark for evaluating water conservation effectiveness. However, the Tribe remains concerned that the IFIM study did not completely capture the benefit to salmon for protecting side channel flows and have requested the Department of Ecology to complete a review of the IFIM recommendations. Other water quantity targets include the following:

- The Trust Water Rights MOU (1998) requires the Sequim-Dungeness Agricultural Water Users to leave 50% of the flow (measured at the USGS gage) instream year-round. Additionally the MOU caps all instantaneous water withdrawals cumulatively at 156 cfs.
- The water users have agreed to sacrifice water withdrawals beyond the levels required by the MOU when instream flows are 60 cfs or less. US Fish and Wildlife Service and National Marine Fisheries Service have indicated that instream flows less than that will cause severe harm to threatened salmonid populations.
- Discussions of target flows by the US Fish and Wildlife, National Marine Fisheries Service, and Sequim-Dungeness Water Users Association have led to a series of informal benchmarks which are not currently part of an agreement:

- Achievement of at least 100 cfs instream in late summer in greater than 50% of the years was a target established by the 1994 Dungeness-Quilcene Plan. This benchmark was also discussed during the CIDMP preparation, and was expanded to subtract 10% from the USGS gage flow to account for groundwater loss.
- The National Marine Fisheries Service guidance for ESA-listed fish requires a rough metric of 80% of mean monthly flow in the late summer. For the Dungeness River in September, the requirement would be 138 cfs. This level of flow would be expected to occur every 2½ years, and 1 in 2 generations of salmon would therefore be exposed to that flow level. (M. Longenbaugh, pers. comm.)
- Achievement of IFIM optimum levels or greater is targeted for long-term salmon recovery, subject to year-to-year flow conditions, and the need to maintain flows in critical side channels.

Salmon Recovery: As described in section 4 of this plan, targets and ranges for the Dungeness Chinook population have been adopted by the Dungeness River Management Team, Jamestown S'Klallam Tribe, and the Puget Sound Technical Recovery Team (appointed by NOAA). Attainment of the minimum targets for a single year does not constitute recovery and the Puget Sound Salmon Recovery Plan has an overall goal of restoring populations to self-sustaining and harvestable levels. Additionally, the Tribe seeks increasing levels of juvenile productivity and enhanced spatial distribution of Chinook in the upper watershed.

Quantitative targets and ranges for other salmon species in the Dungeness have not been determined due to lack of information and are a future research need. However, improvements in habitat conditions for Chinook are considered by federal, state and tribal biologists to be beneficial for other species as well.

Tribal Land and Water Management:
Criteria for Tribal properties that are designated for conservation purposes can be measured in total acreage acquired or restored. Additionally, monitoring of water quality and habitat parameters on these properties will indicate the effectiveness of the Tribe's management. Tribal properties that are designated for development for social service facilities and businesses can be evaluated on the basis of whether best management practices are developed or implemented.

Education and Outreach: In keeping with the Tribe's philosophy of working with watershed partners, the Tribe has focused education and outreach around the Dungeness River Audubon Center facilities and activities. The River Center partners are striving to make River Center programs and facilities financially self-sustaining. The Tribe will also continue to provide education and outreach directly where appropriate. Criteria for measuring progress in education and outreach include number and age of people reached, range of subjects covered, and ultimately the degree of behavior change within the watershed, as measured by responses to polls and questionnaires, and actual improvements in water quality and habitat.

10. Monitoring and Adaptive Management

Monitoring in the Dungeness watershed consists of an integrated strategy of "implementation monitoring" of progress and "effectiveness monitoring" of whether quantitative goals have been achieved. Monitoring and adaptive management are coordinated through the Dungeness River Management Team which has members that are governments with decision-making and implementing authorities. Regular reports and communications occur between the DRMT, governmental entities and the public at large. The DRMT has three standing committees to oversee implementation and effectiveness monitoring and develop adaptive strategies including an Executive Committee to prepare agendas and the annual work plan, and the technical oversight committees: Clean Water Work Group and Dungeness River Restoration Work Group. Additionally, the DRMT appoints project committees as needed. These are outlined in the boxes below.

Adaptive Management Communication and Coordination Structure

Watershed Oversight for Coordination and Communication:
Dungeness River Management Team

Description:
- Ongoing Watershed Council for 20 years
- 2514 watershed planning unit
- 2496 Citizen's advisory group for salmon recovery

Adaptive Management Functions:
- Track implementation.
- Track effectiveness
- Set priorities, forward recommendations
- Communicate progress
- Coordinate data and staff resources across organizations
- Report to funding and regulatory entities

Decision Making and Implementation:
Governmental Entities with Regulatory Jurisdiction (DRMT members)

Other DRMT member organizations and community groups

Description: Tribe, County, State and Federal Agencies, Irrigation Districts

Adaptive Management Functions:
- Project implementation and monitoring
- Set priorities for staff and organizational actions
- Report on effectiveness
- Communicate progress
- Accountable to funding and regulatory agencies in specific cases.

DRMT Standing Committees

Administrative

DRMT Executive Committee:
- *Establishes draft workplans and agendas*
- *AM functions: incorporate ongoing and project specific review of implementation and effectiveness into DRMT workplan. Annual milestones report.*

Technical

Clean Water Work Group:
- *Tech and coordinating body for water quality cleanup in Dungeness watershed*
- *AM functions: Report on compliance with CWA parameters.*

Dungeness River Restoration Work Group:
- *Technical advisory group for DRMT*
- *AM functions: preparation of technical AM targets, monitoring protocols, coordinate monitoring with agencies*

DRMT Ad Hoc Committees

***Education and Outreach**: Subject to funding and staff resources*

***Project Specific:** e.g. flood plan update*

Table 10-1 provides a summary of the current and planned monitoring activities in the Dungeness Watershed area by the Tribe and key partners. In addition to water quality parameters (temperature, turbidity, bacterial, nitrates, metals, etc.), the Tribe and partners have extensive baseline and ongoing monitoring of ecological processes, habitat conditions, and the status of plant and aquatic biological communities. It is the goal of the Tribe and partners to monitor all nine parameters required under the Clean Water Act Section 106 programs by 2012. This will require additional staff training, equipment, laboratory services, data analysis, and preparation of new and updated Quality Assurance Project Plans. Ongoing monitoring and adaptive management is dependent upon adequate funding for these activities.

Table 10.1 Summary of Dungeness Watershed Area Monitoring Activities

Monitoring Activity	Subtasks	Lead Partners	Schedule	Costs[6]
Water Quality: Baseline / Performance				
Clean Water Act 106 Parameters	• Integrate with Puget Sound Ambient Monitoring Program • Temperature and turbidity of tributaries • Temp/ turbidity upper/lower river mainstem • TMDL - bacterial: Dungeness watershed • TMDL - bacterial: Dungeness bay • Clean Water Strategy monitoring program. • Benthic Index of Biotic Indicators • Additional bacterial and sediment sampling for Dungeness river and bay per adaptive management and funding availability • Microbial Source Tracking Study	Ecology, Tribe, Streamkeepers , USFS Clean Water Work Group: (County as lead, and Tribe, Cons District, Ecol, PSAT, DOW, USFWS)	Most sampling is ongoing or seasonal: e.g. temp, turbidity, bacterial, BIBI, flow. Microbial source study 2005-2008 Streamkeepers monitoring at: www.Clallam.net/streamkeepers	Ongoing monitoring by agencies: estimated Tribal cost $200,000 and other partners' cost $200,000 Microbial source studies ($150,000/ tracking study) Streamkeepers not fully funded.
Ecological Processes				
Hydrology - baseline	Measure instream flows: • Continuous recording gage at RM 11.3 • Continuous recording gage at RM 0.8 (Sch, Bridge)	USGS, Ecology	Ongoing	Maintenance costs by USGS, Ecology
	SNOTEL in upper Dungeness watershed to measure and transmit snowpack data	USGS	Installed in 1999 with BIA/NRCS funding, ongoing	Annual $2,600 maintenance via NRCS/Tribe/Cons Dist/ private/0NP
	Aquifer storage and recovery studies: Phase I feasibility and habitat impacts.	Clallam County	2007-2008	

[6] Ongoing costs borne by agencies are subject to continuing budget appropriations.

Hydrology - performance	Measure instream flows: • Spot checks seasonally during low flow • Side Channel flow study 2002 by BOR/Tribe	Tribe, Ecology, Water Users	Seasonally	Approx .25 FTE technician time.
	Measure irrigation water withdrawals: • Continuous measuring weirs are installed at all outtakes • Tailwater discharge monitoring • Site-specific measurements to assess ditch leakage • Other measures described in CIDMP	Water users, Ecology, Cons Dist.	Ongoing during irrigation season	Water user coordinator and Ecology provide maintenance
Sediment transport-Baseline	• Sediment transport study conducted by USGS in 1999	USGS	Baseline / performance studies can be repeated as channel conditions warrant	No additional studies planned at this time.
	• BOR particle samples on gravel bars, 1998	BOR		
Sediment transport-Performance	• Scour chain monitoring of river channel conducted in 1994, 1999 and 2002 to assess scour and fill in proximity to Chinook redds (Reed, Ralph, Hirschi, Rot)	Tribe		
Bathymetry	• Dungeness Bay, bathymetry and circulation study (Rensel, Phase 2, 2003)	Tribe	Completed original study in 2003 with funding from EPA	No additional studies planned at this time
Habitat Conditions and Functions:				
Nearshore/marine	• Inventory of shoreline and nearshore structures and habitat conditions • Marine macroalgae assessment	Tribe, WDFW, MRC, Ecology, PNPTC, DNR	Baseline shoreline inventory completed by PNPTC / Ecology. Assessments should be updated every 5 yrs	Shoreline inventory updates and GIS analysis subject to year to year funding.
Channel morphology - baseline / performance	• Stream channel cross sections were surveyed by BOR in 1997 - 2000, 2002 and locations recorded • Historical research on alternative channel pathways from early survey and airphoto data (Orsborne, BOR) • Annual airphotos taken since 1994 in lower river • Lower river mapped with Loran in 2001 by Clallam County for flood plan update • Channel Migration Zone map	BOR, County, Tribe	Baseline studies can be repeated as channel conditions warrant; Tribe to continue annual air photos	Tribe provides $2,000 - $7,000 annually for airphotos.

Habitat assessment - baseline/ performance	• Comprehensive habitat assessment conducted by Orsborne and Ralph in 1994 covering hydrology, vegetative cover, channel substrate, habitat condition	Tribe	Assessment should be repeated within 5 years	Estimated cost $200,000 for field crew & analysis
Large Woody Debris performance	• 5-year analysis of LWD placement conducted by Tribe (Hagen, 2002) • Proposed LWD projects include GPS and identification of component pieces of constructed log jams at construction and following high flows	Tribe	Project specific, initial monitoring completed	Completed until additional log jam work is done
Soils - baseline/ performance	• Soils analysis of upper watershed in ONF was done during watershed analysis update 2002-3 • Project specific monitoring of road decommissioning and culvert replacement	USFS	• USFS 2002 soils study completed • Project specific	$15,000 monitoring needed in addition to USFS personnel for project monitoring
Biological Response				
Riparian Vegetation - performance	• Annual airphotos • Project-specific monitoring of re-vegetation projects • Re-vegetation plan for river mouth area • Report on Land Use Strategies and CAC (Hals) • Invasive species	• Tribe • Cons District • Tribe • Tribe • County noxious weed board	Generally annual, ongoing, except for preparation of major land use reports.	Technician / staff time by Tribe estimated at $100,000 per year; additional costs by other agencies.
Salmonid populations - baseline/ performance	• Spawning surveys • Chinook redd surveys and GPS mapping • Juvenile monitoring on tributaries and side channels • Productivity assessment (smolt trapping) • Pink salmon weir and scale analysis	• WDFW, Tribe • Tribe • Tribe • WDFW • WDFW	• Annual surveys • Annual GPS • 1998, 2002 • annual, if funded • Bi-annual	WDFW comprehensive monitoring proposal is $1,230,000.00 for 5 years
Other Fisheries populations - baseline/performance	• Bull Trout telemetry studies • Forage fish studies	USFS/USFWS WDFW/MRC	5 year BT study began in 2001 Annual additions to forage fish data base when funded	USFS/USFWS Est. $10,000 / year Forage fish inventories coordinated by MRC and WDFW.
Wildlife populations	• Bird populations - annual Audubon Survey, owl and murrelet surveys • Elk migration analysis: habitat migration plan needed	• Dun. Audubon, USFS, USFWS • WDFW / PNP/ Tribe	Annual, ongoing	Agency staff and volunteers

Changes to Surrounding Land Use				
Land use - baseline	• Airphotos • GIS data - Buildout maps • Land Protection Strategy study (Hals) • Dissertation on Sequim-Dungeness historical land use using GIS provides historical context, but is not current.	• Tribe • County • Tribe/RRWG • P.Eckert	• Annual photos • Completed 2004 • Completed 2003 • 1998	No additional baseline studies planned at this time. Airphotos cost $2,000-$7,000 annually.
Land use-performance	• Critical Areas Code compliance • Buildout scenario based on zoning • County Draft Flood Plan • Review of Critical Areas Code (Hals) • Project specific: Annual monitoring of conservation easements • Property Purchase	• County • County • County • Tribe • County, Tribe, WDFW • North Olympic Land Trust	• Ongoing • In progress • Updated 2003 • 2003 • Ongoing • Ongoing	Agency personnel.

APPENDICES

A. Plans, Studies and Projects in the Dungeness Watershed Area 1989-2006
B. Additional References
C. Salmon Recovery 3-year Project List (2005 update)
D. Environmental Program Goals and Objectives FY 2007-2009: Jamestown S'Klallam Tribe

APPENDIX A
DUNGENESS WATERSHED RESTORATION PLANS AND ACTIVITIES (1989 – 2006)*

[Note: Author and date for the references cited in the 319 Plan are in bold type.]

I. Plans and Studies

A. Major Plans and Documents

- *Clean Water Strategy For Addressing Bacterial Pollution in Dungeness Bay and Watershed and Water Cleanup Detailed Implementation Plan.* **2004. Streeter and Hempleman** for the Clean Water Workgroup. Clallam County and WA Dept. of Ecology.
- *Comprehensive Irrigation District Management Plan.* **2006. HDR** Engineering, Inc., Olympia, WA. Prepared for the Dungeness River Agricultural Water Users Association.
- *Comprehensive Water Conservation Management Plan.* **1999. Montgomery Water Group.** Prepared for Dungeness River Agricultural Water Users Association, WA Department of Ecology.
- *Dungeness Area Watershed Analysis including Gray Wolf River and McDonald, Siebert and Johnson Creeks.* **Dungeness Area Watershed Cooperative Team. 1995**. Prepared for **US Forest Service, Olympic National Forest.**
- *Dungeness River Area Watershed Management Plan.* **1993. Dungeness Watershed Committee coordinated by Clallam County.**
- *Dungeness River Area Watershed Characterization.* **1991. Puget Sound Cooperative River Basin Team for Clallam County.**
- *Dungeness River Comprehensive Flood Control Management Plan.* **1990. Kramer, Chin & Mayo for Clallam County** (update due 2007).
- *Dungeness River Greenway Plan.* 1994. CZM, by Clallam County.
- ***Dungeness-Quilcene Water Resources Management Plan.*** **1994.** Regional Planning Group, Jamestown S'Klallam Tribe Coordinating Entity.
- *Dungeness Watershed Analysis Update.* **2002. USDA Forest Service, Olympic National Forest.** Dungeness watershed analysis - assessment modules for sedimentation and stream channels. Olympia, Washington.
- ***Dungeness Watershed Salmonid Recovery Planning Notebook:*** A Response to the Six Questions from the Development Committee of the Shared Strategy for Puget Sound. **2005**. Submitted by Dungeness River Management Team. [Incorporated into the *Puget Sound Salmon Recovery Plan.* 2005. Submitted by the Shared Strategy Development Committee. Adopted by National Marine Fisheries Service January 19, 2007.]
- Elwha-Dungeness Watershed Plan for Water Resource Inventory Area 18 and Sequim Bay in West WRIA 17. May, **2005. Entrix**, Inc. and the Clallam County Dept. of Community Development for the Elwha-Dungeness Planning Unit. Clallam County, Port Angeles, WA.
- *Historical Geomorphology and ecology of the Dungeness River delta and nearshore environments from the Dungeness Spit to Washington Harbor.* **2005. Collins, B.** Department of Earth and Space Sciences, University of Washington. Prepared for the Jamestown S'Klallam Tribe.

* Updated April, 2007 by the Jamestown S'Klallam Tribe

- *Hydrogeologic Assessment of the Sequim-Dungeness Area, Clallam County, Washington.* **1999. Thomas**, B.E., L.A. Goodman and Theresa D. Olsen**.** US Geological Survey Water-Resources Investigations Report 99-4048.
- *Numerical Modeling Study of Levee Setback Alternatives for Lower Dungeness River, Washington.* 2006. U.S. Bureau of Reclamation. Prepared for Jamestown S'Klallam Tribe.
- *Physical Processes, Human Impacts and Restoration Issues of the Lower Dungeness River.* **2002. Bountry, J., T. Randle, L. Piety and R.A. Link.** US Bureau of Reclamation. Prepared for Jamestown S'Klallam Tribe.
- *Recommended Land Protection Strategies for the Dungeness River Riparian Area.* **2003. Hals, H. and Dungeness River Restoration Workgroup.** Prepared for the Jamestown S'Klallam Tribe.
- *Recommended Restoration Projects for the Dungeness River, (Habitat Plan/Blue Book).* **Dungeness River Restoration Work Group (DRRWG). 1997.** Prepared for the Dungeness River Management Team.
- *Relationship Between the Upper Dungeness River and the Bedrock Aquifer, Clallam County.* December 2001. Garrigues, R. and J. Shedd. WA Department of Ecology.
- *Restoring the Dungeness: An Overview of the Dungeness River Restoration Strategy.* **2003. Newberry, L. Prepared for the Jamestown S'Klallam Tribe.**
- *Salmon and Steelhead Habitat Limiting Factors, WRIA 18, Final Report.* **Haring. 1999.** WA State Conservation Commission with Dungeness River Restoration Workgroup.
- *Sequim-Dungeness Groundwater Protection Project (and "Strategy*"). 1992-1994. Clallam County and Groundwater Committee.
- *Shoreline Master Program/Inventories.* Ongoing. Preparation for future amendments to integrate GMA/CAO/Watershed Planning.
- *Water Cleanup Plan for Bacteria in the Lower Dungeness Watershed.* Total Maximum Daily Load (TMDL) Submittal Report. June 2002. Hempleton, C. and D. Sargeant. WA Department of Ecology Southwest Regional Office.

B. Habitat Assessment

- *An Aquatic Resource Assessment of the Dungeness River Basin System: Phase I.* 1992. Orsborn and Ralph. Prepared for the Jamestown S'Klallam Tribe.
- *An Aquatic Resource Assessment of the Dungeness River Basin System: Phase II - Physical Channel Analysis, Hydrology, and Hydraulics, & Phase III - Fisheries Habitat Survey.* **1994. Orsborn and Ralph.** Prepared for the Jamestown S'Klallam Tribe and USFS.
- *Dungeness Bay Bathymetry, Circulation and Fecal Coliform Studies, Phase I.* 2001. Rensel and Smayda. Prepared for Jamestown S'Klallam Tribe.
- *Dungeness Bay Bathymetry, Circulation and Fecal Coliform Studies, Phase II.* **2003. Rensel.** Prepared for Jamestown S'Klallam Tribe.
- *Dungeness River Engineered Logjam Restoration Project Geomorphic Hazard Assessment.* 2006. Herrera Environmental Consultants. Prepared for the Jamestown S'Klallam Tribe.
- *A Fire-Year Report on Constructed Log Jams Built by the Jamestown S'Klallam Tribe on the Dungeness River.* September 2002. Hagen, M. Prepared for the Jamestown S'Klallam Tribe.
- *Kinkade Island Geomorphic Assessment, Dungeness River, Washington.* 2003. US Bureau of Reclamation. Prepared for Clallam County.

- *Review of Clallam County Critical Areas Ordinance, 2001 in Protecting Riparian Areas* – Using the Dungeness River as a Case Study. **2004. Hals, H.** Jamestown S'Klallam Tribe.
- *Review of the Influence Exerted by Environmental Factors on Spring Chinook Salmon in the Dungeness River.* 1993. Lichatowich. Prepared for the Jamestown S'Klallam Tribe.
- *Seepage and Mainstem Aquifer Characterization.* 2001. USGS, WA Department of Ecology.
- *Siebert Creek Watershed Assessment.* 2003. US Fish and Wildlife Service, Pacific Woodrush, Clallam Conservation District, Jamestown S'Klallam Tribe, Clallam County.
- *Upper Dungeness Aquifer Study – Final Report: Relationship Between the Upper Dungeness River and the Bedrock Aquifer, Clallam County.* 2001. Gibbons. WA Department of Ecology.

C. Stock Analysis / Rebuilding / Recovery

- *Draft Recovery Plan for the Coastal Puget Sound Distinct Population Segment of Bull Trout (Salvelinus confluentus), Volumes I and II. May **2004.** Olympic Peninsula Management Unit, Region 1.* ***United States Fish and Wildlife Service.***
- *Dungeness Bull Trout Telemetry Project. 2003-2007.* U.S. Forest Service, U.S. Fish and Wildlife, WA Department of Fish and Wildlife, Olympic National Park, Washington conservation Corps, Dungeness Farms.
- *Dungeness Chinook Ecosystem Diagnostic Treatment Analysis and Reach Analysis Overview.* **2003. Mobrand** Biometrics, Inc.
- *Dungeness Chinook Acclimation Ponds / Chinook Broodstock Program.* 1996-present. Jobs in the Woods (BIA), Jamestown S'Klallam Tribe.
- *Dungeness Chinook Captive Broodstock Program.* 1992-present. WA Department of Fish and Wildlife, Jamestown S'Klallam Tribe, USFWS, volunteers.
- *Chinook Redd Mapping Study.* On-going. 1992-present. Jamestown S'Klallam Tribe.
- *Dungeness Chinook Salmon Rebuilding Project Progress Report, 1992-1993.* 1995. Smith, WDFW and Wampler, USFWS.
- *Dungeness Fall Pink Captive Broodstock Program and Tagging.* 1995-present. WDFW, Jamestown S'Klallam Tribe, USFWS.
- *Dungeness Pink Outmigration.* 1994. USFWS.
- *Dungeness River Pink and Chinook Salmon Historical Abundance, Current Status and Restoration.* **1993. Lichatowich**. Prepared for the Jamestown S'Klallam Tribe.
- *Dungeness Salmonid Life History Study.* 1998. Hirschi and Reed. Prepared for Jamestown S'Klallam Tribe. Life History Assessment continues by the Jamestown S'Klallam Tribe (2002).
- *The Evolving Dungeness River: juvenile salmon and their use of side channel habitat - A comparison of data collected 1997/1998 vs. 1999/2000.* May 2003. Rot, B. Jamestown S'Klallam Tribe.
- *Key Points in Understanding EDT Action Analysis for Dungeness Chinook. 2004. Lestelle, L. Mobrand Biometrics, Inc.*
- *Smolt Trapping on Siebert, Matriotti (and Jimmycomelately) Creeks.* On-going. Northwest Indian Fisheries Commission, Jamestown S'Klallam Tribe, WDFW, volunteers.

- *Summer Chum Recovery Project.* On-going. WDFW, North Olympic Salmon Coalition, Jamestown S'Klallam Tribe, volunteers.
- *Toward Recovery: Clallam County Response to the Endangered Species Act Listing of and Proposed Listing of Salmonids Species in Puget Sound, the Strait of Juan de Fuca and the Pacific Coast.* Date Unknown. Clallam County Department of Community Development.
- *1992 Washington State Salmon and Steelhead Stock Inventory **(SASSI).*** **1993. WDFW and Washington Tribes.**

D. Instream Flow / Water Conservation / Water Quality / Water Resources Studies

- *Aquifer Storage and Recovery Evaluation Report.* 2003. Tetra Tech FW, Inc. Prepared for Clallam County.
- *Dungeness Bay Fecal Coliform Bacteria Total Maximum Daily Load Study.* March **2004. Sargeant,** D. WA Department of Ecology.
- *Dungeness River and Matriotti Creek Fecal Coliform Bacteria Total Maximum Daily Load Study.* May **2002. Sargeant**, D. WA Department of Ecology Environmental Assessment Program.
- *Dungeness River and Matriotti Creek Post Total Maximum Daily Load Data Review. December 2004. Sargeant, D. WA Department of Ecology.*
- *Dungeness River /Matriotti Creek Total Maximum Daily Load Study Preliminary Data Results for November 1999-October 2000.* January 2001. Sargeant, D. WA Department of Ecology.
- *Dungeness River Instream Flow Side Channel Study*. **2003. Daraio, J. J. Bountry and T. Randle**. US Bureau of Reclamation. Denver, CO. Investigates relationship flows in the mainstem with flows in the side channels, and the impacts from irrigation withdrawals. Prepared for Jamestown S'Klallam Tribe.
- *Dungeness River Irrigation Ditch Leakage Assessment.* 1993. Montgomery Water Group. Prepared for WA Department of Ecology and Dungeness River Agricultural Water Users Association.
- *Dungeness Sediment Reduction for Fish/Shellfish Project.* 1999-2002. Sediment / temperature monitoring instream and extensive bay / small tributaries monitoring. In cooperation with WA Department of Ecology, Clallam County, WA Department of Health, CCWF funds.
- *EIS for Comprehensive Water Conservation Management Plan.* **2003. Foster Wheeler, Inc.** Prepared for WA Department of Ecology.
- *Fish Habitat Analysis for the Dungeness River Using the Instream Flow Incremental Methodology.* **1991. Wampler and Hiss**, USFWS.
- *Groundwater Flow Model of the Sequim-Dungeness Area.* 2003. Tetra Tech FW. Prepared for Clallam County.
- *Groundwater Quality in the Agnew and Carlsborg Area, Clallam County (December 2000*-December 2002). 2003. Department of Ecology. Clallam County.
- *Instream Flow Recommendations for Dungeness-Quilcene Area Salmon and Steelhead Streams, **1993.*** **Hiss**, USFWS, Dungeness River Restoration Work Group, with WA Department of Ecology review of Dungeness watershed streams. Updated 2000.
- *Irrigation Tailwater Quality Assessment.* 2003. Clallam Conservation District.
- *Irrigation and Stormwater Feasibility Study.* 2003. Cline Irrigation District, Clallam County Road Department, Washington Conservation Commission, Clallam Conservation District, Department of Ecology.

- *Potential Application of Microbial Source Tracking Methods to The Dungeness Watershed and Bay.* 2003. Battelle Pacific Northwest Division. Prepared for Clallam County and WA Department of Ecology.
- *Potential Stormwater Impacts on Sediment Quality in Urbanizing Clallam County Streams.* 2003. Prepared by Battelle Pacific Northwest Division for Clallam County. Johnson, A., B. Carey, and S. Golding. WA Department of Ecology.
- *Recommended Instream Flows for the Lower Dungeness River, **1993**.* **Hiss,** USFWS, Dungeness River Restoration Work Group, with WA Department of Ecology review of Dungeness watershed streams. Updated 2000.
- *Results of a Screening Analysis for Pharmaceuticals in Wastewater Treatment Plan Effluents, Wells, and Creeks in the Sequim*-Dungeness Area. November 2004.
- *SNOTEL Gauges* (2). 1998-1999. Installation in upper Dungeness to predict instream flows, drought, flooding. NRCS, for Jamestown S'Klallam Tribe.
- *Stream flow measurements* (on river, tributaries, irrigation ditches), Dungeness River. 1924-present / ongoing. USGS. Also flow measurements are collected by WA Department of Ecology (real-time monitoring on five irrigation outtakes), Jamestown S'Klallam Tribe, Sequim-Dungeness Agricultural Water Users Association, Streamkeepers.
- *Surface Water-Ground Water Interactions Along the Dungeness River and Vertical Hydraulic Conductivity of Streambed Sediments, Clallam County, Washington, September 1999-July 2001.* August **2002. Simonds, F.W. and K. Sinclair**. WA Department of Ecology and US Geological Survey.
- *Potential Stormwater Impacts on Sediment Quality in Urbanizing Clallam County Streams.* **2003. Brandenberger, J.M., C.W. My, N.P. Kohn and L.S. Bingler**. Prepared for Clallam County Department of Community Development by Battelle Marine Sciences Laboratory. Sequim, WA.
- *Water Cleanup Plan for Bacteria in Dungeness Bay:* Total Maximum Daily Load (TMDL) Submittal Report. April 2004. Hempleman, C. and D. Sargeant. WA Department of Ecology.
- *Water Storage and Site Feasibility Study.* 2003. Montgomery Water Group, Inc. Prepared for Clallam County and WA Department of Ecology.

II. RESTORATION AND EDUCATION PROJECTS AND PROGRAMS

A. Restoration Projects and Programs

- *Burlingame Bridge Widening and Habitat Restoration.* 2001. Clallam County.
- *Clallam County Noxious Weed Removal / Survey.* 2003. Surveyed 130 miles and treated 37 miles in upper watershed. U.S. Forest Service, Clallam County, Department of Ecology's WCC Program.
- *Conservation Reserve Enhancement Program (CREP).* Ongoing. Washington Conservation Commission, NRCS.
- *Derelict Fishing Gear Removal Pilot Project.* 2003. Northwest Straits Commission, NOAA, Clallam County Marine Resource Committee, Puget Sound Action Team, WDFW.
- *Dungeness Irrigation System Improvements* – Implementation of projects recommended in the Comprehensive Water Conservation Plan to improve water conveyance efficiency/fisheries survival (fish screens, ditch pipe lining, siphon replacement). Jamestown S'Klallam Tribe/WDFW, JFE-DNR, 1994-1998, IAC

1999-2001, WA SRFB 1999-2001. Clallam Conservation District/CCWF, 1999-2001. Sequim-Dungeness Agricultural Water Users Association, NRCS.

- *Dungeness Large Woody Debris Placement.* 1996-2001. JFE-DNR, JIW-BIA & IAC, Jamestown S'Klallam Tribe.
- *Dungeness Refuge Noxious Weed Removal.* 2001-2003. Dungeness National Wildlife Refuge, volunteers.
- *Dungeness Riparian Habitat Restoration Program.* 1997-2001. Purchase of conservation easements from willing sellers. North Olympic Land Trust, Clallam County.
- *Dungeness River Bank Stabilization* - Bioengineering projects to stabilize eroding banks in lower river. Clallam County/EPA, WDFW, JFW-DNR, and County roads/bridges projects. 1994.
- *Dungeness USFS Roads Sediment Reduction Project.* 2000-2003. Road stabilization and decommissioning, road drainage improvements. USFS, in partnership with Clallam Conservation District, Pacific Coast Watershed Project, WA Conservation Corps, Olympic National Forest.
- *Phase II Lower Dungeness River Restoration Project.* 2003-2007. U.S. Fish and Wildlife, Jamestown S'Klallam Tribe, willing landowners.
- *Sequim Prairie Irrigation Channel/Fish Screens/By-Pass/Habitat Restoration Project.* 1999-2001. Joint Funding WACERT, Sustainable Solutions, Jamestown S'Klallam Tribe. Completed by Jamestown S'Klallam Tribe.
- *Stream Restoration Projects* (fencing/re-vegetation along rivers/creeks - Gray Wolf, Bell, Cassalery, Hurd, Matriotti, Meadowbrook, Siebert). 1994–present. JFE-DNR, Clallam County, Clallam Conservation District, Jamestown S'Klallam Tribe, Youth Conservation Corps, Pacific Woodrush.

B. <u>*Public Education Projects*</u>

- *"A Manual of Tools for Understanding the Natural History of the Dungeness River Watershed."* 1996. Clark, Clark and Newberry. Prepared for the Jamestown S'Klallam Tribe.
- *"Every River Has Its People" (The 1993 State of the Dungeness River Report).* 1993. Jamestown S'Klallam Tribe, Public Involvement and Education (PIE) Grant, Puget Sound Water Quality Authority.
- *"Keys to an Understanding of the Natural History of the Dungeness River System."* 1996. Clark and Clark. Prepared for the Jamestown S'Klallam Tribe.
- Dungeness Bay Stewardship Initiative. 1999. Clallam County, CCWF.
- Dungeness Bay Tour. 1998. Clallam County.
- Dungeness Bay Watchers. 1999. Public Involvement and Education (PIE) Grant, Puget Sound Water Quality Authority, Clallam County.
- *Dungeness River Audubon Center at Railroad Bridge Park* – Public access, education, research, annual river festival. Ongoing. Rainshadow Foundation, Olympic Peninsula Audubon Society, Jamestown S'Klallam Tribe.
- *Dungeness River Riparian Landowners Education Project* – "Living on the River" booklet. 1998. Clallam County, CCWF.
- *Dungeness River Festival.* Biennial festival featuring booths from Dungeness River stakeholder groups, and including environmental stewardship activities and information for children and adults.
- *Groundwater Guardian Program.* 2001-present. Clean Water District, Clallam County, Groundwater Foundation.

- *Living by the Coast, Coastal Processes Workshops.* 1998-1999. CZM, Clallam County.
- Matriotti Creek Environmental Learning Area. 1992 – Ongoing. Clallam County.
- *Pollution Prevention Outreach Program* (Landowner Education). 1994-1995. Clallam and Jefferson Conservation Districts, WSU Cooperative Extension, funded by Jamestown S'Klallam Tribe/EPA grant.
- *Salmon in the Dungeness River: From Abundance to Emptiness, Parts 1 and 2.* McNulty, T. 2001. Prepared with the Jamestown S'Klallam Tribe.
- *Sequim Irrigation Festival – Increasing Awareness of the Dungeness River* - -Parade entry and "River Gone Run" play. 1996-1998. Jamestown S'Klallam Tribe, Olympic Theatre Arts.
- Stream Keepers of Clallam County. 1999-present. Clallam County.

III. Studies / Projects in Progress 1998-2006

A. Projects / Plans / Studies / Programs in Progress

- *Dungeness Artificial Recharge Feasibility Study*. Due 2007. PGG. Prepared for Clallam County. Funded by WA Department of Ecology.
- *Conservation Reserve Enhancement Program.* On-going. Washington Conservation Commission, Clallam Conservation District.
- *Draft Dungeness River Comprehensive Flood Hazard Management Plan.* Draft completed June 2003. Final expected 2007. Update to Comprehensive Flood Control Management Plan. Clallam County, Dungeness Flood Planning Committee.
- *Dungeness Bull Trout Telemetry Project.* 2003-2007. US Forest Service, Us Fish and Wildlife Service, WDFW, Olympic National Park, Ecology's Washington Conservation Corps, Dungeness Farms.
- *Dungeness Estuary Restoration* – Purchase of estuarine land from willing sellers (including appraisals, reviews and environmental assessments of estuarine parcels), relocation of dwellings, demolition and revegetation. 1999-present. Clallam County, Jamestown S'Klallam Tribe, WDFW, US Fish and Wildlife Service, landowners.
- *Dungeness In-stream Flow Rulemaking.* Executive and Technical Groups regularly meeting to develop Rule for in-stream flows and water management strategies. Discussions are based on recommendations in the Elwha-Dungeness Watershed Plan. Rule will guide future water right and water availability decision-making, and will protect existing water rights and water in streams for ESA-listed salmonids. Final Rule expected 2008,
- *Dungeness Irrigation System Improvements*. On-going. To improve water conveyance efficiency, water conservation, and fisheries survival. Sequim-Dungeness Agricultural Water Users Association, Clallam Conservation District, Jamestown S'Klallam Tribe, NRCS.
- *Dungeness Irrigation Water Leasing*. 2003-2005. Sequim-Dungeness Agricultural Water Users Association, WA Department of Ecology.
- *Dungeness Refuge Noxious Weed Removal*. 2001-ongoing. Dungeness National Wildlife Refuge, volunteers.
- *Dungeness Scour Chain Study of Bedload Scour and Deposition.* 1999-2002. (Data collection completed 2002.) BIA, Jamestown S'Klallam Tribe.
- *Dungeness USFS Roads Sediment Reduction Project.* 2002-ongoing. Stabilization / decommission and repair. USFS, in partnership with Clallam Conservation

District, Pacific Coast Watershed Project, WA Conservation Corps and Olympic National Forest.

- *Microbial Source Tracking Study.* 2005-2008. Fresh and marine water sampling and source sampling to determine fecal coliform sources at select sites in watershed and bay. Report due 2008. Battelle Marine Sciences Laboratory preparing for Jamestown S'Klallam Tribe.
- *Phase II Lower Dungeness River Restoration Project* – historical characterization of Lower Dungeness River and floodplain, and native replanting of 90 acres of riparian/floodplain habitat. 2003-2007. US Fish and Wildlife Service, Jamestown S'Klallam Tribe, willing landowners.

B. Planning

- *State HB2496 North Olympic Peninsula Salmon Recovery Planning (WRIA's 17-20).* 1998-present. Clallam County lead.
- *State HB2514 Watershed Planning (WRIA 18).* 1998-present. WRIA 18 Initiating Governments (Clallam County, City of Port Angeles, Jamestown S'Klallam Tribe, Lower Elwha S'Klallam Tribe, Agnew Irrigation District, Washington State Department of Ecology), DRMT planning group. Project lead: Clallam County. Phase III completed 2004.
- *Clallam County Marine Resource Committee.* 2001-present/ongoing.
- *Agricultural Conservation Planning and Implementation.* On-going technical assistance for: agricultural conservation and Best Management Practices, farm conservation plans, dairy nutrient management plans, restoration planning. Clallam Conservation District.

APPENDIX B: ADDITIONAL REFERENCES CITED

[Note: Most of the references cited in the 319 Plan are in bold type in Appendix A. Appendix B contains additional references.]

Clallam Conservation District, 2007. 2006 Projected Farm Water Quality Remediation in the Dungeness and Sequim Bay Drainages. Port Angeles, WA.

Drost, B.W. 1986. Water Resources of Clallam County, WA; Phase 1 Report. US Geological Survey Water Resources Investigation Report 83-4227. Tacoma, WA.

Eckert, P. 1998. The Social Construction of a Watershed: Changing Rights and Changing Land. PhD dissertation; University of Washington, College of Forest Resources. Seattle, WA

Forest Ecosystem Management and Assessment Team (FEMAT), 1993. Forest Ecosystem Management: An Ecological, Economic and Social Assessment. USDA Forest Service.

Gray and Osborne, 2003. Update to the City of Sequim Comprehensive Wastewater Facilities Plan. Sequim, WA.

Jamestown S'Klallam Tribe, 1994. Comprehensive Plan. Sequim, WA.

Kirk, R. and R. Daugherty, 2007. Archaeology in Washington. University of Washington Press. Seattle, WA.

Kruckeberg, A.R. 1991. The Natural History of Puget Sound Country. University of Washington Press. Seattle, WA.

Puget Sound Action Team. 1994. 1994 Puget Sound Water Quality Management Plan

Seiter, A., L. Newberry and P. Edens, 2000. Cooperative Management of the Dungeness Watershed to Protect Salmon in Washington State. Journal of the American Water Resources Association, Vol. 36, No. 6, December, 2000.

Shared Strategy, 2005. Puget Sound Salmon Recovery Plan. Shared Strategy for Puget Sound. Seattle, WA. [Adopted by NOAA-National Marine Fisheries Service, January 19, 2007]

Shreffler, D., M. Hagen, H. Turnbull and Clallam Conservation District, 2004. Siebert Creek Watershed Assessment and Prioritization of Restoration, Protection and Education Opportunities. US Fish and Wildlife Service, Lacey, WA and Pacific Woodrush, Port Angeles, WA.

Soule, A. 2005. Monitoring for Stormwater Contaminants in the Shallow Aquifer Near Priest Road, Clallam County, WA. Clallam County Environmental Health Services. Port Angeles, WA.

Todd, S., N. Fitzpatrick, A. Carter-Mortimer and C. Weller. 2006. Historical Changes to Estuaries, Spits, and Associated Tidal Wetland Habitats in the Hood Canal and Strait of Juan de Fuca Regions of Washington State. PNPTC Technical Report 06-1. Point No Point Treaty Council. Kingston, WA.

US Department of Agriculture (USDA) Forest Service. 1990. Olympic National Forest Land and Resources Management Plan. USDA Forest Service, Pacific Northwest Region, Portland, Oregon.

US Department of Agriculture (USDA) Forest Service and US Department of the Interior (USDI) Bureau of Land Management (BLM). 1994a. Record of decision for amendments to Forest Service and Bureau of Land Management planning documents within the range of the northern spotted owl *and* Standards and guidelines for management of habitat for late-successional and old growth forest related species within the range of the northern spotted owl. Forest Service; USDI Bureau of Land Management, Fish and Wildlife Service, National Park Service; US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service; US Environmental Protection Agency, Portland, Oregon

US Department of Agriculture (USDA) Forest Service and US Department of the Interior (USDI) Bureau of Land Management (BLM). 1994b. Final supplemental environmental impact statement on management of habitat for late-successional and old growth forest related species within the range of the northern spotted owl. Forest Service; USDI Bureau of Land Management, Fish and Wildlife Service, National Park Service; US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service; US Environmental Protection Agency, Portland, Oregon.

Washington Department of Ecology, 2005. Western Washington Land Cover Change Analysis: Final Report. Olympia, WA

Appendix C: Dungeness 3yr project list updated 2005									
Project Name	**Likely sponsor**	**Project ranking (out of 24)**	**Project Type**	**Project Summary**	**Current Status**	**Total cost for first three yrs**	**Start date**	**End date**	**Post 2009 funding**
Rivers End Risk Assessment	Jamestown S'Klallam	top 5	Pre-project Study	The study will examine the risks and benefits of the River occupying its 1855 channel. This study was requested by adjacent landowners and would be a first step to dike removal.	This is the next step following acquisition which is 80% completed	$100,000	2007	2007	
Rivers End saltmarsh recovery Phase I	Clallam County WDFW Jamestown S'Klallam	top 5	Pre-project study	Estuarine dikes have been in place since 1855. The study will look at increasing salt marsh extent through fill removal and dike removal scenarios. Public meetings will be held to determine extent and scope of restoration project.	WDFW owns part of the site, the dikes are on privately held property.	$75,000	2007	2007	
Rivers End saltmarsh recovery Phase II	Jamestown S'Klallam Clallam County WDFW	top 5	Restoration	Dikes will be opened or removed and fill removed.	WDFW owns part of the site, the dikes are on privately held property.				
Beebe acquisition	Jamestown S'Klallam/NOLT	1	Acquisition	Purchase property to implement Corps dike setback restoration plan		$1,000,000	2008	2008	$2,000,000 dike setback following or in conjunction to Corps work
ACOE dike setback Phase I	Clallam County	2 and 3	Restoration	2.3 mile dike setback on east bank of lower river	Bureau of Rec alternative analysis in process	$7,500,000	2007	2009	
LWD placement and channel reconstruction Phase II	Jamestown S'Klallam	10	Restoration	Log jam construction and channel reconstruction in dike setback reach	dependent on Phase I but will occur at same time	$2,175,000	2007	2009	

Dungeness corridor protection Hurd Creek - WDFW Hatchery	WDFW JSKT NOLT	5 , 6 ,7 ,9 ,11, 13	Acquisition	Tier I parcels identified for acquisition. Contain important main channel, side channel and riparian habitat. Areas identified that are integral to removing dikes and recovering floodplain.	Negotiations are underway for some Tier 1 parcels by WDFW	$4,295,000			
Middle Dungeness River Restoration Plan	JSKT WDFW CCD	5, 6, 7	Pre-project study	Risk/benefit analysis of various restoration alternatives using existing information and developing a hydraulic reach model.	Landowner on the reach requested in, needs funding	$175,000	2007	2008	
Removal or setback of upper Haller dike	JSKT WDFW Clallam County	6	Restoration	Recover lost floodplain on the west bank	Pending acquisition and the Middle Dungeness Restoration Plan	$300,000	2008	2009	
Riparian reforestation	CCD JSKT Clallam County	High	Restoration	Reforest unvegetated riparian land with cooperating landowners		$150,000	2007	2009	
Agnew Irrigation piping	Agnew Irrigation District	High	Water conservation	tightlining leaking irrigation ditches	Next step in implementing irrigation water conservation plan	$500,000	2008	2008	
Clallam-Cline-Dungeness Irrigation piping	Clallam-Cline Irrigation District	High	Water conservation	Put main ditch for these three districts into one pipe	Next step in implementing irrigation water conservation plan	$2,000,000	2007	2007	match in hand
Dungeness Irrigation piping	Dungeness Irrigation Group	High	Water conservation	Put entire ditch system into pipes	Next step in implementing irrigation water conservation plan	$2,000,000	2007	2007	match in hand
					TOTAL OF ALL PROJECTS	$20,270,000			

APPENDIX D:
Jamestown S'Klallam Tribe: ENVIRONMENTAL PROGRAM: Goals and Objectives FY 2007-2009:

Goal: Supervise Environmental Staff and Program.
Objective: To implement the Program goals, supervise staff, coordinate with other Tribal departments.
Outcome: Integrated management of the Tribe's environmental capacity building.
Milestone: On-going. Report to EPA at six month intervals.

Goal: Coordinate Tribal Water Quality and Environmental Program.
Objective: Provide coordination with other Tribal and non Tribal entities; increase efficiency.
Output: 100% attendance CTWQP meetings, serve on one special task force on behalf of CTWQP
Outcome: Jamestown's program is kept informed by other Tribes and other processes on all relevant activities impacting our watersheds.
Milestone: On-going

Goal: Seek funding for Program Goals and Objectives
Objective: Apply for state, federal and foundation grants
Output: Minimum of three grant applications per year
Outcome: Adequately funded Environmental Program
Milestone: On-going

Goal: Update Environmental Program Work Plan.
Objective: Keep Work Plan current with new environmental findings, new Tribal policies.
Output: Revised Work Plan.
Outcome: Work Plan guides staff to meet current needs
Milestone: Biannually in March

PROTECTION PLANNING:

Goal: Protect human health in Shellfish Growing Waters.
Objective: Develop capacity to monitor and prevent pollution and toxins from entering tribal shellfish growing waters.
Output: Monitoring, laboratory work, participation in workgroups addressing pollution

Outcome: Shellfish growing areas certified as safe; tribal and general public health protected.
Milestone: No new downgrades; one up-grade by June 2008.

Goal: Protect human health through prevention of air pollution.
Objective: Develop capacity to monitor and assess air quality on Tribal lands and facilities.
Product: Establish basis for potential Clean Air Program
Milestone: Start date FY 2008

Goal: Wetlands Mitigation and Wetlands functions.
Objective: Develop capacity to monitor wetland functions, and plan for mitigation of wetland problems including impacts on receiving waters.
Output: Wetland monitoring, assessment; retention of consultants
Outcome: Establishment of a wetland protection system.
Milestone: On-going

Goal: Protect surface water (In-stream Flows, Water Quality).
Objective: Develop capacity to monitor and analyze in-stream flows and quality characteristics of surface waters, storm water and irrigation water, to protect beneficial uses, especially fish and shellfish habitat.
Output: Monitoring, laboratory work, participation in workgroups addressing water quality and water quantity issues
Outcome: Pollution sources and habitat problems identified for future action.
Milestone: On-Going

Goal: Protect specific wildlife species from human interference
Objective: to protect specific species of wildlife of interest to the Tribe which are being threatened by human development (elk, waterfowl, shellfish, salmon)
Output: Research, mapping, participation in workgroups addressing wildlife issues
Outcome: wildlife protection plans in place
Outcome: local development regulations and enforcement are appropriately conditioned to protect wildlife species of concern.
Milestone: Ongoing

Goal: Protect ground water.

Objective: Develop capacity to monitor ground water quality and assess ground water threats.
Outputs: Participation in workgroups addressing ground water issues; training; retention of consultants
Outcome: Expanded ability to manage Ground Water Program
Milestone: Ongoing

RESTORATION/ENHANCEMENT PLANNING:

Goal: Protect human health by Upgrading Shellfish Beds.

Objective: Participate in shellfish growing area planning.
Output: lead Clean Water Work Group; participate in Department of Health Tribal Shellfish Workgroup and related efforts
Outcome: Re-certify shellfish beds (with WA Dept of Health).
Milestone: June, 2009.
Outcome: Prevent shellfish growing area downgrades.
Milestone: On-going

Goal: Improve water quality in receiving waters through Wetland Restoration planning.

Objective: Restore wetland functions.
Output: Wetland Restoration Plan (with County, State and Federal agencies.)
Outcome: Plan in place to insure wetlands are restored; protected
Milestone: Ongoing for other watersheds

Goal: Improve surface water quality and habitat through Stream Corridor Restoration.

Objective: Plan to improve stream flow and water quality, and restore lost habitat in several streams.
Output: Stream Restoration Plans (with Co, State and Federal agencies and funding)
Outcome: Plans in place to improve stream flow and water quality; restore lost habitat
Milestone: On-going

Objective: Implement restoration plans (with others)
Output: Secure funding, complete design, engineering, permitting; construction; re-vegetation; adaptive management
Product: Restored stream corridors, flood planes and estuaries

Milestone: On-going

Goal: Restore threatened and endangered species of fish and shellfish.
Objective: Plan for and implement Broodstock programs and other culture methods to restore specific species
Output: Assist with brood stock, hatchery and other programs, in cooperation with WA Department of Fish and Wildlife and volunteer groups
Outcome: Species restored to appropriate ecosystem function
Outcome: Species restored to harvestable levels
Mile-stone: Ongoing

Goal: Remove invasive vegetation; plant native vegetation; restore riparian corridors and wetland and shoreline buffers
Objective: Plan for and implement vegetation removal and native vegetation planting projects
Output: Vegetation removal and re-vegetation plans; plan implementation
Outcome: Restored buffers protecting water quality and wildlife habitat
Milestone: Ongoing

ENVIRONMENTAL MANAGEMENT:

Goal: Protect human health through Tribal Drinking Water protection.
Objective: Expand capacity to continuously monitor drinking water sources; analyze problems.
Outputs: Monitoring, training in new techniques, requirements; plan for needed equipment
Outcome: Well management system to prevent pollution of drinking water; protect public health
Milestone: On-going

Goal: Protect human health and prevent surface water pollution through management of Tribal sewage treatment systems.
Objective: Develop capacity to continuously monitor and assess sewage treatment systems, and to plan for long term sewage treatment needs on Tribal land.
Output: Monitoring; training in new techniques, and permitting requirements; plan for new system and equipment needs
Outcome: Expanded sewage system management plan.
Milestone: On-going

Goal: Insure no negative environmental impacts of all tribal activities

Objective: Develop capacity to assess environmental impacts
Output: Environmental assessments; training; retention of consultants
Outcome: Improved Environmental Management System; Tribal projects properly assessed, planned and managed.
Milestone: On-going

Goal: Insure no negative environmental impacts of other actions within the tribe's Usual and Accustomed Area.
Objective: Keep abreast of all activities within our watersheds which may impact tribal interests
Output: Review and comment on development and forestry proposals within the Tribe's U & A
Outcome: Improved development proposals; prevention of seriously negative actions.
Milestone: On-going

ENVIRONMENTAL EDUCATION:

Goal: Educate individuals on importance of environmental stewardship by holding Public/Tribal Workshops.
Objective: Sponsor workshops, alone and with other entities, especially on land use, storm water management, and watershed planning processes.
Output: Minimum of 2 workshops per year.
Outcome: Individuals are educated
Milestone: On-going

Objective: Prepare publications, presentations, hand-outs, newsletter articles, press releases and other forms of communication on issues of importance to the Tribe
Output: Minimum of two communication products per year
Outcome: Individuals are educated; a broader audience is reached
Milestone: On-going

Goal: Educate public on importance of water quality and resource protection (focus on fish, shellfish, other wildlife, water quality and habitat needs, native versus non-native vegetation, and personal stewardship)
Objective: Provide lectures and/or displays at suitable public events on water quality and natural resource issues.
Output: Minimum of two lectures/displays per year
Outcome: Individuals are educated
Milestone: On-going

Goal: Introduce children to importance of water quality and resource protection.

Objective: Plan day camp for K-8 age levels, and one for Tribal children.
Output: Two weeks of day camp and Tribal summer program.
Outcome: Children, including Tribal children, are educated
Milestone: Annual; On-going

Objective: Provide regular environmental education to Tribal After-School Program.
Output: Provide curriculum for at least two after school activities per year
Outcome: Environmental content part of After School Program; children are educated
Milestone: On-going

Goal: Educate general public by exposure to informal educational information.

Objective: Establish capacity to support a permanent interpretive center with ongoing environmental programs and displays.
Output: participate in groups planning and developing interpretive center
Outcome: Support for Interpretive center educational programs
Milestone: On-going

Objective: Plan and participate in festivals and similar events to educate all ages.
Output: Plan for environmental educational display and activity component of a minimum of one festival event per year
Outcome: Environmental education is integral to the Festival.
Milestone: Two day: Bi-annual every even-numbered year; one-day as opportunity arises (Streamfest; Tribal Health Fair, etc.).

TRAINING:

Goal: Train Tribal staff.

Objective: Enhance technical knowledge/skills of Tribal staff through college credit and short courses, workshops and professional conferences.
Output: Send staff to appropriate training opportunities
Outcome: Trained staff.
Milestone: On-going; at least one training for each staff per year

Objective: Secure outside expertise to assist tribal staff; provide on-the-job training
Output: Consultants retained for specific program-related tasks
Product: Enhanced knowledge base; trained staff.
Milestone: On-going

GRANT MANAGEMENT:

Goal: Fulfill EPA and other grant requirements.
Objective: Prepare and file Reports.
Output: Interim and Final Reports.
Outcome: Grant requirements are met
Milestone: as required by grantee.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue, Suite 900
Seattle, Washington 98101-3140

Reply to
Attn of: OWW-137

W. Ron Allen, Tribal Chair/Executive Director
Jamestown S'Klallam Tribe
1033 Old Blyn Highway
Sequim, Washington 98382

Re: Corrected Certification Letter for the Waters of the Dungeness Watershed Based Plan

Dear Mr. Allen:

I am pleased to inform you that the Environmental Protection Agency (EPA) Region 10 is certifying that the Waters of the Dungeness Watershed Based Plan meets or exceeds our expectations for each of the required nine elements of a watershed based plan under the Clean Water Act Section 319 Nonpoint Source Program.

EPA encourages tribes to develop and implement scientific based watershed plans to prevent and resolve non point pollution problems. A watershed based plan is a coordinating framework that provides geographic focus, integrates strong partnerships, incorporates science, sets priorities, and identifies solutions. The Waters of the Dungeness Watershed Based Plan outlines an extensive coordinating framework and demonstrates the Jamestown S'Klallam Tribe's leadership over the years to build partnerships and use science to guide actions on the Dungeness. We value your diligence in addressing the critical issues of the Dungeness – a watershed supporting valuable resources and facing many threats.

We appreciate the national leadership you and your staff demonstrated by developing this plan. It is the first tribal watershed based plan in the country to be certified. With your concurrence, we hope to provide it as an example to other tribes. We look forward to continuing to support your efforts to implement your plan and achieve environmental results in the Waters of the Dungeness.

If you have any questions, please do not hesitate to contact me at (206)553- 1906, or you may contact Krista Mendelman of my staff at (206)553-1571.

Sincerely,

Christine Psyk, Associate Director
Office of Water and Watersheds

cc: Hansi Hals, Jamestown S'Klallam Tribe