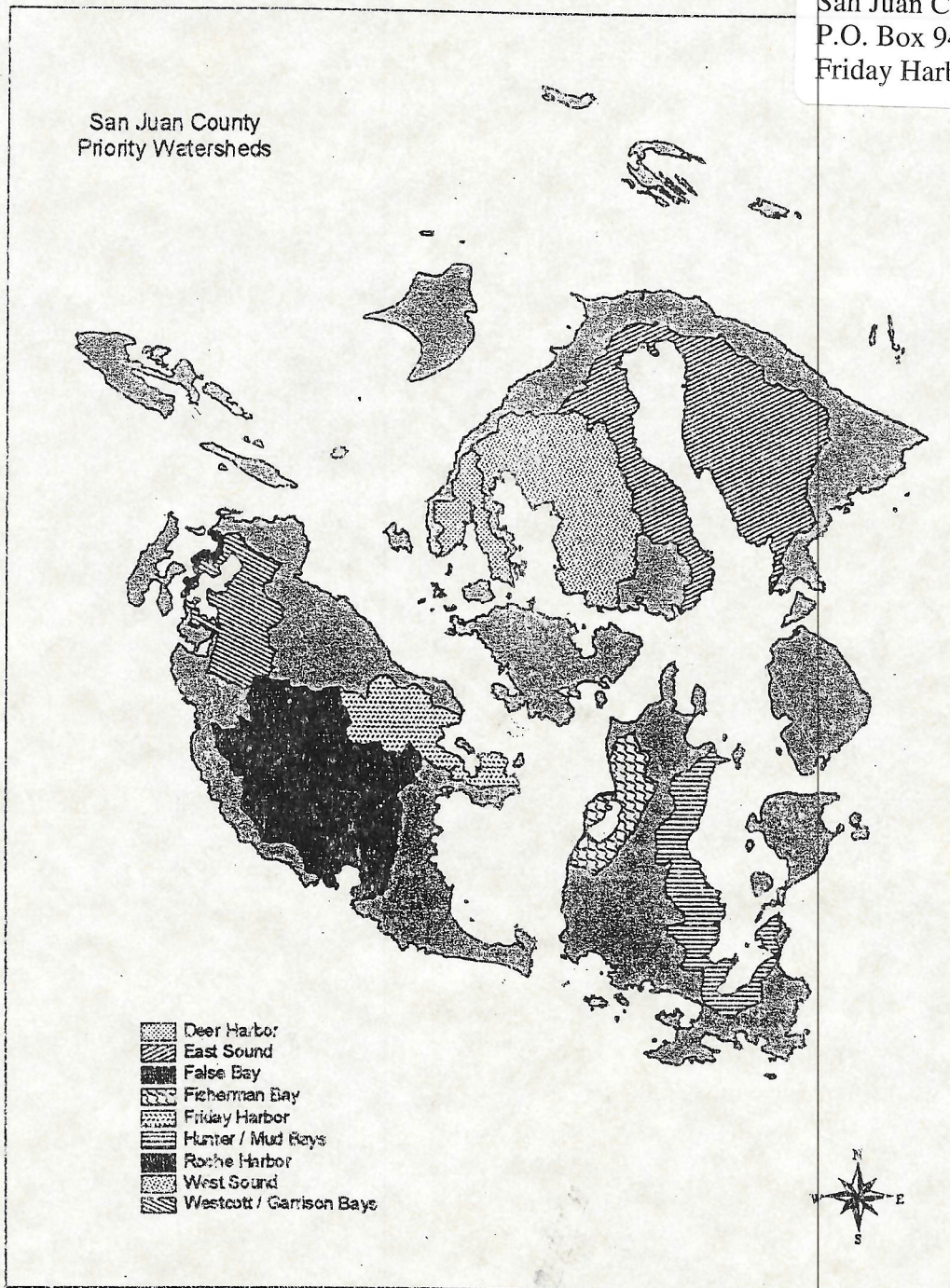


San Juan County Watershed Management Action Plan and Characterization Report

San Juan County Lead Entity
P.O. Box 947
Friday Harbor, WA 98250



Final
Approved 8/24/00

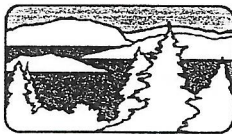
San Juan County Watershed Management Action Plan

San Juan County Watershed Management Committee:

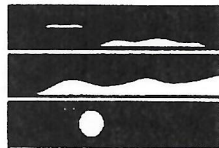
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**San Juan County
Health and Community Services**



**WASHINGTON STATE
DEPARTMENT OF
E C O L O G Y**

**San Juan County
Watershed Management Action Plan
and
Characterization Report**

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Abbreviations and acronyms

BMP	Best Management Practices
CCW	Centennial Clean Water, funding through Department of Ecology
DNR	Department of Natural Resources, Washington State
DOE	Ecology, Department of Ecology, Washington State
DOH	Department of Health, Washington State
EAP	Environmental Assessment Program, DOE
EPA	Environmental Protection Agency
HCS	Health and Community Services, San Juan County
NPDES	Nonpoint Pollution Discharge Elimination System
NRCS	Natural Resource Conservation Service, USDA
PSWQA, PSAT	Puget Sound Water Quality Authority, Puget Sound Action Team
RCW	Revised Code of Washington
SJC	San Juan County
SJCCD	San Juan County Conservation District
TMDL	Total Maximum Daily Loading
USGS	US Geological Survey
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WMC	Watershed Management Committee
WRIA	Water Resources Inventory Area
WSP&R	Washington State Parks and Recreation

Preface

The San Juan County Watershed Management Action Plan was developed by the Watershed Management Committee, consisting of volunteer citizens, between 1997 and 1999, with adoption by the Board of County Commissioners on June 21, 2000. During the history of this project several key implementation strategies have been established and funded. San Juan County Health and Community Services, Environmental Health Section, has developed an operation and maintenance program for on-site septic systems that has received solid support from professionals and property owners (OS4, OS5, OS6, OS7). The Health Department also received a grant to develop a long-term, septage and sewage management plan, with participation from private and public operations. The San Juan County Conservation District has added two resource specialists to its staffing and received grant funding to conduct surveys in target watersheds in order to develop a plan for riparian and wetland protection and to work with landowners to develop stewardship plans for agricultural and forest lands (WQ6, WQ7, WQ9, AP1, AP2, AP5, FP1, FP2, FP3). The District just recently was awarded full funding through the Natural Resources Conservation Service for a revised soil survey for San Juan County (WQ3).

A long-term monitoring program has been initiated by the completion of the Institute for Watershed Study's year-long monitoring and report. Their recommendations for further monitoring will form the basis for an ongoing program.

This Plan and the Characterization Report are available at the county's web site, which includes scalable copies of the maps. The address is: www.co.san-juan.wa.us/apages/health/html.

Executive Summary

Introduction:

The draft San Juan County Watershed Management Action Plan was prepared by the San Juan County Watershed Management Committee, San Juan County Health and Community Services, and San Juan County Conservation District. The development of this plan was funded by a Centennial Clean Water Fund grant administered by the Department of Ecology.

The San Juan County Watershed Management Action Plan differs from other watershed plans because it addresses watershed issues county-wide, and then uses priority watersheds to focus on specific examples of non-point problems and recommended solutions. Some issues, such as on-site septic design, maintenance, and repair, are county-wide concerns. Other issues, such as agricultural practices, are concentrated in a few watersheds.

Watersheds as a Natural Resource:

Although a significant part of the land in San Juan County is privately owned the watersheds of San Juan County provide a public benefit for both residents and visitors. This plan includes recommendations for a program to protect water quality, for human consumption and wildlife habitat, and as a result also addresses protection of the county's wealth of natural resources, forests and grasslands, wetlands and shoreline habitats.

Drinking Water and Habitat

The Committee ranked domestic water supplies as the most critical resource in the county. With limited quantities of fresh water available, protection of water quality is essential for safe, economical drinking water supplies. Habitat was ranked equally with drinking water as a critical benefit needing life-giving, clean water supplies. Fish, shellfish, and wildlife all depend on clear, fresh water for the healthy wetlands, streams, and estuaries that provide food, cover, rearing, spawning, and nesting sites.

Recreation, Agriculture, Commercial/Industrial Activities, and Aquaculture

Clean water is essential to outdoor recreation throughout San Juan County. Residents and visitors play, fish, swim, and boat in the waters and along shorelines of the county. The Committee ranked recreation as the third priority for clean water, benefiting the economy with recreational and educational opportunities. Agriculture, commercial and industrial activities, and aquaculture were also ranked as essential uses needing clean supplies of fresh water.

Water Quality Problems:

The marine waters of San Juan County have been ranked as Class AA (WAC, 1992), and are considered typically high quality, compared to many areas in Puget Sound and the Northwest Straits. When the Committee began reviewing available information the persistent question was: What problems are we supposed to be solving if the water quality is so good?

Two answers resulted from this question. The first is that prevention of water quality problems costs a fraction of fixing problems once they occur. The county is at a critical point, where water quality degradation is not extensive (although during the course of this project many trouble spots were identified). At this time it is possible to establish management programs that will prevent costly and potentially irreversible damage. The second answer is that no comprehensive water quality evaluation has been done in the county, so potential and existing problems have not been documented. Water quality monitoring done as part of this planning project, as well as a careful look at monitoring done by state agencies, has shown that the county does have some problem areas.

On-Site Septic Systems

The majority of county residents treat their waste water with on-site septic systems. With very poor native soils for treatment of waste water, sophisticated treatment systems requiring regular maintenance are needed. The Committee designated on-site septic failures as the number one potential source of pollution in San Juan County.

Conversion to Residential and Commercial Development

As one of the fastest growing counties in the state, with the smallest land area, conversion of forestlands, grasslands, and wetlands to residential and commercial development is designated as the second highest potential impact to water quality in the county. By removing the natural systems that protect water quality, and introducing impervious surfaces and other alterations in the terrain, development activities introduce sources of pollution and convey these pollutants into wetlands, streams, and estuaries as stormwater runoff.

Stormwater runoff

Runoff is surface water that runs directly to streams and marine waters because of impervious surfaces, such as pavement, or because the soil is saturated. Much of the county is bedrock or clay soils that inhibit infiltration and promote surface runoff. Stormwater runoff, as a source of nonpoint pollution, is defined as runoff from impervious surfaces created by residential, commercial, and other urban development. Unchecked stormwater can convey pollutants, such as heavy metals, oils, toxic organics, pathogens, nutrients, and sediment directly to water bodies if it is not intercepted by natural filtration systems such as trees, grasses, and wetlands. Stormwater runoff was ranked in the top three as a

potential source of pollution, due, in part, to significant water quality violations from stormwater drains in Eastsound and Friday Harbor.

Agricultural Practices

Agricultural lands cover a major part of a few of the county's watersheds. These fertile lands are associated with extensive stream and wetland areas that tend to be saturated in the winter. As a result, careful management of pasture, stream corridors, wetlands, and animal waste is critical to water quality. Because of water quality violations in the False Bay and West Sound watersheds, and a growing number of small-parcel livestock operations, the Committee identified agriculture as a significant potential source of pollution for some watersheds.

Forestry Practices

Forest lands cover seventy percent of San Juan County. Most of these forested properties are privately owned. Forest practice regulations address a mainland scale of logging activity and miss altogether many of the critical issues for this county that occur on a much smaller scale. Intermittent and ephemeral streams and tiny wetland areas are essential to water quality and quantity in the county, but are generally unregulated. Fragile soils and micro-climates create the need for site specific management practices. Clearing for residential development is not regulated. For these reasons the Committee ranked forestry practices as an important potential source of pollution.

Marinas and Boating Activities

Recreational boating is a major activity in the county, but little is known about the impact on marine water quality from boaters and kayakers. The Committee recommends surveys and monitoring to evaluate these impacts, and education to promote good practices.

Solid Waste and Hazardous Waste

Because of the logistics of solid waste management in the county, including costs to haul waste to the mainland, the Committee recognized this important potential source of pollution. The county has active recycling and hazardous waste programs, which the Committee endorses, wholeheartedly.

Recommended Strategies To Protect Water Quality:

The Committee developed nearly 100 strategies to protect water quality in the county. Fifty-five are county-wide, and 41 are recommended for individual priority watersheds. Many of these strategies are interrelated and involve an ongoing program that includes monitoring, surveys, education, and technical assistance as preventive measures. Nineteen of the strategies involve regulation, most of which address a new component or approach to existing regulations.

Cumulative Impacts

One of the greatest concerns expressed by Committee members is the cumulative impact of development in the watershed. Current regulations and permit process address individual projects on a case by case basis. This process limits the reviewer's perspective to the immediate vicinity of a project, without looking at larger picture of runoff and infiltration of water, land cover, downstream receiving waters, wildlife habitat, and the many essential functions of natural systems in the watershed. It is the Committee's hope that county staff, landowners, contractors, developers, and policy makers begin to see the watershed as a whole when making important development decisions. To this end, several recommendations involve developing better resource information and making this information available to staff and the public.

Ongoing Monitoring

The Committee struggled with the lack of concrete information about water quality in the county. The assumption that marine water quality in the San Juan Islands is pristine has limited the initiative to conduct monitoring and surveys. Monitoring was begun as part of the planning project, and a long term monitoring plan will be developed in the spring of 2000. The Committee made long-term, ongoing water quality monitoring its #1 strategy. Watching water quality trends over the long term, with consistent methods, will give the county the best management tool available to prevent degradation before it happens.

Plan Adoption:

Adoption of this plan will include a request for concurrence from participating agencies and a series of public workshops and hearings to solicit public comment. When adopted, an implementation committee and lead agency will follow through with the recommended implementation strategy.

Implementation of the Recommended Strategies:

Some of the recommendations in this plan have been funded since the beginning of the planning process and are being implemented. Many of the recommendations involve better coordination of existing programs to benefit the watershed and water quality, such as cooperative education programs with state and county agencies, and developing a water quality perspective for conservation priorities for the county. Overall, full implementation of a new, ongoing water quality program is estimated to involve the addition of one full-time and one part-time county employee. Proposed funding for these projects and programs includes grants and, if adopted by ordinance in the future, a water quality district.

County-Wide Watershed Goals and Objectives

Goals:

- Reduce and eliminate nonpoint sources of pollution including pathogens, toxic contaminants, sediment, and nutrients from the waters of San Juan County and Puget Sound.
- Develop county policies that manage water resources, by protecting existing water rights, by protecting and enhancing flows and habitat for water-related wildlife and fish, and by providing for the public health and well-being of the county.
- Develop a watershed management plan that includes realistic objectives and durable solutions that reflect the diversity of the watersheds and island communities and will survive political change.

Objectives:

On-site septic systems, failing systems

- Set up ongoing monitoring and surveys to identify problem areas.
- Set up programs offering education, incentives, and technical assistance to homeowners to prevent residential pollution from on-site septic systems, landscape management, and stormwater runoff.

Agricultural practices

- Set up programs offering education, incentives, and technical assistance to property owners to prevent pollution from agricultural practices for large and small acreages.
- Recommend best management practices for stormwater, agriculture, clearing and grading to be implemented through new development codes

Forestry practices

- Recommend best management practices for stormwater, agriculture, clearing and grading to be implemented through new development codes.

- Establish water quality standards for water bodies, intermittent and perennial streams in conjunction with Department of Ecology
- Identify streams for consideration on forestry projects by the DNR and county
- Evaluate and develop standards for the role of wetland and riparian areas in the protection and enhancement of water quality and quantity

Conversion of resource lands to residential and other development

- Recommend best management practices for stormwater, agriculture, clearing and grading to be implemented through new development codes.
- Establish water quality standards for water bodies, and intermittent and perennial streams in conjunction with Department of Ecology.
- Evaluate and develop standards for the role of wetland and riparian areas in the protection and enhancement of water quality and quantity.
- Recommend policies for protection of marine habitat management areas and for drinking water protection areas including well head protection and watershed control areas.
- Work with the Marine Resources Committee to evaluate impacts on fish and shellfish from the degradation of water quality and loss of habitat. This evaluation will include boating activities and nearshore and upland land uses.
- Conduct a county-wide inventory to identify critical water resource areas. This inventory should be conducted on a watershed scale and include infiltration, runoff, rainfall, land use and density, ground and surface water withdrawals, existing water rights, and beneficial use, taking into consideration seasonal and other variations.

Marinas

- Adopt a public involvement and education plan that establishes a permanent community involvement in water resource protection (stewardship), including: educational and technical assistance programs, incentives, coordination with other agencies and non-profit organizations, on-going surveys and studies
- Work with the Marine Resources Committee to evaluate impacts on fish and shellfish from the degradation of water quality and loss of habitat. This evaluation will include boating activities and nearshore and upland land uses.

Stormwater runoff

- Set up programs offering education, incentives, and technical assistance to homeowners to prevent residential pollution from on-site septic systems, landscape management, and stormwater runoff.
- Recommend best management practices for stormwater, agriculture, clearing and grading to be implemented through new development codes

The Problem Definition Process

Under WAC 400-12-515(3), the Watershed Management Committee is required to develop a Problem Definition that includes the beneficial uses of water that are threatened by non-point source pollution. This involves evaluating how well the water quality standards for surface waters are being met, what the existing and potential impacts are, how wetlands are affected, and to list and rank the existing and potential sources of nonpoint pollution. Finally, using the information gained through the problem definition process, a water quality program is developed to correct known pollution sources and to prevent future ones. This water quality program will be presented in the following sections on Implementation Strategies.

In order to evaluate beneficial uses and sources of nonpoint pollution, the San Juan County Watershed Management Committee used a ranking process that assigned a numeric value to each beneficial use and each pollutant source.

Beneficial uses of water

The Committee identified six categories of beneficial uses of water:

- domestic supply,
- habitat/special areas,
- recreation,
- agriculture,
- commercial/industrial, and
- aquaculture.

Domestic supply and habitat/special areas were ranked equally as the highest category of use, with recreation in the next category, and agriculture, commercial/industrial and aquaculture ranked equally in the bottom category.

Domestic water supply is a critical resource in San Juan County. Habitat for wildlife -- such as, wetlands, stream corridors, forest, grass lands, and nearshore areas -- is ranked as equally important and the Committee included in this category the term *special areas*, to acknowledge the value of the many research/educational/biologic preserve areas in the county. When the Committee ranked the pollution threats to beneficial uses, habitat/ special areas received the highest rating with 33% of the points given. Domestic supply was a close second with 28% of the points.

The beneficial use of the county's waters for recreation is important for the economy and for education and public enjoyment. Recreational use, which includes shellfish harvesting, swimming and other human contact with water, was ranked as the third

most threatened by non-point pollution sources with 15% of the total ranking points. Finally, the essential commercial benefits of water use for agriculture, commercial/ industrial activities, and aquaculture are identified. The Committee recognized that aquaculture is an important industry and especially vulnerable to non-point pollution, although not as extensive as other beneficial uses.

Sources of pollution

The Committee then identified the sources of nonpoint pollution in San Juan County. These are:

- on-site septic systems;
- conversion of forest-, grass- and wetland areas to residential and commercial developments;
- stormwater runoff;
- agricultural practices;
- forestry practices;
- marinas and boating activities; and
- solid waste/hazardous waste.

For each source of pollution a ranking process was done for each of the nine priority watersheds. This process involved rating the various sources of pollution based on existing and potential impacts. In some cases, a shortage of firm data forced the Committee to rely on anecdotal information, and through a process of subjective consensus the Committee assigned values in the ranking steps. After the numbers were added up, the Committee discussed the relative rankings at length, and decided that the final outcome should reflect their conclusions about the overall threat from each source of pollution. The sources were grouped into three levels: first, second and third; or high, medium and low. See Table A at the end of this section to review the rankings.

Although the numbers varied between individual watersheds the relative rankings for the pollution sources were consistent. On-site septic systems and conversion of resource lands had the highest overall numeric score, with stormwater runoff also included in the first level. County-wide, on-site septic systems, conversions, and stormwater runoff are ranked as the primary pollution sources. Agriculture is ranked as a second level pollution source.¹ And, marinas, forestry practices, and solid/hazardous waste are ranked, overall, as a third level concern.

¹ An evaluation of current conditions resulted in an initial ranking for agricultural practices as low, but the Committee concurred that changes in agricultural activities from traditional agriculture to rural-residential land use indicates a high potential for pollution. This trend involves a greater density of livestock and more intensive use on smaller acreage.

Looking at individual watershed rankings, the threat of failing on-site septic systems ranked highest for the Westcott/Garrison, East Sound, Fisherman Bay, and Mud/Hunter watersheds. Contamination from failing septic systems has been documented or reported in these areas. Conversion of resource lands ranked as the highest source of pollution for Deer Harbor, a small watershed with steep terrain that is undergoing clearing of forest lands for residential development. Marinas ranked highest for Roche Harbor, the smallest priority watershed, with an extensive resort and marina complex. Stormwater runoff ranks highest for the Friday Harbor watershed, which includes the largest urban area in the county. Agricultural practices rank highest in the False Bay and Westsound watersheds, where the most extensive agricultural lands and livestock operations in the county are found.

Potential Pollution Problem Statements

- I. On-site Sewage Systems** -- On-site sewage treatment/disposal systems (OSS) currently serve the majority of the residences in San Juan County and will continue to do so as the number of residences increase. Septic systems are an effective tool in treating and disposing of sewage if properly sited, designed, installed, operated, and maintained. Systems that do not meet all of these conditions fail and can contaminate surface water (fresh and marine) and ground water with pathogens, nutrients, and chemicals.

The majority of the land available for development has soils with moderate to severe limitations for septic installation (see appendix B, soil suitability maps, San Juan County Watershed Characterization Report). As a result, alternative septic systems are being installed that require an active program of operation and maintenance to insure the system functions properly. Specific problems identified in San Juan County include:

- San Juan County Health and Community Services has limited resources to inform homeowners, Realtors, and contractors about septic system operation and maintenance.
- San Juan County currently has a limited program for tracking systems failures to insure prompt repairs.
- San Juan County has a limited program to insure systems are being properly maintained.
- Many homeowners are not maintaining their septic systems.
- The lack of a septage disposal facility on San Juan Island increases the cost for pumping a septic tank discouraging many people from routinely servicing their systems.
- San Juan County's wetland maps are incomplete and county personnel are not trained in the identification of wetlands resulting in septic systems being installed within wetlands and their buffers.

- II. Land Conversions** -- The population in the San Juan islands continues to increase. Population increases, projected to continue for several years, heightens the demand for land suitable for residential use causing more land to be converted from forest, wetland, and agricultural property to residential and/or commercial use. As land is converted, vegetation is removed increasing the amount of impervious surfaces. This can lead to increased run-off, erosion, and sedimentation. Specific problems include:

- Current controls on residential development are inadequate for reducing and/or preventing run-off, erosion, and sedimentation.

- Simple Land Divisions are the commonest form of land conversions and can be completed with little or no regulatory oversight.
- The use of Conversions Option Harvest Plan may be accelerating the removal of forestland for residential development.
- The county wetland inventory is incomplete making protection difficult.
- No mechanism is in place to measure cumulative impacts on the watersheds.

III. Stormwater – Stormwater, as a source of non-point pollution, is defined as run-off from impervious surfaces created by residential, commercial, and other urban development. As growth continues the amount of impervious surfaces increases, generating more stormwater which can adversely impact stream channels. Unchecked, stormwater can contaminate surface and ground water with heavy metals, oils, toxic organics, pathogens, nutrients, and sediment. In addition, stormwater, when directly channeled through a series of ditches, pipes, and drainage ways, can dramatically increase the erosion potential of creeks and streams. Identified problems include:

- Best Management Practices for controlling run-off and erosion are not fully understood or implemented by some property owners and developers.
- Existing regulations do not adequately cover residential development (see Land Conversions for additional potential problems).
- Stormwater management strategies are different for urban and rural areas yet the same standards apply.

IV. Agricultural Practices -- Agricultural operations have been changing throughout San Juan County, shifting from large commercial operations to smaller more intensive use. All operations regardless of size must be properly managed. Without proper management agricultural operations can degrade water quality through erosion, sedimentation, bacteriological and chemical contamination, and nutrient loading. Potential problems with agricultural operations include:

- Best Management Practices¹ (BMPs) are not fully understood and/or implemented by all farm owners.
- The Conservation District/NRCS has limited resources to inform and assist farmers in BMP implementation.
- Implementation of BMPs is not required for agricultural lands to receive tax credits. Parcels under 20 acres must show profits from agricultural activities to qualify for agriculture tax benefits. This promotes intensive farming activities which may discourage BMP implementation.
- An accurate farm inventory, including the number of farms and management problems, has not been completed.
- Enforcement of water quality violations from farming activities is ineffective.

¹ See appendix D

V. Forestry Practices – Forested land comprises a majority, close to seventy percent, of the landmass in San Juan County. Timber harvested here is used as a source of sawlogs, pulpwood, export logs and firewood. Timber harvesting, without proper management, has the potential to adversely affect water quality and watershed stability. Potential pollution arising from timber operations, generally from skid trails and roads, can include soil erosion and sedimentation, temperature increases in surface water, and run-off contaminated with chemicals and nutrients. Identified problems include:

- The Forest Practice Rules, including Best Management Practices² (BMPs) do not take into consideration the unique growing conditions that are found in San Juans, such as low rainfall, shallow soil conditions, and low productivity rates.
- The Forest Practice Rules do not protect the small seasonal streams and forested wetlands located in the San Juans.
- State and local agencies are ineffective at providing oversight and monitoring of forest practice permits and subsequent land development.
- The Forest Practice Rules are difficult for the property owner to understand.
- Forestry Best Management Practices are not fully understood and/or implemented by all landowners and loggers.
- The cumulative effect of exempt timber harvesting on watershed stability and function is unknown.
- Monitoring of BMP implementation is inadequate on Designated Forest Land.

VI. Marinas and Recreational Boating -- San Juan County is a very popular boating destination. Each year, thousands of boats flock to the San Juan islands to explore the many coves and inlets. While the boaters are very important to the economy of San Juan County, they also can pollute the marine and fresh water. Pollution can be from illegal sewage discharges, oil and/or gas spills, and from solvents and paints used to maintain the vessels. Problems include:

- The percentage of boat owners discharging sewage overboard is unknown. However, previous surveys indicate the percentage may be very high.
- The number and impacts of boats anchoring in small bays is unknown.
- Installation and maintenance of pump-out facilities are costly, particularly at remote parks and bays.
- Enforcement of federal regulations regarding illegal discharges is inadequate due to a lack of resources by the United States Coast Guard.

VII. Solid and Hazardous Waste -- The volume of solid and hazardous waste generated will continue to increase as the population grows. Disposal costs continue to climb as more landfills are closed. Proper management (i.e.: the use, storage, recycling, treatment and disposal of solid and hazardous waste) is essential for reducing or eliminating the potential water quality pollution from

² See appendix D

these waste. If not properly managed, these wastes can pollute surface and ground water with hydrocarbons, heavy metals, toxic organic chemicals, and/or pathogens. Problems identified include:

- Old unregulated landfill sites have not been inventoried or assessed.
- Illegal dumping may increase if disposal costs increase.
- Many homeowners and business owners are not fully aware of impacts resulting from improper disposal of hazardous wastes.
- There are inadequate disposal facilities for household hazardous waste throughout the county

Table A: Priority Watershed Conditions

	East Sound		Fisherman Bay		Mud-Hunter	
1988 Ranking	1		4		6	
Watershed Acreage	13,933		2,070		4,688	
Landcover Vegetation						
Grasses	1,626	12%	882	42%	928	20%
Dense Forest	8,947	64%	846	35%	2,611	56%
Sparse Forest	736	5%	166	8%	333	7%
Scrub	1,997	14%	281	13%	685	15%
Wetlands/Lakes/Streams						
Upland freshwater	358	3%	97	5%	161	3%
Marine and intertidal	517		310		470	
Lakes	432.5	3%	na		4	
Streams	14.7 miles		2 miles		3.8 miles	
Current Land Use*						
Agriculture	479	3%	0		537	11%
Timber Land	1,754	13%	61	3%	610	13%
Conservation	1,256	9%	46	2%	684	15%
Residential parcels	2,174	16%	638	31%	1,144	24%
Public Lands	3,783	27%	27	1%	564	12%
Critical Management Areas						
Designated Growth Areas		Yes		Yes		No
Upland Native Ecosystem		Yes		No		No
Critical Marine Habitat		Yes		Yes		Yes
Surface Water Resource Area		Yes		No		No
Research/Education Areas		Yes		Yes		No
Nonpoint Source Pollution Risk						
Onsite Sewage Systems		Hi		Hi		Hi
Agricultural Practices		Med		Low		Low
Forestry Practices		Low		Med		Med
Conversion of Resource Lands		Med		Hi		Hi
Marinas and Recreational Boating		Low		Med		Hi
Stormwater Runoff		Hi		Med		Low
Solid/Hazardous Waste		Med		Med		Med
Management Priorities						
Marine Habitat Management Area		✓		✓		✓
Water Resource Protection Dist.		✓		✓		
Riparian Restoration/Preservation		✓				
Wetland Restoration/Preservation		✓				

* This table is based on current land use categories for tax purposes. The average size of parcels is not reflected in these calculations. Percentage of residential, timberland, or agriculture, so percentages shown are not accurate.
 **Does not include commercial parcels in the Town of Frid

County-Wide Action Strategies

Introduction:

The goals of the Watershed Advisory Committee are to develop durable solutions to prevent, reduce, and eliminate non-point sources of pollution that can negatively impact the beneficial uses of surface waters, both fresh and marine, and ground water county-wide. These durable solutions have been coined "Action Strategies" and are listed below.

The Action Strategies were developed to address the pollution problem statements contained in the preceding chapter. These strategies were developed after months of technical presentations, discussions with implementing agencies, committee discussions, and public workshops. The strategies identify implementing agencies as well as additional participating entities. The strategies were assigned an implementation schedule consisting of a start and completion date. Implementation costs were projected based on the following three categories:

Low: Implementation with existing staff with total cost not to exceed \$10,000

Moderate: Implementation with existing staff or under contract, cost between \$10,000 and \$50,000

High: Additional staff needed, cost in excess of \$50,000

See Section 4, Implementation Strategies, for more detailed estimates of implementation costs.

The strategies contain recommendations for new regulations, proposed regulation changes, development and implementation of Best Management Practices (BMPs)¹, financial incentives, education, monitoring, and inventories. The Action Strategies are listed below, starting with overall water quality strategies and then by source of pollution.

Water Quality Strategies:

WQ1: Develop and fund a long term water quality monitoring program to measure the cumulative impacts of non-point source pollution including but not limited to; sewage disposal, land conversions, stormwater, agricultural, forestry, marinas and recreational boating, and solid and hazardous waste.

- *Long term water quality monitoring of both marine and fresh waters is the best way to look for changes that indicate contamination. Early warning thresholds for changes in water quality give state and county staff and decision makers an opportunity to prevent degradation before it damages valuable resources.*

¹ See appendix D for information on BMPs.

Implementing Agency: San Juan County Health & Community Services
Participating Agencies: Board of County Commissioners
Cost: High
Implementation Schedule: Immediate on adoption of monitoring plan, On-going

WQ2: Inform Realtors, Developers, Regulators, Decisions Makers, Contractors, Planners, and Property Owners about wetlands and non-point sources of pollution including, but not limited to, septic systems, land conversions, stormwater, agricultural and forestry practices, marinas and boating, and solid waste.

Implementing Agency: San Juan County Permit Center, Health and Community Services, Planning Department, Public Works, and Conservation District
Participating Agencies: Department of Ecology, Department of Health,
Cost: Moderate
Implementation Schedule: Year 1, On-going

WQ3: Update the United States Department of Agriculture Soil Survey for San Juan County.

- *The original soil survey was completed in 1963 and needs to be revised to provide updated and more relevant soil capability and limitation interpretations. The new survey would be at a larger scale (1:12,000) to provide more accurate and detailed soil information.*
- *This information will benefit county agencies, state agencies, and individual property owners when planning for siting homes, wells, septic systems, and roads; planning development; evaluating cumulative effects in a watershed; developing agriculture and forestry plans; providing wetland delineation and protection; and supporting natural resource conservation and management.*

Implementing Agency: San Juan County Board of Commissioners
Participating Agencies: San Juan County Conservation District, San Juan Planning Department, & Natural Resource Conservation Service
Cost: High
Implementation Schedule: Year 1 to 5

WQ4: Review and revise, if appropriate, wetlands regulations, Section 3.6.8 of the Unified Development Code for consistency with good water quality management and best management practices.

Implementing Agency: San Juan County Planning Department
Participating Agencies:

Cost: Moderate
Implementation Schedule: Year 2

WQ5: Update and maintain the county's wetland inventory in a computerized GIS format with information developed from jurisdictional wetland delineations.

- *Delineations provide the most accurate, site specific information on wetlands. The county's wetland inventory was developed in 1993 based on aerial photo and satellite image analysis, with limited field identification. The more detailed information from delineations should be incorporated into the county's maps and data systems.*

Implementing Agency: San Juan County Permit Center
Participating Agencies:
Cost: Moderate
Implementation Schedule: Year 1, Ongoing

WQ6: Train county personnel and interested parties in wetland identification.

- *Currently, county staff, including permit center staff and on-site sewage sanitarians, are not trained in wetland identification. Staff must be trained in the wetland identification to insure proper setbacks are maintained to wetlands and wetland buffers.*

Implementing Agency: San Juan County Health and Community Services, Permit Center, and Conservation District
Participating Agencies: Department of Ecology
Cost: Low
Implementation Schedule: Year 1, On-going

WQ7: Coordinate with and utilize public schools and other private and public organizations in long term water quality monitoring efforts.

- *Using students and community volunteers to accomplish water quality monitoring in the long term lowers costs and provides the additional benefit of stewardship and community participation in protecting water quality.*

Implementing Agency: San Juan County Conservation District, WSU Extension Service
Participating Agencies: Public Schools & Non-Profit Groups
Cost: Low
Implementation Schedule: Year 1, On-going

WQ8: Utilize an early warning threshold of no more than 10% of the samples used to calculate the geometric mean exceed 10 cfu/100mL in marine waters for San Juan County shellfish water quality monitoring. This early warning should initiate an investigation of sources of contamination, such

as sanitary surveys for failing septic systems and inventories of upland farm practices.

- The State Department of Health Shellfish Program uses an early warning threshold of 30 cfu/100mL for 10% of samples used to calculate a geometric mean. Because San Juan County waters are relatively pristine, a more conservative warning level is recommended.*

Implementing Agency: SJC Health and Community Services
Participating Agencies: SJC Conservation District, Washington State Department of Health Shellfish Program
Cost: Low
Implementation Schedule: Immediate

WQ9: Complete a computerized geographic information system (GIS) of watershed characteristics for all of San Juan County and continue to develop resource information to complete a watershed management database for resource technicians and planners, permit staff, developers, conservation groups, and citizens of the county.

Implementing Agency: San Juan County GIS
Participating Agencies: San Juan County Health and Community Services, Planning, Permit Center, Conservation District, Washington State Department of Natural Resources, Department of Fish and Wildlife, Department of Ecology, the US Geologic Survey, and universities
Cost: Moderate
Implementation Schedule: Immediate

WQ10: Work with the San Juan County Land Bank to establish a priority rating system for watershed based land acquisition, which includes riparian and wetland protection as well as habitat preservation. In addition, establish a point rating system for Open Space designations that encourages preservation of riparian and wetland areas that are valuable for the functions of protecting and storing water and providing habitat in the watershed.

- This would offer county property owners an incentive to protect a watershed's system of surface waters to benefit water quality, quantity, and wildlife habitat.*

Implementing Agency: San Juan County Land Bank, San Juan County Planning
Participating Agencies: San Juan County Health and Community Services, San Juan County Conservation District
Cost: Moderate
Implementation Schedule: Year 1

WQ11: Designate priority watersheds as Marine Habitat Management Areas under San Juan County's Shoreline Master Program.

- This is an existing program, currently under development for the Westcott-Garrison watershed. Priority watersheds meeting the criteria for this designation are identified in the Action Strategies for Priority Watersheds. This designation is a tool to ensure that critical marine habitat areas are preserved and restored, and includes a process to evaluate the vulnerability of marine ecosystems and develop management plans to ensure protection.*

Implementing Agency: San Juan County Planning
Participating Agencies:
Cost: High
Implementation Schedule: 3

WQ12: Establish water resource protection areas or districts for drinking water sources.

- This program would include specific priority watersheds and consist of education, monitoring, and inventories. See Priority Watershed Management Strategies.*

Implementing Agency: San Juan County Health and Community Services
Participating Agencies: Planning
Cost: Moderate
Implementation Schedule: Year 3, On-going

On-site Sewage System Strategies:

OS1: Inform homeowners, Realtors, and contractors about proper septic system operation and maintenance. Information sources should include, articles in newspaper similar to "OPALCO Gram", brochures, column in Realtor newsletters, yearly workshops, and "owner manuals."

Implementing Agency: San Juan County Health and Community Services
Participating Agencies: Conservation District
Cost: Moderate
Implementation Schedule: Year 1, On-going

OS2: Continue to inform property owners that low interest loan money is available to repair failed septic systems.

Implementing Agency: San Juan County Health and Community Services
Participating Agencies:
Cost: Low
Implementation Schedule: Ongoing

OS3: Facilitate workshops with septic tank pumpers and maintenance providers about contracting with homeowners' groups, including non-ferry islands, for services at a reduced cost.

- The cost of travel for pumpers causes a financial burden to homeowners and is a limiting factor to good septic system maintenance. By contracting for maintenance as a group, homeowners would be able to get timely service and share the expense.*

Implementing Agency: San Juan County Health and Community Services
Participating Agencies:
Cost: Moderate
Implementation Schedule: Year 2

OS4: Develop and implement an effective on-site septic system operation and maintenance program for San Juan County.

- The program should consider a phased approach that initially requires proof of septic system operation at time of real estate transaction. Ultimately the program should notify and insure, through appropriate enforcement action, that property owner(s) inspect their septic system on a regular basis. Systems that are not maintained should have the property flagged to notify future buyers and county permit staff.*

Implementing Agency: San Juan County Health and Community Services
Participating Agencies: San Juan County Permit Center, San Juan County Auditor
Cost: Moderate to High
Implementation Schedule: Year 1, On-going

OS5: Develop and implement a certification program for septic pumpers and wastewater system inspectors.

- By licensing wastewater professionals and establishing an inspection program, the county has an opportunity to educate and cooperate with private industry on septic system maintenance, and assure the homeowner that standards are being met.*

Implementing Agency: San Juan County Health and Community Services
Participating Agencies:
Cost: Low
Implementation Schedule: Year 1, On-going

OS6: Develop and utilize a computerized tracking system to insure identified septic system failures are repaired in a timely fashion.

- Currently, county staff is not equipped to follow-up on the repair of failures. A simple computer system will accomplish this task at little cost.*

Implementing Agency: San Juan County Health & Community Services

Cost: Low
Implementation Schedule: Year 1, On-going

OS7: Require septic tank pumpers complete and submit a checklist on all tanks pumped.

- This will give the homeowner and county staff an opportunity to evaluate maintenance requirements for systems, and potential failures.*

Implementing Agency: San Juan County Health and Community Services
Participating Agencies:
Cost: Low
Implementation Schedule: Year 1, On-going

OS8: Take enforcement action against/ revoke certification for problem contractors. The county should take an active role in disciplining certified contractors for poor work. Contractors with a history of poor work should have their license suspended or revoked.

Implementing Agency: San Juan County Health & Community Services
Participating Agencies:
Cost: Moderate
Implementation Schedule: Year 1, On-going

OS9: Develop and implement a comprehensive septage and sludge management plan for San Juan County.

- Currently, the cost of septic system pumping is high enough to discourage regular maintenance due to high septage disposal costs. The county's two septage lagoons are overused and regularly fail. Both of these factors call out for an economical and efficient septage disposal program for the county.*

Implementing Agency: San Juan County Public Works
Participating Agencies: San Juan County Board of Commissioners, San Juan County Health & Community Services
Cost: High
Implementation Schedule: Year 3

OS10: Construct a septage treatment facility on San Juan Island to reduce septic tank pumping cost.

- San Juan County is currently pursuing construction of a Solar Aquatics Septage Treatment Facility on San Juan Island, which has no facility at the time of this plan. The county should continue moving forward in this effort.*

Implementing Agency: San Juan County Public Works
Participating Agencies: San Juan County Board of Commissioners, San Juan County Health & Community Services
Cost: High

Implementation Schedule: Year 1

OS11: Provide adequate funding to maintain an effective operation and maintenance (O&M) program. The county needs to provide and maintain the necessary funding and resources to sustain an effective O&M program.

- *This strategy addresses the need for county staff to support an effective O&M program, and also the need to provide funds to homeowners who have limited financial ability to pay for expensive repairs.*

Implementing Agency: San Juan County Board of Commissioners
Participating Agencies: San Juan County Health and Community Services
Cost: High
Implementation Schedule: Year 1, On-going

OS12: Continue to pursue funding for sanitary surveys in areas of the county with high risk for septic failure, such as: areas where water quality monitoring shows elevated levels of fecal contamination and areas where older subdivisions and septic systems have a direct impact on the shoreline or drainage.

- *San Juan County has completed two on site septic surveys in the last two years. The results of these surveys are inconclusive, due to seasonal occupancy and other factors. The rate of repair permits continues to rise, indicating that failures may be a real concern. Conducting careful surveys will give the county a better picture of failures and offers homeowners important assistance for maintenance and repair of their systems.*

Implementing Agency: San Juan County Health and Community Services
Participating Agencies: San Juan County Conservation District,
Washington State Department of Ecology
Cost: Moderate
Implementation Schedule: On-going

OS13: San Juan County should continue to encourage alternative and experimental on-site systems and monitor on performance-based criteria.

Implementing Agency: San Juan County Health and Community Services
Participating Agencies: Washington State Department of Ecology
Cost: Moderate
Implementation Schedule: On-going

Land Conversion Strategies:

LC1: Review and revise, if appropriate, Clearing and Grading regulations, Section 6.6.5A of the Unified Development Code for consistency with good water quality management and best management practices.

- *San Juan County's shallow soils, dry climate, and small drainage basins call for site specific planning to protect water quality and quantity. The cumulative effect of residential development poses the greatest potential threat to the county's water resources unless carefully managed.*

Implementing Agency: San Juan County Planning Department
 Participating Agencies:
 Cost: Moderate
 Implementation Schedule: Year 2

LC2: Insure implementation of BMPs for clearing and grading are instituted for all land development, including single family residences.

- *Currently, clearing and grading for single family residences is exempt from county review.*

Implementing Agency: San Juan County Permit Center
 Participating Agencies: SJC Public Works, Department of Ecology
 Cost: Moderate
 Implementation Schedule: Year 3, On-going

LC3: Develop and insure implementation of Small Parcel Drainage plans for land development, including single family residences.

Implementing Agency: San Juan County Permit Center
 Participating Agencies: Public Works, Department of Ecology
 Cost: Moderate
 Implementation Schedule: Year 3, On-going

LC4: Provide incentives to property owners to decrease densities on undeveloped property.

- *This is intended to encourage property owners to voluntarily down-zone, particularly in areas with density designated less than five acres, to a maximum density of one residence per five acres or greater.*

Implementing Agency: San Juan County Planning Department
 Participating Agencies: Board of County Commissioners, Land Bank
 Cost: Moderate to High
 Implementation Schedule: Year 3

LC5: Inform developers, Realtors, and property owners on all issues surrounding land conversions (i.e.; "ConversionGram" and newsletters)

Implementing Agency: San Juan County Permit Center
 Participating Agencies: Department of Ecology
 Cost: Moderate
 Implementation Schedule: Year 1, On-going

LC6: Develop resource management overviews for county staff, developers, property owners and homebuyers using existing data and technology.

- *Such an overview would provide information on natural settings, habitat, hydrology, land capabilities, and limitations, with recommended measures to minimize impacts during development. It would give county staff better information on the cumulative impacts on the watershed and it would provide the property owner or buyer with a perspective of how their property fits in the watershed.*

Implementing Agency: San Juan County Conservation District
Participating Agencies: San Juan County Planning, Permit Center,
Environmental Health and GIS
Cost: Moderate
Implementation Schedule: Year 2, On-going

LC7: Develop and implement policies and procedures for assessing the cumulative impacts of land conversion and development on a watershed basis. This should include identifying baseline conditions, thresholds of unacceptable change, and remediation/regulation to address unacceptable impacts if determined to be necessary.

Implementing Agency: San Juan County Planning Department
Participating Agencies:
Cost: Moderate
Implementation Schedule: Year 2, On-going

LC8: For all subdivisions, require conservation design plans to protect critical habitat, resource lands, aquifer recharge, and surface water supplies.

Implementing Agency: San Juan County Planning Department
Participating Agencies: Permit Center
Cost: Moderate
Implementation Schedule: Year 2, On-going

Stormwater Runoff Strategies:

SW1: Improve enforcement of stormwater control measures, through inspection, to insure their effectiveness.

- *Currently the only time surface water run-off, erosion, and sediment control measures are checked is if a complaint is registered. A program of conducting periodic inspections to insure control measures are installed and functioning properly is needed.*

Implementing Agency: San Juan County Permit Center
Participating Agencies: San Juan County Public Works, Town of Friday Harbor
Cost: Moderate
Implementation Schedule: Year 3, On-going

SW2: Require contractors that construct stormwater facilities be certified by the Department of Transportation or other reputable organization (such as, IECA) in surface water run-off, erosion, and sediment control.

- *Requiring contractors to become certified will assure that contractors are knowledgeable in the installation of erosion control techniques.*

Implementing Agency: San Juan County Permit Center
Participating Agencies: San Juan County Public Works, Town of Friday Harbor
Cost: Low
Implementation Schedule: Year 2, On-going

SW3: Require an "as-built" drawing and operation and maintenance manual be completed and submitted on all new and revised permanent stormwater facilities.

- *A certification of completion or as-built is needed to document the installation of the stormwater facilities and an O&M manual describes how to operate it effectively.*

Implementing Agency: San Juan County Permit Center
Participating Agencies: San Juan County Public Works, Town of Friday Harbor
Cost: Low
Implementation Schedule: Year 1, On-going

SW4: Develop a Best Management Practice (BMPs) manual for stormwater that is specific to rural development in San Juan County.

- *Department of Ecology's Stormwater Manual contains BMPs for urban settings but fails to address BMPs for the rural settings typical of San Juan County.*

Implementing Agency: San Juan County Planning Department
Participating Agencies: SJC Public Works
Cost: Moderate
Implementation Schedule: Year 2

SW5: Inform developers, contractors, and property owners of the methods and benefits of BMP implementation for stormwater, erosion, and sediment control (e.g.; "ConversionGram" etc.)

Implementing Agency: San Juan County Planning Department

Participating Agencies:
Cost: Moderate
Implementation Schedule: Year 2, On-going

Agriculture Practices Strategies:

AP1: Inform property owners and farmers of the existence of Best Management Practices (BMPs) and their benefits for all conventional and exotic livestock. The Conservation District (CD) should actively contact farmers to explain BMPs, the benefits received, and investigate the obstacles to BMP implementation.

- *Farm operators in the county are concerned about good management practices, but few are aware that technical advice and funding are available through the county's Conservation District.*

Implementing Agency: San Juan County Conservation District
Participating Agencies:
Cost: Low
Implementation Schedule: On-going

AP2: Conduct an inventory to identify farmland and numbers of animals countywide. An accurate survey is needed to assess the total extent of farming activities including potential water quality problems.

Implementing Agency: San Juan County Conservation District
Participating Agencies: Natural Resource Conservation Service
Cost: Moderate
Implementation Schedule: Year 1

AP3: Review and revise, if appropriate, Section 4.2, Agricultural Activities, Best Management Practices for Water Quality, in the Unified Development Code.

Implementing Agency: SJC Planning Department
Participating Agencies: San Juan County Conservation District
Cost: Moderate
Implementation Schedule: Year 2, On-going

AP4: Develop and activate a Memorandum of Understanding (MOU) between the Department of Ecology and San Juan County to clarify the various agencies roles and responsibility in preventing water quality degradation from farming activities.

- *The current enforcement program, administered by the Department of Ecology, is inadequate. Development of an MOU may provide for quicker and more effective response to potential water quality problems.*

Implementing Agency: Department of Ecology

Participating Agencies: San Juan County Conservation District, Permit Center
Cost: Low
Implementation Schedule: Year 2, On-going

AP5: Identify and obtain cost share funds to assist farmers in implementing BMPs.

- *Implementing BMPs can be both costly and time-consuming. Funding and programs are available to help defray the cost and may even provide the labor to implement the BMPs.*

Implementing Agency: San Juan County Conservation District
Participating Agencies:
Cost: Moderate
Implementation Schedule: On-going

Forest Practices Strategies:

FP1: Inform landowners and loggers of the requirements of the forest practice rules and benefits of BMPs.

- *The state forest practice rules are complex and not easily understood by the general public and there is no educational program for best management practices relating to land clearing and logging. Better understanding of the rules and the benefits of best management practices will lead to greater protection of water quality.*

Implementing Agency: Department of Natural Resources
Participating Agencies: San Juan County Conservation District, Permit Center
Cost: Moderate
Implementation Schedule: Year 1, On-going

FP2: Develop and implement a program to present information to landowners, loggers, and contractors who clear and grade property through workshops and training on BMPs and site specific conditions in San Juan County, including identification of wetlands, important habitat characteristics, and the importance of preventing erosion and sedimentation. Ongoing education should be a part of this program.

Implementing Agency: San Juan County Conservation District
Participating Agencies: Department of Natural Resources, Permit Center
Cost: Moderate
Implementation Schedule: Year 1, On-going

FP3: Develop Best Management Practices (BMPs) specific to San Juan County that relate to clearing and grading, roads, skid trails, and revegetation that promote watershed stabilization and reduction of surface water run-off, erosion, and off-site sediment impacts.

- *San Juan County's soils, climate, and topography differ greatly from the nearby mainland. Forest practices need to address site specific conditions.*

Implementing Agency: Natural Resource Conservation Service
Participating Agencies: San Juan County Conservation District
Cost: Moderate
Implementation Schedule: Year 2

FP4: Develop and require implementation of BMPs or guidelines to protect habitat and water quality as well as timber management for land classified as Timber Open Space and Designated Forest Land.

- *Property owners can gain a substantial tax reduction under the timber open space designation. Protection of water quality and habitat should be included as part of the requirements under this tax incentive.*

Implementing Agency: Department of Natural Resources & San Juan County Planning Department
Participating Agencies: San Juan County Assessor
Cost: Moderate
Implementation Schedule: Year 2, On-going

FP5: The Department of Natural Resources (DNR) needs to monitor and provide the necessary enforcement to insure BMPs are implemented for all timber harvest activities to promote watershed stabilization and reduction of surface water run-off, erosion, and off-site sediment impacts. Explore possibility of utilizing a volunteer citizen group to monitor and report to DNR.

- *Currently, DNR has limited ability (staffing) to enforce its rules. This is a problem throughout the area but even more so in San Juan County due to relatively small harvests and travel constraints. Other jurisdictions have established groups of trained volunteers to work with DNR by monitoring local logging activities.*

Implementing Agency: Department of Natural Resources
Participating Agencies:
Cost: Moderate
Implementation Schedule: Year 2, On-going

FP6: Review and revise, if appropriate, the Forest Practices regulations, Section 3.6.8D(1) of the Unified Development Code for consistency with good water quality management and best management practices.

Implementing Agency: SJC Planning Department

Participating Agencies:
Cost: Moderate
Implementation Schedule: Year 2, On-going

FP7: Develop a memorandum of understanding with Department of Natural Resources to provide specific, current county information for their review of forest practice permits.

- *Provide DNR with computerized geographic information and develop a Memorandum of Understanding with DNR to assure that the information provided by San Juan County will be used.*

Implementing Agency: San Juan County Planning Department
Participating Agencies: San Juan County Permit Center, Department of Natural Resources
Cost: Moderate
Implementation Schedule: Year 1, On-going

FP8: Develop and utilize a computer tracking system, which includes mapping of activities, for forest practice applications and subsequent land development.

- *Currently, neither the state or county is tracking the rate of conversion of forest land to residential and other development.*

Implementing Agency: San Juan County Permit Center
Participating Agencies:
Cost: Moderate
Implementation Schedule: Year 2, On-going

Marinas and Recreational Boating Strategies:

MR1: Facilitate a survey at marinas and recreational areas and high traffic areas to determine the number of boats, overnight activity, number of mooring buoys, use of pump-out facilities and discharge areas in San Juan County.

- *San Juan County is a popular boating destination, but the state and county have little information on boating activities and impacts to water quality.*

Implementing Agency: Planning Department/Marine Resource Committee
Participating Agencies: Port of Friday Harbor, State Parks and Recreation
Cost: Moderate
Implementation Schedule: Year 1

MR2: Disseminate educational material to boaters on the effects of illegal discharges, particularly on shallow poor flushing bays and other sensitive areas.

Implementing Agency: Planning Department/Marine Resource Committee

Participating Agencies: Port of Friday Harbor, State Parks and Recreation,
Stewardship Network
Cost: Low
Implementation Schedule: Year 2, On-going

MR3: Pursue obtaining funding to develop additional pump-out facilities, either portable or at marinas, and their continue operation, making it easier for boaters to dispose of their waste. In addition, final waste disposal areas will need to be identified.

- Pump-out facilities for boaters are an important service to encourage proper waste disposal, but maintenance costs are prohibitively high due to transportation from out islands and disposal costs. Funding and developing disposal sites for boater waste is critical to the success of this program.*

Implementing Agency: WS Parks and Recreation
Participating Agencies: Port of Friday Harbor, State Parks and Recreation,
National Parks Service, & San Juan County Health
and Community Services
Cost: High
Implementation Schedule: Year 1 to Year 3

Solid and Hazardous Waste Strategies:

SH1: Inventory and evaluate all unregulated landfills.

Implementing Agency: San Juan County Health & Community Services
Participating Agencies: Department of Ecology
Cost: Moderate
Implementation Schedule: Year 2,

SH2: Continue to subsidize cost for proper disposal and recycling of household hazardous waste. Additional funds should be sought to increase existing services.

Implementing Agency: San Juan County Public Works
Participating Agencies: Town of Friday Harbor
Cost: Low
Implementation Schedule: Year 1, On-going

SH3: Continue to and increase the dissemination of information on what constitutes hazardous waste and how to limit or eliminate their use. Focus should be given to agricultural operations as well as to individual households

Implementing Agency: San Juan County Public Works
Participating Agencies: San Juan County Conservation District, Town of
Friday Harbor

Cost: Low
Implementation Schedule: Year 1, On-going

SH4: Continue to support and increase county's efforts to recycle.

Implementing Agency: San Juan County Public Works
Participating Agencies: San Juan County Conservation District, Town of Friday Harbor
Cost: Low
Implementation Schedule: On-going

SH5: Develop and enforce regulation on illegal dumping and other solid waste violations.

Implementing Agency: San Juan County Health and Community Services
Participating Agencies:
Cost: Moderate
Implementation Schedule: Year 2, On-going

SH6: Develop an education program for contractors to encourage recycling and proper disposal of waste materials and require that building and demolition contractors fill out a waste management plan before projects are begun.

Implementing Agency: San Juan County Permit Center, Town of Friday Harbor
Participating Agencies: San Juan County Public Works
Cost: Moderate
Implementation Schedule: Year 2, On-going

Priority Watershed Action Strategies

East Sound Watershed:

Management issues

- Stormwater contamination in Eastsound (Parsons and Ogier, Azous)
- Water quality problems at Coon Hollow, Buck Bay (DOH Shellfish Program monitoring)
- Water quality problems at ambient monitoring station near Rosario: DO and nutrients (DOE ambient monitoring)
- High potential for conversion of steep forested upland areas
- Effect of flushing in marine waters unknown
- High erosion potential

Recommended action strategies

- ES1: Identify sources of contamination at Eastsound (Fishing Bay), Coon Hollow, and Buck Bay and develop remedial action
- ES2: Develop a water quality and habitat conservation plan for Cascade Creek that includes: protection of the riparian buffer through conservation easements, purchase, and/or stewardship plans
- ES3: Designate East Sound as a Marine Habitat Management Area under SJC's Shoreline Master Program
- ES4: Establish a water resource protection district for the Purdue Lake watershed and Eastsound aquifer, which would include: education of property owners about BMPs for home and farm, conservation easements, conservation purchase, inventory of current sources of contamination, ongoing monitoring
- ES5: Establish baseline and long term water quality and streamflow monitoring and modeling of stormwater runoff to determine the cumulative impact of conversions upland in the watershed
- ES6: Request that DOE investigate sources of low DO and high nutrient levels in East Sound

West Sound Watershed:

Management issues

- Livestock access to wetlands and stream corridor in Crow Valley
- Stream contamination (Azous)

- High potential for conversion of steep forested upland areas
- Rate of flushing of bay is unknown
- Shallow groundwater sources are vulnerable to contamination (SJC Conservation District, 1994)

Recommended action strategies

- WS1: Inventory farm practices in Crow Valley and approach land owners with recommended BMPs to remedy problems
- WS2: Establish baseline and long term water quality and streamflow monitoring and modeling of stormwater runoff to determine the cumulative impact of conversions upland in the watershed
- WS3: Designate West Sound as a Marine Habitat Management Area under SJC's Shoreline Master Program
- WS4: Request that DOE establish an ambient monitoring station in West Sound
- WS5: Develop a water resource protection area for the Crow Valley aquifer, which would include: education of property owners about BMPs for home and farm, conservation easements, conservation purchase of critical recharge areas, inventory of current sources of contamination, ongoing monitoring
- WS6: Set up conservation and restoration project for the Crow Valley Creek and wetland system

Deer Harbor Watershed:

Management issues

- Potential for high level of residential density
- High erosion potential
- Two marinas and a boat yard
- No protection of domestic water supply for Spring Point
- Growing number of livestock with access to stream corridors and wetlands

Recommended action strategies

- DH1: Establish a water resource protection district for the Spring Point water supply, which would include: education of property owners about BMPs for home and farm, conservation easements, conservation purchase, inventory of current sources of contamination, ongoing monitoring

DH2: Establish baseline and long term water quality and streamflow monitoring and modeling of increased stormwater runoff to determine the cumulative impact of conversions upland in the watershed

DH3: Long term monitoring of water quality in Deer Harbor

Friday Harbor Watershed:

Management issues

- Outstanding percentage of wetland area
- Stormwater contamination in Friday Harbor (DOE EAP, Azous)
- Extensive marina/boat activities
- Town's wastewater system is strained during summer peak season

Recommended action strategies

FH1: Set up conservation and restoration project for Beaverton Valley wetland system

FH2: Identify and remedy source of stormwater contamination in Friday Harbor

FH3: Long term monitoring of water quality in Harbor

FH4: Recommend state and federal funding for improvements to the Town of Friday Harbor's wastewater treatment plant, including water conservation measures

Westcott-Garrison Watershed:

Management issues

- Enclosed shallow bays with valuable habitat shellfish, educational, recreational resources
- High potential for conversion of steep forested upland areas
- Source of domestic water for suburban and master planned resort area at Roche Harbor
- Agricultural activities with high livestock density

Recommended action strategies

WG1: Designate Westcott-Garrison watershed as a Marine Habitat Management Area under SJC's Shoreline Master Program

WG2: Set up conservation and restoration project for the Garrison Bay Creek and wetland system

- WG3: Inventory farm practices in West Valley and approach land owners with recommended BMPs to remedy problems
- WG4: Recommend that conversion of the forest lands under control of the Roche Harbor ownership incorporate the highest degree of management for stormwater control, wetland preservation, and development covenants that assure the long term protection of water quality in the watershed
- WG5: Recommend that the Trust Lands under control of DNR be deeded to permanent conservation ownership (Mitchell Hill)
- WG6: Ensure adequate streamflow to maintain beneficial uses within the watershed
- WG7: Identify priority areas for conservation easements by the San Juan County Land Bank and Open Space designation for riparian, wetland, and habitat protection
- WG8: Establish baseline and long term water quality and streamflow monitoring and modeling of stormwater runoff to determine the cumulative impact of conversions upland in the watershed
- WG9: Inventory boating activity in both bays

False Bay Watershed:

Management issues

- Extensive surface water resource area
- Agriculture activities in wetlands and stream corridors
- Shallow bay with valuable educational resources
- Contamination, sedimentation, and poor riparian vegetation at San Juan Valley Creek

Recommended management strategies

- FalseB1: Inventory farm practices in San Juan Valley and approach land owners with recommended BMPs to remedy problems
- FalseB2: Establish a water resource protection district for the the Town of Friday Harbor's drinking water supplies, Trout Lake, Aug 1, and Aug 2 watershed basins, which would include: education of property owners about BMPs for home and farm, conservation easements, conservation purchase, inventory of current sources of contamination, ongoing monitoring
- FalseB3: Designate False Bay as a Marine Habitat Management Area under SJC's Shoreline Master Program
- FalseB4: Set up conservation and restoration project for the San Juan Valley Creek and wetland system

Roche Harbor Watershed:

Management issues

- Extensive marina/boating activities
- High density development activity under the Master Planned Resort designation

Recommended action strategies

- RH1: Ongoing monitoring of water quality in the Harbor
- RH2: Recommend that future development of the Roche Harbor Resort include the highest degree of environmental protection and BMPs, including water conservation and wastewater reuse

Fisherman Bay Watershed:

Management issues

- Enclosed shallow bay with valuable estuarine and nearshore habitat
- Two marinas and one boat yard
- Potential for high density residential and commercial development
- Valuable unconfined aquifer

Recommended action strategies

- FishB1: Designate Fisherman Bay as a Marine Habitat Management Area under SJC's Shoreline Master Program
- FishB2: Set up ongoing water quality monitoring in the bay
- FishB3: Develop a water resource protection area for the Lopez aquifer, which would include: education of property owners about BMPs for home and farm, conservation easements, conservation purchase of critical recharge areas, inventory of current sources of contamination, ongoing monitoring
- FishB4: Establish baseline and long term water quality and streamflow monitoring and modeling of stormwater runoff to determine the cumulative impact of conversions upland in the watershed, particularly to groundwater recharge

Mud-Hunter Watershed:

Management issues

- Shallow bays and extensive coastline with valuable nearshore and estuarine habitat
- High density development along portions of shoreline
- High level of boating activity

Recommended action strategies

- MH1: Designate the Mud-Hunter watershed as a Marine Habitat Management Area under SJC's Shoreline Master Program
- MH2: Inventory boating activity in the area
- MH3: Recommend that the Trust Lands under control of DNR be deeded to permanent conservation ownership (Lopez Hill)

Watershed Management Action Plan Draft Implementation Strategy

Introduction:

The San Juan County Watershed Action Plan was developed to prevent and eliminate non-point source pollution. At this time, the marine water quality within San Juan County is exceptional compared to other Puget Sound counties. However, the county has reached a critical point in its development where good management decisions are needed to protect and maintain these outstanding conditions. Growth and development put greater and greater pressures on the capacity of natural conditions to protect water quality. This calls on the citizens of the county to make careful plans when developing land and to practice good management of domestic, farm, and forest activities. The county and Watershed Management Committee recognize that the investment in maintaining these pristine conditions is desirable, as restoration efforts can be both costly and ineffective.

The action plan contains fifty-five county-wide strategies aimed at eliminating and preventing non-point source pollution before degradation occurs. Since beginning this planning project some of these strategies have already been completed and several are underway. The committee realizes that developing an implementation plan is essential for assuring the remaining strategies are fully implemented. The implementation plan contains the following strategies:

- ✓ Lead Agency Responsible for Overseeing Implementation
- ✓ Utilization of a Citizens Oversight Committee
- ✓ Potential Cost and Revenue Sources
- ✓ Provisions for Public Involvement
- ✓ Implementation Review and Evaluation
- ✓ Procedures for Annual Review and Revisions

The intent of the implementation plan is to assure the Watershed Management Committees goals and objectives are realized. The committee is aware that resources, both staff and money, are the biggest barriers most agencies will face in implementing this plan. The committee spent a great deal of time researching potential funding sources and has including recommendations in this regard.

Lead Agency & Other Implementing Entities:

San Juan County Health and Community Services (HCS) will be the lead agency to oversee the implementation of the action plan. HCS was selected given their involvement and commitment in developing the plan from the start. As lead agency, HCS will coordinate, lead and monitor the activities of the various implementing agencies and

groups. The committee recognizes that the department does not currently have the resources to effectively oversee the implementation. Therefore the committee recommends that a part-time or contract position be established and funded to oversee plan implementation, staff the citizens advisory committee, identify additional funding sources, and prepare the annual report.

Other county agencies involved in implementation include; the Board of County Commissioners, Planning Department, Conservation District, Permit Center, and Public Works. State agencies involved include; Department of Ecology and Department of Natural Resources.

Citizens Review and Implementation Committee:

In order to insure the various concurring agencies implement the action strategies a citizens oversight committee should be established. The committee will assist the lead agency by reviewing the status of the action strategies, evaluating the overall effectiveness of the strategies, and proposing revisions to the plan as necessary to insure the goals and objectives are met. The committee responsibilities should include the following:

- 1) Overseeing the implementation of the action plan.
- 2) Evaluating the effectiveness of implemented strategies in meeting the overall goals and objectives.
- 3) Reviewing results of the long-term water quality monitoring to identify potential "hot spots" and recommend action, if necessary.
- 4) Reviewing the potential sources of pollution and recommended action strategies to determine if revisions are needed.
- 5) Assisting the lead agency in revising the action plan if necessary.
- 6) Assisting the lead agency in completing the annual report in accordance with Chapter 400-12-535 WAC.

Committee membership must include representation from all three districts. Staff from the lead agency will coordinate the committee activities. Representatives from the other implementing agencies will be invited to participate as needed.

Potential Costs and Revenue Sources:

Cost

Costs required to implement the action strategies have been estimated at well over \$1,000,000. This estimate only takes into consideration costs that will be incurred by an implementing entity. Cost to individual homeowners and contractors are unknown and were not included.

Implementation Table B, Plan Implementation, County-Wide Strategies gives an estimated cost for each action strategy. The costs are broken down into two categories, fixed and on-going. Fixed costs are one-time expenses such as developing a program or conducting a survey. On-going cost include operating expenses for additional staff, on-going education programs, maintenance activities and new programs. These cost are estimates only and should not be used as final budgetary figures.

Revenue Sources

Implementation of the sixty action strategies is dependent on funding. The committee recognizes that many of the agencies listed do not currently have the resources, both in staff and money, to implement the action steps. In this regard the committee has researched numerous funding options and made the following recommendations.

Grant funding, both federal and state, is available and should be sought to implement the action strategies. Grant sources include Centennial Clean Water Funds through the Department of Ecology, funding for water quality projects from Natural Resources Conservation Service, and Federal funding through the Environmental Protection Agency. Various agencies have been successful in obtaining grant funds to carry-out non-point source pollution activities. Recent examples include San Juan County Health and Community Services grant to complete sanitary surveys adjacent to shellfish growing areas and San Juan County Conservation District funding to conduct a survey for riparian restoration and a farm inventory.

Grant funding is only a partial funding solution. Most grants require matching funds which are getting harder and harder to obtain as competition for the funds increase. A permanent funding source is needed to insure implementation of all the action strategies. After reviewing several different options the committee recommends forming a Water Quality Utility District to levy and collect assessments. Funds collected are to be used solely for implementation of non-point source pollution action strategies. San Juan County Health and Community Services should manage the fund as the implementing agency.

Establishing a utility district to fund a water quality program

- Step 1. Apply for Centennial Clean Water grant for funding to accomplish Steps 2 through 4.
- Step 2. Develop a comprehensive water quality program based on the Watershed Management Action Plan. This would include specific goals, objectives, and tasks; interlocal agreements with implementing agencies; scope of work, timelines, and reporting for projects; and an agency oversight committee.
- Step 3. Draft an enabling ordinance.
- Step 4. Conduct workshops and hearings for adoption.

Why set up a utility district

A fee system for all homeowners is a fair and stable way to fund needed water quality programs to assure that maintenance of septic systems is affordable, good management practices are supported, long term water quality monitoring is established, and capital improvements funded. In addition, basic funding for a county program opens the door for additional state and federal funds. This type of fee structure has been well supported by citizens in other counties.

Water quality issues

Water quality issues addressed through a comprehensive water quality program include on-site septic operation and maintenance; pollution and flooding from stormwater runoff; aquifer protection; lake, stream, and wetland management and protection; and shellfish protection.

Types of projects

- Long term water quality monitoring;
- Grants and loans for septic maintenance and repair;
- Capital improvements such as septage disposal and stormwater facilities;
- Investigation of pollution sources and remediation;
- Surveys of boating activities, farm practices, on-site septic systems, wildlife impacts, and other potential sources of pollution;
- Educational materials and programs;
- GIS mapping and modeling of hydrology and water quality trends;
- Coordination of easement acquisition and other types of conservation for protection of water quality.

Implementing agencies

San Juan County Health and Community Services, Planning, Permit Center, Public Works; Town of Friday Harbor; San Juan County Conservation District; WSU Extension Service; and public and private schools.

Public Involvement:

Continued public involvement is critical for this plan to be fully implemented. The plan was developed by and for the citizens of San Juan County. Public support and involvement is essential for the plan to be successful. Many of the action strategies involve educating the citizens on the importance and benefits of eliminating non-source pollution. The committee feels that strong educational programs and opportunities are critical to making this action plan a success.

Public involvement will also be sought during public hearings to revise ordinances or regulations. A recent example includes the public workshop and hearing held for the proposed countywide Operation and Maintenance program. Additional public input will be provided at the implementation committee.

Implementation Review and Evaluation:

The lead agency and implementation committee are responsible for determining the effectiveness of the plan in reducing and preventing non-point source pollution. This will require HCS coordinate and work with the various implementing agencies and review the results of the long-term water quality monitoring project. An annual review workshop should be convened. The purpose of the workshop will be to:

- ✓ Hear progress reports from implementing entities.
- ✓ Receive feedback from implementing agencies on the relevance the action strategies
- ✓ Review water quality data from long-term monitoring project.
- ✓ Receive public input

Revisions:

The San Juan County Watershed Action Plan was developed based on the best available information at the time. Changes to control techniques and/or technology may render some of the recommended action steps obsolete. In addition, potential pollution sources may change and water quality may degrade. The committee recognizes this and fully expects the plan to be a working document that is revised periodically. To insure the plan is reviewed and revised, the lead agency and implementing committee are encouraged to review the action plan annually. The review should focus on:

- 1) Are the action strategies implemented; if not then why not
- 2) Are the strategies effective
- 3) Are the strategies still relevant
- 4) Are additional strategies needed to achieve the desired goals.

After reviewing the plan the lead agency and/or implementing committee may determine that revisions are needed. The implementing committee and the Board of County Commissioners must approve all revisions.

Table B. Plan Implementation, County-Wide Action Strategies

Strategies	Implementing entities	Type of strategy	Status	Schedule		Yearly costs
				Start year	On-going	
Water Quality						
WQ1: Develop and fund a long term water quality monitoring program	HCS, Conservation District	Monitoring	New program, initial development complete 2000, staff and monitoring costs needed (WQS)	1	Yes	(70,000) 20,000
WQ2: Inform realtors, developers, regulators, and property owners about the importance wetlands & prevention of non-point source pollution	Permit Center	Education	New program: workshops, brochures, newsletters (RT)	1	Yes	1,500 1,000
WQ3: Update the county's soil survey	BOCC	Information	New program: ½ funding available from NRCS	1		100,000
WQ4: Review and revise wetland regulations, Section 3.6.8, UDC	Planning Dept.	Regulation	Existing program: additional requirements (RT)	2		4,000
WQ5: Use information from delineation's to update the county wetland inventory	Permit Center	Information	Existing program: additional requirements (RT)	3	Yes	2,000 1,000
WQ6: Train county personnel and interested parties in wetland identification.	DOE, Conservation District	Education	Early implementation: 1999	1	Yes	(1,000) 1,000
WQ7: Use students and local volunteers in the water quality monitoring effort	Conservation District, Extension Agent	Monitoring	New program: coordinator needed (WQS)	3	Yes	5,000 5,000
WQ8: Use lower threshold for early warning for marine water quality in shellfish program.	HCS, WS DOH Shellfish	Regulatory/Monitoring	Existing program	1	Yes	1,000 500
WQ9: Complete and maintain GIS data for watershed management.	SJC GIS	Information	Existing program (GIS, 1998): new data management procedures	1	Yes	(10,000) 1,000 – 5,000
WQ10: Set priorities for acquisition for Land Bank, and points for Open Space designations based on watershed functions	Land Bank, Planning	Conservation easements	Existing programs: new criteria	1	Yes	2,000 1,000
WQ11: Designate priority watersheds as Marine Habitat Management Areas under SJC Shoreline Master Program	Planning	Planning	Existing program in process for Westcott-Garrison, see Priority Watershed Strategies	--	--	(85,000) --
WQ12: Establish water resource protection areas or districts for drinking water sources	HCS, Planning	Education, Inventory, Monitoring	New program, would need to be established through land use designation (WQS)	--	--	4,000 2,000
On-site Sewage Disposal						
OS1: Inform Realtors, contractor and homeowners on septic system operation and maintenance.	HCS	Education	New OS&M program (2000) (WQS)	1	Yes	2,000 500

Table B. Plan Implementation, County-Wide Action Strategies

Strategies	Implementing entities	Type of strategy	Status	Schedule		One time costs	Yearly costs
				Start year	On-going		
OS2: Inform property owners of low interest loans available to repair failing systems.	HCS	Incentive	Existing program: support for continuation	1	Yes	--	--
OS3: Facilitate workshops with pumpers and maintenance providers on contracting with outer island groups for services at a reduced cost.	HCS	Education/ Incentive	New program (WQS)	3	Yes	1,500	1,000
OS4: Develop an effective on-site septic system operation and maintenance program for San Juan County	HCS	Education/ Regulation	New program: adopted in 1999 (WQS)	1	Yes	5,000	5,000
OS5: Develop and implement a certification program for pumpers and wastewater inspectors	HCS	Regulation		2	Yes		
OS6: Develop a computerized failure tracking system.	HCS	Regulation		1	Yes		
OS7: Requires pumpers to submit checklist for every tank pumped	HCS	Regulation		1	Yes		
OS8: Take enforcement action against/ revoke certification for problem contractors	HCS	Enforcement		1	Yes		
OS9: Develop and implement a comprehensive septic & sludge management plan for San Juan County	Public Works, HCS	Information/ Planning	New program	3	Yes	5,000	1,000
OS10: Construct a septicage treatment facility on San Juan Island.	Public Works	Capital Facility	Plans approved 1999, construction 2000	1	Yes	350,000	5,000
OS11: Provide funding to maintain O&M program.	BOCC	Funding	New program	1	Yes	--	--
OS12: Continue to pursue funding for on-site sanitary surveys	HCS	Information/ Monitoring	Existing program: renew	--	Yes	1,000	1,000
OS13: Continue to encourage alternative and experimental on-site systems	HCS	Regulation	Existing program	1	Yes	--	--
Land Conversions							
LC1: Review and revise Clearing and Grading, Section 6.6.5A, UDC	Planning Dept.	Regulation	Existing program: revisions	2		4,000	
LC2: Insure implementation of BMPs	Permit Center	Regulation	Existing program(RT)	2		4,000	
LC3: Develop and insure implementation of Small Parcel Drainage plans for land development and single family residences	Permit Center	Regulation	Existing program: new criteria (RT)	3	Yes	2,000	2,000
LC4: Provide incentives for property owners to reduce densities on undeveloped property	Planning, Land Bank	Conservation easements	Existing program	3	Yes	5,000	
LC5: Inform developers, Realtors, and property owners on land conversions (e.g., "ConversionGram" etc.)	Planning	Education	New program (RT)	1	Yes	1,500	1,000

Table B. Plan Implementation, County-Wide Action Strategies

Strategies	Implementing entities	Type of strategy	Status	Schedule		One time costs	Yearly costs
				Start year	On-going		
LC6: Develop resource management overviews	Conservation District, Planning	Information	New program	2	Yes	2,000	1,000
LC7: Develop and implement policies to track cumulative impacts of land conversion	Planning Dept.	Information/Regulation	New program (RT)	2	Yes	4,000	4,000
LC8: Require conservation design plans for all new subdivision	Planning Dept.	Regulation	New program (RT)	2	Yes	2,000	4,000
Stormwater							
SW1: Improve enforcement of stormwater control measures to insure their effectiveness	Permit Center, Public Works	Regulation	Existing program (RT)	3	Yes	2,000	2,000
SW2: Require contractors began certified by DOT or equivalent in erosion control	Permit Center, Public Works	Regulation	New program(RT)	2	Yes	5,000	1,000
SW3: Require "as-built" be completed and submitted for stormwater control facilities	Permit Center, Public Works	Regulation	Existing program: new criteria (RT)	1	Yes	1,000	1,000
SW4: Develop a BMP manual for stormwater that contains BMPs for rural development	Public Works	Information	New program (RT)	2	--	2,000	--
SW5: Inform developers, contractors and property owners on all issues surrounding stormwater	Permit Center	Education	New program (RT)	2	Yes	1,500	1,000
Agricultural Practices							
AP1: Inform property owners and farmers on the benefits of BMP implementation.	Conservation District, NRCS	Education	Existing program: add'l staffing needed	1	Yes	(25,000)	25,000
AP2: Conduct a farm inventory	Conservation District	Survey/Monitoring	New program (4 ferry islands)	1		12,000	
AP3: Review and revise Agricultural Practices, Section 4.2, UDC	Planning Dept.	Regulation	Existing program: revisions	2		4,000	
AP4: Develop MOU between DOE and SJC to clarify roles and responsibilities to prevent water quality pollution from farming operations	Permit Center	Regulation	Existing program: new criteria	3	Yes	2,000	
AP5: Identify and obtain funding for assisting farmers in implementation of BMPs	Conservation District	Incentive	Existing program: staffing needed	1	Yes	1,000	1,000
Forestry Practices							
FP1: Inform landowners and loggers about the requirements of forest practice permits and benefits of BMPs	DNR	Education	New program: workshops, brochures, newsletters	1	Yes	--	--
FP2: Develop and implement an information program on BMPs and site specific conditions in San Juan County	Conservation District	Education	New program: workshops, brochures, newsletters	1	Yes	2,000	2,000

Table B. Plan Implementation, County-Wide Action Strategies

Strategies	Implementing entities	Type of strategy	Status	Schedule		One time costs	Yearly costs
				Start year	On-going		
FP3: Develop BMPs that are specific to San Juan County	NRCS	Information	New program	1		2,000	--
FP4: Develop and require implementation of BMPs for land designated as Timber Open Space	DNR	Regulation	Existing program: new criteria	3	Yes	--	--
FP5: Monitor and provide enforcement to insure BMPs are implemented for timber harvest activities	DNR	Regulation	Existing program: better staffing	2	Yes	--	--
FP6: Review and revise Forest Practices regulations, Section 3.6.8D(1), UDC	Planning Dept.	Regulation	Existing program: revisions	2		4,000	1,000
FP7: Develop MOU with DNR to provide current county information for their review of forest practice permits	Planning Dept.	Information	New program	2	Yes	4,000	
FP8: Develop computer tracking for forest practice permits	Permit Center	Regulation	New program (RT)	2	Yes	1,000	2,000
Marinas and Recreational Boating							
MR1: Facilitate boater survey to determine numbers, overnight activity, and pump-out use	Planning	Survey	New program	1		6,000	--
MR2: Disseminate educational material to boaters on the effects of illegal discharges	WSP&R	Education	New program: staff or volunteers, brochures	2	Yes	--	--
MR3: Pursue obtaining or developing additional pump-out facilities	WSP&R	Capital facilities	Existing program: needs to be expanded	3	Yes	--	--
Solid and Hazardous Waste							
SH1: Inventory and assess all unregulated landfills	HCS	Survey	New program	2		3,000	--
SH2: Continue and pursue additional subsidies for disposing of household hazardous waste	Public Works	Funding	Existing program: support for successful program	1	Yes	--	--
SH3: Continue and increase dissemination of information regarding household hazardous waste and ways to reduce it.	Public Works	Education	Existing program: support for successful program	1	Yes	--	--
SH4: Continue to support and increase county's efforts to recycle	Public Works	Education	Existing program: support for successful program	1	Yes	--	--
SH5: Develop and enforce regulations on illegal dumping	HCS	Regulation	Existing program: new criteria	2	Yes	2,000	500
SH6: Develop education program and waste management plan process for contractors	Permit Center, Town of Friday Harbor	Education, Regulation	New program	2	Yes	2,000	2,000

Costs estimates are for county implementing agencies for additional or enhanced programs. This table does include costs to state and federal agencies or costs to property owners to implement best management practices.

- (WQS) indicates job description for a Water Quality Specialist. (RT) indicates job description for a Resource Technician.
- Numbers in parentheses () have already been funded.

Table C. Plan Implementation, Priority Watershed Action Strategies

Priority Watershed Strategies	Linked to	Implementing entities	Type of strategy	Status
East Sound				
ES1: ID sources of contamination at Fishing Bay, Coon Hollow, Buck Bay	WQ1, OS12, AP2	DOE, HCS	Investigation, Monitoring	State and county monitoring done, need to conduct survey/investigation
ES2: Conservation plan for Cascade Creek riparian area	WQ10, AP1, Highest beneficial use	Conservation District, NRCS	Conservation	CCW grant funded for initial stages of this project in 1999
ES3: Designate East Sound as a MHMA	WQ11	Planning	Planning	Need to establish funding source
ES4: Establish water resource protection district for Purdue Lake watershed	WQ12, Highest beneficial use	HCS, Planning, Conservation District	Education, Inventory, Monitoring	Initial development partially funded as part of 2000 Water Resource Assessment (defining areas) (RCW 90.82)
ES5: Baseline/long term monitoring to assess cumulative effects	WQ1	HCS, Conservation District	Monitoring, Information	97/00 USGS study and 99/00 IWS baseline monitoring, need to develop and fund long term monitoring program
ES6: DOE investigate DO and nutrient levels in East Sound	DOE Needs Assessment, 1996 and TMDL Ranking 1999	DOE	Monitoring	Pass recommendation to DOE as part of plan implementation
West Sound				
WS1: Farm inventory in Crow Valley	AP2, Characterization Report	Conservation District, NRCS	Inventory, Education	CCW grant funded for this project in 1999
WS2: Baseline/long term monitoring to assess cumulative effects	WQ1	HCS, Conservation District	Monitoring, Information	97/00 USGS study and 99/00 IWS baseline monitoring, need to develop and fund long term monitoring program
WS3: Designate West Sound as a MHMA	WQ11	Planning	Planning	Need to establish funding source
WS4: Request DOE ambient monitoring station in West Sound	DOE Needs Assessment, 1996 and TMDL Ranking 1999	DOE	Monitoring	Pass recommendation to DOE as part of plan implementation
WS5: Develop a water resource protection area for West Sound aquifer	WQ12	HCS, Planning, Conservation District	Education, Inventory, Monitoring	Initial development partially funded as part of 2000 Water Resource Assessment (defining areas) (RCW 90.82)
WS6: Conservation/restoration project for Crow Valley Creek and wetlands	WQ2, WQ11, AP6, Highest beneficial use	Conservation District, NRCS	Education, Conservation	CCW grant funded for initial stages of this project in 1999

Table C. Plan Implementation, Priority Watershed Action Strategies

Priority Watershed Strategies	Linked to	Implementing entities	Type of strategy	Status
Deer Harbor				
DH1: Establish water resource protection district for Spring Point watershed	WQ12, Highest beneficial use	HCS, Planning, Conservation District	Education, Inventory, Monitoring	Initial development partially funded as part of 2000 Water Resource Assessment (defining areas) (RCW 90.82)
DH2: Baseline/long term monitoring to assess cumulative effects	WQ1	HCS, Conservation District	Monitoring, Information	97/00 USGS study and 99/00 IWS baseline monitoring, need to develop and fund long term monitoring program
DH3: Long term monitoring marine water	WQ1	HCS, DOE	Monitoring	WQ1, county-wide action strategies
Friday Harbor				
FH1: Conservation/restoration of Beaverton Valley wetlands	WQ2, WQ11, AP6, Highest beneficial use	Conservation District, NRCS, Land Bank	Conservation	CCW grant funded for initial stages of this project in 1999, NRCS funding available also
FH2: ID source of stormwater contamination	DOE Needs Assessment, 1996; SJC Characterization Report; and DOE TMDL Ranking 1999	DOE, Town of Friday Harbor	Investigation, Monitoring	Town of Friday Harbor investigating sources, 11/99
FH3: Long term monitoring of marine water quality	WQ1	DOE, HCS	Monitoring	DOE ambient monitoring, need to fund long term monitoring program
FH4: Recommend funding to FH wastewater system	Characterization Report	EPA, DOE	Funding	Pass recommendation to DOE and EPA as part of plan implementation
Westcott-Garrison				
WG1: Designate Westcott-Garrison as a MHMA	WQ11, Characterization Report	Planning	Planning	Need to establish funding source
WG2: Conservation/restoration of Garrison Bay Creek and wetlands	WQ2, WQ11, AP6, Highest beneficial use	CD, NRCS, Land Bank	Education, Conservation	CCW grant funded for initial stages of this project in 1999
WG3: Farm inventory	AP2, Characterization Report	CD, NRCS	Inventory, Education	CCW grant funded for this project in 1999
WG4: Recommend BMPs and covenants to protect water quality for conversion of Roche Harbor forest lands	LC1, LC2, LC3	Planning, CD, NRCS, HCS	Management Practices, Conservation	Need to develop cooperative agreement with property owners and agencies
WG5: DNR Trust Lands into permanent conservation ownership	WQ10	DNR, Land Bank, CD	Conservation	Pass recommendation to DNR as part of plan implementation

Table C. Plan Implementation, Priority Watershed Action Strategies

Priority Watershed Strategies	Linked to	Implementing entities	Type of strategy	Status
WG6: Ensure adequate streamflow	Highest beneficial use	DOE, HCS	Regulation	Water resource assessment/planning scheduled in 2000 with WMC (RCW 90.82)
WG7: ID priority areas for conservation and Open Space designation	WQ10	Land Bank, Planning, HCS, CD	Conservation	Need to develop as part of plan implementation
WG8: Establish ambient monitoring station in bays	WQ1	DOE	Monitoring	Pass recommendation to DOE as part of plan implementation
WG9: Survey boating activity	MR1, MR2	HCS	Inventory	Need to establish funding source
False Bay				
FalseB1: Farm inventory	AP2, Characterization Report	CD, NRCS	Inventory, Education	CCW grant funded for this project in 1999
FalseB2: Establish water resource protection district for Friday Harbor water supplies	Highest beneficial use	HCS, Planning, CD	Education, Inventory, Monitoring	Initial development partially funded as part of 2000 Water Resource Assessment (defining areas) (RCW 90.82)
FalseB3: Designate False Bay as a MHMA	WQ11, Characterization Report	Planning	Planning	Need to establish funding source
FalseB4: Conservation/restoration of San Juan Valley creek and wetlands	WQ2, WQ11, AP6, Highest beneficial use	CD, NRCS, Land Bank	Education, Conservation	CCW grant funded for initial stages of this project in 1999
Roche Harbor				
RH1: Long term monitoring of marine water quality	WQ1	DOE, HCS	Monitoring	Initial monitoring by Roche Harbor Resort ownership, need to fund long term monitoring program
RH2: Recommend BMPs, water conservation and wastewater reuse	LC1, LC2, LC3	Planning, CD, NRCS, HCS	Management Practices, Conservation	Need to develop cooperative agreement with property owners and agencies
Fisherman Bay				
FishB1: Designate Fisherman Bay as a MHMA	WQ11, Characterization Report	Planning	Planning	Need to establish funding source
FishB2: Long term monitoring of marine water quality	WQ1	DOE, HCS	Monitoring	DOE ambient monitoring, need to fund long term monitoring program
FishB3: Develop water resource protection area for Lopez aquifer	WQ12	HCS, Planning, CD	Education, Inventory, Monitoring	Initial development partially funded as part of 2000 Water Resource Assessment (defining areas) (RCW 90.82)
FishB4: Baseline/long term monitoring to assess cumulative effects	WQ1	HCS, CD	Monitoring, Information	97/00 USGS study and 99/00 IWS baseline monitoring, need to develop and fund long term monitoring program

Table C. Plan Implementation, Priority Watershed Action Strategies

Priority Watershed Strategies	Linked to	Implementing entities	Type of strategy	Status
Mud-Hunter (Lopez Sound)				
MH1: Designate Mud Bay, Hunter Bay, and Lopez Sound as a MHMA	WQ11, Characterization Report	Planning	Planning	Need to establish funding source
MH2: Inventory boat activity in the area	MR1, MR2	HCS	Inventory	Need to establish funding source
MH3: DNR Trust Lands into permanent conservation ownership	WQ10	DNR, Land Bank, CD	Conservation	Pass recommendation to DNR as part of plan implementation

Part 2, San Juan County Watershed Management Action Plan San Juan County Characterization Report

December, 1999



by
San Juan County Conservation District
and
San Juan County Health and Community Services
with funding from



WASHINGTON STATE
DEPARTMENT OF
E C O L O G Y

San Juan County Watershed Characterization Report

Developed in conjunction with the
San Juan County Watershed Management Committee

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White Point BioMarine

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San Juan County
Conservation District



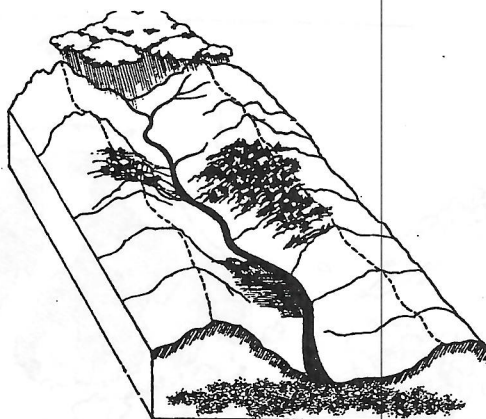
San Juan County
Health and Community Services

Chapter 1, Introduction and Summary of Findings

Introduction

This report is part of a water quality management plan for San Juan County. The San Juan County Watershed Management Committee developed the goals for this project as follows:

- Reduce and eliminate contamination from nonpoint sources of pollution including pathogens, toxic contaminants, sediment, and nutrients from the waters of San Juan County.
- Develop county policies that manage water resources, by protecting existing water rights, by protecting and enhancing flows and habitat for water-related wildlife and fish, and by providing for the public health and well-being of the county.
- Develop a watershed management plan that includes realistic objectives and durable solutions that reflect the diversity of the watersheds and island communities and will survive political change.



A watershed

Background

This report is an assessment of watershed conditions in San Juan County. It includes information on hydrology, land cover, soils, land use activities, habitat, beneficial uses of water, current water quality conditions, and potential sources of pollution. This assessment is part of an overall effort by San Juan County and the Watershed Management Committee to develop strategies to alleviate and prevent pollution through the development of a watershed management action plan. These strategies will address countywide conditions as well as specific local watershed concerns. This report, along with baseline water quality monitoring being conducted during 1999 - 2000, will describe water quality conditions in the county at the end of the 20th century. In the future, as the county grows and water quality conditions change -- for better or worse -- this information will serve as a benchmark to assist county

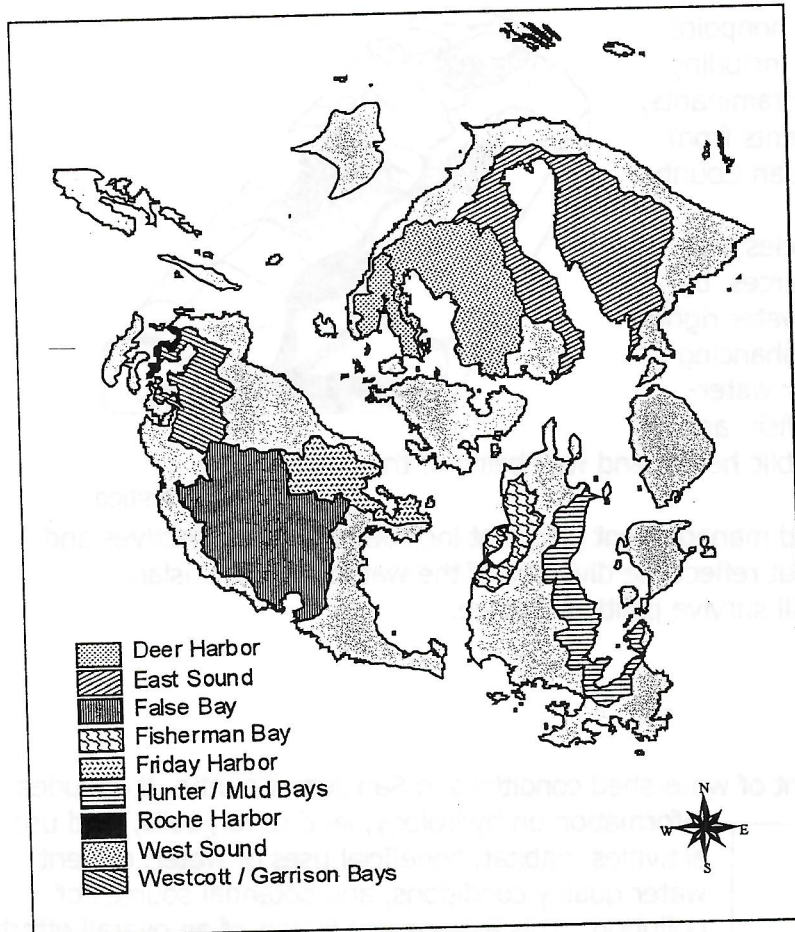
Watershed Physical Components

- Climate
- Precipitation
- Geology
- Topography
- Soils
- Surface Waters
- Ground Waters
- Wetlands

citizens and officials in protecting water quantity and quality and the biologic health and diversity of the waters of the county.

Watershed planning

Watershed management involves looking at all aspects of the hydrologic cycle on a watershed basis and evaluating the impacts on water quality and quantity. Watershed planning started in San Juan County in 1987, with an initial Watershed Ranking project.



The nine priority watersheds described in this report.

planning. The criteria included an evaluation of beneficial uses of water and potential for pollution. The ranking was:

1. East Sound (Orcas Island),
2. Friday Harbor (San Juan Island),
3. Westcott/Garrison bays (San Juan Island),
4. Fisherman Bay (Lopez Island),
5. Roche Harbor (San Juan Island),
6. Mud/Hunter bays and Lopez Sound (Lopez Island),
7. West Sound (Orcas Island),

This effort was part of a movement in the Puget Sound basin to manage pollution entering the region's fresh and marine surface waters. The watershed ranking was funded through Centennial Clean Water Funds administered by the Washington State Department of Ecology. The development of this characterization was guided by 400-12 WAC (Local Planning and Management of Nonpoint Source Pollution).

In 1988, the San Juan County Watershed Ranking Report established a priority ranking for 13 watersheds, based the need for management

8. Deer Harbor (Orcas Island), which tied for points with,
9. False Bay (San Juan Island),
10. Squaw Bay (Shaw Island),
11. Blind Bay (Shaw Island),
12. Mitchell Bay (San Juan Island),
13. MacKaye Harbor (Lopez Island).

In 1996, San Juan County was awarded a grant by Department of Ecology (DOE) and Puget Sound Water Quality Authority (PSWQA) for Centennial Clean Water Funds to complete this assessment, establish a citizens' advisory committee (the Watershed Management Committee), and develop a Watershed Management Action Plan for all the watersheds in San Juan County.

Watersheds in San Juan County have many things in common, but each watershed has unique characteristics and unique management needs. This characterization report discusses conditions on a countywide basis and also describes specific local conditions for the top nine ranked watersheds, in order to present a more detailed picture.

How this report was developed

This characterization report is the result of a cooperative effort between the San Juan County Conservation District and San Juan County Health and Community Services. Consultant services for the project were contracted with Azous Environmental Science and Analysis and White Point Biomarine. Funding for the report was provided through grant #G9600277, Centennial Clean Water Funds, under the Washington State Department of Ecology.

Field observations and water quality sampling were conducted in the spring of 1997 and winter of 1997-98. Information was collected on water quality, hydrology, land cover, marine and terrestrial habitat, and activities that impact water quality, such as on-site septic systems, forestry and agricultural practices, marinas, storm water, and land development. A computerized geographic information data system (GIS) was developed to analyze information and produce informational maps of the county and watersheds.

Watershed boundaries were determined by using a digital elevation model to predict where water drains to the designated receiving waters (salt water bays). Maps were then developed to show the type of land cover; extent of documented wetlands and streams; documented wildlife habitat; soil conditions for septic systems, agriculture, forestry, and erosion potential; current parcel and land use activities; and land use designations.

The following subjects are covered in this report to determine the characteristics of the county's watersheds.

Beneficial uses

As part of its goals and objectives, the San Juan County Watershed Management Committee identified beneficial uses of water for the county as the following: Domestic supply, habitat and special areas, recreation, commercial/industrial, agriculture, and aquaculture. Domestic use and habitat were ranked as the highest beneficial use of water in the county. Discussion of the use of water in these areas is included in Chapter 3, and is based on water resource technical reports and data on water use from local and state agencies.

Land cover

Land cover information was developed from SPOT satellite data acquired on July 26, 1996. The land cover categories include, 1) urban, gravel, mowed grasses¹, 2) grasses, 3) sparse (thinned or partially cut) forest, 4) dense forest, and 5) scrub. The land cover data is based on a pixel size representing a 30-meter square, which limits the level of detail of the information. Land cover plays a critical role in how water is captured, filtered, and stored in the landscape.

Soil conditions

The USDA Soil Conservation Service mapped soil conditions in 1962, published as the San Juan County Soil Survey. This soil information was computerized and used to show the extent of soil conditions for on-site septic systems, agricultural, and forestry operations. This information is essential to determining how well soils in a watershed treat effluent from septic systems, maintain healthy pasture conditions, and resist damage from logging, road building, construction, and other activities that cause erosion.

Streams, lakes and wetlands

Streams, lakes and wetlands were mapped using digital information from the Department of Natural Resources, the US Geological Survey, National Wetlands Inventory, and San Juan County's wetland survey. Because much of this information was drawn from satellite images and aerial photos, many small streams and wetlands do not appear on these maps. The surface hydrology, volume, and flow of surface water in a watershed determine how a watershed stores water and maintains water quality.

Habitat

Maps of fresh- and salt-water wetlands and riparian (stream) areas, eel grass and kelp beds, terrestrial habitat, shellfish and educational/research areas are mapped. This additional information is drawn from digital images from the Washington State Department of Fish and Wildlife Natural Heritage Program and data collected as part of

¹ Because this image was developed in mid-summer, some mowed fields resemble urban/gravel conditions.

the Department of Ecology's Coastal Zone Atlas. A discussion of wildlife and plant species in the county is included in Chapter 2, based on information from several texts on the natural history of the county.

Sources of nonpoint pollution

Nonpoint sources of pollution in San Juan County are discussed in detail in Chapter 5. They include on-site septic systems, agricultural and forestry practices, storm water runoff, the conversion of resource lands (forest/grass/wetlands) to residential and commercial development, marinas, and hazardous/solid waste.

Existing and potential development

Existing land use and development activities are mapped for each watershed based on the County Assessor's information in San Juan County's GIS database. At the time of this report, December, 1999, the county's land use and density designations are under review and as a result future development potential is not represented. Maps of potential density will be developed as part of the county's Growth Management Act review, scheduled for completion in summer, 2000.

Summary of findings

San Juan County is a community of bedrock islands in the rainshadow of the Olympics and Vancouver Island with the smallest land mass of any county in Washington and the greatest extent of shoreline of any county in the United States. The dominant natural features of the watersheds in the county are their small size, lack of rainfall, extensive runoff, shallow soils, and direct contact with estuaries, bays, coves, inlets, and open shoreline. All fresh water in San Juan County comes from rainfall and all runoff flows to marine waters.

Almost seventy percent of the county is forested. The balance is mostly grasslands and scrub, with less than one percent overall of paved area. Lakes and fresh water wetlands cover an estimated four percent of the landscape. At the time of this report the county's year-round population is an estimated 13,000 people, with residential development on approximately 3,110 shoreline parcels and 4,641 inland parcels. Almost 2,000 people live in the Town of Friday Harbor (Washington State OFM, 1998). Currently the county population growth is estimated at between one and two percent. Historically the county was a fishing, farming, mining, and logging community with related industries, such as canneries and lime production. In the last 20 years the local economy has changed to an economy based on vacation homes and tourism. The county is considered an extremely desirable place to live, play, and visit.

There is a considerable lack of detailed information on the natural resources and water resources in the county, including wetlands, streams, aquifers, shoreline inventories, and up to date information on birds, fish, and other wildlife. Much of the data used to develop maps and analysis for this report is based on inventories and studies that are 20 to 30 years old and in many cases these studies involved limited field work, due to problems such as staffing and time limitations and the difficulty with covering extensive

areas of shoreline or travelling interisland. The Coastal Zone Atlas and Natural Heritage Program fieldwork was done in the 1970s, and the San Juan County Soil Survey was published in 1962! Soil characteristics of the county have not changed, but soil science and the value system attached to soils have changed considerably in the last 50 years. The scale of areas mapped in these studies can be misleading, as well. In the Soil Survey, soil areas as large as five acres are lost because of the scale used for the maps (1:20,000).

In order for policy makers and property owners to make informed decisions, up to date information about the physical and biological conditions in the watershed and shoreline is needed.

Watersheds can be viewed as the sum of their physical and biological components and the interactions between these components. Biological components include vegetation, fish, and wildlife, while physical factors include geology, hydrology, and topography. Surrounding all of these components is the history of past interactions and outside events.

The relationships between watershed components change in response to disturbances in the watershed. These changes frequently result in greater diversity within the watershed. Natural disturbances in the San Juan Islands have included wildfires, droughts, volcanic, and glacial activities.

Humans tend to perceive watersheds from a utilitarian viewpoint that includes agriculture, logging, recreation, urbanization, or water development. Human use of watershed components alters the balance of the interactions between all the components. Human disturbances, such as road construction, timber harvesting, urbanization, or water use, often lead to simplified drainage patterns and reduced biodiversity within a watershed (Euphrat and Warkentin).

Two physical factors in the San Juan Islands create severe limitations not usual in other western Washington watersheds. Very low annual precipitation combined with large areas of soils with restricted water holding capacity create severe ground water shortages in many locations.

Water quality is critical to the two primary beneficial uses of water in San Juan County, domestic use and natural habitat. Water quality is an indicator of the quality of all biologic life in the San Juans. The marine waters and upland terrain of the county support a rare biologic diversity. In order to protect the natural beauty of this unusual environment, careful management of the hydrologic balance of each watershed is needed. This is not a new concept for San Juan County. Residents here have long been known for their concern about water quantity and quality. Historic accounts almost always mention the importance of water resources. In 1928, the county was declared a marine biologic preserve, due, in part, to concerns about marine water quality and its importance to sustaining ideal conditions for marine biologic studies.

Current marine water quality monitoring by the Washington State Department of Health, Shellfish Section, and by the Department of Ecology Ambient Monitoring Program

indicate that, compared to other counties in the Puget Sound Basin and Northwest Straits, the marine waters of San Juan County are of very high quality. However, this monitoring also shows that that pollution potential is present (see Chapter 5, Water Quality).

Because the county's watersheds are so small, there is limited natural filtration and treatment time available to runoff before it enters receiving waters. This feature makes the prevention of pollution even more critical. Water quality testing conducted as part of this characterization revealed a number of locations with high levels of fecal contamination. Storm water in Friday Harbor and Eastsound was consistently above acceptable levels for fecal coliform and contamination was also found in streams flowing through agricultural areas and in residential developments. Although extensive surveys have not been conducted, it is realistic to assume that the failure rate for on-site septic systems is at least as great as the regional average of seven percent and that the increasing numbers of livestock, for recreational and commercial use, are having an impact on water quality. The potential for contamination is clearly present.

The key to watershed management in San Juan County is prevention. Unlike other counties in the region that have had to face costly shellfish harvest and beach closures that last for many years, this county has yet to deal with the expense of restoration after extensive degradation. Prevention of this type of damage will not only save the community money, but also, more importantly, will protect irreplaceable resources that benefit both the human and natural environment.

Conclusions -- gaps in what we know

Good information is essential to good management. In producing this report, many gaps were found in the available information. Very little water quality monitoring has been done in the county. As a result, the first step in developing information for this report involved an initial investigative monitoring to get general idea of current conditions. Water quality monitoring has been limited in the past largely due to the county's remote and pristine image. This lack of baseline information makes it difficult to evaluate changes. Although the county's water quality is very good compared to other areas in the region, ongoing monitoring and an early warning system are needed to detect changes and prevent damage.

Limited information on the rate of septic system failure and farm management practices make it difficult to quantify risks and identify problem areas. This is a significant gap because the county's soil conditions and small drainages are not well suited for the natural filtration and treatment of contaminants.

The amount of fresh water available for human use and habitat has not been quantified. This task is extremely difficult due to the diverse nature of the county's geology, topography, and rainfall. Although it is possible to estimate the amount of water used for domestic and commercial activities, little actual data is available.

Because of the county's geographic and geologic diversity, specific information is needed for each drainage basin in order to make sound management decisions for forestry, farming, residential development, and habitat conservation. This report cannot cover all the complexity of the county's many watersheds and sub-basins. In order to evaluate conditions, geographic information at a scale that is appropriate for the small drainage basins is needed. Currently, the maps available can fail to show important features for areas less than five acres². Many small wetlands, and wetlands that do not show up on photo or satellite images (such as areas covered with forest and some grass land) are not documented. In a county where water resources are a critical factor, every wetland and seasonal stream is important.

For a rural county which values its natural settings and abundant wildlife, information on habitat is sketchy or nonexistent. Surveys of habitat conditions are out of date and limited in detail. Shoreline and riparian conditions are not documented. No systematic studies have been conducted of wildlife and natural systems in the county. Funding for specific study areas, such as salt marshes or warm water lakes, has added to the information about habitat, but the overall picture is far from complete.

² The satellite images and elevation models used in this report are at a resolution of 30 meters. Soil and wetland information is at a scale of 1:20,000 and 1:24,000

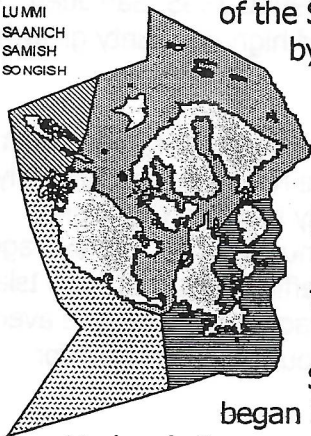
Chapter 2, Characterization of San Juan County

The purpose of this chapter is to characterize the physical, biological, and cultural conditions of the County's watersheds.

History

The San Juan and Gulf islands have been seasonally occupied by central coast Salish tribes from approximately 5000 years ago through the eighteenth century. According to tradition, the Songhees, Saanich, Lummi, and Samish all had winter villages in the southern Gulf and San Juan islands, as well as many permanent structures for other seasons (Suttles 1990). The seasonal and local availability of fishery resources had a great impact on population movements and settlement patterns of local Indian tribes. During summer months, populations commonly disbanded and dispersed to locations where resources were seasonally available. Small units of people left their winter villages and migrated to optimal fishing and plant gathering areas, where they resided in temporary lodges. It is thought that Native Americans influenced native grasslands and oak woodlands through the use of fire (Agee and Dunwiddie 1984). The population of native peoples

■ LUMMI
■ SAANICH
■ SAMISH
■ SONGISH



of the San Juan islands declined by over 80 percent within 100 years of the arrival of Europeans, in 1774, due to the introduction of disease and the subsequent political removal of these peoples to mainland reservations. Settlement in the islands began in 1850, when the Hudson's Bay company established a fish-salting station at Salmon Banks on the southern tip of

San Juan Island. Bellevue Farm was established in 1853

A watershed is a marvelous thing to consider: this process of rain falling, streams flowing, and oceans evaporating causes every molecule of water on earth to make the complete trip once every two million years. The surface is carved into watersheds — a kind of familial branching, a chart of relationships, and a definition of place. The watershed is the first and last nation whose boundaries, though subtly shifting, are unarguable. Races of birds, subspecies of trees, and types of hats or rain gear often go by the watershed. For the watershed, cities and dams are ephemeral and of no more account than a boulder that falls in the river or a landslide that temporarily alters the channel. As constrained and polluted as the Los Angeles river is at the moment, it can also be said that in the larger picture that river is alive and well under the city streets, running in giant culverts. It may be amused by such diversions. But we who live in terms of centuries rather than millions of years must hold the watershed and its communities together, so our children might enjoy the clear water and fresh life of this landscape we have chosen.

-- GARY SNYDER

as an agricultural station with over 4000 head of livestock. By the time American troops arrived on southern San Juan Island in 1859, native grasslands were already disturbed by the extensive grazing activities. Until 1872, the San Juan islands were claimed both by the United States and Great Britain. Military forces from both countries jointly occupied the islands until October 1872, when the San Juans became a part of the United States. Within 20 years settlers had spread to Lopez, Shaw, Orcas, Decatur, and Blakely islands, raising sheep, cattle, and poultry on small subsistence farms. Sheep farming was the most important livestock industry on the islands. Vegetables and fruits were also grown for markets on the mainland, with the advantage of easy transportation by boat, before roads provided access to markets in Seattle from mainland agricultural areas.

Extensive logging at the beginning of the 20th century removed all old growth and valuable timber on most of the islands. Establishment of the local lime industry also consumed great amounts of wood to run lime kilns, as well as young trees to make barrels for the lime. The lime company at Roche Harbor continued to operate until 1956. Quarrying activities for sandstone used for streets in Seattle were extensive on Waldron, Sucia, and Stuart islands. Fishing was a major industry in the islands, with canneries located at Friday Harbor and Deer Harbor. The recent collapse of the herring fishery, as well as the virtual shutdown of commercial salmon fishing due to population declines, has brought an end to the natural resource based economy that supported the island population in the past.

Population and growth

San Juan County's year-round population is just under 13,000 people making it thirty-first in overall population among 39 counties in the state. The fastest growth in population in the San Juans occurred between 1970 and 1990 when the number of year round residents more than doubled (Figure 2-1, OFM). Growth in San Juan County was the fifth highest among Washington counties for the period between 1980 and 1990, increasing by 28 percent over the ten year period. During 1990 to 1995, San Juan County population increased 22.6 percent and had the second highest county growth rate in Washington State.

These numbers do not account for transient increases in population during the summer tourist season. Summer increases from visitors and part-time residents are generally three to four times the winter resident population, periodically bringing the county population to over 30,000 people (OFM). For instance, in January, 1996, the average daily passenger count for Washington State Ferries (WSF) traffic to the San Juan Islands from Anacortes was 1,173. But in August, 1996, a popular vacation month, the average daily passenger count was 5,367 (WSF 1999). Planes and tour boats account for additional summer visitors to the county.

The Washington State Office of Financial Management (OFM) forecasts that the county will grow in population between one and 1.5 percent annually from 1990 to the year 2010. The rate projected by OFM is substantially lower than the annual growth rates of up to six percent that the County has actually seen from 1990 to 1995. Although growth rates have slowed since the large increases between 1970 and 1990 (2.5 percent

annually in the 1980s), growth has not leveled out to any appreciable extent. A continued growth rate averaging 2.5 percent per year between 1990 until 2012 would result in a winter residential population of 18,516 people by 2012.

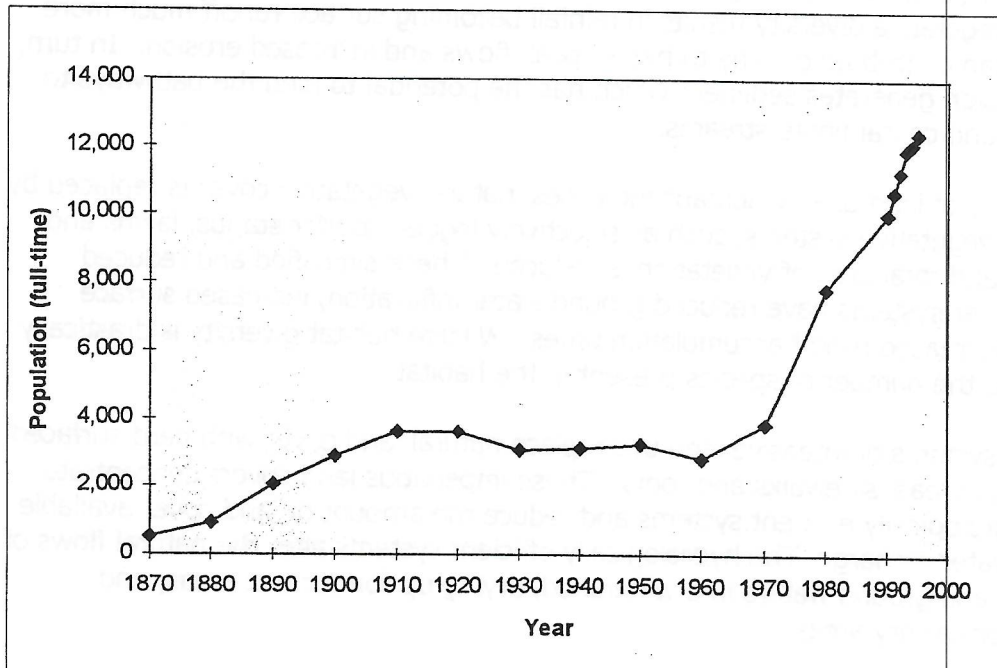


Figure 2-1. Population in San Juan County from 1870 until 1995. (OFM)

Land Cover

Land cover describes the above-ground elements in a watershed that have a direct bearing on the infiltration of precipitation, erosion potential, and the wildlife habitat within a watershed. Cover is the summation of the vegetation and structures that intercept or direct water entering the watershed.

Naturally occurring land cover in the San Juan Islands includes second-growth conifer forests, hardwood forests, scrub and shrub plant communities, and open prairies. Rock outcrops and beaches are non-vegetated land cover types that occur naturally on the islands.

Vegetative cover absorbs the energy of falling raindrops, protecting bare soil from erosion-activating impacts. Intercepted rainfall flows slowly down the leaves, stems and roots of protective vegetation, infiltrating into the underlying soil or becoming surface runoff. Varying heights and densities of vegetation slow down the delivery of this rainfall to surface water runoff and groundwater systems. These delays result in lower peak flows of surface runoff, with reduced rates of soil erosion and sediment deposition. Rainfall runoff from the impervious rock outcrops is almost instantaneous, while infiltration of rainfall into sandy beaches is also instantaneous.

As areas of natural vegetative cover are replaced by low-intensity land uses such as pasture and hayfields, rainfall absorption and runoff patterns are modified. For

instance, grass sod, with a lower water absorption rate than a forest duff layer, causes less rainfall to be absorbed into ground water and more rainfall to become surface runoff. In pasture, the diversity of vegetation is significantly reduced both in height and plant character (single blades of grass replace multi-branched, leafy vegetation). This reduction of vegetative diversity results in rainfall becoming surface runoff much more quickly, and can contribute directly to higher peak flows and increased erosion. In turn, increased erosion generates sediment which has the potential to plug the pathways to groundwater and contaminate streams.

As the intensity of land use by humans increases, natural vegetative cover is replaced by less complex vegetative systems, such as selectively logged conifer stands, lawns and flower beds, and total area of vegetation is reduced. These simplified and reduced vegetative cover systems have reduced ground water infiltration, increased surface runoff, and decreased runoff accumulation times. Wildlife habitat diversity is drastically reduced, as is the number of species present in the habitat.

The support systems of intensive land use replace natural land cover with hard surfaced roads, parking areas, sidewalks and roofs. These impervious land covers concentrate runoff in hydrologically efficient systems and reduce the amount of land cover available for ground water recharge. The hydrologically efficient systems alter the natural flows of both surface and ground waters in a watershed, drying up former wet areas, and inundating former dry areas.

Complexity of wildlife habitat is in direct correlation to the complexity of vegetative cover. Complex land covers support a wide variety of native species of animals, insects, and birds. Simple systems of land cover support only a narrow variety of animals, insects, and birds, many of which are introduced to the area. For example, opossums, starlings, rock doves and English sparrows seem to dominate many heavily urbanized areas. Simplified areas of vegetative cover, such as lawns, are maintained as biologically static communities.

San Juan County's land cover is dominated by forests, which protect the shallow soils and provide abundant habitat for many species. Almost seventy percent of the county is covered by forest lands consisting mostly of conifers such as Douglas fir, Western hemlock, and Western red cedar. Big-leaf maple and Red alder are also common to the area. Most of the remaining landcover in the county is grasslands, largely used as agricultural land for hay or pasture, but with some naturally occurring open prairie areas. The remainder of the county is covered by scrub/shrub plant communities such as willow, Nootka rose, bitter cherry, and ocean spray.

From the 1800s to the 1930s the entire county was logged to produce lumber, fuel for lime kilns and steam-powered boats, or to clear land for agriculture. However, a large portion of the county's landcover has regenerated into second-growth woodlands. The county contains significant natural areas of great diversity and beauty. A discussion of the value of landcover as habitat is in the subsection on Terrestrial Habitat in this Chapter.

Land cover is a condition that changes over time and is best measured by examination of aerial photographs, topographic maps, and analysis of satellite imagery.

Land use does not have a direct correlation to land cover. Areas of permitted land use are best measured by using official county land use planning maps and plats. Designated land use categories under San Juan County's Comprehensive Land Use Plan include: Agricultural Resource Lands, Rural Farm Forest, Forest Resource Lands, Rural Commercial Lands, Rural Industrial Lands, Rural Residential, Special Districts, Conservancy and Natural areas, including public lands. See the following section for a description of these designations.

Special tax categories (current use taxation) have a higher correlation to land cover than the land uses listed above. These include Designated Forest and Farm Lands and Open Space designations, such as Open Space Agriculture, Timber, Recreational, and Open-Open Space. These tax incentive programs reward landowners who maintain their property as resource land, under the state Open Space Taxation Act of 1970. This Act supports the concept that it is in the best interest of the State to maintain, preserve, and conserve adequate open space lands for the production of food and forest crops and the enjoyment of natural resources and scenic beauty.

Land Use

Land use, from the watershed perspective, is the modification of natural vegetation cover and permanent alteration and removal of land cover for development, and the various resulting activities that can impact water quality and quantity. Clearing, grading, constructing ditches and impervious surfaces, such as roofs, roadways and even lawns¹, change the flow of surface water and introduce sediment into wetlands, lakes and streams.

Land use activities affect watershed conditions by covering the ground with impervious and semi-pervious surfaces and introducing pollutants into surface water through home and business practices, such as the use of toxic substances for construction, equipment maintenance, and fuels. The islands have 210 miles of paved county roads (and 71 miles of dirt roads) covering a total of 1,295 acres, or more than 1 percent of the land area of the county. Additional paved surfaces include areas in the Town of Friday Harbor, airports on San Juan, Orcas and Lopez, and parking areas in Roche Harbor, Eastsound, Rosario, and Lopez Village. Gas stations, car washes, boat repair yards, golf courses, animal enclosures and septic waste disposal systems are some of the land uses that generate pollutants. Existing residential development in San Juan County tends to be concentrated along shorelines and in upland areas with views. This creates a potential for pollution where runoff is high and nearshore environments are directly impacted.

¹ Lawns are semi-pervious, limiting the infiltration of surface water with its root mat and creating a biologically static community.

The San Juan County Comprehensive Plan establishes four principal land use classes for the County. Each class permits a different level of activity. The four general classes are Activity Centers, Rural Lands, Resource Lands, and Special Districts; the individual land use categories within the classes are referred to as "Districts." These classes have been developed based on: natural systems and land capability; existing land use patterns; the needs and expressed desires of the community; and coordination with the Shoreline Management Act and the County Shoreline Master Program.

1. Activity Centers. The purpose of this land-use class is to provide centers of activity in a concentrated development pattern which offer diverse employment opportunities; a variety of residential densities and housing types; and general commercial, general industrial, institutional, recreational, and community uses. This land-use class includes five categories or "districts" a. Friday Harbor Urban Growth Area District (UGA), b. Village District (V): Commercial (VC), Industrial (VI), Residential (VR); c. Hamlet District (H): Commercial (HC), Industrial (HI), Residential (HR); d. Island Center District (IC); and, e. Master Planned Resort District (MPR)

2. Rural Lands. Rural lands are intended to retain the pastoral, forested, and natural landscape qualities of the islands while providing people with choices of living environments at lower densities or use intensities than those in Activity Centers. This land-use class includes five categories or "districts": a. Rural General Use (RGU); b. Rural Residential (RR); c. Rural Farm Forest (RFF); d. Rural Industrial (RI); and, e. Rural Commercial (RC)

3. Resource Lands. The purpose of this land-use class is to recognize and protect the physical conditions and characteristics of agricultural and forest resource lands which are conducive to the use of such lands for long-term commercial production. This land-use class includes three categories or "districts": a. Agricultural Resource Lands (AG); b. Forest Resource Lands (FOR); and, c. Mineral Resource Lands (MRL) Overlay District

4. Special Districts. The purpose of this land-use class is to protect, conserve, and manage existing natural conditions, resources, and valuable historic, cultural, educational, or scientific research areas and to preserve indigenous plant and animal species and ecosystems in a natural state for the benefit of existing and future generations without precluding compatible human uses. This land use class includes two categories or "districts": a. Conservancy Lands (C); and, b. Natural Lands (N)

Climate

The climate of the San Juan Islands is influenced by the Olympic Mountains and Vancouver Island, situated southwest and west northwest of the San Juan Islands, which create a "rain shadow" effect producing less rainfall in the San Juans than the rest of northern Puget Sound.

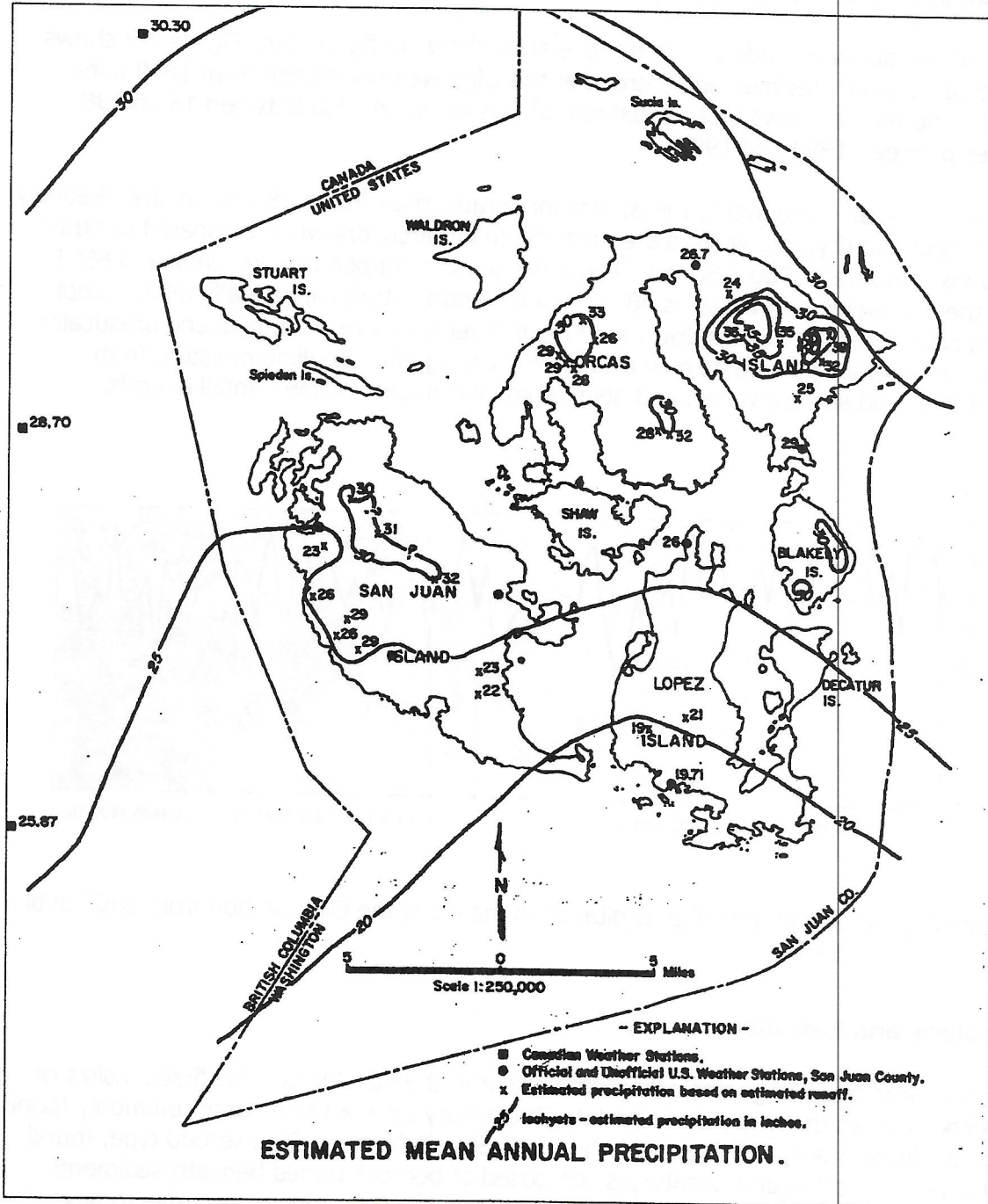


Figure 2-2. Precipitation estimates for the San Juan Islands. (Russell 1975)

Precipitation at sea level increases from south to north in the islands as the rainshadow influence dissipates. For example, the average annual precipitation at the south end of Lopez Island is 19 inches, while the northern portion of Orcas Island receives 30 inches average annual precipitation (EES 1990). Precipitation also increases with higher elevation producing a maximum average annual precipitation of 45 inches on Mount Constitution. Snowfall is not a significant factor in the San Juan Islands.

Rainfall can also vary widely from the averages shown in figure 2-2. Figure 2-3 shows the mean annual precipitation recorded at the Olga weather station from 1890 until 1997. The record shows that annual rainfall has varied at Olga between 15 and 38 inches between 1890 and 1997.

The maritime air surrounding the islands moderates the climate. Summers are relatively short, cool and dry, and winters are mild and moderately dry when compared to other portions of northern Puget Sound. The average high temperature in summer is 65° F, and the average low in winter is 40° F. Winter temperatures are usually mild, except when cold, arctic air funnels down the Fraser River Valley from Canada and drastically lowers temperatures. Winds may also have a drying effect, pulling moisture from vegetation and surface water, and heightening the impact of low rainfall periods.

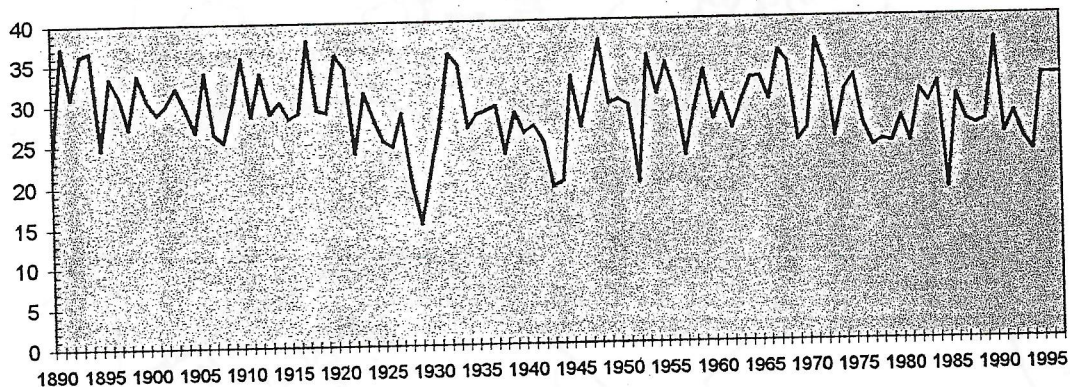


Figure 2-3. Graph of annual precipitation in inches at the Olga Station from 1890 until 1997.

Geology and Hydrology

Two distinct types of geologic landforms occur in the San Juans. The first consists of bedrock domes thinly covered with late Quaternary (glacial) sediments commonly found on San Juan, Shaw, and Cypress (which is in Skagit County). The second type, found on Lopez, Waldron, and Decatur, is composed of bedrock buried beneath sediments more than 300 feet thick in places. However, neither formation is exclusive to any

single island. Portions of Orcas, Lopez, and Waldron have surface exposures of bedrock, and parts of Orcas and San Juan have thick glacial deposits. (White 1994)

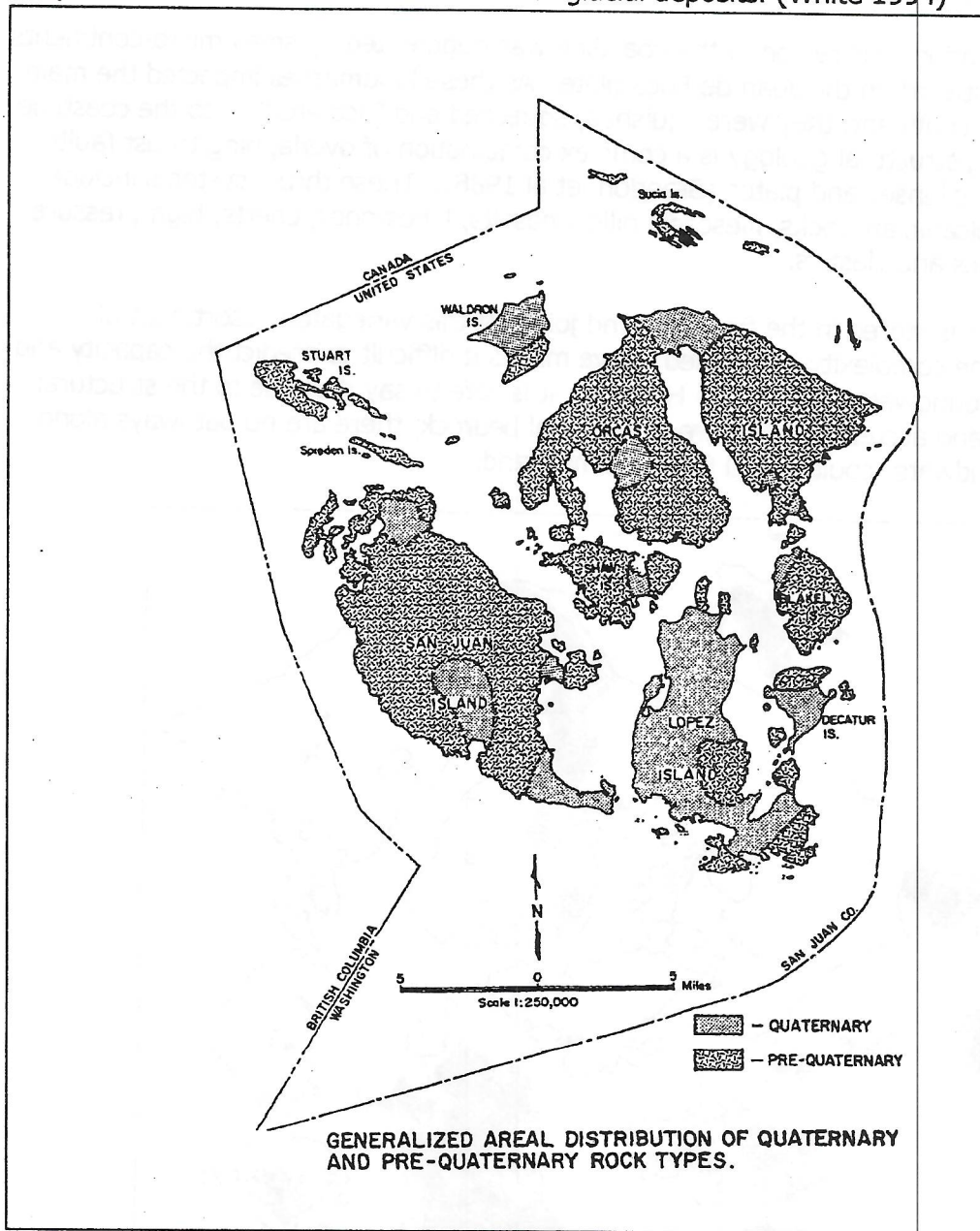


Figure 2-4. Water Supply Bulletin No. 46, 1975, Russell et al. Quaternary areas are covered with glacial deposits. Pre-quaternary are exposed bedrock.

Bedrock Geology (Pre-Quaternary)

Bedrock geology dominates the San Juan County landscape. Surface elevations range from sea level to 2,454 feet at the summit of Mt. Constitution on Orcas Island. The

highest point on San Juan Island is Mt. Dallas (1,036 feet); on Lopez Island it is Lopez Hill (535 feet).

Prior to glaciation, this region of the coastline was augmented by small micro-continents traveling eastward on the Juan de Fuca plate. As these landmasses impacted the main N. American continent, they were squished, squeezed and "accreted" onto the coastline. The resulting structural geology is a complex combination of overlapping thrust faults along tectonic lenses and plates (Brandon, et al 1988). These thrust systems include Paleozoic volcanic arc rocks, Mesozoic pillow basalts, limestones, cherts, high-pressure metamorphics and clastics.

Groundwater is stored in the fractures and joints of this variegated assortment of bedrock. The complexity mentioned above makes it difficult to predict the capacity and extent of groundwater resources. However, it is safe to say that due to the structural complexity and accretionary nature of the local bedrock, there are no pathways along which groundwater could travel from the mainland.

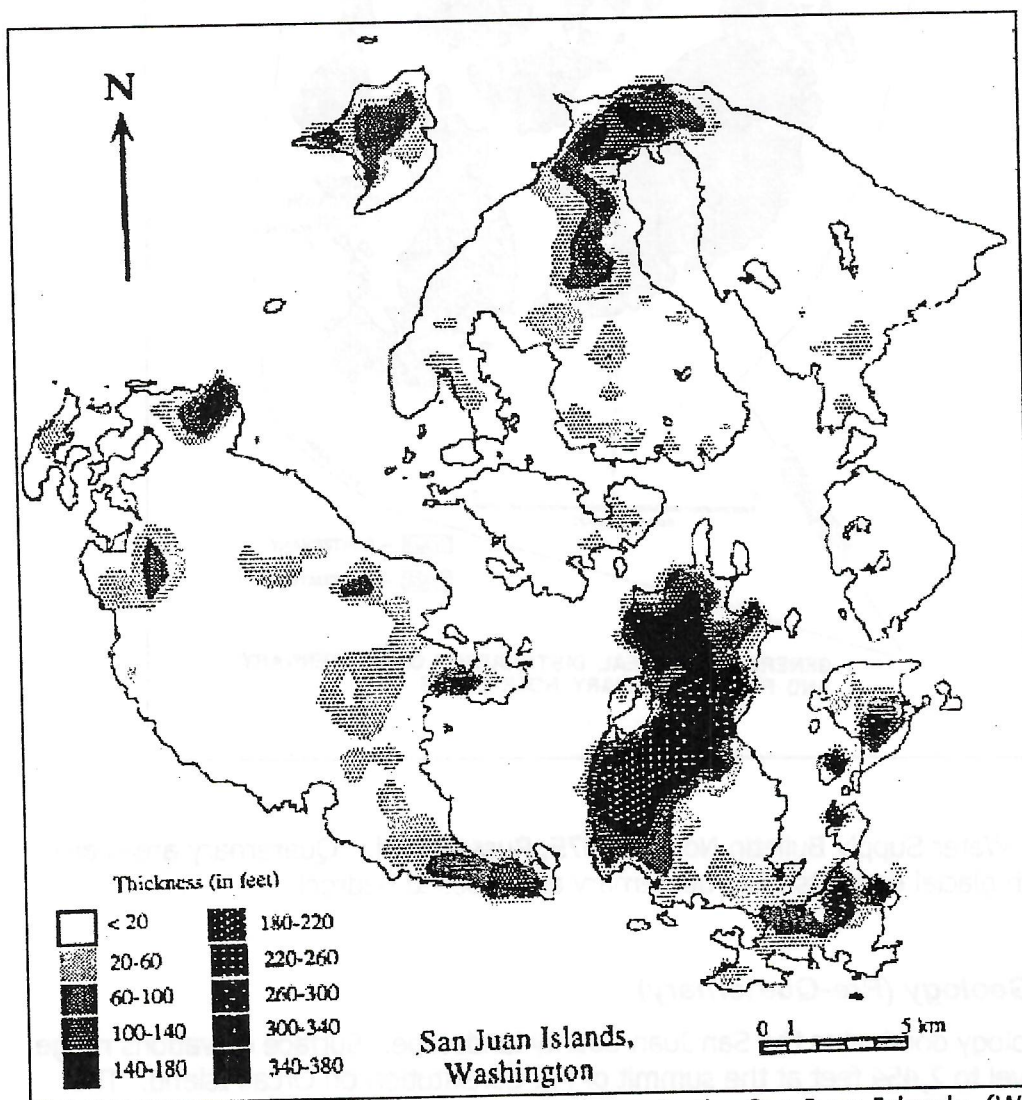


Figure 2-5. General map of sediment thickness in the San Juan Islands. (White 1994)

Glacial History (Quaternary)

Repeated glaciations during the last ice age shaped the bedrock and developed the rugged landscape of the islands. The region was scoured by a blanket of ice as much as a mile thick which carved out marine channels, creating the scenic beauty for which San Juan county is world renowned.

As the glaciers advanced from north to south they created numerous bays and waterways including San Juan Channel, West Sound, East Sound and Lopez Sound. Higher elevations of bedrock were carved, scraped, and rounded. When the glaciers began melting the resulting debris was left behind, blanketing low-lying areas with unconsolidated glacial deposits of clay, silt, sand, gravel, and boulders.

In the San Juans, glacial and interglacial deposits are relatively thin when compared to other areas in Puget Sound where this type of deposition may be several thousand feet thick. Contour maps of sediment thickness generated from county well logs by White (1994) show most of the San Juans to have less than 20 feet of sediment cover (see Figure 2-5.). This thickness, compared to the Quaternary sediment layers in other parts of the Puget Lowland, is miniscule, and reflects the role that the bedrock elevations played in the glacial history of the islands. Glacial sediment distribution in the county varies greatly, with large pockets scattered at random in low-lying areas and little or no sediment found elsewhere. The two largest concentrations of sediment are located on Lopez and Orcas, where sections extend below sea level.

Hydrology

Over eleven thousand years ago, the final melting of the glaciers supercharged this area with groundwater. All available underground spaces were filled as meltwater percolated as deeply as possible into cracks, pores, and pockets within the bedrock. Today all of the "resupply" or "recharge" of this groundwater comes from local rainfall. San Juan County has no rivers and no snow pack upon which to rely for fresh water. cause the San Juans are so heavily dependent on rainfall to supply domestic needs and maintain physical and biological functions, it is important to understand how the hydrologic cycle works in the islands.

Hydrology is the study of the character, distribution, movement and effects of the earth's water. The conditions of climate, topography, geology, soils and vegetation are interacting elements in the hydrologic cycle.

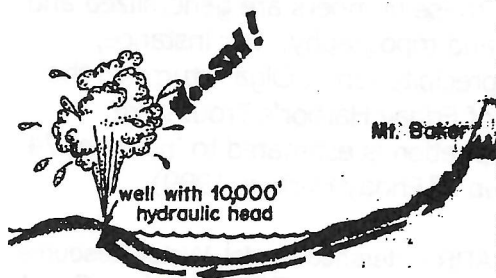


Figure 2-6. (Russell 1975)

There is a common misconception in the county that fresh groundwater comes from Mt. Baker and the Cascades. This is not possible due to the structural complexity previously mentioned in the Bedrock Geology section. As well, the hydraulic head of a well is directly proportional to the elevation of the source of the groundwater. This relationship holds true no matter how far the

groundwater travels from its original source. Were groundwater to originate in the mountains of the mainland, the hydraulic head of such wells would be legendary (see Figure 2-6).

Under natural conditions, precipitation either runs off the land into larger bodies of water (runoff), is used by plants and evaporates into the atmosphere (evapotranspiration), or enters ground water and is stored (recharge). All of these components influence the yield and distribution of water within a watershed.

Runoff

The amount of runoff varies depending on slope gradient, depth of soil, type and condition of vegetation, and precipitation. The higher the amount of runoff, the higher the potential for erosion and subsequent nonpoint pollution due to sedimentation.

Runoff estimates for an undeveloped landscape² indicate that annual runoff at sea level varies from a low of 3 inches to a high of over 8 inches proceeding from south to north through the islands. Runoff also increases with increasing precipitation at higher elevations, up to 13 inches on Mount Constitution.

Runoff throughout the county is low for Western Washington, due to limited rainfall, small catchment areas, and coarse, porous glacial sediment over bedrock. However, runoff is high proportionally, due to the presence of bedrock and impervious soil layers. Runoff occurs chiefly from December through March when soils are saturated and rainfall is heaviest. Runoff estimates developed using the runoff modeling program³ indicate that 28 percent of average annual precipitation is not captured and becomes runoff. This amount can vary from 11 percent to 45 percent depending on the impact of evapotranspiration combined with variations in rainfall (Russell 1975). San Juan Island's False Bay watershed has the greatest volume of runoff for any basin in the county with 3,154 acre-feet per year. The next largest volume of runoff is for the Crow Valley basin, with 2,276 acre-feet. The largest drainage on Lopez drains to Davis Bay with a volume of 743 acre-feet (EES 1990).

Evaporation and transpiration

Evaporation and transpiration, or evapotranspiration, is water cycled back to the atmosphere from surface waters, soils and plant surfaces. In the San Juan Islands, evapotranspiration is the most important water loss annually. Although EES, in the Water Resource Assessment Technical Report, estimated that 42 percent to 49 percent of annual precipitation is lost to evapotranspiration, these numbers are generalized and individual basins will vary, depending on landcover and topography. For instance, Dietrich (1975) reported that 67 percent of annual precipitation at Olga returns to the atmosphere through this process; and in the Town of Friday Harbor's Trout Lake watershed, which is steep and forested, evapotranspiration is estimated to intercept 74 percent of the water from annual precipitation (Town of Friday Harbor, 1999).

² Computed using the U.S. Army Corps of Engineers SSARR watershed model, Water Resource Assessment Technical Report, Economic and Engineering Services, Inc.(EES), San Juan County Comprehensive Water Plan

Evapotranspiration is greatest during the summer months, when precipitation is minimal and plants are actively respiring. In an average year in the San Juans, actual evapotranspiration is greater than precipitation from mid-April through September, causing water to be depleted from the soil.

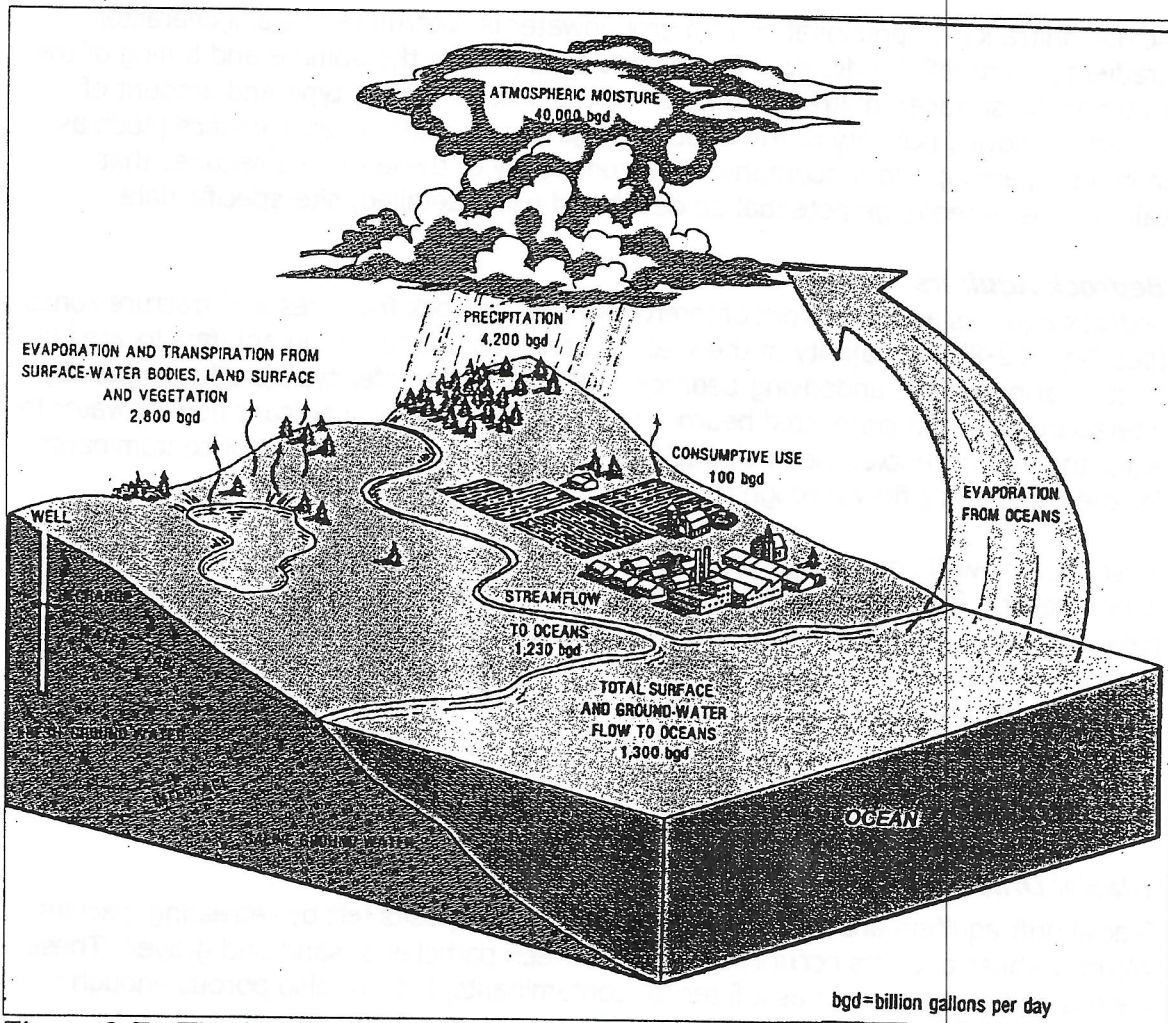


Figure 2-7. The hydrologic cycle.

Groundwater recharge

Wells in San Juan County are generally completed in and produce from two major aquifer types: glacial/interglacial aquifers and bedrock aquifers. Aquifers are geologic zones where groundwater is found and can be extracted. Large, productive glacial sand and gravel aquifers exist on Lopez Island and northern Orcas. However, most wells in the county obtain water from bedrock aquifers which are less productive. Generally, groundwater flows radially outward from the centers of the islands toward the shorelines. Because of a high ratio of shoreline length to land area in the San Juans there is an appreciable flow of groundwater seaward.

Evapotranspiration and runoff affect groundwater recharge. Using Detrich's figures for Olga as an example: the average annual rainfall is 29" and 67 percent, or 19.4", is lost to evapotranspiration, another 6.49" is lost to runoff, and the remaining 3.1" (10

percent) is available for recharge. In the Water Resource Assessment Technical Report (EES 1990), recharge estimates varied from as low as .1" (less than 1 percent) for southern Lopez during a drought year, to a maximum of 13.6" (30 percent) in an average year for the largest drainage on Orcas.

Actual infiltration of precipitation into groundwater is determined by soil character, gradient and runoff conditions. These conditions include the volume and timing of the water at the surface; infiltration capacity of the soil; condition, type and amount of vegetative cover; porosity of the underlying geology; aquifer characteristics (such as storage capacity); and topography. The complexity of these factors requires that calculations of recharge potential be developed using detailed, site-specific data.

Bedrock Aquifers

Bedrock aquifers are a network of interconnected bedrock fractures and fracture zones (see Figure 2-8). A majority of the wells in San Juan County are in aquifers located in fracture zones in the underlying bedrock. Wells of this aquifer type produce water by intersecting enough connected bedrock fractures to cause a significant flow of water to enter the well borehole. Bedrock aquifers provide very little filtration of contaminants for the waters that flow through them.

Most bedrock wells have water levels within 20 to 30 feet of the surface, although the water-yielding fractures may be much deeper (EES 1990). Whiteman (1983) cites the mean well-bottom altitude of bedrock wells at 123 feet below sea level. Yield for most bedrock wells is typically low, with rates between one and 10 gallons per minute. Most bedrock wells are drilled deeply in anticipation of intercepting additional water-yielding fractures. However, the occurrence of water-yielding fractures usually decreases with increasing depths and these added depths only provide additional storage capacity from which to draw water (Whiteman 1983).

Glacial Drift Aquifers

Glacial drift aquifers are located in outwash glacial deposits left by retreating glaciers. Water in these aquifers occurs in spaces between particles of sand and gravel. These gravels and sands can act as a filter for contaminants, but are also porous enough to allow contamination under the right conditions.

Wells drilled into glacial drift aquifers on Lopez Island generally have water levels within 10 feet of sea level, regardless of the land surface elevation. Yields for wells in glacial deposits can exceed 50 gallons per minute³, however, yields in most glacial drift wells are closer to 5 to 10 gallons per minute (Whiteman, 1983; SJC Health and Community Services, 1999).

³A volume calculation shows that for a sustained withdrawal of 50 gallons per minute, a drainage area of 250 acres (radius 1/3 mile) is needed for a 4-inch recharge rate, with no other withdrawals in the area. For a 2-inch rate, the required area is 500 acres (radius 1/2 mile) with no other withdrawals in the area. Such requirements for land area in the San Juans are becoming increasingly difficult to meet (Richey, pers. comm.).

The high degree of porosity and hydraulic connection to seawater as well as depth and location make these wells highly susceptible to seawater intrusion. Seawater intrusion is the migration of seawater into a freshwater aquifer. It is usually caused by pumping water at an excessive rate from an aquifer that is hydraulically connected to the sea, or by drilling too deep and penetrating the salt water interface. Seawater intrusion is an existing problem in many sand and gravel aquifers as well as in some fractured bedrock aquifers in San Juan County.

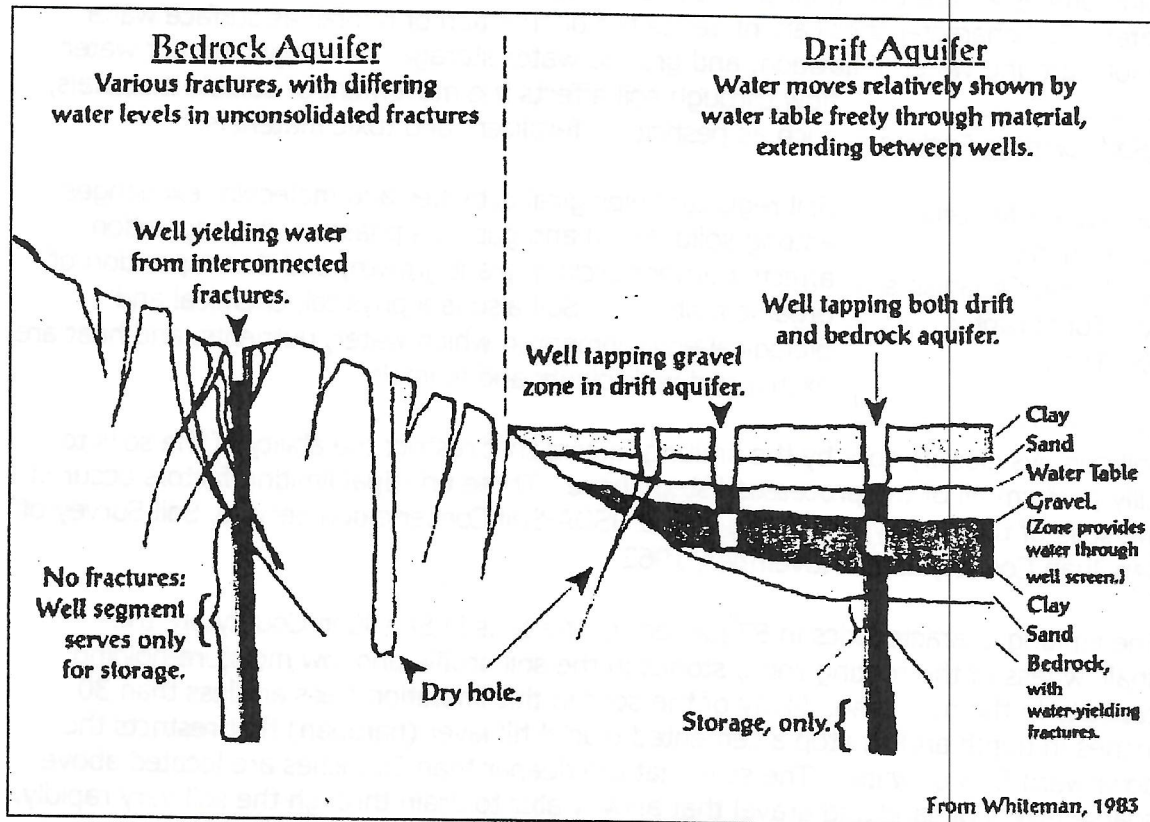


Figure 2-8. Illustration of rock aquifer wells as compared with wells in glacial sedimentary deposits. (Whiteman 1983)

In addition to limited rainfall recharge and aquifer storage capacity, the safe yield from many aquifers is limited by seawater intrusion. A study of San Juan County groundwater by the U.S. Geological Survey (USGS) in 1981 found that 9 percent of 279 wells sampled county-wide had evidence of seawater intrusion (Whiteman, et al. 1983). Additional work is being conducted by the USGS to further assess the capacity of the county's glacial drift and bedrock aquifers, and the extent of seawater intrusion. A report on chloride concentrations in wells on Lopez is due in spring of 2000. Data from this study indicate that 25% of the wells sampled in 1997 on Lopez are experiencing salt water intrusion and almost 50% have elevated chloride levels.

Soils

Soil is a product of the soil-forming processes acting on material deposited or accumulated through geologic forces. Climate and living organisms, particularly

vegetation, are the active forces in soil formation. Their effect upon the parent material is modified by topography and the length of time the parent material has been in place.

Soil is composed of varying sizes of mineral particles, organic matter and multiple species of living organisms. The biological, chemical and physical properties of soils are in a constant state of flux.

Many processes are taking place in the soil. Soil acts as a filter to protect the quality of water. Soil characteristics can influence the distribution of rainfall as surface water runoff, ground water infiltration, and ground water storage. The regulation of water flow through soil affects the movement of soluble materials, such as pesticides, fertilizers and toxic materials.

Soil Forming Factors

- ◇ Parent Material
- ◇ Climate
- ◇ Living Organisms
- ◇ Topography
- ◇ Time

Soil regulates biological activities and molecular exchanges among solid, liquid and gaseous phases. This regulation affects nutrient cycling, plant growth, and decomposition of organic materials. Soil also is a physical, chemical and biological environment in which water, nutrients, and heat are exchanged with plants and animals.

Soil surveys classify soils by the limiting factors that restrict the ability of the soils to fully perform all of the processes listed above. Three principal limiting factors occur in the soils of the county, according to the USDA-Soil Conservation Service, Soil Survey of San Juan County, dated November, 1962.

The limiting characteristics in 57 percent of the soils in San Juan County are the shallowness of the rooting zone, stones in the soil profile and low moisture-holding capacity in the root zone. Many of the soils in this limitation class are less than 30 inches in depth and sit atop a cemented glacial till layer (hardpan) that restricts the downward flow of water. The soils that are deeper than 30 inches are located above coarse layers of sand and gravel that allow water to drain through the soil very rapidly.

Excessive water is the dominant hazard or limitation affecting the use of 23 percent of the soils in the San Juan soil survey. This hazard/limitation includes poor soil drainage, soil wetness and a high water table.

Susceptibility to erosion is the dominant hazard or limiting factor in 19 percent of the soils in the County. The majority of the soils and soil complexes in this classification have slopes in excess of 30 percent and were mapped as rock areas or soil and rock complexes in the soil survey.

Soil erosion is a natural process that can be accelerated by human action. Removal of protective vegetative cover from topsoil exposes the soil to the impacts of rainfall. This impact can cause individual soil particles to break loose and be carried downslope. This process causes a loss in soil nutrients and often leaves behind an environment that is less favorable for plant growth. Water eroded soil particles become sediment that moves offsite, damaging fish and marine habitats, decreasing infiltration, and degrading

water quality. Increased surface water runoff from human actions can also accelerate soil erosion.

Human actions can degrade soil capability by compacting the air spaces in a soil. Compaction occurs primarily when heavy equipment or farm animals exert pressure on wet soils. The effects of soil compaction include restricted plant growth, increased soil moisture, decreased soil temperatures, decreased water infiltration and increased surface water runoff. The soils of San Juan County are particularly susceptible to damage by compaction because of their thinness and relatively high clay content.

Wetlands, Lakes and Streams

Wetlands, lakes and ponds provide water storage in the landscape. The number and size of lakes, ponds and wetlands in a watershed are measures of its water storage capacity. Wetlands, lakes, ponds and streams also serve an important function in maintaining good water quality. Wetlands provide a beneficial use of water by providing wildlife habitat and aesthetic enjoyment. As land is developed and used, these important qualities -- storage, purification and habitat -- are disrupted.

Wetlands

Wetlands benefit the hydrologic function of a watershed. Wetlands store water, purify water, filter runoff, abate flooding and decrease erosion. They act as ground water recharge and discharge sites. In general, the higher the proportion of acreage in wetlands in a watershed, the greater the functional capacity of that watershed to store, purify and filter water, and to capture sediments. In the watersheds studied in this report, identified fresh water wetlands⁴ comprise as little as one percent to as much as 12 percent of the total watershed area.

Wetlands are generally identified as areas where excess water is present during part of the growing season (either soil saturation or inundation), a wetland vegetation community is evident, and soils show evidence of periodic saturation or flooding.

The maps in this report show the general location and extent of wetlands from the National Wetlands Inventory (U.S. Department of the Interior) and the San Juan County Wetlands Inventory (Sheldon, 1993)⁵. These wetland boundaries were derived from analysis of aerial photos and some field reconnaissance. Delineations, which define the actual boundaries of a wetland based on field surveys of soil conditions, are not included in these maps. Not all wetlands were identified by these two surveys. Many known wetlands are not shown on the maps, particularly small wetlands, forested wetlands and some estuarine (where fresh and marine waters meet) wetlands. Many of the wetlands found in San Juan County are small -- less than 50 ft² -- and are unregulated under

⁴ Identified wetlands in the County have been documented using aerial photos and satellite images, with some field verification. Many wetlands have not been documented, including those in forested areas and small wetland areas that are not easily distinguishable within the surrounding landscape.

⁵ Appendix B, figures B-3 and B-4.

state and county laws. Under federal law, wetlands are more stringently protected. For example, a wetland less than 50 ft² that contains habitat for listed species or significant cultural resources is protected with no limitation to size.

Freshwater wetlands in the County mostly occur in bedrock depressions or in depressions underlain by glacial till, deposited and compacted by glaciers. The largest freshwater wetland systems in the county are found in the False Bay and Friday Harbor watersheds on San Juan Island.

Information on present or historic wetland loss for San Juan County is not available. Data gathered for the National Wetlands Inventory (NWI)⁶ suggests that the Puget Lowland (which includes San Juan County) lost between 30 and 70 percent of its wetlands up to 1980, when wetland data was first collected. Federal wetlands protection legislation was started in 1972, under the Clean Water Act.

Alterations to wetlands include ditching and draining, mowing or grazing of wet meadows, dredging for ponds, and filling for roads and building sites. Some wetlands in the County have been converted to ponds and to pasture for grazing and hay production. Although they have lost some of their use as wildlife habitat, these areas remain wetlands and, depending on the degree of alteration and management practices, can perform important wetland functions, such as storage and filtration.

There are a variety of laws and regulations at the federal, state, and county level that affect construction and other activities in wetlands and adjacent areas. Some of these regulations only apply to certain wetlands or certain activities in wetlands, and the provisions of these laws can vary. In San Juan County, wetland regulations treat wetlands differently depending upon their location, and how they score in a wetland rating/classification system. Case-by-case review is needed for individual projects that occur in or near wetlands, and applicants are advised to contact the proper authority prior to project development. The primary means for protecting water quality and maintaining beneficial uses in wetlands in the State of Washington is through the implementation of water quality standards when issuing development permits. The beneficial uses of wetlands can be protected and maintained through permit requirements tied to the Clean Water Act. These federal regulations apply even to wetlands not covered in county regulations.

Lakes and Ponds

Lakes, reservoirs and ponds occur throughout the islands and are important sources of water for wildlife, domestic use, irrigation, stock watering, fishing and recreation. Lakes supply much of the domestic water used on San Juan and Orcas islands. Trout Lake and Briggs Pond supply domestic water for the Town of Friday Harbor and Roche Harbor, respectively. Rosario uses Cascade Lake; the Olga and Doe Bay water systems

⁶ The National Wetlands Inventory (NWI) is managed by the US Fish and Wildlife Service for the purpose of monitoring wetland losses and reporting improvements in wetland acreage in the United States.

depend on Mountain Lake; and Eastsound uses Purdue Reservoir as a back-up for well water sources.

Orcas Island, with its rugged, rocky terrain, has the largest lakes in the county. Lopez Island, due to gentle topography, lack of rainfall and porous, glacial sediment overlay, has the least amount of surface water impoundment.

Table 2-1. Major Lakes San Juan County.

Island / Watershed	Lake	Surface Area (acres)	Lake Volume (acre-feet)
Orcas Island			
East Sound	Mountain Lake	198	8,800
East Sound	Cascade Lake	172	4,600
East Sound	Martin Lake	27	200
East Sound	Summit Lake	10	40
San Juan Island			
False Bay	Trout Lake	60	1,400
San Juan Channel	Sportsman Lake	87	400
False Bay	Zylstra Lake	48	350
Westcott Bay	Briggs Pond	29	210
Blakely Island			
	Horseshoe Lake	84	6,900
	Spencer Lake	64	5,400
Lopez Island			
Swifts Bay	Hummel Lake	36	272

Streams

Watersheds in the islands are usually less than five square miles in size, with streams that flow between late November-December and early May. There are two perennial streams of significant size on Orcas Island: Cold and Cascade creeks (Whiteman 1983). Cold Creek is fed by a large spring, and Cascade Creek by Mountain Lake. On San Juan Island two streams run all year. These streams are San Juan Valley Creek, which starts at Trout Lake on Mt. Dallas and joins up with the drainage system for the wetlands of the False Bay watershed, and a small creek that begins at the back of Mt. Cady and drains into Garrison Bay.

Because most streams in the San Juans are seasonal, they have limited value for salmon production. Many of the county's streams have been altered by ditching or diversion, and have been affected by the extensive logging that took place in the county at the turn of the century. However, long-time residents report that most of the larger streams supported fish runs in the recent past. Some of these streams include: the creek running from Trout Lake through San Juan Valley to False Bay and the creek running into Garrison Bay⁷ on San Juan Island; the creek from Hummel Lake to Swifts Bay on Lopez; and the creek that drains Crow Valley -- which is reported to have been a

⁷ Both of these creeks have been referred to as Trout Creek.

perennial stream prior to the logging of Turtleback Mountain in the 1920's and 1930's. Cascade Creek on Orcas currently supports anadromous fish in its upper reaches.

The state has classified streams into five designations (222-16 WAC, State Forest Practice Regulations), roughly described as follows. Class 1 type waters are designated as "shorelines of the state," but not including their related wetlands. Class 2 type streams are those used as a major public source of drinking water, or used by a substantial number of anadromous or resident game fish for spawning, rearing or migration, or streams having more than 20 feet in width and less than a four percent grade. Class 3 type streams are those serving as a smaller public water source, also habitat for fish, with a width of five feet or greater and a grade of less than 12 percent. Class 4 and 5 type streams are significant for the protection of downstream, Class 1 – 3 waters.

In 1999, according to the Forest Practices division of the Washington State Department of Natural Resources, emergency rules governing Class 4 and 5 streams are currently in effect. These rules require that all Class 4 and 5 waters that are two feet or wider between ordinary high water marks, and have a gradient of less than 16 percent be treated as Class 3 streams. These emergency rules apply to waters that have not been evaluated to determine the presence or absence of fish.

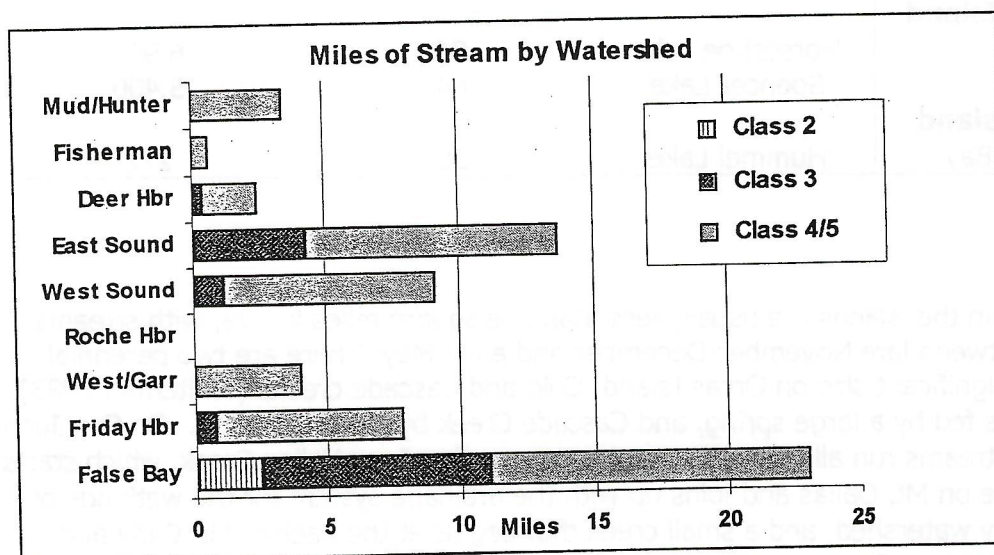


Figure 2-8. (Watershed Ranking Report 1988)

Habitat

Habitat is the term used to describe physical and biological conditions of the land that support the feeding, breeding, nesting and rearing of young for wildlife. San Juan County has three major types of habitat: freshwater, terrestrial (uplands), and marine.

Over 291 species of birds are recorded in the San Juan Archipelago, and it is one of the most important regional locations for breeding, migrating and wintering of seabirds.

The shorelines of the county support the largest bald eagle population in the lower United States and host a rare Golden eagle population. Other birds of distinction found in the county include loons, vultures, herons, peregrine falcon, merlin, purple martin, trumpeter swans, Cooper's hawk and the marbled murrelet (Lewis & Sharpe 1987).

Twelve species of marine mammals, 24 different terrestrial mammal species, including river otter, mink, and Columbia black-tailed deer, and hundreds of species of marine invertebrates and fish are found in San Juan County. Small mammals include the white-footed deer mouse, Townsend's vole and vagrant shrew. Beavers are found in some parts of Orcas Island and have been present on San Juan and Lopez in the past. Amphibians and reptiles that may be observed in the San Juans are the rough-skinned newt, red-legged frog, Western toad and Northern alligator lizard. (Vernon 1996).

Species found in San Juan County listed by state and federal agencies for protection under the federal Endangered Species Act. These animals are considered priority species due to their food value, game status or rarity by the Washington State Department of Fish and Wildlife (WDFW). Priority Habitats are designated by WDFW in areas where species of concern are found. Species of Concern or Priority Species in Washington include all Endangered, Threatened, Sensitive, and Candidate species. Priority species also include Federal, Endangered, Threatened, and Candidate fish stocks. The Washington Natural Heritage Program (WNHP) develops and recommends strategies for protection of the native ecosystems and species most threatened in Washington State.

Wetland Habitat

Both fresh- and salt-water wetlands provide important habitat functions in San Juan County. Wildlife associated with wetland ecosystems includes resident and transient mammals, birds, reptiles, amphibians and the many insects that provide food and essential biologic functions in the watershed. Many wildlife species, such as, beaver, frogs and salamanders depend on wetlands for their survival. Other upland wildlife species depend on wetlands for essential aspects of their life support. Different wetland types: open water, scrub/shrub, or forested, support a diversity of wildlife. (DOE 1996) Freshwater wetlands support many bird species in the county, for forage, drinking and bathing, and nesting. Some seabirds, such as grebes, live on salt water but nest in freshwater areas. (Lewis and Sharpe 1987)

Common species found in freshwater wetlands and bogs in San Juan County are the tree Pacific willow and the shrubs hardhack and swamp gooseberry. Speedwells and herbs most always found in wetlands and long the edges of streams and lakes, as well as buttercups field mint, and small bedstraw. Alder and salmon berry often dominate in wet areas, generally where disturbances have occurred. Slough sedge is the most abundant sedge occurring in poorly drained areas as well as dominating many wet meadow pasture lands. Indian pond-lily is an important aquatic wetland species and a critical component of the ecology of the county's wetlands, with large flat leaves which lay on the water surface and serve as feeding and hiding sites.

Freshwater wetlands and marshes also support several of the endangered plant species⁸ that are found in San Juan County, including swamp sandwort, rush aster, water lobelia, few-flowered sedge, and blunt-leaved pondweed. Some of these valuable marsh areas include: Otter's Den Marsh on Orcas, and Panorama Hill Marsh, Mt. Finlayson Marsh, and Three Meadows Marsh on San Juan (The Nature Conservancy 1975). Spruce bogs are another important type of freshwater wetland, which are rare in the county. Point Colville on Lopez contains a spruce bog, which is hidden in the dense old-growth forest, dominated by sedges, rushes, Sitka spruce, grand fir and red alder. The rare grape fern is found here, also.

Saltwater marshes and brackish lagoons are found at the edge of the shoreline, generally associated with accretion shoreforms. This combination of eroding shoreline, mud flats, and the mixing of fresh and salt water support unique plant life that is essential to the ecology of eelgrass beds and the rich microorganism communities that

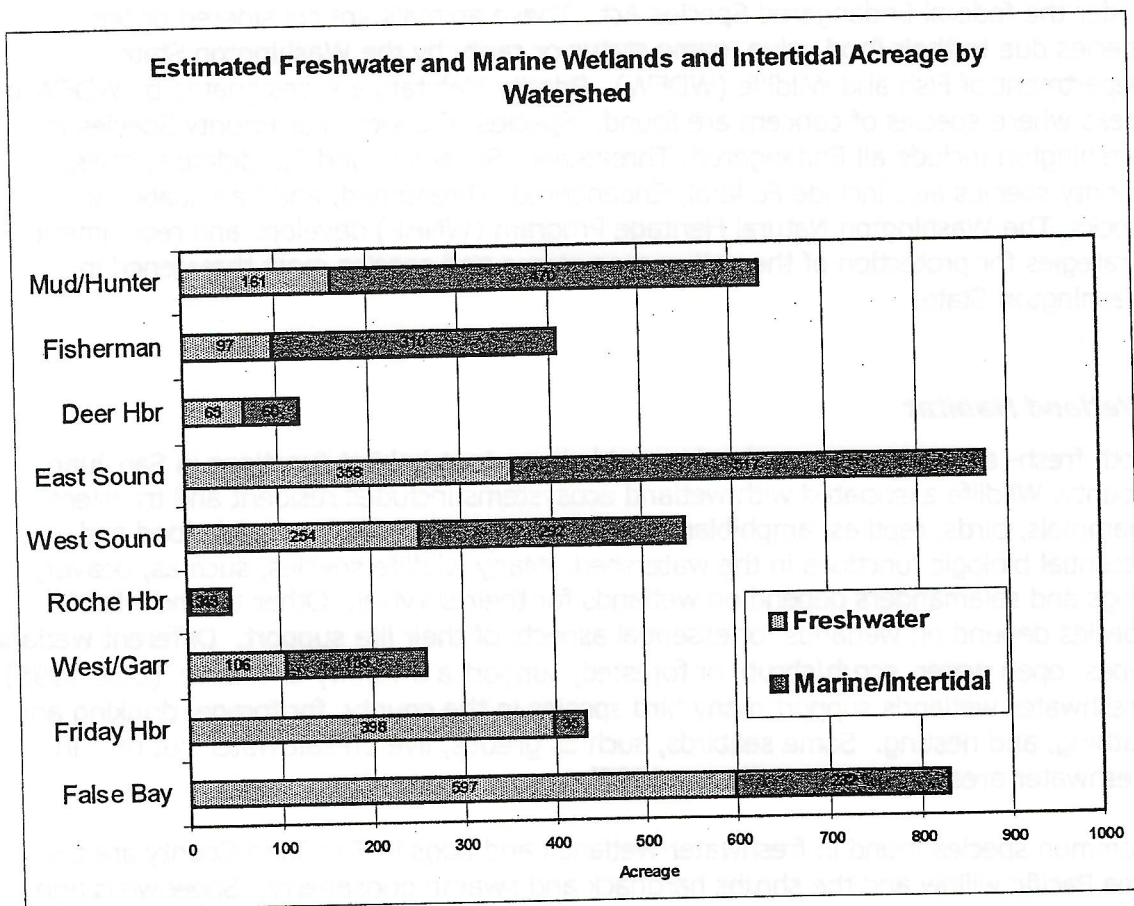


Figure 2-9. Source: Department of Ecology Coastal Zone Atlas, WDFW Natural Heritage Program, SJC Wetlands Inventory

⁸ Washington Natural Heritage Program, Department of Natural Resources

sustain marine life through a complex food chain. Salt marshes are dominated by salt grass and pickleweed. Examples of these important biologic areas include: Nelson Bay on Henry Island, White Point and Westscott Bay on San Juan, and Mud Bay on Lopez.

Terrestrial Habitat

San Juan County's upland habitat is characterized by rocky hills of exposed bedrock thinly covered by soil. Near-drought conditions during the summer months combined with these soil conditions have created arid sites with plant communities unusual for the Puget Sound area. Forest lands are the predominant land cover in the county, with second-growth coniferous trees taking hold where water is available. In these wooded areas birds such as the Cooper's Hawk, Pileated Woodpecker, and Red Crossbill thrive.

Extensive grassy prairies and grassy balds, and open savannah-like woodlands are common on southern and western exposures.⁹ Over 800 kinds of vascular plants have been cataloged in the San Juan Islands, two-thirds of which are native (Lewis and Sharpe; 1987, Atkinson and Sharpe, 1985). Large grassland complexes are evident on Mount Constitution and the southern slopes of the Turtleback Range on Orcas Island, the west side of San Juan Island, Iceberg Point on Lopez Island, Speiden Island and Yellow Island. Relatively undisturbed prairies (as indicated by the dominance of native plants) are identified by the Washington Department of Fish and Wildlife as a priority habitat. Such areas are considered to have high species diversity as well as limited and declining availability.

Open, rocky outcrops with rocky knolls and steep slopes are a common feature, and plant communities in this terrain are survivors of extreme conditions. Lichens and mosses survive on the bare rock and grasses and herbs are common in pockets that retain some soil and moisture. Garry oak, Rocky Mountain juniper and Pacific madrona are able to anchor in the thin soil in these areas (Atkinson and Sharpe 1985).

San Juan County forests are much drier than those of the mainland Puget lowland. Many forested areas are lacking in underbrush and have an open canopy and park-like appearance. Douglas fir dominates in most areas but varies substantially in growth habit depending on environmental conditions. Forest character in the San Juan Islands changes from site to site as a result of wind, sunlight, soil type and depth, topography and moisture, as well as human management.

Old growth (more than 200 years) and mature forests (80 to 200 years) of any kind are identified as priority habitat areas by WDFW. This designation is largely due to their declining availability, due to selective harvest, and high value for plant and animal diversity.

Where forests are disturbed by logging, fire, or clearing of any kind, pioneer native species such as red alder, bitter cherry, bracken, Nootka rose, ocean spray, stinging nettle and the red-flowering currant, as well as non-native species, including weeds, may move in to fill the openings.

⁹ These open areas were maintained by fire in the presettlement past, but are declining due to fire suppression.

Dry sites (Xeric)

In dry sites with poor soils, an open transitional type of forest is found, often on very steep rocky slopes adjacent to saltwater. Trees in these areas include Garry oak, Pacific madrona, and occasional lodgepole pine and Rocky Mountain juniper. Other species that survive in these conditions include ocean spray, serviceberry, snowberry and tall Oregon grape.

Pure or mixed stands of oak or oak savanna larger than one acre are considered state priority habitats as they have significantly declined in extent and have high wildlife and plant diversity. Open grassland and grass balds, as described above, are also dry site communities. These areas are dominated by grasses that can survive dry soil conditions such as Idaho fescue, brome, and velvet grass; and wildflowers such as Hooker's onion, nodding onion, harvest brodiaea, thrift, camas, death camas, and chocolate lily.

Moist sites (Mesic)

In intermediate moisture conditions between dry and moist woodland, Douglas fir is more dominant and denser although transitional species occur. This forest habitat type is found on gentler slopes, with greater sun and wind protection. Soils are deeper and heavier than in the open transitional forest and have a thicker duff layer.

Typical shrubs are salal, low Oregon grape and little wild rose (*Rosa gymnocarpa*). In some areas soopolallie, rare west of the Cascades, is abundant. Often heavy moss beds interspersed with herbs are also present.

On north-facing slopes and areas where cool, humid and low wind conditions prevail, Douglas fir declines slightly in dominance among tree species and western hemlock and western red cedar, which grows in shade, increases. Big-leaf maple is evident. Red alder and western red cedar are found in poorly drained sites, the former requiring full sun and the latter needing shade.

Sword fern, western foam flower and fringe cup are found in moister forests. On poorly drained sites, thickets of salmonberry are prevalent.

As this forest type ages, western hemlock dominates as it is able to regenerate under a closed canopy. Much of Mount Constitution is an example of this forest type where the understory is often virtually bare except for fall mushrooms, coralroots and saprophytic heaths in the spring and summer. Another example of this forest type is near Point Colville on Lopez Island.

Priority site characteristics

Pure or mixed stands of aspen of more than two acres are also considered a priority habitat. Such stands are found at Crescent Beach on Orcas Island and in the Swift's Bay watershed on Lopez. Cliffs more than 25 feet high are considered to be significant for wildlife breeding.

¹² Washington Natural Heritage Program, Department of Natural Resources.

Other upland habitat of importance includes the presence of snags in numbers and sizes of exceptional value to wildlife due to their overall scarcity or location in a particular landscape. Examples include large, sturdy snags adjacent to open water and remnant snags in highly developed or urbanized settings.

Marine Habitat

San Juan County's marine habitat is one of the most unique in the nation. Located at a juncture of the Straits of Juan de Fuca and the Straits of Georgia, the archipelago forms a complex tidal region where many different shoreforms offer feeding, spawning, and resting areas for diverse resident and migrating marine life. The San Juans support a vast number of baitfish, salmon, marine birds, and marine mammals, including porpoise and several species of whales. Over 100 orca whale live in the archipelago, as well as the largest octopus in the world (*O. doffeini*) which thrives on the cold, oxygen-rich water. (Lewis, Kozloff)

The watersheds of San Juan County all feed directly to salt water. Although this report is focused on larger watersheds that have been defined by the bays they drain to, all of the shoreline of the county is affected by upland and shoreline activities. Much of the county's rocky shoreline is drained by micro-watersheds of only a few acres.

Rocky shores

The rocky shores of the San Juan archipelago vary greatly due to differences in geology, topography, and their situation relative to the prevailing climate, currents and wave action (Kozloff, 1973). Unlike lower Puget Sound, where wave action is negligible, these rocky shores are subject to strong wave action during storms and many animals and seaweeds thrive in this turbulent intertidal zone. Varying rock formations provide barriers that create protected ledges, crevices and tide pools offering a rocky intertidal zone where an abundance of marine organisms thrives.

Kelp reefs along these shorelines are highly productive and the strong tidal currents provide nutrient rich waters that support many marine organisms and feeding areas for birds. Offshore islets and rocks are used by large numbers of harbor seals and a large percentage of the seabirds of the state breed and roost here (Lewis 1988).

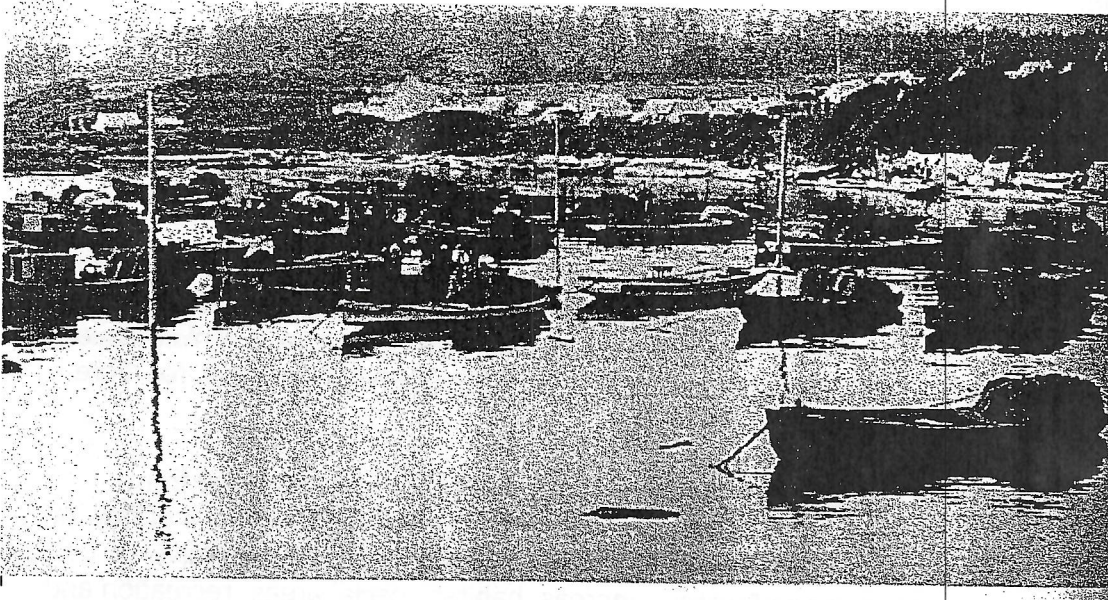
Sandy beaches

The sandy, gravelly beaches of the San Juans, with their breaking waves and shifting sands, do not offer extensive intertidal habitat, but the associated accretion shoreforms and marshes provide abundant seabird nesting and feeding areas. These beaches also provide extremely valuable offshore marine habitat, including eelgrass beds, where smelt and sand lance breed, providing prey for larger fish, such as salmon, and birds.

Protected bays

The quiet bays of the San Juans are generally protected from wave action and provide a rich intertidal zone where fresh and marine waters mix. The character of the substrate in bays ranges from fine sand to real mud and hard-packed clay, with gravel and rocks scattered about. This allows for a diverse fauna and flora (Kozloff 1973). The sandy substrate provides shallow pools at low tide which may have extensive colonies of eelgrass. Eelgrass supports a wealth of marine organisms, including important spawning ground for baitfish, such as herring. Mud and muddy sand support large populations of astonishing diversity, from the microscopic level up to the bivalves and crustaceans so popular for commercial and recreational harvesting. In San Juan County the accessibility and variety of these bays and the outstanding populations of marine organisms provide exceptional opportunities for scientific research. Researchers and students have produced hundreds of studies based on local marine flora and fauna and courses in marine botany, marine phycology, marine zoology, advanced invertebrate zoology, and comparative invertebrate embryology depend on local sites for research (Strathmann, pers. comm. 1998).

Chapter 3, Beneficial Uses of Water



Salmon fishing, San Juan County, 1905

Introduction

It is important to evaluate the beneficial uses of water in a watershed in order to assess the impacts of pollution. Some watersheds have a greater number and extent of beneficial uses and need greater protection from potential degradation. In the overall water budget, human consumption of water for domestic activities and commercial enterprise accounts for a small percentage of annual rainfall, however, human actions have a wide-ranging effect on a watershed's hydrologic balance, both in terms of water quality and quantity. The county's watersheds differ in the volume of water they transport and store, the extent of potential sources of pollution, and the beneficial uses that need to be protected. See Chapter 2, for a discussion of the hydrologic cycle, and Chapter 6, for descriptions of individual watersheds.

The beneficial use of water is defined under federal law in the federal Clean Water Act, as the following:

- (i) Water supply.
- (ii) Fish and shellfish: salmonid migration, rearing, spawning, and harvesting. Other fish migration, rearing, spawning, and harvesting. Clam, oyster, and mussel rearing, spawning, and harvesting. Crustaceans and other shellfish (crabs, shrimps, crayfish, scallops, etc.) rearing, spawning, and harvesting.
- (iii) Wildlife habitat.
- (iv) Recreation (primary contact recreation, sport fishing, boating, and aesthetic enjoyment).
- (v) Commerce and navigation.
- (vi) Aesthetics.

Beneficial uses, as defined by the San Juan County Watershed Management Committee, include:

- domestic supply,
- habitat and special areas,
- recreation,
- commercial/industrial uses,
- agriculture, and
- aquaculture.

As part of the characterization process the Watershed Management Committee ranked domestic supply and habitat/special areas as the first priority use, with recreation second. Industrial/ commercial use, agriculture and aquaculture were ranked equally in the third category. See Part 1, Section 2, The Problem Definition Process, for more information on this ranking.

Under state and federal law, the beneficial use of water is to be protected from degradation. This degradation can occur from pollution and also from lack of flow or quantity. Domestic supply, irrigation, and commercial/industrial uses involve withdrawal and consumption of water, whereas, habitat/special areas, recreation and aquaculture are particularly dependent on water retention and quality for beneficial use. The consumption, or withdrawal, of water for beneficial use is regulated through the water rights process by the Department of Ecology. Many changes have taken place in recent years regarding water right law, and the volume of water needed to maintain fish habitat is now taken into consideration as part of the water rights process. This involves determining the amount of water needed in a stream or waterbody to support fish.

The quality of water for domestic use is the highest standard and clearly defined through the federal Safe Drinking Water Act. The amount of water needed for domestic supply is a very small amount of the overall hydrologic picture (water budget) in San Juan County. The quality of water for habitat and special areas, such as research sites, is defined in terms of the biologic health of streams and wetland areas and the diversity of wildlife they support. The volume of water needed to support this biologic health is difficult to quantify. On the mainland, the amount of flow needed to support fish can be quantified (instream flow) for streams and rivers, but here, with seasonal flows and small, complex drainage basins, the requirements for the beneficial use of water for habitat is harder to define. The value of pumping water for consumption (human activities) is easy to quantify because it has a direct value in monetary terms. The value of a natural discharge that supports a stream, wetland, and the proper balance of an estuary must be determined in terms of the health of the watershed and its adjoining marine habitat.

Water quality for recreational activities can be described in terms of recreational shellfish harvest and human contact activities, such as swimming and beach walking. Fecal contamination, algae and other toxins can cause degradation that leads to closures of lakes and beaches for harvest and other recreational enjoyment. Water

recreation -- clamming, boating, fishing, diving, bird watching and beach walking -- for seasonal visitors and residents, is a major part of the quality of life in the San Juans.

Agriculture and commercial/industrial uses of water are not as dependent on water quality as other beneficial uses, but it makes up a major portion of water consumption by human activities. Although there are few irrigation and industrial water uses in the county, the volume of water they consume is estimated at as much as 50 percent of overall human use in a watershed (Town of Friday Harbor Water System Plan Update 1997; EES 1990).¹

Aquaculture, the farming of aquatic organisms, is an important commercial use of water in San Juan County. Shellfish growing is a part of the islands' local economy and because of its value and dependence on good water quality, aquaculture is identified as a separate beneficial use.

An example: The False Bay Watershed

The False Bay watershed provides water for all of the listed beneficial uses except aquaculture. Because it contains the source water for the Town of Friday Harbor's municipal supply, water use has been well documented.

The False Bay watershed is the second largest watershed in the county (East Sound is the largest). It has the largest drainage capacity, with the greatest number of streams and wetlands. Average annual runoff is estimated at 3154 acre-feet or 1,028 million gallons in the Water Resource Assessment, Technical Report, developed for San Juan County in 1990 (EES 1990)².

Thirty to 40 percent of the False Bay watershed is in pasture or hay and the largest active irrigation operation in the county occurs in San Juan Valley. Irrigation is used for forage and hay production. Water rights for 372.2 acre-feet (121.3 MG) have been allocated by Department of Ecology for irrigation in this area. Estimates in the Technical Report of 1990 for irrigation totals 130.5 MG/yr for these water rights, but actual water consumption is not known.

The Town of Friday Harbor uses surface water from Trout Lake and two supplemental streams as its supply. The Town has water rights for 1473.5 acre-feet per year, and used an average of 116 MG/year between 1997 and 1998 (KCM 1997). Water consumed in Friday Harbor for industrial users, such as Friday Harbor Sand and Gravel, JJ Theodore Fish Cannery, and the boat yard, was 2.7 percent of total consumption in

¹ These numbers are for San Juan Island.

² The drainage basins used to develop these runoff estimates are somewhat different than the watershed boundaries developed for this assessment. The estimates were developed using the Army Corps of Engineers streamflow modeling computer program for the Technical Report produced in 1990, and are referenced here to give the reader a general idea of runoff conditions.

1998.³ Commercial users, such as hotels/motels and the University of Washington accounted for 25 percent of the total.

According to these figures, human activities consume roughly 246 MG/year of surface water in a watershed that produces an estimated 1,028 MG/year of runoff.

Water not withdrawn from the False Bay watershed provides a beneficial use to terrestrial, wetland, and marine habitats. The watershed includes an abundant terrestrial habitat of regional and national significance. Extensive wetlands and streams provide wildlife habitat for nesting, feeding, and rearing young. The watershed contains one of the few year-round streams in the county and contains the county's only stream section categorized as a Class 2 stream (Watershed Ranking Report 1988). These freshwater sources discharge into False Bay, helping maintain its unique estuarine water quality conditions, which support one of the most valuable tidelands in the county with a great diversity and abundance of marine organisms.

The False Bay marine preserve is owned by the University of Washington. The 200 acres of tidelands, due to their unique richness and accessibility, are the location of extensive marine research. Numerous research papers have been produced from studies conducted in the bay.

The watershed has one resort, no parks, and only one campground (for bicyclists only) but False Bay and the surrounding area provide much scenic enjoyment to residents and visitors. It is extensively used by students and researchers, bird watchers, walkers, bicyclists, and mopedists.

Domestic water use

Thirty percent of the county population gets its drinking water from surface water sources through the Town of Friday Harbor, Roche Harbor, Rosario, Doe Bay and Olga water systems. The rest of the county is served by individual and community wells. In the 1990 Water Resource Assessment, Technical Report (EES 1990), the average consumption rate per capita was reported as 100 gallons per day (average residential occupancy is 2.5, or 250 gallons/residential connection). At that time there was little actual data on water use in the county. Recent water system plans by the Town of Friday Harbor and Eastsound report an average daily household consumption of 310⁴ and 210, respectively. By contrast, the smaller utility, Cape San Juan Water Users, consumes 100 gallons per connection per day. These rates are extremely low compared to other counties in Western Washington.

³ Friday Harbor Sand and Gravel closed operations in the spring of 1999. These numbers are included as an example.

⁴ The Town's average connection consumes 443 gallons/day. This includes all classes of users and incorporates losses through leaks.

Domestic water use, for drinking and residential irrigation, accounts for the beneficial use of less than 0.5% of the water accumulated from rainfall in San Juan County in an average year (EES 1990). Although it represents a small percentage of total rainfall, the successful interception and storage of fresh water for domestic use is highly variable. In some areas, due to limited, seasonal rainfall and limited catchment and storage capacity, aquifers and surface impoundments are depleted.

Well failures during the dry season are not uncommon, as shown by the drop of the water level in wells and increased salt water intrusion (SJC Health and Community Services). Limits to the overall capacity for some surface water systems, such as the Town of Friday Harbor and Roche Harbor, have led to extensive capital improvements. The Town developed augmentation pump stations, Aug 1 and Aug 2, which capture seasonal stream flows and pump the water to storage in Trout Lake. Roche Harbor developed an extensive emergency well field to supplement Brigg's Pond during a recent drought. On the other side of the county, the east side of Orcas Island has an abundant water supply stored in Cascade and Mountain lakes, while the village of Eastsound struggles to develop new supplies to meet the demands of growth. Increasing numbers of wells contaminated with salt water intrusion on Lopez have caused private and community water systems to seek new water sources.

Habitat

Habitat in San Juan County consists of terrestrial, wetland and marine areas (for more information, see Chapter 2). San Juan County includes an estimated 5,000 acres freshwater wetlands and there are 88 documented streams, totalling over 100 linear miles. In addition, many upland areas provide a variety of micro-environments that support terrestrial habitat with unique plant communities of regional and national significance (Lewis 1988). The county's 375 miles of shoreline, with its bays, inlets, coves, and rocky bluffs, provide near-shore habitat of world renown. This includes an estimated 5,000 acres of saltwater marshes and intertidal areas, and extensive eelgrass and kelp beds.⁵

There are almost 1000 acres of marine preserve in the County, with 84 sites in the San Juan County National Marine Preserve (WFWD). Approximately 13,000 acres are set aside as federal, state, and county parks, with almost 30,000 acres preserved through voluntary conservation easements or current use tax incentive programs,⁶ for a total of 38 percent of the county.

San Juan County has been a prime location for research about the natural world since the turn of the century. In 1904, the University of Washington conducted its first classes at the Friday Harbor Marine Station. Because of concerns that the threat of

⁵ Wetland and intertidal area acreage estimates are based on National Wetlands Inventory and Coastal Zone Atlas data. See Chapter 2 for a discussion of this information.

⁶ Current use tax incentive programs are not permanent conservation. For a discussion of these programs see Chapter 2, Land Use.

pollution could impair the value of local marine waters for biologic research, the county was declared a marine biologic preserve by the State in 1923. The University of Washington owns over 1,500 acres in San Juan County and conducts extensive, world-class marine research. Western Washington University and Seattle Pacific University also have marine and environmental study areas in the County, and Moran State Park and YMCA Camp Orkila offer summer environmental learning courses.

Seventy percent of San Juan County is in forest cover. Forests protect watersheds through numerous means. Forest cover provides slope stability, minimizes erosion and reduces sediment input to streams, wetlands, and bays. Intact forest canopies provide protection from thermal heating, keeping water temperatures at acceptable levels. Forests help maintain summer flows in streams. Organic layers on the forest floor, along with plant roots in the soil, act as sponges, holding and slowly releasing ground water into adjacent streams and wetlands. The evaporation/transpiration cycles of forest vegetation provide cooling to the surrounding air. The above-ground forest vegetation intercepts rainfall and slows its descent to the forest floor. This delay causes peak runoff to occur over a longer period of time with lower peak flows and reduced flooding. Areas of forest cover also provide habitat and aesthetic enjoyment. Forests intercept and consume the largest volume of rainfall annually through the process of evapotranspiration (see Chapter 2). According to the Quilceda Allen Watershed Management plan, "Under natural forested conditions in the Puget Sound region, up to 70 percent of rainfall is intercepted or evaporated before it reaches streams." Forests are the greatest beneficiary of water in San Juan County (Hamilton 1998).⁷

Agricultural water use

Most agricultural and livestock operations in San Juan County involve dryland farming practices. Currently, most irrigation involves market gardeners and orchardists, who generally utilize low water use systems, such as drip irrigation (Schultz 1998). Some irrigation involving large withdrawals and water rights does take place, but actual consumption is not known. Estimates of irrigation practices were made as part of the Water Resource Assessment, Technical Report, of 1990. Based on water rights issued by the Washington State Department of Ecology (1983 data), a table of projected acreage under irrigation by surface and ground water sources was developed.

Total county irrigation water rights:

Irrigated water right	1,201 acre-feet
Irrigated acres surface water right	2,302 acres
Irrigated acres groundwater right	496 acres
<i>Total irrigated acres</i>	<i>2,798 acres⁸</i>

⁷ For instance, in the Trout Lake watershed, which is forested, evaporation and transpiration by plants is estimated as an average annual amount of 19.4". The average rainfall in that area is 25" annually. (Trout Lake Capacity Analysis, KCM 1994)

⁸ 2.5 percent of total land acreage in the county and 14 percent of designated farmland

Commercial and Industrial Beneficial Uses of Water

Commercial uses of water in San Juan County include tourist accommodations, government agencies, universities, and port districts. Using the Town of Friday Harbor's consumption numbers for 1998, commercial use accounts for 29.4 MG/year, or 25 percent of the town's yearly water supply. Industrial uses include: sand and gravel operations, boatyards, concrete and asphalt plants, and fish processors. For the Town, this category of users consume 2.7 percent of the total, or 3.1 MG/year. (Note: these numbers include Friday Harbor Sand and Gravel, which ceased operation in April, 1999.)

Other uses of water in this category include irrigation for the three golf courses and recreational fields for sports activities. The Buck Park facility in Eastsound utilized 2.3 MG in 1997. Golf course water consumption is not known.

Fish and shellfish

In the past, commercial and recreational fishing has been easily the greatest occupation or vocation in the county. Commercial fishing in the San Juans has declined in recent years, and sport fishing is undergoing limitations as well, due to the decline in fish stocks. The spring of 1999 listing of Chinook and Coho as endangered species (under the federal Endangered Species Act) will have strong effects on local fishing practices and upland water quality management.

San Juan County is prime marine habitat for juvenile and migrating salmon, providing shelter and abundant feeding areas. Eight species of anadromous fish spend all or part of their lives in the waters of the county.

The Pacific herring is an important fish resource found in the waters of the San Juan islands. Herring are forage fish for other fish species, notably salmon. Herring spawn on eelgrass or sea lettuce in late January to early April. Eelgrass beds occur in estuarine habitats, and provide food and refuge for fish and invertebrates.

More than 200 species of marine fishes have been found in San Juan County waters, over three times the number found in San Francisco Bay (Yates, 1988).

Shellfish growing operations in San Juan County include nine commercial sites, totalling over 1000 acres. Commercial shellfish from the San Juans enjoy an outstanding national reputation. In addition, 78 percent of the intertidal zone is state owned and available to the public for shellfish gathering. One of the main recreational clamming beaches in the county is on San Juan Island at English Camp National Park. This Garrison Bay site includes harvest of twelve clam species.

San Juan County Commercial Shellfish Growing Areas

Island	Site	Status (1999)
Orcas	Buck Bay	Approved
	East Sound	Approved
Lopez	Hunter Bay	Approved
	Mud Bay	Approved
	Shoal Bay	Approved
	Mackaye Harbor	Approved
	Barlow Bay	Conditionally Approved
San Juan	Westcott Bay	Approved

Table 2-1.

Recreation

Recreation and aesthetic beauty are the primary reasons for living in and visiting the San Juans. The natural landscape and unique environment of the San Juans draws nearly half a million visitors annually. Seventy-eight percent of the county's 375 miles of tidelands is state owned. Federal parks total 1,749 acres, state parks, 6,192 acres, and county parks total approximately 140 acres. In addition, Department of Natural Resources and the US Coast Guard own over 2,000 acres. Approximately 13,000 acres of the county is in public lands, for a total of 11 percent. Wildlife and whale watching, particularly for resident pods of orcas, has become increasingly popular over recent years. Visitors to English Camp, American Camp, Lime Kiln State Park, Spencer Spit State Park, and Moran State Park hike, camp, bicycle, whale watch and otherwise enjoy the endless marine vistas. Boating visitors flock to the State's marine parks on Jones, Socia, Matia, Stuart, Turn, and James islands.

Chapter 4, Sources of Pollution

Ground and surface water can be polluted from either point or nonpoint pollution sources. Point source pollution is pollution that enters waters of the state through a pipe or conduit from a specific activity. Activities or sources would include discharges from wastewater treatment plants, commercial activities, and industry. Nonpoint source pollution, on the other hand, is pollution that enters waters of the state from any dispersed land-based or water-based activities or sources, including farm practices, storm water and erosion, on-site sewage disposal, forest practices, marinas and boats, atmospheric deposition, garbage, and other residential, commercial, and industrial sources.

Point sources are generally regulated by the Washington State Department of Ecology through the National Pollution Discharge Elimination System (NPDES) and other types of water quality permits. There are currently eight NPDES permitted point source discharges in San Juan County; six are for discharge from sewage treatment plants, one for the Town of Friday Harbor's water treatment plant, and one for a fish processing plant. The sources have quantity and quality limits placed on the pollutants being discharged. In past years the Friday Harbor sewage treatment plant experienced high loadings during the summer tourist season, but is currently in compliance. Other Department of Ecology permits include boatyards, sand and gravel operations, asphalt and concrete plants, bulk storage for fuel, and sites where toxic materials are routinely used.

Until the late 1960s there was little public awareness of nonpoint source pollution, which is difficult to quantify and regulate. Nonpoint sources are not easily monitored at their source of origin, and are often difficult to identify and track. Nonpoint pollution is cumulative, the result of actions by individuals as well as businesses, and can vary depending on seasons, geography, and geology. In San Juan County nonpoint pollution can vary from seasonal impacts such as summer tourism or winter storm events. Managing the impact of nonpoint pollution requires a much more complex approach than a regulation that requires a discharge permit. On an individual basis it calls for education, technical assistance, and good management practices; and on a community basis it calls for a management perspective that includes the entire watershed. This chapter discusses the potential sources of nonpoint pollution in San Juan County.

Sewage Disposal and Management

Sewage generated from residential and commercial development must be treated and disposed either by municipal sewage treatment plants or on-site sewage treatment and disposal systems (septic systems). In San Juan County there are only five sewage treatment plants serving the communities of Friday Harbor, Roche Harbor, Eastsound, Orcas Village, Rosario, and a portion of Lopez Village. These communities represent approximately one-quarter of San Juan County's population. The remaining population utilizes septic systems to treat and dispose of sewage.

Septic systems are an effective tool for treating and disposing of sewage. Systems that are properly sited, designed, installed, operated and maintained provide a level of treatment and

disposal that meets or exceeds that of most municipal sewage treatment plants (WSDOH 1990). Septic systems are regulated by Chapter 246-272 WAC, On-Site Sewage Systems Rules and Regulations. Permits for sewage disposal systems are divided into three categories based on designed daily flows. In San Juan County, on-site systems with design flows under 3,500 gallons per day are regulated by the San Juan County Department of Health and Community Services. Larger community systems, 3,500 to 14,500 gallons per day, are regulated by San Juan County Health and Community Services under an agreement with the State Department of Health. Systems over 14,500 gallons per day fall under the jurisdiction of the Department of Ecology.

Over ninety percent of the septic systems in San Juan County are individual systems under 3,500 gallons per day. These systems are divided into two types, conventional and alternative. A conventional system is a gravity flow system consisting of a septic tank and subsurface soil adsorption field (drainfield, see Figure 4-1). Alternative systems generally include a treatment component, such as a sand filter, mound, or aerobic unit.

Looking at recent septic permit applications (1998 through June of 1999), sixteen percent are conventional gravity systems, with the remaining 84 percent involving some kind of treatment or mechanical device. Sand filters are currently the most common forms of treatment system. In the 1980s, mound systems were commonly installed where conventional systems were not feasible. Improved technology and stricter regulations have almost completely eliminated the use of mound systems in the county.

A third category of septic systems are experimental systems. Experimental systems are systems that do not have State Department of Health approved guidelines or specifications. These systems can be designed and installed provided an area exists where an approved system can be installed and the system has on-going testing and monitoring. No experimental systems have been installed in San Juan County in recent years. However, several inquiries have been made recently regarding utilizing drip irrigation to dispose of treated wastewater. Currently, the State regulations only allow the use of drip irrigation to dispose of treated graywater. Disposing of combined flows, graywater from sinks and laundry and blackwater from toilets, is not allowed. This type of system, drip irrigation for combined flows, would be beneficial given the county's limited freshwater supplies.

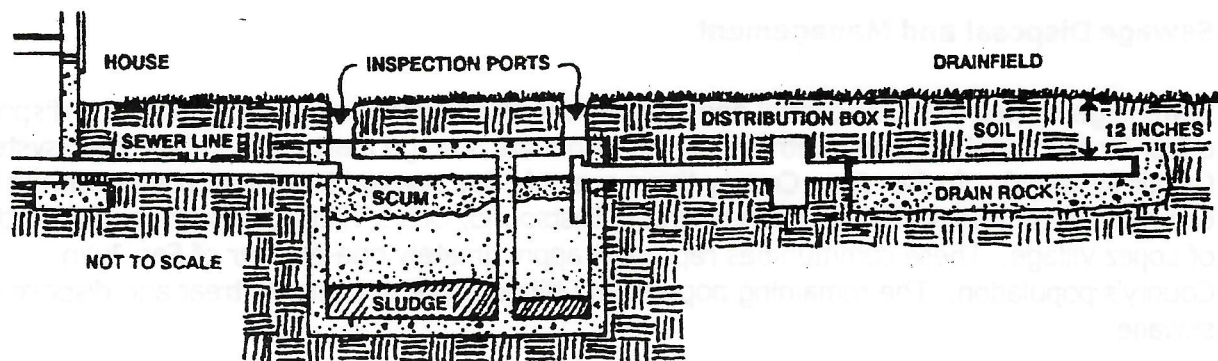


Figure 4-1. Standard on-site septic system.

Treatment of sewage occurs in the septic tank, treatment unit (alternative systems only) and drainfield. The septic tank provides a minimal level of treatment including, anaerobic decomposition of organic matter and separation of heavier solids from floating solids to produce a somewhat clarified effluent. In alternative systems, a treatment unit further "purifies" the effluent. The drainfield then receives either the clarified effluent from the septic tank (conventional system) or treated effluent from the treatment unit (alternative system) and provides final treatment in the soil through physical, chemical and biological actions. The treatment and disposal capabilities of the soil depend upon soil depth, soil permeability, slope and susceptibility to flooding.

Soil depth determines the type of system required. Effective treatment is dependent upon septic systems having adequate vertical separation. Vertical separation is the depth of unsaturated soil that exists between the bottom of the drainfield trench and a restrictive layer such as a water table, bedrock, hardpan, or excessively permeable material (WSDOH 1990). Vertical separation provides for the treatment of sewage effluent through degradation of organic matter and removal of bacteria and viruses. Washington State requires three feet of vertical separation for conventional gravity systems. In order to maintain three feet of vertical separation, a minimum of four feet of original undisturbed soil is needed. Pressure distribution systems require two feet of vertical separation or three feet of original undisturbed soil. Where there is less than one to two feet of vertical separation, installation of a treatment unit is required. Washington State regulations prohibit installation of septic systems in areas that have less than one foot of original undisturbed soil.

Soil permeability determines the rate at which the soil can accept and treat septic effluent. As the soil permeability increases, the size (square footage) of the septic system decreases. However, infiltration rates can be too excessive (greater than 6 inches per hour) or too slow (less than 0.6 inches per hour) for adequate treatment. Excessive infiltration rates cause the effluent to pass too quickly through the soil column, limiting the necessary contact time between the soil particles and sewage effluent. Slow infiltration rates will cause the effluent to pond and prematurely surface.

Other factors including slope and flooding susceptibility also affect septic systems ability to treat and dispose of sewage. Excessive slope can cause groundwater mounding and lateral seepage. Washington State prohibits installation of septic systems on slopes in excess of 24 percent to 45 percent. Flooding enables effluent to bypass treatment in the soil column and moves it to the nearest stream, pond, or other water body.

Based on soil ratings established by the Soil Conservation Service (Natural Resource Conservation Service, NRCS), very little area in San Juan County is suitable for conventional on-site septic systems. Maps of these soil characteristics are included in Appendix B, Figure B-5, Soil Conditions.

Soils with limitations for on-site disposal generally require that alternative systems be installed. Alternative systems provide an additional level of treatment; however, these systems must have regular maintenance to insure proper function. Septic systems, conventional and alternative, are an effective tool for treating and disposing of sewage. However, septic systems

can fail and pollute surface and ground water with pathogens, nutrients, and chemicals. Failures occur for a variety of reasons including improper siting, design, installation, operation or maintenance. San Juan County Department of Health and Community Services is responsible for insuring that failed systems are repaired. Table 4-1 shows the number of repair permits issued county-wide per year since 1996 (HCS 1999). Repair permits are issued for drainfield failures, so these numbers do not reflect the extent of component failure, such as pumps, switches, and filters.

Sanitary Surveys (Westcott/Garrison & Shoal bays)

In 1998, San Juan County Health and Community Services applied for and received a Special On-site Shellfish Grant from the Department of Ecology. The goal of the grant was to identify and provide funds to repair failed septic systems in shellfish growing areas. Westcott/Garrison Bay was the primary area to be surveyed. If funds remain, additional surveys are to be completed in Shoal, Buck, Mud/Hunter, and Eastsound bays, respectively.

Surveys were completed in Westcott/Garrison and Shoal bays in 1998. The survey areas included all developed shoreline parcels and upland parcels that bordered drainage-ways that had the potential to adversely affect marine receiving waters. All property owners were mailed a description of the program and asked to grant permission to inspect their septic system. In addition to the mailings, two workshops were held in each community to discuss the scope of the project and inform residents that funds were available to help pay for repairs, if necessary.

In Westcott/Garrison Bay, surveys were completed on 90 septic systems between June and October 1998. Of the 90 system surveyed, 9 failures (10%) were identified. In addition, 9 individuals did not grant permission to inspect their system. Surveys were completed in Shoal Bay in December 1998 and yielded similar results. A total of 76 parcels were identified in the survey area. Surveys were completed on 33 systems with 1 failure identified (3%). Permission was denied from 3 property owners. The remaining lots were either undeveloped or had seasonal use.

Additional surveys are scheduled to be completed in the winter of 1999.

Repair Permits Issued

Year	Number of Repair Permits	Percent of All Septic Permits
1996	63	23%
1997	48	16%
1998	55	14%

Table 4-1

Agricultural Operations

The dynamics of agriculture in San Juan County are changing. Chapter 2 describes how the number, size and type of farms have changed since 1920. Smaller operations and more

intensive uses are taking the place of larger farms. Animal husbandry is the primary agriculture activity including raising sheep, cattle, horses, llamas, alpacas, and poultry. There are many small operations raising vegetables and specialty crops for market produce. While all agricultural activities can affect water quality, this section mainly focuses on livestock operations. Practices in the county involve few pesticides and herbicides (SJC Extension).

The Department of Ecology assumes the primary enforcement role to ensure that agricultural operations do not degrade water quality. Ecology's enforcement is triggered by documented water quality degradation, and usually initiated by a complaint. Generally enforcement actions are used as a last resort only. Farm owners are encouraged to work with the Natural Resources Conservation Service (NRCS) and the local Conservation District to develop and implement farm plans and Best Management Practices (BMPs) to protect water quality.

If not properly managed, agriculture operations can pollute ground and surface water. Pollution can include, but is not limited to, sediment from soil erosion, and water quality degradation through nutrient loading, bacteriological contamination, and chemical (pesticides and herbicides) contamination. Farming activities that can cause water quality problems include poor pasture management, poor management of animal wastes, unlimited animal access to surface waters, and over grazing in wetlands and other sensitive terrestrial habitats.

Proper pasture management is crucial for eliminating or reducing soil compaction, soil erosion, sedimentation and waste run-off. Pasture management involves managing hay production and animal grazing. Both of these management techniques depend upon the capabilities and limitations of the soil to sustain pasture. The Natural Resources Conservation Service has determined the soil suitability for pastures based on the diversity and estimated average acre yield. Maps of agricultural soils can be found in Appendix B. Figure B-5, Soil Conditions.

With the average acre yield for a given soil type, management techniques can be established to

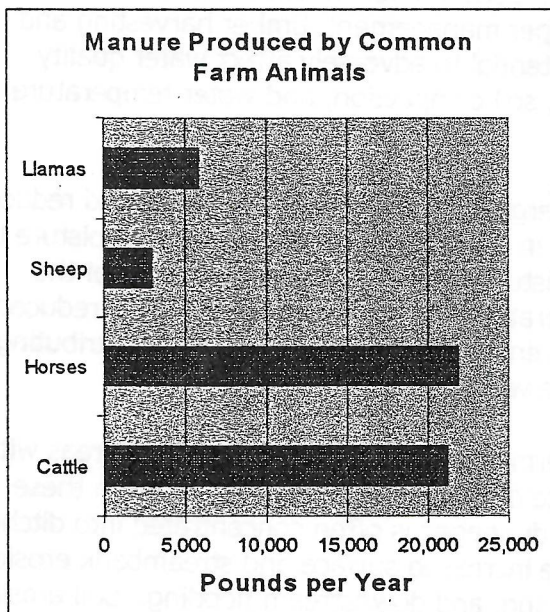


Table 4-2

optimize crop yield and protect water quality. Rates for the number of livestock can be established once the estimated crop yield and months available for grazing are calculated. Many of the soils with good to excellent pasture suitability have other limitations that can affect pasture management. For example, the majority of the soils with excellent pasture suitability ratings are hydric (water holding) soils, many of which are wetlands, and require artificial drainage before they can be used for forage crops. The banks of drainage ditches and ponds, if not protected and managed, can erode and carry pollutants to surface water.

Animal access to surface water and wetlands can be detrimental to water quality through loss of protective vegetation, bank erosion, nutrient loading, and bacteriological

contamination. Animal access refers to livestock having unlimited access to surface water (i.e., no fences or barriers). This does not mean that surface water should not be used for stock watering. If done correctly, stock watering sites can be constructed with minimal impacts on water quality.

Animal waste management is another crucial factor in protecting water quality. Animal wastes, the solids and liquids, contain large quantities of nitrogen, phosphorous, potassium, and bacteria. If not properly managed, these wastes can enter surface water and cause eutrophication. Figure 4-2 summarizes the amount of waste products produced by different animals.

Grazing of wetlands can also be detrimental to water quality. With proper management, some wetlands can be safely grazed during dry periods when animals won't sink in and the nutrients from waste will be utilized by plant uptake. During periods when the soils are saturated and there is excess water over the soil the stock should rotated to drier pastures.

Visual surveys conducted in 1997 and 1998 documented occurrences of all of these adverse activities on farms in San Juan County. Actual farm surveys including animal counts and incidents of poor farming practices were not completed. Therefore, the extent of water quality problems resulting from agricultural practices is unknown. Although San Juan County has limited use of chemicals compared to other counties (SJC Extension), it is safe to assume that the potential for water quality degradation from other agricultural practices does exist.

Forestry Practices

Forest lands comprise over 70% of the land area in San Juan County (see Appendix B, for maps of both landcover and parcels that are managed as forestlands) Chapter 2 elaborates on the amount, ownership, and type of these forestlands. Local timber harvested is used as sawlogs, pulpwood, export logs and firewood. Without proper management, timber harvesting and subsequent site preparation activities have the potential to adversely affect water quality through increased soil erosion and sedimentation, soil compaction, and water temperature increases, as thermal cover is removed.

Forest cover intercepts rainfall, absorbing the energy of the individual raindrops and reducing the erosive potential. Vegetation stores moisture in cells, releasing some of that moisture to the atmosphere through transpiration. Other moisture is retained on the surfaces of the vegetation and reenters the atmosphere as evaporation. When the forest cover is reduced during logging or clearing operations, rainfall can enter the soil profile directly, contributing to saturated conditions that are conducive to surface water run-off and erosion.

Haul roads, skid trails, and log landings create permanent and temporary surface areas with reduced permeability and interrupt natural surface drainage patterns. Run-off from these surfaces combined with run-off from interrupted drainages is often concentrated into ditches and culverts. This concentrated run-off can cause increased surface and streambank erosion, sediment transport and deposition, channel scouring, and downstream flooding. Soil erosion

and sediment transport and deposition in the San Juan Islands commonly ends up degrading the marine waters surrounding the Islands.

Under RCW 84.34, the County has the authority to regulate timber harvest under the Timber-Open Space program. The County also has land use authority in the conversion of forest land to residential and other uses. For a discussion of these current use tax programs, see Chapter 2.

Standards for logging operations are addressed through Chapter 76.09 RCW, Washington Forest Practices Act. The Act created the Forest Practices Board which promulgates Forest Practice Rules and Regulations under Chapter 222-10-010 WAC. The Department of Natural Resources has the authority to administer these rules and regulations to protect the public resources of the State of Washington. The broad definition of "public resources" includes fish, water, and capital improvements of the state.

There are four classes of forest practices that apply to the harvest of timber. Complete definitions of these classes can be found in Chapter 222-10-010 WAC. A brief description of each class is listed below.

- ◆ Class I – No direct potential to damage public resources. Examples: Christmas tree cultivation, personal use harvest of less than 5,000 board feet/year, tree planting, tree pruning or precommercial thinning, or operations on less than 2 contiguous acres under a single ownership.
- ◆ Class II – Less than ordinary potential to damage public resources. Examples: harvest on slopes less than 40 percent with no streams.
- ◆ Class III – All activities that require hydraulic project approval and activities not in other categories. This includes forest practices within the shorelines of the state.
- ◆ Class IV – A. Special – Sensitive areas requiring additional information.
B. General – Activities on lands to be converted to non-forestry lands and not reforested.

Activities under the Class I category are the only activities that can lawfully take place without a Forest Practice Permit issued by the Department of Natural Resources.

Table 4-3 is a record of forest harvest permits issued in the San Juan Islands by the Department of Natural Resources from 1989 through 1996. This table is based upon data compiled by the Sedro-Woolley office of DNR. The majority of these permits were Class IV – General, which will be discussed in the Land Use Conversion section. The notable increase observed in 1992, 1993, and 1994 may be a direct result of increased log prices for export logs bound for Asia, and/or the increase in land conversions for residential use. The areas recorded as "partially cut, selectively logged or salvage logged" may represent areas whose land cover has dramatically changed. Technically these may still be forested lands but their hydrologic characteristics may have been seriously compromised.

Forest harvest permits issued between 1989 and 1996.

Year	Permits	Acres clearcut as part of forest practice permit	Acres partially cut, selectively or salvage logged	New road miles built
1989	10	24	731	.4
1990	11	15	226	0
1991	18	0	602	.1
1992	38	20	738	1.8
1993	70	88	1218	2.6
1994	44-	41	1085	3.1
1995	21	10	573	1.4
1996	24	46	577	.1

Table 4-3.

Accurate comprehensive statistics on all logging activities occurring in the county are difficult to obtain because the amount of harvesting taking place without permits is unknown. Compliance with the Forest Practice Act to protect public resources is administered by an employee of the Department of Natural Resources who resides on Whidbey Island.

Washington State's Forest Practices Rules and Regulations are written to address logging operations state-wide. However, the San Juan Islands have unique characteristics that are worth noting. First, Chapter 222-3-110 WAC, Timber Harvesting on Islands, applies to all of San Juan County. This regulation restricts clearcut harvesting within 200 feet of a marine shoreline and limits clearcuts to a maximum of 40 acres with 200 foot between adjacent harvest units in the San Juans. Many of the streams and creeks in the San Juan Islands did not meet the Forest Practice Act protection minimums based upon stream types. According to the Forest Practices division of the Washington State Department of Natural Resources, emergency rules governing Class IV and V streams are currently in effect. These rules require that all Class IV and V waters that are two feet or wider between ordinary high water marks and have a gradient of less than sixteen percent be treated as Class III streams. These emergency rules apply to waters that have not been shocked to determine the presence or absence of fish. These emergency rules will continue to be renewed until a set of final stream protection rules is written and accepted. Finally, implementing wetland management zones and associated requirements is difficult as a large percentage of the wetlands have not been identified or mapped (see Chapter 2, Wetlands, Lakes and Streams).

Because several species of salmon found in the waters of the State of Washington have been given protection under the Endangered Species Act (ESA), the Forests and Fish legislation was passed by the State legislature to meet requirements of the ESA. The Forest Practices Division of the Department of Natural Resources is currently (May 1999) writing rule language that will be incorporated into the Forest Practices Act. According to a spokesperson from DNR, the issues that must be addressed in riparian areas are very complex and not easily understood.

These newly amended rules to the Forest Practices Act will probably have an impact on timber harvesting in the San Juan Islands.

Land Use Conversions

The population in the San Juans continues to increase rapidly and increases are projected to continue for several years, heightening the demand for land suitable for residential use. (Chapter 2 discusses the population increases.) Conversion of forest, wetland, and agricultural property to residential and/or commercial use has the potential to negatively impact water quality. Tree-covered properties, especially those with saltwater or mountain views, are prime locations for land conversions to residential development. Conversion impacts can include increased run-off, soil erosion, and interruption of hydrologic flows. Mitigation measures can lessen the negative impacts, but development will generally degrade of water quality.

When land is converted from resource lands such as forests, wetlands, or farmlands to a more intensive land use such as residential or commercial, a typical series of events transpire. Vegetation is removed from the building site, an access road is constructed, and utilities are installed. Earthwork, including cuts and fills, may be shaped for the building site or roads. The building is constructed, the final grade is established, and landscaping is undertaken.

Each of these activities causes changes in the hydrologic cycle. Existing vegetation was acting as above ground storage for rainwater, delaying run-off from the site and creating conditions conducive to ground water recharge. Removal of the vegetative cover increases surface water run-off, soil erosion, and sediment transfer and deposition. Access roads and driveways with hard surfaces, ditches, and culverts may radically change the flows of water within a watershed. Both surface and subsurface drainages are altered and diverted by these structures.

These alterations decrease the time it takes run-off to flow into drainageways and streams, resulting in concentration of run-off. The concentration of run-off in a condensed time frame usually leads to increased peak flows, higher stream velocities, bank erosion, and increased flooding. All of these factors set up circumstances for erosion and sediment transport. In addition, by altering existing overland and subsurface flows, the effectiveness of wetlands and waterbodies for water storage and treatment is diminished.

Where vegetative cover is replaced with impervious surfaces, such as roofs, roads, driveways, and lawns, concentrated run-off becomes a permanent condition, which is labeled stormwater run-off. This run-off may also contain petroleum by-products, further contaminating the receiving waters. As with soil erosion and deposition, nonpoint pollution from impervious surfaces in the San Juan Islands frequently is deposited in the marine waters surrounding the islands.

Land use conversions and their accompanying modifications of an area appear minimal on individual sites. However, the cumulative effects of land use conversions can be permanently damaging to natural systems in a watershed. There is no current water quality data available to determine the cumulative effects of land use conversions on water quality.

Forest land conversion permits issued through October 1997.

Year	Permits	Acres clearcut as part of land conversion permit	Acres partially cut	New road miles built
1989	10	2	37	.7
1990	9	2	0	0
1991	2	0	0	0
1992	31	5	316	3.8
1993	33	9	416	1.7
1994	24	65	89	1.2
1995	11	1	63	2.3
1996	9	20	40	.3
1997*	18	37	603	1.0

Table 4-4. *Permit totals through 10/97.

The areas listed as partially cut in this table may represent a dramatic modification in the forested land cover and its hydrologic functions.

Under rules adopted December 1991, by the Forest Practices Board, counties can identify forest lands that are "likely to convert." Forest Practice Applications (FPA) in these areas will be upgraded to Class IV- General, unless the land is designated as "Open Space - Timber." The "likely to convert" designation grants the county primary responsibility for the State Environmental Policy Act (SEPA) compliance. The designation also gives the county opportunity to review, recommend, and/or set conditions for any forest practice application on forestland identified for conversion.

Chapter 222-20-050 establishes a review procedure for timber harvest applications associated with the conversion of forestland to non-forest use. The procedure, Conversion Option Harvest Plan (COHP), is designed to assist in the identification of potential impacts on drainage courses and critical areas prior to the issuance of the permit by the Department of Natural Resources (DNR). The procedure establishes the opportunity for county review and modification of the permit. Modifications will be made based upon existing county ordinances and policies, including the county comprehensive plan and the shoreline management plan. The County has 30 days to review COHP applications and recommend modifications that must meet guidelines under Chapter 222-20-040 WAC.

When the COHP process has been completed, DNR can more promptly issue Forest Practice Permits. The COHP procedure allows the DNR to modify applications using county guidelines, after reviewing Department of Natural Resource standards. DNR is responsible for site inspections and compliance with the Forest Practice Rules and the conditions of the COHP. The county can also inspect permitted areas and invoke penalties for violations of the COHP as described in the COHP ordinance.

The Conversion Option Harvest Plan is a voluntary plan, developed by the landowner and approved by the County, limiting the timber harvest area, road locations and open space. This jointly developed plan is submitted to DNR as part of a Class II, III or IV Forest Practices Application. The plan is attached to and becomes a part of the conditions on the permit. If the requirements of the COHP are continuously met by the landowner, the COHP maintains the landowner's option to convert to a use other than commercial forest production.

Conversions of forestlands to residential or commercial land use is regulated by the Washington Forest Practice Rules and Regulations. Class IV – General Permits defined in the forestry section, are issued by the Department of Natural Resources to landowners who indicate their intentions to convert forest lands to other uses. With the exception of COHP, this class of forestry is the only one subject to county review and approval. Table 4-4, above, indicates the number of permits, total acres involved and miles of new roads built between 1989 and 1997, as part of a land use conversion from forest to residential use.

Solid and Hazardous Waste Management

As the population of San Juan County increases so will the volume of solid and hazardous waste generated. These wastes, if not managed correctly, can pollute surface and groundwater with hydrocarbons, heavy metals, toxic organic chemicals, and/or pathogens. Proper management is essential for reducing or eliminating the potential water quality pollution from these waste streams. Management includes the use, collection, storage, transportation, transfer, treatment, and disposal of the waste material.

The State Solid Waste Management Act, Chapter 70.95 RCW, assigns solid waste management to local governments. To insure effective management, the County and Town of Friday Harbor jointly developed both a Solid Waste and a Hazardous Waste Management plan. These plans are reviewed and approved by the Department of Ecology. Each plan is required to be updated every six years to insure effective waste management. For more information see, San Juan County's Solid Waste Management Plan and Household and Hazardous Waste Management Plan.

Solid Waste

Solid waste includes all putrid and nonputrid solid and semisolid waste including but not limited to garbage, rubbish, ashes, industrial wastes, swill, demolition and construction debris and abandoned vehicles. San Juan County currently relies on "long-hauling" all its solid waste off the islands for disposal. Transfer stations located on Lopez, Orcas and San Juan islands collect and store the waste until the material is transported to the mainland for disposal. The volume of solid waste handled at these facilities continues to increase. Table 4-5, below, shows the volume of waste deposited at each of these facilities (Stuhr 1999).

Year	Volume of Garbage Received (Tons/yr)		
	Lopez	Orcas	San Juan
1996	1,065	3,015	3,015
1997	1,400	3,300	3,300
1998	1,400	3,300	3,300

Table 4-5.

These transfer stations are issued permits by the San Juan County Department of Health and Community Services and inspected annually to insure the material is handled properly and any leachate (contaminated runoff) is contained.

Long-hauling all of the solid waste off the islands has been occurring since April, 1994. Prior to that, the county operated landfills on Lopez and Orcas islands and the Town of Friday Harbor operated an incinerator and landfill on San Juan Island. In 1980, the State Department of Ecology reviewed county dump sites for listing under the Federal Conservation Recovery Act of 1976, which triggered the need for permits and costly monitoring procedures. This resulted in the county's Lopez landfill closing in 1980, although a septage lagoon continues to be used there. Several local landfills, including Roche Harbor and Blakely Island, also ceased operations at this time. Several smaller community landfills have also been utilized, but the number and location of these sites is unknown.

The Orcas landfill is approximately eight acres in size and was closed in 1994. A transfer station and septage lagoon continue to operate at the site. Operation of the incinerator and landfill by the Town of Friday Harbor ceased in 1995 and a transfer station is located at this site now. The map at the end of this chapter shows the approximate location of the transfer stations and closed landfills.

Septage lagoons on Lopez and Orcas are an ongoing problem for the county. Septic tank waste and other septage can only be disposed at these two sites, a costly problem for San Juan and other island septic pumpers and residents. These lagoons are overused and prone to overflowing. In 1999, a solar greenhouse treatment system was engineered and approved for San Juan Island. When constructed, this facility should take some pressure off the lagoons, and save conscientious septic system owners on San Juan the cost of sending waste to other islands. Septage is considered solid waste under State law.

Groundwater monitoring at the Orcas and Friday Harbor landfills has been occurring quarterly since the early 1990s. Post-closure monitoring will continue for 20 years or until the site becomes stabilized (i.e., little or no settlement, gas production, or leachate generation). Monitoring wells are located both above and below the sites to determine if the landfills are impacting water quality. To date, no contamination has been identified in the groundwater.

Unfortunately, not all solid waste ends up in the transfer stations. Illegal dumping of solid waste, albeit minor compared to other areas, exists in San Juan County. The San Juan County Department of Health and Community Services is responsible for investigating illegal dumping activities. The county receives and investigates approximately twenty complaints per year.

Hazardous Waste

Hazardous wastes are defined as all flammable, toxic, corrosive, and reactive waste generated by residences and businesses. These wastes must be properly disposed to prevent surface and groundwater from becoming severely contaminated with heavy metals, hydrocarbons, and other toxic compounds. Hazardous waste should not be disposed with the regular trash, down the drain, or on the ground. Instead the waste should be separated and taken to the county operated hazardous waste collection facility at the San Juan Island transfer station. The county and town offer regular hazardous waste round-up, allowing individuals to properly dispose of these wastes for free or at a minimal cost.

Businesses that routinely generate hazardous waste are defined as Small Quantity Hazardous Waste Generators. They include school district facilities, bulk petroleum stations, vehicle maintenance service centers, and the University of Washington Marine Laboratory.

Marinas and Recreational Boating

San Juan County is a very popular boating destination. Each year thousands of boats flock to the San Juan Islands to explore the many coves and inlets. While boaters are important to the economy of San Juan County, if uneducated they also can pollute the marine and fresh water environments. Pollution from boating activities can include illegal sewage discharges, oil and/or gas spills, and spilled solvents, antifoulants, and paints used to maintain the vessels.

Recreational Boating

Recreational boating is increasing steadily in the San Juan Islands. In the more popular bays for anchoring, such as Garrison Bay, as many as 100 boats have been observed anchoring over busy holiday weekends. This popularity is also shown by the expansion of marinas at Roche Harbor, Friday Harbor, West Sound, and Fisherman Bay. In addition to power boating, kayak touring has become a booming business in the county. The extent that these many recreational visitors adequately dispose of waste by using boat pump-outs and other sanitary facilities is unknown.

Washington State Parks Department surveyed over 3000 boat owners in 1988 and found that over 75 percent discharged sewage directly overboard. Nineteen percent of all respondents had no toilet facilities onboard their boat and/or used a bucket. Almost 20 percent had a direct discharge marine toilet and another 19 percent had a portable toilet. About 35 percent of boats surveyed had an approved Marine Sanitation Device (MSDs) with holding tanks. The remaining seven percent of boaters had an MSD with a macerator and treatment system.

Even the boats with MSDs routinely discharged sewage overboard. Boaters with Type 3 MSD's (holding tanks with "Y" valves) were asked when discharge overboard took place. The survey indicated that about 35 percent of boats had "Y" valves on their holding tanks. Of these, almost 15 percent kept the "Y" valve open all the time (5 percent of all boaters). Eighteen percent discharged their waste when at least three miles offshore (6 percent of all boaters). Thirty

eight percent discharged holding tanks when in the major channels of Puget Sound (14 percent of all boaters).

Fecal coliform pollution in the marine waters of Friday Harbor and San Juan Channel resulted in San Juan Channel being proposed for listing in 1996, as a waterbody needing management actions to attain water quality standards under the Federal Clean Water Act, Section 303(d). In 1983, investigators for Department of Ecology concluded the fecal coliform bacteria concentrations in Friday Harbor waters and shellfish were a direct result of poor effluent disinfection and improper boater waste disposal. Boat waste discharges were considered a significant contributor to violations of bacteria criteria (Determan and Kendra 1986).

Boats are prohibited from discharging untreated sewage into the waters of the United States (within three miles of the U.S. Coast) by the Federal Clean Water Act of 1972 (and as amended). Enforcement of this regulation is under the jurisdiction of the U.S. Coast Guard. The Coast Guard admits that catching someone in the act of discharging raw sewage overboard is very difficult given that the discharge usually occurs below the water line.

Marinas

There are 13 commercial marinas in San Juan County as well as numerous public and private docks and ramps. Table 4-6, below, lists the marinas, including the number of slips and whether pump-out facilities or restrooms are available. See map at the end of this chapter, for marina locations.

Commercial marinas in San Juan County

Marina	Location	Approx. Total Moorage	Pumpout Facilities	Restrooms Available
Cayou Quay Marina	Deer Harbor	~35	no	yes
Deer Harbor Marina	Deer Harbor	90	yes	yes
Rosario Resort Marina	East Sound	35	planned	yes
Island's Marine Center	Fisherman's Bay	96	yes	yes
Lopez Islander Marina	Fisherman's Bay	50	no	summer only
Capron's Landing	Friday Harbor	62	yes	yes
Port of Friday Harbor	Friday Harbor	464	yes	yes
Shipyard Cove	Friday Harbor	200	no	yes
Bay Head Marina	Harney Channel	70	no	no
Snug Harbor Resort	Mitchell Bay	80	no	yes
Brandt's Landing	President's Channel	~30	no	portable
Roche Harbor Resort	Roche Harbor	377	yes	yes
West Sound Marina	West Sound	160	yes	yes

Table 4-6. Occupancy of moorage slips varies seasonally among marinas.

The presence of a marina does not necessarily indicate the presence of pollution. If properly sited, designed, operated, and maintained, a marina can greatly reduce boat related nonpoint source pollution. However, the pollution potential is significant enough that the State Department of Health considers any site adjacent to an active marina as prohibited for shellfish harvesting. Activities at marinas that have the potential to cause pollution include sewage discharges, fuel spills, and use of toxic cleaning compounds.

Boat Yards & Maintenance

As with all types of vehicles, boats require on-going maintenance. Maintenance is normally performed at boat yards and/or marinas. Maintenance involves the use of a wide variety of chemicals to repair, fix, clean, paint, and restore boats. Detergents and paints are associated with hull cleaning and painting. Solvents and other chemicals such as fiberglass resins, acetone and acids and are commonly associated with hull and engine repairs. These chemicals must be used, stored and disposed of properly to prevent water pollution.

Six boat yard and marine repair facilities are located in San Juan County. These facilities include a variety of services, including haul-out, engine repair, boat refinishing and refurbishing, and storage. See the map at the end of this chapter, for these locations.

These facilities are regulated by the Washington State Department of Ecology (DOE) through general water quality permits. The permits require the boatyards to contain, collect, and treat all pressure wash water and monitor all discharges. Ecology's Northwest Regional Office in Bellevue monitors pollution control at boatyards and commercial operations in San Juan County. Boatyards in the county are currently in compliance with pollution control regulations as required by federal law.

Stormwater

Stormwater is defined as run-off from residential, commercial, and urban areas. The quantity of stormwater will grow as the county's population increases and the amounts of impervious surface expand. Pollution from stormwater can be separated into two categories, quantity and quality.

Increased quantities of stormwater can cause flooding and soil erosion. These increased quantities are a result of run-off being channeled through hydrologically efficient systems of ditches, pipes, and drainage ways. These efficient systems allow rainwater to accumulate as surface run-off more quickly than vegetated ground covers, and decrease the time it takes for rainwater to enter creeks, rivers and surrounding marine waters. This reduced time concentrates run-off and causes increased peak flows, higher stream velocities, bank erosion, flooding and sediment deposition.

Stormwater is a primary transport mechanism for other nonpoint source pollution. Pollution enters a stormwater drainage system as contaminants washed by rain falling on impervious surfaces. As a result, stormwater quality can be contaminated with petroleum products, heavy metals, toxic organic substances, fertilizers, herbicides and pathogens.

Stormwater is addressed in San Juan County by two principal sets of regulations. In 1998, the county adopted the Department of Ecology's "Stormwater Management Manual for Puget Sound Basin" (SSM) as a part of the county's Unified Development Code. Under county regulations, all new development and redevelopment must conform with the SSM. Class IV General and COHP forest practices must meet the stormwater requirements of the county's Unified Development Code. "Small parcel developments" that create less than 5000 square feet of impervious surface must develop an erosion and sediment control plan or illustration, and utilize Best Management Practices to deal with stormwater. All other regulated developments under county jurisdiction are required to prepare and submit to the county a Stormwater Site Plan that analyzes potential water quality impacts, the effectiveness of proposed Best Management Practices, and an erosion and sediment control plan.

The Town of Friday Harbor formed a stormwater utility in 1992 and adopted a Stormwater Management Plan in 1997. This plan describes deficiencies in the existing stormwater system, recommends system improvements, and identifies Best Management Practices for new developments. The Town funds improvements to the stormwater system through an assessment of landowners with developed parcels.

Some of the adverse effects of stormwater can be minimized through proper management techniques. Site plans that address erosion and sedimentation are a component of stormwater management. Best Management Practices such as infiltration trenches, wet ponds, biofiltration swales and vegetative filter strips can be utilized to prevent flooding and improve the quality of discharged stormwater.

The need for stormwater management is likely to increase significantly as more land is developed and urban centers continue to grow. Currently, stormwater quality problems were evident in the urban zones of Friday Harbor and Eastsound. Recent water quality monitoring results, reported in Chapter 5, indicate degraded water quality at culverts in Friday Harbor and Eastsound. Similar results were identified at Eastsound in 1995 (Parsons and Ogier 1995). While these samples are not conclusive, they do indicate potential water quality problems and the need for control and protection of stormwaters in the county.

Atmospheric Pollution

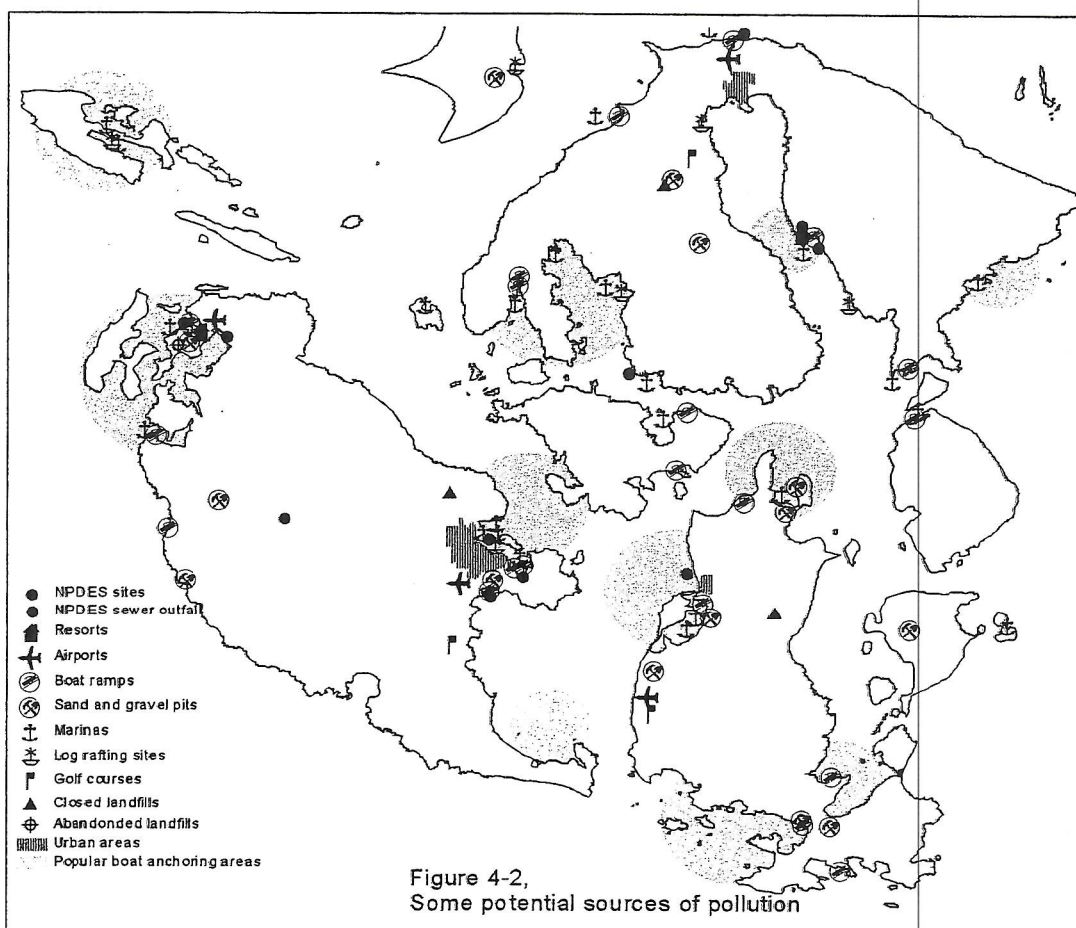
Suspended solids in the air can be deposited in surface water, thereby adding to pollution problems. All air pollution sources and emissions in the county must comply with the general emission standards contained in Chapter 173-400 WAC. Most federal air pollutant emission standards apply only to industrial point sources larger than those in San Juan County. Point and area sources of air pollutants in San Juan County have been identified in Chapter 173-400 WAC. The Friday Harbor incinerator and Friday Harbor Sand and Gravel have been the only sources of air contaminants in the county documented in the state emission inventory, both of which are now closed.

Water quality and air quality issues are also affected by aerated waste lagoons and land application of sludges and wastewaters. The Washington Clean Air Act provides for the formation of local air pollution control authorities for each county of the state. San Juan County was part of a multi-county local air authority: Northwest Air Pollution Authority

(NWAPA), but the county left the Authority in 1988. Air quality regulation in San Juan County is now done through the Northwest Regional Office of the Department of Ecology.

Large point sources of air pollutants that are listed within specific industrial categories are required to register each year with Ecology under Chapter 173-400-100 WAC. Most of the listed point sources in San Juan County are small enough to avoid registration, but some, such as the Friday Harbor incinerator, and gasoline retailers that pump more than 360,000 gallons of gasoline per year, are required to register.

A review is required for construction of any new point source, or for any modification of a listed existing source. To date, the only sources that have gone through new source review are the Friday Harbor incinerator, Island Asphalt (now a portable unit owned by Lakeside Industries), and closures of the Friday Harbor and Orcas Island landfills (Garland 1996).



Chapter 5, Water Quality

The preceding chapters discuss the beneficial uses and potential pollution sources of surface water in San Juan County. By knowing the existing quality of the surface water it is possible to identify pollution sources and protect beneficial uses and to determine whether restoration or prevention strategies are needed. This chapter lists the relevant water quality standards and discusses the water quality conditions as currently known.

Water Quality Standards

Washington State has established water quality standards for surface water to protect public health and public enjoyment, and for the propagation and protection of fish, shellfish, and wildlife, pursuant to Chapter 90.48 RCW. The standards are contained in Chapter 173-201A WAC, Water Quality Standards for Surface Water of the State of Washington. The State established five criteria classes for surface water: Class AA extraordinary, Class A excellent, Class B good, Class C fair, and Lake class, based on the present and future use of the surface water.

The standards identify and place specific classification on various marine and fresh surface waters around the State. Surface water bodies not specifically classified receive a general classification. The marine waters surrounding San Juan County have received a specific classification of Class AA extraordinary (WAC 173-201A-140). Marine waters are the only surface water that has received a specific classification in San Juan County. In this classification all unclassified surface water that are tributaries to Class AA water are classified as Class AA. Therefore, since all surface water in San Juan County flows into marine waters, by default all fresh surface water in San Juan County is Class AA and must meet the standards in Table 5-1.



Within each criteria class, characteristic uses and water quality standards were defined. The characteristic uses of Class AA waters includes water supply (domestic, agricultural and industrial); stock watering; fish and shellfish rearing, spawning, and harvesting, wildlife habitat; recreation; and commerce and navigation. Chapter 3, Beneficial Uses, further explains these uses in the various watersheds.

The regulated water quality parameters for Class AA surface water include fecal coliforms, dissolved oxygen, total dissolved gas, temperature, pH, turbidity, toxic, radioactive or deleterious materials, and aesthetic value. Table 5-1 summarizes the water quality parameters for Class AA waters.

It should be noted that water quality criteria for conditions that are due to natural causes (not as a result of human activities) are lower than those listed below. In San Juan County temperature is an example of a parameter that may be naturally above the criteria in some locations.

Water Quality Standards for Class AA (extraordinary) Surface Water

Water Quality Parameter	Freshwater Standard	Marine Water Standard
Fecal Coliform	a geometric mean \leq 50 cfu/100 mL, with less than 10% of samples exceeding 100 cfu/100 mL	a geometric mean \leq 14 cfu/100 mL, with less than 10% of samples exceeding 43 cfu/100 mL.
Dissolved Oxygen	$>$ 9.5 mg/L.	$>$ 7.0 mg/L.
Total Dissolved Gas	$<$ 110 percent of saturation at any point of sample collection	
Temperature	\leq 16°C	\leq 13°C
pH	6.5 - 8.5	7.0 - 8.5
Turbidity	$<$ 5 NTU over background, with a background of $<$ 50 NTU. If background is $>$ 50 NTU, shall not exceed a 10% increase	
Toxic, Radioactive and Deleterious Materials	concentration below those that adversely affect characteristic water uses, cause acute or chronic conditions to the most sensitive biota or adversely affect public health.	
Aesthetic Value	shall not be impaired (including senses of sight, smell, touch or taste)	

Table 5-1. Note: cfu refers to colony forming unit (bacterial colonies).

Additional water quality parameters of significance that do not have official State standards include nitrate and total suspended solids (TSS). Values recommended by EPA were used as a guideline for TSS thresholds. Values for nitrate were based on a study of conditions in the East Lake Sammamish watershed of King County (\leq 1.25 mg/L), and recommendations from EPA for nitrogen levels to avoid algal blooms in estuaries (0.1 to 1.0 mg/L). Table 5-2 indicates these values.

Recommended water quality threshold values for surface waters

Water Quality Parameter	Recommended threshold values
Nitrate (N)	$<$ 1.25 mg/L
Total Suspended Solids (TSS)	\leq 50 mg/L

Table 5-2.

Fecal coliforms¹

Fecal coliform bacteria are microscopic organisms that live in the intestines of warm-blooded animals and are excreted in waste, or feces. Although not necessarily agents of disease, fecal coliform bacteria indicate the presence of disease carrying organisms. Unlike other water quality parameters fecal coliforms are living organisms and instead of mixing in water they can grow quickly in favorable conditions or die off when conditions are poor. The source of coliforms can be variable as well, due to heavy rains washing pollutants into streams, or a failing septic system being overloaded when guests arrive. The concentration, or loading rate, for fecal coliforms in a stream can vary depending on the volume of water. The state standard for fecal coliforms requires a geometric mean of a number of samples.

Dissolved Oxygen

Oxygen is essential to aquatic organisms, for the decomposition of organic material, and for other biologic and chemical processes. Oxygen is produced during the day by photosynthesis and consumed by respiration and decomposition. Dissolved oxygen (DO) varies between day and night, and increases in turbulent, fast-flowing waters. Pollution tends to cause a decrease in stream and surface water oxygen by adding chemical or biological constituents that have a high oxygen demand, by adding effluent, and runoff water with low oxygen levels. It can be difficult to tell where pollutants are entering surface water, since the low DO levels can occur downstream from the source of contamination. Sediments, nutrients (waste and fertilizers), and organic matter all increase the oxygen demand.

Temperature

Temperature governs the kinds of aquatic life that can live in a stream or waterbody. Fish, insects, zooplankton, phytoplankton, and other aquatic species all have preferred temperature ranges. Temperature also influences chemistry and in turn affects biological activity and oxygen levels. Warm water holds less oxygen than cool water, and may be "saturated" with oxygen but still not contain enough to support aquatic life. Water temperature varies naturally based on air temperature, source water, and velocity. A forested watershed with steep terrain moves water quickly and protects it from the sun. A flat, sparsely vegetated watershed, where water moves slowly, causes water to absorb more heat from the sun. The pollution impact from increased temperature is caused by removal of vegetative cover from the banks of streams, ponds, and wetlands. Paved surfaces also tend to heat runoff into surface waters.

pH

The pH of water affects solubility and the biological availability of chemical constituents. This determines how nutrients and heavy metals are utilized by aquatic life. Geology and the origin of the source water determine the initial pH of water.

¹ See A Citizen's Guide to Understanding and Monitoring Lakes and Streams (Michaud 1991) for more information.

Seasonal and daily changes in photosynthesis are the greatest causes of variation in pH. Small or localized changes in pH are easily buffered and changes in the overall pH during the course of a day are usually fairly small. The pH scale goes from acid to alkaline, from 0 to 14, with neutral being 7. Natural fresh waters generally stay between 6.5 and 8.5, marine waters are usually between 7.5 and 8.4.

Nutrients

Nutrients in surface water serve the same purpose they do for all life. They are essential for growth. This can be beneficial, but in a stream or other surface water can cause excessive growth of algae and other plants. Phosphorus (total phosphorus, soluble reactive phosphate, or orthophosphate) and nitrogen (total nitrogen, total Kjeldahl nitrogen, nitrate-nitrogen, or ammonia-nitrogen) are the main nutrients of concern for surface waters. Measuring these nutrients in their various forms can be complex, but is necessary in order to determine the overall effect. Concentrations of nutrients vary seasonally. Man-made pollution from fertilizers and inadequate waste disposal can enter streams at different times of the year, and in the winter high rainfall washes organic materials down stream, which then decompose into nutrients. Increased nutrients are almost always an indication of pollution from human activities.

Turbidity

Turbidity and total suspended solids (TSS) indicate the amount of particles suspended in water. High concentrations of particulate matter can cause sedimentation and siltation in streams and wetlands and ruin habitat for fish and other aquatic life. Turbidity is also an indicator of other potential pollutants. Turbidity increases during heavy rainfall, depending on the native soils and geology of the area. Land use activities are probably the greatest factor in increased turbidity in a surface water body.

Water Quality Conditions

The majority of existing surface water monitoring in San Juan County has been for marine waters as part of state programs. Two state agencies, the Department of Health (DOH) and Department of Ecology (DOE), conduct ongoing marine water monitoring at several locations throughout San Juan County. In the past, fresh water monitoring, except for drinking water sources, has been one time only for specific studies. Currently, the county is conducting a one-year, county-wide monitoring project to determine baseline water quality parameters and develop an on-going monitoring program.

The DOH Shellfish Section monitors marine water for fecal coliform pollution over and adjacent to commercial shellfish growing operations. Monitoring stations are located in Shoal Bay, Lopez Sound, Mud Bay, Hunter Bay, Mackay Harbor, Ship Bay (East Sound), Buck Bay, and Westcott Bay. A new station has been located in East Sound at Coon Hollow. Stations are generally monitored six times per year or every other month. Compared to most shellfish areas, San Juan County has the highest marine water quality in the state and all stations are currently in compliance with the fecal coliform

standard. However, stations at Buck Bay and the new Coon Hollow site show increasing coliform counts. (Lenartson 1998)

The Department of Ecology Environmental Assessment Program Ambient Monitoring Section monitors three stations in the San Juans. One core station that represents the Strait of Georgia, with influences from the Fraser River, is sampled monthly. In 1997, two rotating stations, East Sound and Lopez Sound, were monitored monthly. Three other stations were monitoring prior to 1989. Ecology has eight to 12 rotating marine ambient stations, which rotate between north, central, and south Puget Sound every third year. The water quality parameters monitored include, but are not limited to, fecal coliform, dissolved oxygen, pH, temperature, and nitrate. The East Sound monitoring station has recorded low dissolved oxygen concentrations. The frequency of the excursions has increased, suggesting human activity influences. (Garland, et al, 1996) The East Sound area was proposed for listing as impaired under the federal Clean Water Act 303(d) section in 1996, as a waterbody needing management actions to meet federal standards. Ecology chooses monitoring locations on the basis of current water quality concerns and local requests. The next round for San Juan County will occur in 2003, particularly if local government makes its needs known to Ecology in advance.

Additional surface water assessments have been conducted by Ecology's Watershed Assessment Section. Two surveys were completed in Friday Harbor and adjacent San Juan Channel. Singleton and Joy completed a survey in 1983 and concluded that high fecal coliform concentrations were attributable to the Town of Friday Harbor's Wastewater Treatment Plant and boater wastes. A follow-up survey by Determan and Kendra in 1986, completed after improvements to the treatment plant operations, concluded that boater wastes were the significant contributor to the fecal coliform counts in Friday Harbor. San Juan Channel was also proposed for 303(d) listing in 1996.

The monitoring conducted by DOH and DOE focuses on marine water quality only. The quality of the fresh water entering the marine environment is relatively unknown. As part of the characterization project for this report, San Juan County conducted stream sampling to get a snapshot of current water quality conditions in the watersheds. The sampling regime involved taking initial spot samples in May and June of 1997 with follow-up samples collected between November 1997 and February 1998 for sites where the initial sampling showed concentrations of contaminants greater than standards. The initial samples were collected from the mouths of streams as they enter marine embayments. Follow-up samples were collected from the same location and upstream, typically where the stream crossed a roadway, to try and isolate the pollution source.

The initial samples were analyzed for temperature, pH, conductivity, nitrate, total suspended solids, dissolved oxygen, and fecal coliforms. The follow-up samples were analyzed for the same parameters except nitrate. A Solomat meter was used to take field measurements for temperature, pH, conductivity, and dissolved oxygen. Samples for total and fecal coliform were transported to the Skagit County Laboratory.

Monitoring locations and data tables are shown on pages 64 through 66, for more detailed monitoring results see Appendix A. Data sets for fecal coliform, temperature, pH and TSS were analyzed at sampling sites that had multiple (more than one) sampling events to determine if the water quality exceeded (contamination was in excess of) the standards. The data for dissolved oxygen and conductivity were excluded due to sampling errors. Nitrate concentrations were not analyzed as only one round of sampling was completed on a small number of monitoring sites. Complete sets of data for all sampling sites, events, and parameters can be found in Appendix A, Water Quality Monitoring Data.

A review of the data indicates that at several stations water quality was in violation of the standards for fecal coliform, temperature, and Total Suspended Solids (TSS). On Lopez Island, samples at stations L26, L18, L32, and L33, located in the Fisherman Bay and Mud/Hunter watersheds, exceeded the fecal coliform standard. Station L26 exceeded the TSS standard on one occasion and station L18 exceeded the standard on three out of the eight sampling events. The sources of pollution were not determined, however, potential causes include agricultural operations, on-site septic systems, and residential development. See Table 5-6, on page 66.

Water sampling on Orcas Island indicated water quality at stations in Buck Bay, East Sound, and West Sound violated the fecal coliform, TSS, and temperature standards. Station O1 in Buck Bay, station O11 in Eastsound Village and stations O9, O13, and O19 in West Sound violated the fecal coliform standards. Stations O1 and O13 raise the most concern with geometric means of 333 fecal coliform (fc)/100 mL and 237 fc/100 mL, respectively. Samples at station O11 exceeded the temperature standard on one occasion. TSS standards were exceeded at stations O1, O2, O11, O9, O13, and O19. Station O19 exceeded the standard most frequently; 50 percent of the time (3 out of 6 samples), followed closely by station O11 at 43 percent (3 out of 7 samples). The stations with high fecal counts in Buck Bay and West Sound are primarily affected by agricultural operations, although on-site septic systems may also be contributing to the problem. Station O11 in East Sound is a stormwater drain for the village of Eastsound. The area is heavily developed with a large percentage of impervious surfaces. Potential pollution sources may include the sewer system serving the community and stormwater. See Table 5-5, on page 65.

San Juan Island samples at stations in the False Bay, Friday Harbor, and Westcott/Garrison Bay watersheds violated the fecal coliform and TSS water quality standards. Station SJ2 in False Bay, station SJ8 in Friday Harbor, and station SJ6 in Westcott/Garrison Bay exceeded the fecal coliform standard. Station SJ8, a stormwater drain for the Town of Friday Harbor, raises the most concerns with a geometric mean of 2147 fc/100mL. All samples from this station were in excess of 1000 fc/100mL. Stations SJ2, SJ5, SJ6, and SJ15 exceeded the TSS standard. Station SJ6 exceeded the standard most frequently (71 percent or 5 out of 7 samples). The high counts at station SJ2 in False Bay are attributable to agricultural activities in the area. Residential development may be contributing to the pollution, however, given the agricultural character of this part of watershed the potential seems quite low. Station SJ8 in Friday

Harbor is a stormwater culvert and may be influenced by leaking sewer pipes, pet waste, and other stormwater sources. Stations in Westcott/Garrison Bay may be affected by both on-site sewage disposal systems and agricultural operations. The shoreline area along Westcott Bay is largely residential development. Agricultural operations are present upland from the shoreline. See Table 5-4, on page 64.

As discussed above, water quality standards were exceeded at numerous sampling sites throughout the county. This discussion focuses on stations with more than one sampling event. However, many additional stations were included in this study but were only sampled once. Several of these stations had samples that exceeded the water quality standards. While this information is useful, a single sample, from any station, is simply a "snap-shot in time" representing the conditions when the sample was collected and is not a complete picture of water quality at the site.

Pollution sources were not identified as part of this project. The water quality monitoring was completed to provide an overview of potential "hot spots." In the spring of 1999, Health and Community Services contracted with the Institute for Watershed Studies, Huxley College, to conduct a year of baseline monitoring and develop recommendations for establishing a long-term monitoring program for the county. Results of this monitoring will be available in the spring of 2000.

In October 1999, Department of Ecology issued a Total Daily Maximum Load (TMDL) Ranking for San Juan County, based on the monitoring described above. This initial ranking will give Ecology priorities for further assessment and, if necessary, remediation through their water quality programs. Based on the second level of standards used to determine surface water quality, which is no more than 10% of the samples used to calculate the geometric mean exceed 100cfu/100mL in fresh water or 43 cfu/100 mL in marine waters, the report recommends the following ranking for candidate watersheds for fecal coliform TMDLs:

- 1st East Sound, Orcas Island with a score of 22;
- 2nd Buck Bay (part of the East Sound watershed in this report), Orcas Island, with a score of 21;
- 3^d Friday Harbor, San Juan Island, with a score of 19;
- 4th Westcott Bay, San Juan Island, with a score of 14;
- 5th West Sound, Orcas Island, with a score of 13.

Water Quality Programs in San Juan County

	Program	Services/Projects	Time frame
San Juan County	Drinking Water Program	Individual and community water supplies	Ongoing
	On-Site Septic System Program	Individual and community septic systems	Ongoing
	Solid Waste Facilities permitting and enforcement	Permitting, monitoring, and enforcement	Ongoing
	Nonpoint Source Pollution, Watershed Management Action Plan	Watershed Management Action Plan Baseline surface water quality monitoring Long-term monitoring program	1997-2000
San Juan County, (cont.)	Watershed Management Plan, WRIA 02	Water resource assessment Watershed Management Plan addressing: instream flows, water quality, habitat	1999-2002
	SJC Conservation District	USGS Salt Water Intrusion and Recharge Distribution	Identification of salt water intrusion areas and recharge analysis
	Centennial Clean Water Puget Sound Funds	Farm and forestry plans for protection of water quality and habitat	1998-2000
	Centennial Clean Water Funds	Wetlands, riparian assessment and restoration projects	1999-2000
Town of Friday Harbor	Trout Lake Watershed	Water quality monitoring, watershed community education	Ongoing
WSU/SJC Extension Service	Education programs	Information on farm and home water quality problems and management (FarmAssist, HomeAssist)	Ongoing
SJC Stewardship Network	Coalition of educational, environmental groups	Coordination of projects, surveys and monitoring, data sharing	Ongoing
State programs	Department of Health Shellfish Section	Monitoring of approved shellfish areas	Ongoing
	Department of Ecology Ambient Monitoring Program	Monitoring of marine stations throughout the county	Ongoing
	Department of Ecology Water Quality programs.	Regulatory programs for point discharge permits, stormwater, dairies, shorelands	Ongoing
	Department of Natural Resources	Forestry practices permits, include water quality standards	Ongoing
Federal Programs	Army Corps of Engineers	Federal Clean Water Act Section 404, fill and dredge of wetlands	Ongoing
	Environmental Protection Agency	Revolving funds and grants for nonpoint pollution control projects	Ongoing

Table 5-3

Table 5-4 -- Water Quality Data for San Juan Island, 1997-98 Characterization Monitoring

Watershed Sampling Site	Fecal Coliform (cfu/100mL)			pH			Temperature (°C)			Total Suspended Solids (mg/L)			
	Samples	Range	Geo. Mean	Samples	Range	# Excd. Stnd.	Samples	Range	# Excd. Stnd.	Samples	Range	# Excd. Stnd.	
False Bay	SJ2	7	3 - ≥2400	112	7	7.5 - 8.05	0	7	4.6 - 15	0	7	5 - 54	1
Friday Harbor	SJ7	6	4 - ≥2400	22	6	7.63 - 8.2	0	6	5.3 - 14.3	0	6	5.3 - 14.3	0
	SJ8	7	1100 - ≥2400	2147	6	8.4 - 8.7	3	6	6.7 - 8	0	6	6.7 - 8	0
Westcott/Garrison	SJ5	9	9 - 240	37	4	7.67 - 8.19	0	4	4.8 - 11.02	0	4	23.1 - 175	1
	SJ6	8	4 - 1100	156	7	7.5 - 8.42	0	7	5.1 - 11	0	7	22.3 - 323	5
	SJ15	8	3 - ≥2400	22	6	7.3 - 8.7	1	6	5.1 - 6.7	0	6	4.8 - 70	2
	SJ16	9	4 - 240	40	6	3.19 - 7.62	0	6	5.1 - 6.6	0	6	20.9 - 48	0
	SJ22	5	3 - 93	6	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a

Note: The range for the lab analysis used for fecal coliform has an upper limit of 2400 organisms. Actual counts may be significantly higher.

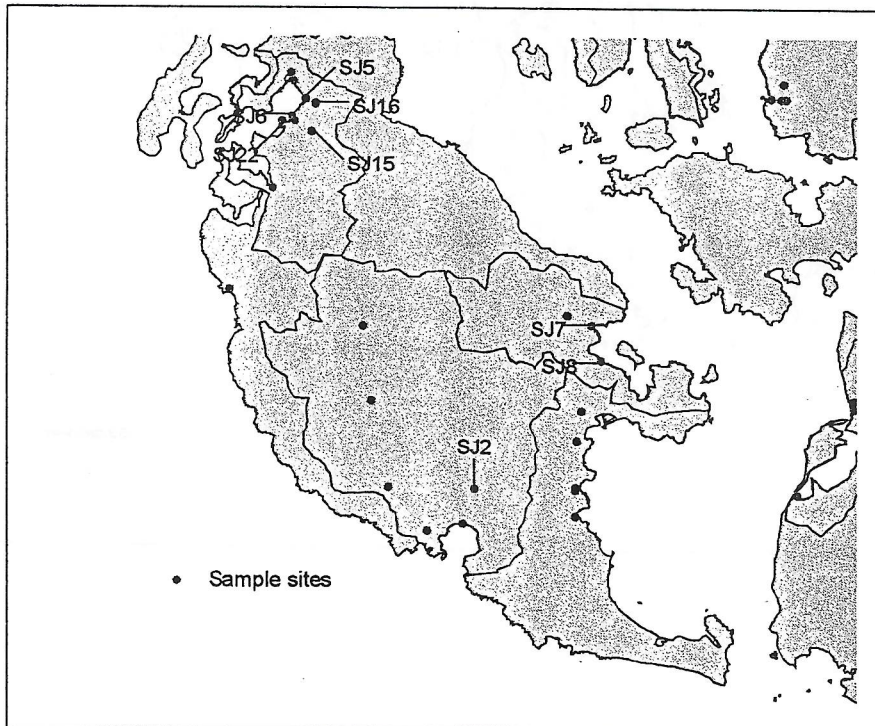


Table 5-5 -- Water Quality Data for Lopez Island, 1997-98 Characterization Monitoring

Watershed Sampling Site	Fecal Coliform (cfu/100mL)			PH			Temperature (°C)			Total Suspended Solids (mg/L)			
	Samples	Range	Geo. Mean	Samples	Range	# Excd. Stnd.	Samples	Range	# Excd. Stnd.	Samples	Range	# Excd. Stnd.	
Fisherman	L26	7	23 - ≥2400	187	5	7.9 - 8.2	0	5	7.4 - 8.2	0	5	32.7 - 57	1
Bay	L31	6	3 - 23	4	0	n/a	n/a	0	n/a	n/a	0	n/a	0
Mud/Hunter	L18	8	23 - ≥2400	199	8	7.5 - 8.1	0	8	5.6 - 12.7	0	8	33 - 92	3
Bays	L32	6	3 - 1100	70	6	7.4 - 8.2	0	6	5.1 - 7.3	0	6	8.2 - 41.2	0
	L33	6	4 - 1100	121	1	7	0	1	8.2	0	1	0	n/a

Note: The range for the lab analysis used for fecal coliform has an upper limit of 2400 organisms. Actual counts may be significantly higher.

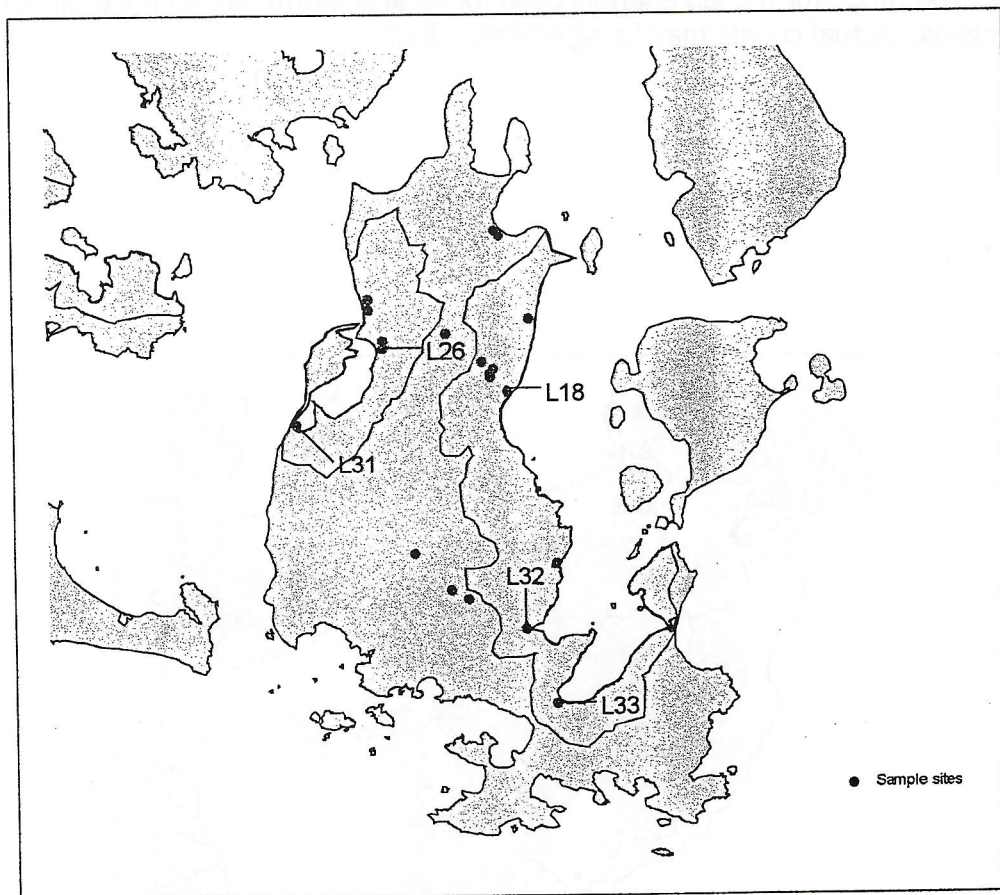
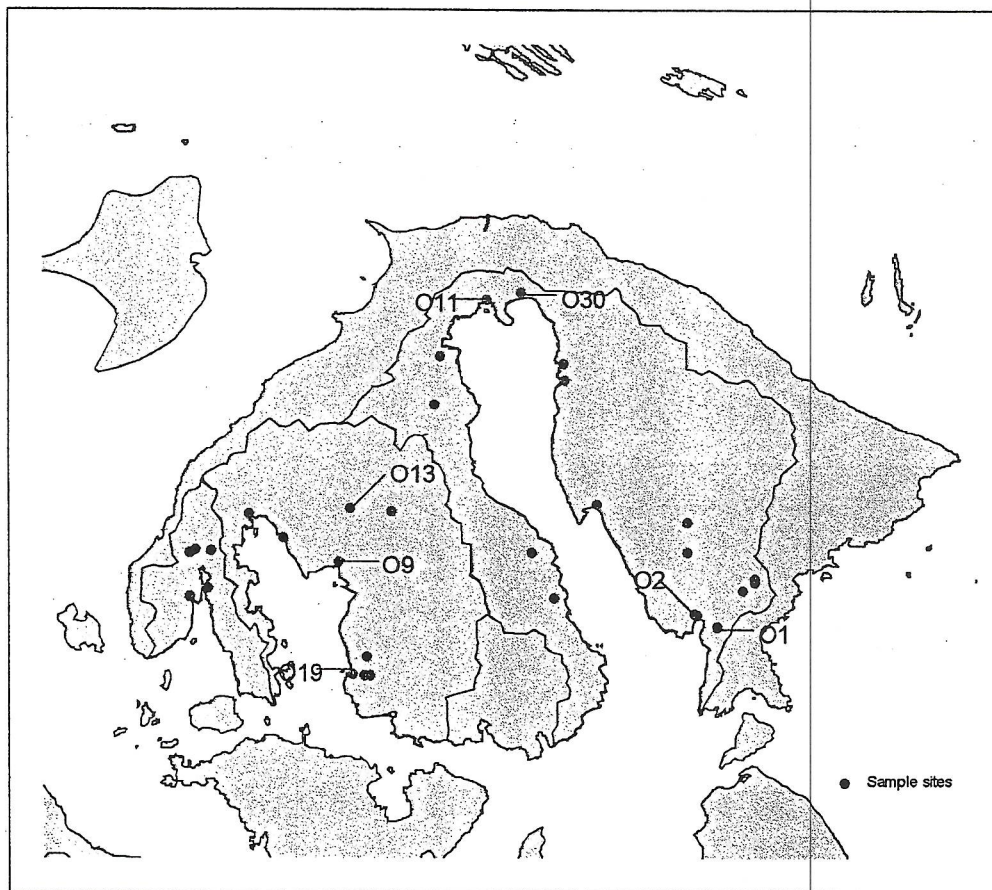


Table 5-6 -- Water Quality Data for Orcas Island, 1997-98 Characterization Monitoring

Watershed Sampling Site	Fecal Coliform (cfu/100mL)			pH			Temperature (°C)			Total Suspended Solids (mg/L)			
	Samples	Range	Geo. Mean	Samples	Range	# Excd. Std.	Samples	Range (°C)	# Excd. Std.	Samples	Range	# Excd. Std.	
Buck Bay	O1	9	15 - ≥2400	333	7	7.5 - 8.1		7	5.6 - 11.1	0	7	23.2 - 73	1
	O2	7	9 - 93	35	6	8.0 - 8.3		6	6.4 - 11.4	0	5	0.1 - 123	2
Eastsound	O11	7	7 - 1100	71	7	8.1 - 8.5		7	6.4 - 18.9	1	7	2.8 - 8146	3
	O30	7	4 - 290	22	6	7.1 - 7.4		6	6.4 - 7.6	0	5	19.3 - 33	0
Westsound	O9	8	15 - 460	52	7	8.0 - 8.1		7	5.9 - 14.6	0	7	26.4 - 56	1
	O13	6	93 - ≥2400	237	6	7.7 - 7.9		6	5.0 - 7.2	0	6	22 - 115.2	2
	O19	7	4 - ≥2400	71	6	8.0 - 8.1		6	6.7 - 12.2	0	6	5 - 88	3

Note: The range for the lab analysis used for fecal coliform has an upper limit of 2400 organisms. Actual counts may be significantly higher.



Chapter 6, Descriptions of the Individual Priority Watersheds

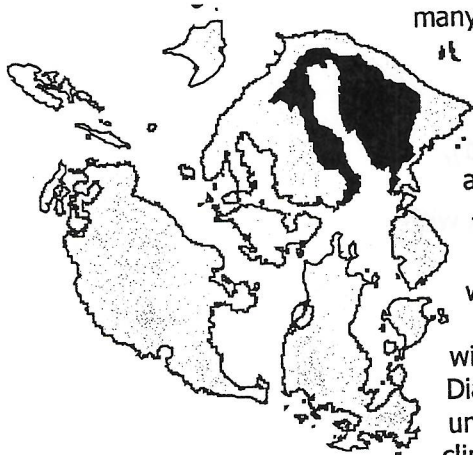
The following watersheds have been used as examples throughout this document and are described in this chapter in detail. They are the top ranked watersheds from the 1988 San Juan County Watershed Ranking Report.

1. East Sound (Orcas Island),
2. Friday Harbor (San Juan Island),
3. Westcott/Garrison bays (San Juan Island),
4. Fisherman Bay (Lopez Island),
5. Roche Harbor (San Juan Island),
6. Mud/Hunter bays and Lopez Sound (Lopez Island),
7. West Sound (Orcas Island),
8. Deer Harbor (Orcas Island), which tied for points with,
9. False Bay (San Juan Island).

East Sound

Beneficial Uses

Because of its wetlands, streams, lakes, and habitat areas, as well as large area of state parks, the East Sound watershed was ranked number one by the San Juan County Watershed Ranking Committee in its 1988 watershed ranking report. The East Sound watershed has



many of the important wetlands found on Orcas Island. These include Crescent Beach wetland, a 5.5 acre brackish marsh adjacent to Crescent Beach, Otter's Pond, one of the most diverse wetlands in the County, and the Eastsound swale, which once was a large wetland but has been greatly diminished and altered by adjacent development.

The large lakes and many ponds found in the watershed also provide wildlife habitat and scenic values. Several sites within the watershed have been inventoried by the Nature Conservancy and ranked according to their significance for maintaining biodiversity within the county. The largest site is the Woolard Mountain - Diamond Hill area. The site is noteworthy as it is mostly undeveloped with several stands of virgin hemlock, which is the climax forest species for this site. An area on Entrance Mountain,

recently purchased by the San Juan County Land Bank, was also identified as significant to the County for its unusually large stand of Sitka Spruce.

Watershed Acreage	13,933			
Landcover Vegetation			Current Land Use*	acres
Grasses	1,626	12%	Agriculture	479 3%
Dense Forest	8,947	64%	Timber Land	1,754 13%
Sparse Forest	736	5%	Conservation	1,256 9%
Scrub	1,997	14%	Residential parcels (813)	2,174 16%
Wetlands			Public Lands	3,783 27%
Upland freshwater	358		Designated Growth Areas	Yes
Marine and intertidal	517		Upland Native Ecosystem	Yes
Lakes			Critical Marine Habitat	Yes
Class 1 Cascade	172		Surface Water Resource Area	Yes
Class 1 Mountain	198		Research/Education Areas	Yes
Class 1 Martins	28			
Class 2 Summit	10			
Class 2 Ayer Res.	10			
Class 2 Flahertys	2.5			
Class 2 Fowler	9			
Class 3	3			
Lakes/Freshwater Wetlands		6%		
Streams		miles		
Class 3		4.2		
Class 4/5		9.5		
Drainage runoff		acre-feet		
Mountain Lake		1,899		

*Current land use information is from the County Assessor's records.

East Sound, itself, contains critical habitat for River Otter, Harbor seal and Pacific Herring and boasts a rich diversity of plant and animal species, including increasingly rare eel grass beds. The coastal portions of the watershed provide extensive areas of eagle habitat and many nests of Bald Eagle, Osprey, Great Blue Heron and turkey vulture are documented by Washington State's Natural Heritage Program. The depths of East Sound are fairly uniformly 90 feet throughout its six to seven mile length. State certified Oyster growing areas are actively used along Crescent Beach off of Ship Bay and the Buck Bay area has an active commercial shellfish operation. Hard-shell clams are located on the northwest and southeast portions of the sound. Areas located at the mouth and at the head of the sound on the eastern side are used for crabbing. Almost the entire sound is used for fishing. A small private fish hatchery for King salmon is operated inland about mid-way on the eastern side of the watershed.

The watershed encompasses Moran State Park which is among the largest state parks in Washington. The Class 1 Lakes, Cascade Lake (171.6 acres) and Mountain Lake (198 acres) provide recreation to the island's residents and visitors as well as drinking water for the Rosario and Doe Bay-Olga water systems. Summit Lake (10 acres), also in Moran State Park, is much smaller and shallower (only about 10 feet deep) and is a Class 2 lake. Other significant lakes in the watershed include Martin Lake (27.8 acres, Class 1), Ayer Reservoir (10.3 acres, Class 2) and Flaherty's Pond (2.5 acres, Class 2). Many small ponds are also distributed throughout the watershed which vary from Class 2 to 5.

Streams flowing to East Sound include a creek that flows from Cascade Lake to Cascade Bay, a creek that starts from Ayer reservoir and another creek that begins near the head of Crow Valley drains northeast into Judd Cove. Cascade and Cold creeks are year-round streams that support anadromous fish and have been established as a priority for Searun Cutthroat trout and Coho salmon by Washington State Department of Fish and Wildlife (1999). Many other creeks exist in the watershed, though the majority are seasonal.

Watershed Conditions

Land use in the watershed is primary residential, with some forestry and agriculture. Eastsound Village, at the head of East Sound, is the second largest town in the county but is unincorporated. Land cover in the East Sound watershed is primarily forest land (70% of watershed), with some grass (14%) and scrub (15%) lands. Much of the forest land is harvestable timber. Most of the impervious areas are located in the village of Eastsound, the Village of Orcas, and Moran State Park. Moran State Park is one of the most developed areas in the County due to its network of roads, parking lots, and camping areas. Because of the heavy tree cover in the watershed, particularly in Moran State Park, impervious area is difficult to determine for the East Sound watershed.

Eastsound, the village, has the largest concentration of impervious area on Orcas. A stormwater collection system collects surface water from the streets and parking lots and pipes it directly to East Sound with no treatment, with the exception of the parking lots from Island Market which drain in to a constructed wetland provided for stormwater treatment. Contamination of the water from the storm drain entering Fishing Bay was documented in 1996 by Parsons and Ogier. The county has purchased property and conducted the design process to build a biofiltration facility in the Eastsound drainage.

There is a log rafting operation in Judd Cove at the head of East Sound. There are two small hazardous waste generators¹ in the village of Eastsound. There is a solid waste facility with a septic pumpout (septage) disposal lagoon in the western portion of the watershed. There are two service stations in the watershed, one just east of Crescent Beach and one on the shore of Eastsound above Fishing Bay.

There are approximately 27 miles of major county roads within the East Sound watershed. These roads carry the highest traffic loads recorded in San Juan County. The Eastsound watershed has among the steepest topography found in the San Juan Islands with more than 35 percent of the area having slopes of 15 percent or greater. Many of the soils found within the watershed are ranked high for erosion

¹ Permitted through the Department of Ecology, includes such businesses as gas stations, medical facilities, etc.

potential which means that once the soil is uncovered, it has a high propensity to erode and travel down gradient, often affecting other properties, wetlands, lakes, ponds and streams. Much of the land with the greatest erosion potential is located within the state park but the southeast shore and to a lesser extent the southwest shore of East Sound are also prone to erosion. Moreover, while much of the watershed receives an estimated 7 to 9 inches of stormwater runoff per year, many of the higher elevation slopes receive between 9 and 13 inches of runoff and some areas around Mount Constitution have more than 27 inches of runoff per year. These levels of runoff indicate the necessity for measures to reduce erosion impacts.

The steep topography increases the limitations already imposed by poor soils for on-site septic systems. The majority of the watershed has poor conditions for septic suitability.

East Sound has one marina located at Rosario Resort in Cascade Bay on the east side of East Sound. The resort has 35 permanent and transient moorages available. Fuel service and a boat ramp are provided. No repair facilities are available and liveaboards are permitted. Rosario Resort also has a permit to discharge treated wastewater into East Sound.

There are few areas of active agriculture within the East Sound watershed. The majority of agricultural uses are found on the west side of the watershed, with small scale agriculture operations in other areas. Livestock are limited but do include llamas in the area of Dolphin Bay and sheep, horses, and cattle. Animals observed ranged from 1 to 2 (cattle and horse) and 3 to 7 (sheep and llama) animals per acre.

Results of the initial water quality survey of the East Sound watershed showed that most sampling locations met state water quality standards for all parameters. The locations that did not meet standards were the stormwater outlet in the village of Eastsound across from the Outlook Inn (O11), the creek to Judd Cove (O10) and two sites in the Buck Bay area (Pickett Springs, O1, and Cascade Creek, O2).

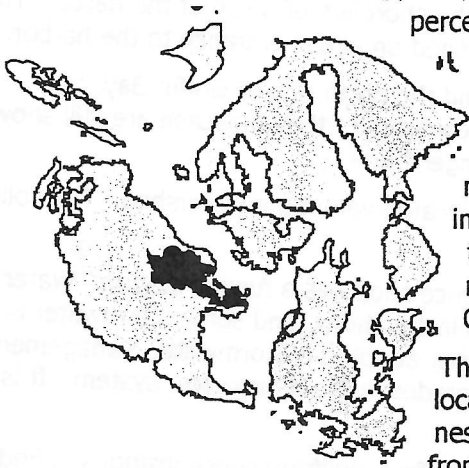
In follow-up monitoring performed during November through February (1997-1998) fecal coliforms were generally much lower but exceeded state standards in some samples. The Eastsound storm drain exceeded total suspended solids (TSS) thresholds on two occasions and one other small tributary to East Sound exceeded TSS the single time it was measured. On one occasion the Eastsound storm drain reached the upper limit (alkaline) of pH thresholds but all other results were within acceptable ranges. (See Chapter 5, Water Quality, for more information about sample results.)

In the Buck Bay area failing septic systems have been documented over the years where homes were built prior to the requirements for septic permits. Recent monitoring by the State Department of Health Shellfish Program show rising counts of coliforms in this area, although within state standards for shellfish growing.

Friday Harbor

Beneficial Uses

The Friday Harbor watershed was ranked second in the 1988 San Juan County Watershed Ranking Report. The watershed includes the Town of Friday Harbor, the only incorporated jurisdiction in the county, and the Port of Friday Harbor. Wetlands constitute over 11 percent of the Friday Harbor watershed, the largest proportion found in the county. Much of the area shown as wetland is currently in agriculture use but some small remnants of natural wetlands remain. Salmon Creek (also known as Beaverton Creek) is the largest creek draining to Friday Harbor and terminates near the UW Marine Labs. Two other small drainages terminate in Friday Harbor including the Spring Street culvert which drains the Town of Friday Harbor and a second short drainage just north of Spring Street. There are no lakes but there are several Class 3 ponds.



The harbor includes River Otter habitat. Some eel grass beds are located in the southeast portion of the harbor. Some Bald Eagle nests are documented. Historically, herring have been harvested from Friday Harbor in commercial quantities but no commercial or recreational fishing occurs now, except some crabbing and shrimp netting off the docks at the Port.

Watershed Condition

In addition to the Town and Port, the Friday Harbor watershed has five marinas, a haul-out facility, the Washington State Ferry dock, a community dock and several private docks on Brown Island. The harbor is used extensively for boat rendezvous. The Port of Friday Harbor is the largest marina in the San Juan Islands with 464 moorages. Liveboards are permitted in most of the marinas as well as permanent and transient moorage. Liveboards also moor in the harbor. A sewage pumpout facility is available at the

Watershed Acreage	3,505			
Landcover Vegetation			Current Land Use*	acres
Grasses	1,747	29%	Agriculture	491 14%
Dense Forest	2,227	38%	Timber Land	384 11%
Sparse Forest	570	10%	Conservation	0
Scrub	966	16%	Residential parcels (782)	913 26%
Wetlands			Town of Friday Harbor	250 7%
Upland freshwater	398	11%	Designated Growth Areas	Yes
Marine and intertidal	35		Upland Native Ecosystem	No
Lakes	na		Critical Marine Habitat	No
Streams	miles		Surface Water Resource Area	No
Class 3	0.75		Research/Education Areas	Yes
Class 4/5	7			
Drainage runoff	acre-feet			
Salmon Creek	1,476			

*Current land use information is from the County Assessor's records. Does not include commercial. Of the Town's 250 acres, 34% is commercial/industrial and 45% is vacant.

Port of Friday Harbor. Many tour boat operations utilize the Port facilities as well as seaplane service. Two marinas provide fuel service.

The largest contiguous area of impervious surfaces in the county is in Friday Harbor. Traffic levels in Friday Harbor are very high as all traffic to the island enters at this point. Many walk-on passengers from the ferries, tour boats, and small planes visit the Town, creating strains on the water and wastewater systems. The Town has chosen to limit sewer and water services to customers within its existing boundaries.

Urban, residential, and marina development has occurred along the shoreline of much of the harbor. The UW Marine Labs are located at the northeast corner of the watershed on at the entrance to the harbor.

A gravel pit is located between the south end of Friday Harbor and the north end of Griffin Bay, but closed extraction operations in the spring of 1999. The original contours of the landscape are still shown on the topography layer of the maps, but the hill shown is no longer there.

There are several permitted small hazardous waste generators¹ located within the watershed. The solid waste facility for San Juan Island is located in this watershed.

There are five service stations in town, and the county maintenance shop has a fueling station. Water and oil separators are present in some of the newer storm drain installations, and some stormwater is treated, but most drains to the harbor. The Town of Friday Harbor adopted a Stormwater Management Plan in 1997 and created a stormwater utility district to fund upgrades in the stormwater system. It is currently upgrading portions of its storm sewer system.

An investigation by Department of Ecology in 1983 concluded that fecal coliform concentrations in Friday Harbor marine waters were due to inadequate treatment of sewage discharge and improper boat waste disposal. A follow up report in 1986 cited improvements in the wastewater discharge and pointed to boat waste as a source of contamination.

Agriculture constitutes about 15 percent of the land use and is primarily pasture and hay land. Most of the lands in agriculture are located in or adjacent to wetlands. There is some harvestable timber in the watershed, mostly in the uplands. There are clearcut and thinned patches of forest evident.

Animals have access to the creek drainage at some locations. During a survey in the winter of 1997-98, animals observed were cattle, sheep, and some horses at densities of between one and four animals per acre. Ponded water was observed on many fields during the rainy season.

Much of the land outside of the Town of Friday Harbor has been designated for a high level of growth with a one-half acre density in the county's 1998 Comprehensive Plan and at this time is not built to development potential. The majority of the watershed is comprised of soils and terrain that have low erosion potential. The Town of Friday Harbor has sewer service, but much of the land with one-half to two acre development potential is not included. These lands occur in areas with poor soils for septic systems.

Water samples were taken near the outlet at Salmon Creek and at the Spring Street culvert in May of 1997. Both samples exceeded State standards for fecal coliforms and the Spring Street culvert exceeded recommended thresholds for nitrate. During subsequent sampling between November 1997 and February 1998, fecal coliform were in excess of 50 colonies/100 mL on all six sampling occasions at the Spring Street culvert. Levels of pH were close to threshold values, between 8.5 and 8.7 on all occasions, and exceeded the State freshwater standard of 8.5 in three out of seven samples. All other parameters were within acceptable ranges.

¹ Permitted through the Department of Ecology. These facilities include gas stations, medical facilities, the UW Marine Labs, etc.

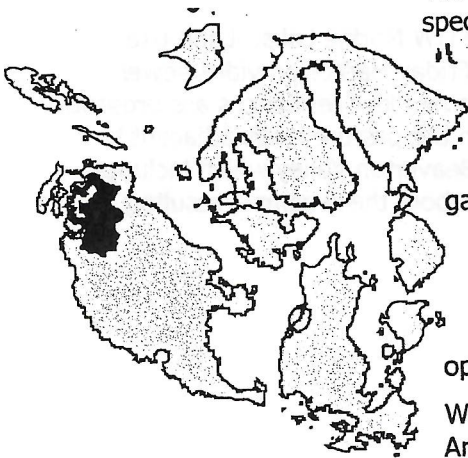
At Salmon Creek, fecal coliforms thresholds were exceeded in two out of six samples. During December and January, significant amounts of foam were observed at Salmon Creek (more than all other creeks surveyed) to the extent that foam levels reached past the top of the culvert under the road leading to the UW Marine Labs. Recommended thresholds for total suspended solids were exceeded once in Salmon Creek.

The sample site for Salmon Creek is located adjacent to the road to the UW Marine Labs. Land use upstream of the creek is agricultural and residential housing. Town of Friday Harbor provides sewer service to the majority of residential housing immediately upstream. Some older residences are present. A trailer park is located near the creek. Cattle were observed grazing in the pasture lands adjacent to some upstream stretches. This creek drains the extensive wetlands of Beaverton Valley which includes dense peat bogs. (See Chapter 5, Water Quality, for more information about these sample results.)

Westcott and Garrison Bay

Beneficial Uses

The Westcott-Garrison watershed was ranked third in the San Juan County Watershed Ranking Report of 1988. Westcott and Garrison bays have large areas of kelp beds and eel grass beds which are critical habitat for Pacific Herring and other prey fish that are essential for salmon and larger fish species. These bays are the primary shellfish harvest areas (mussels, clams and oysters) on San Juan Island. Westcott Bay has an active sea farm and Garrison Bay, which is bordered by English Camp National Park, is a popular recreational harvesting area.



Garrison Bay is an important historic site. In recent history, the British garrison that occupied San Juan Island was located in this sheltered bay, and prior to that time native peoples inhabited the site. English Camp National Park is a popular destination for visitors to the island. Westcott Bay is an important research area for marine biologists from the University of Washington and the location of Westcott Bay Sea Farms, a gourmet shellfish operation.

Westcott Bay has been proposed for designation as a Critical Marine Habitat Area, under the county's Shoreline Master Program, due to its value as a marine biological study area, shellfish resource, and its unique intertidal habitat which includes areas of salt marsh. A draft Westcott-Garrison Marine Habitat Mangement Area Plan has been prepared by the county that includes recommendations for marine habitat protection strategies.

English Camp is a 529 acre park administered by the National Park Service located in the watershed, as well as Briggs pond, a Class 1, 29.1 acre water body, the source of drinking water for the Roche Harbor area.

Watershed Acreage	3,609			
Landcover Vegetation			Current Land Use*	acres
Grasses	547	15%	Agriculture	552 15%
Dense Forest	1,158	32%	Timber Land	1,256 34%
Sparse Forest	227	6%	Conservation	616 17%
Scrub	538	14%	Residential parcels (134)	260 7%
Wetlands			Public Lands	830 22%
Upland freshwater	106			
Marine and intertidal	153		Designated Growth Areas	Yes
Lakes			Upland Native Ecosystem	Yes
Class 1 Briggs Pond	29		Critical Marine Habitat	Yes
Class 3	10		Surface Water Resource Area	Yes
Class 4/5	14		Research/Education Areas	Yes
Lakes/Freshwater Wetlands		4%		
Streams		miles		
Class 4/5	4			
Drainage runoff		acre-feet		
Briggs Pond	349			

*Current land use information is from the County Assessor's records.

There is a Class 3 lake of about 10 acres and a string of Class 4 and 5 intermittent lakes, wetlands and creeks, just over 14 acres total, draining to Garrison Bay. Westcott Bay has two significant creeks and one other small drainage feeding it. The southern creek to Westcott Bay, Doe Creek, begins at Brigg's Pond. The northern creek begins as a drainage from the hills at the top of the watershed boundary.

Watershed Condition

There are no marinas or boat ramps in Westcott and Garrison Bays but both are used extensively for boating rendezvous. A boat dock is provided for park visitors at English Camp. There is no fuel service in either watershed. There are no pumpout facilities for boats in these bays. There are no significant paved areas in the watershed.

The Westcott-Garrison watershed is about 50 percent forested and about 20 percent grass lands. Much of the forest land is harvestable timber though a significant proportion is part of English Camp and is not likely to be logged. The Department of Natural Resources and Roche Harbor Resort own the balance of the major forest land and have forest management plans. These areas were logged in recent years.

There are some agricultural uses in this watershed. Agricultural uses are primarily fields for hay and grazing. Large alpaca operations are present as well as a boarding stable for horses. In the winter of 1997, alpaca densities appeared to be about 3 to 10 per acre. Other livestock operations include cattle and sheep. Most of this farm land has been divided into 10 and 20 acre parcels. Livestock have access to the lower reaches of the stream leading to Garrison Bay.

The shoreline of all of Westcott Bay and the western edge of Garrison Bay is almost fully developed with an average density of one-half acre per unit. The northern edge of the watershed is part of the Roche Harbor Master Planned Resort area and could experience significant changes as the plans for the resort are developed. The balance of the watershed has a density of five to 10 acres per unit. Much of the land which is now forest resource lands, including the DNR land can be developed to 10 acres per unit. The National Park preserves a large portion of the forested watershed.

A drinking water treatment plant is located in this watershed near the drainage to the northern creek to Westcott Bay. This plant has a permit for discharge of waste water from the treatment process into the creek at the head of the bay. There is a closed solid waste landfill, once operated by Roche Harbor Resort, in the watershed, adjacent to Roche Harbor. No testing has been conducted at the site to determine possible contaminants.

The upper part of the watershed has a high erosion potential, most of which is currently forested, and the entire area has poor soils for septic treatment.

Water was sampled at the outlet of both streams leading to Westcott Bay and at the outlet to Garrison Bay in May of 1997. On that occasion fecal coliforms thresholds were exceeded at one site at Westcott Bay. Recommended thresholds for total suspended solids were exceeded at both creeks. All parameters were within acceptable ranges for the sample taken at the outlet to Garrison Bay.

A second sample was taken in June at both Westcott Bay locations and two upstream locations at major road crossings (*SJ15* and *SJ16*). Additional samples were taken during August and then November 1997 through February 1998. New sites were added including the saltwater near the dock at Westcott Bay Oyster Farm (*SJ22*) and one-time bacterial samples were also taken from a tributary to the north stream (*SJ16A*), the Bellevue Farm Pond (*SJ17*), a ditch downstream (*SJ24*) from an alpaca operation, and an upstream location on Doe Creek (*SJ23*).

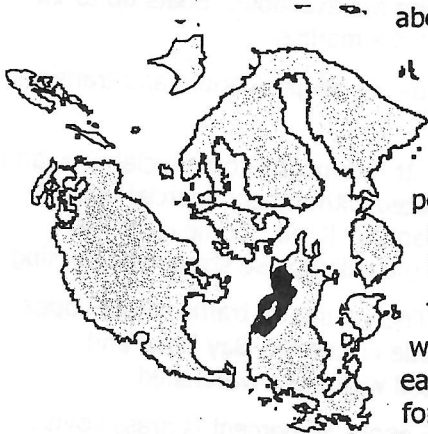
During the winter of 1997-8, both creeks to Westcott Bay exceeded 50 colonies/100mL on multiple occasions. The results indicate that runoff events are likely driving the flushing of bacterial pollution to the creeks and bays. Identification of problem areas may require frequent sampling during all stages of runoff events to assure that intermittent sources are not missed. (See Chapter 5, Water Quality, for more information on these results.)

In response to initial sample results, San Juan County Environmental Health conducted a sanitary survey of septic systems in the area during the winter of 1997-98. As a result, several failing septic systems were found in use that appeared to contribute directly to the streams with high fecal coliform counts. A program to repair these systems is currently underway.

Fisherman Bay

Beneficial Uses

The Fisherman Bay watershed was ranked seventh in the 1988 San Juan County Watershed Ranking Report. The bay consists of a narrow inlet with a mud flat barrier built up by wave action and widens to about one-half mile, forming a long, shallow, low-flushing bay between six and 24 feet deep. The west shore of the bay consists of a rocky island, which has been joined to the mainland of Lopez by a barrier beach formed through the process of accretion.



Fisherman Bay has substantial eel grass beds around the shore perimeter. The bay is no longer used for recreational hard-shell claming but historically was a local resource for shellfish. The bay has a large intertidal area which is highly valued by marine birds.

There are no fishery resources within the bay, but historically fin fish were harvested at the mouth of the bay. There are three documented eagle nests in the watershed and the bay is frequently used by eagles for hunting. Week's Wetland, purchased by the San Juan County Land Bank in 1993, lies adjacent to Lopez Village. This wetland is composed of two adjacent areas of high-salinity salt marsh. There is a channel between Fisherman Bay and the salt marsh which carries tidal waters into the wetlands producing an unusual and interesting plant community. The south end of the bay consists of a large area of tidal wetlands, shallow mudflats, and salt marsh with extensive shore- and seabird communities.

Fisherman Bay has many wetlands within its watershed which provide important wildlife habitat for wintering populations of waterfowl as well as migratory species of shorebirds. Some wetlands areas are used for agriculture.

There are two streams that connect wetlands that empty into San Juan Channel near the mouth of the bay. One other significant stream empties directly to Fisherman Bay, and there are two small drainages at the south end of the bay. This watershed overlays one of the few, large glacial aquifers in the county.

Watershed Acreage	2,070			
Landcover Vegetation			Current Land Use*	acres
Grasses	882	42%	Agriculture	0
Dense Forest	846	35%	Timber Land	61 3%
Sparse Forest	166	8%	Conservation	46 2%
Scrub	281	13%	Residential parcels (286)	638 31%
Wetlands			Public Lands	27 1%
Upland freshwater	97	5%	Designated Growth Areas	Yes
Marine and intertidal	310		Upland Native Ecosystem	No
Lakes	na		Critical Marine Habitat	Yes
Streams	miles		Surface Water Resource Area	No
Class 4/5	2		Research/Education Areas	Yes
Drainage runoff	acre-feet			
	na			

* Current land use information is from the County Assessor's records.

Watershed Condition

Fisherman Bay has two marinas, two boat ramps, and is used extensively as a rendezvous location for boaters. The two marinas, Island Lopez and Island Marine Center, are both located toward the center and on the east side of the bay.

Island Marine Center is a full service marina with 96 slips. Transient moorage is available, consisting of thirteen slips and 700 feet of breakwater. Liveboards are permitted at the marina and there are pumpout facilities. Motor repair, fiberglass repair and bottom scrubbing are available. Boats up to 15 tons can be hauled out with two travel lifts. A boat ramp is located at the marina.

The Island Lopez Resort is adjacent to Island Marine Center and provides 50-permanent and transient moorage spaces. Fuel is available, but there is no pumpout facility.

The community of Lopez Village is near the center of the watershed. It has mostly commercial uses and adjacent housing. Impervious areas within the watershed are associated with the commercial uses in the village, the marinas, and a few businesses located along Fisherman Bay Road. Some off street parking is provided, and many, particularly the businesses located in the village, use street side parking.

Fisherman Bay has approximately 7.9 miles of major county roads. The volume of traffic within Lopez Village is the highest in the area but other highly traveled roads include Fisherman Bay Road and Hummel Lake Road. Two vehicle service stations on Lopez are located within the watershed.

About 56% of the watershed is forested with harvestable timber and about 36 percent is grass cover. Much of this land is located in the northern watershed and is in agricultural uses. Most of the fields are hayed but some are grazed at low densities (1 to 5 animals per acre).

The Fisherman Bay watershed has very low erosion potential among the watersheds in the county, and moderate runoff. Much of the watershed has soils that have severe limitations for septic suitability. The Lopez Village core has sewer service as does some of the shoreline to the north and south of the village.

Residential development of the upland areas is increasing, with suburban-type densities in much of the watershed. The Lopez Village area has been designated as an activity center under the county's Comprehensive Plan. A large area to the east and south of the village has significantly more development capacity. The inland portions of the Fisherman Bay watershed are designated at 10 and 15 acres per unit. Currently, many large parcels remain larger than 100 acres.

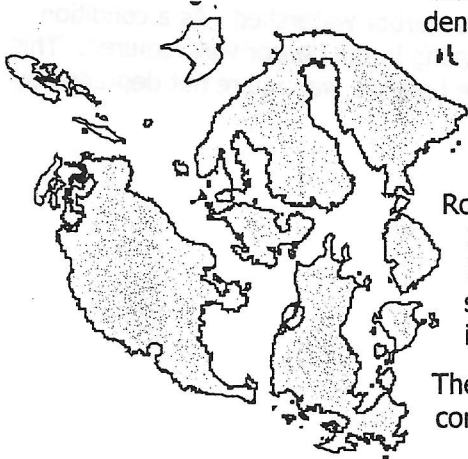
Water Quality

Three of the streams entering Fisherman Bay were sampled in early May of 1997. Water quality was good for all samples. A second sampling of the tributary to the main stream flowing direct to Fisherman Bay was sampled for bacteria in June of 1997 and, at that time, it exceeded 50 colonies/100 mL. This site and one other site, located at the south end of Lopez Sound, in saltwater, were monitored again on six occasions from November 1997 until February of 1998. Fecal coliforms standards for saltwater were exceeded once among the six samples taken of the salt water site. Fecal coliform standards for fresh water were exceeded five out of eight samples for the tributary to the creek draining to Fisherman Bay. All other parameters were in acceptable ranges.

Roche Harbor

Beneficial Uses

Roche Harbor watershed was ranked fifth in the 1988 San Juan County Watershed Ranking Report, despite its small size. This was due to concerns about impacts from potential sources of pollution, rather than beneficial uses, such as tourist-related activities and high density levels. There are no surface water resources in the Roche



Harbor watershed. There is a valuable coastal lagoon adjacent to Mosquito Pass dominated by intertidal communities. There is also a small freshwater wetland at the watershed boundary with Westcott Bay.

Roche Harbor has kelp beds and extensive eel grass habitat used by Pacific Herring. The northwestern side of White Point is noted for having habitat features important to migratory waterfowl and supporting a high diversity of plants and animals. It is also an important eagle habitat area.

There is no commercial fishing resource in Roche Harbor. Crabs are common and are harvested by residents and visitors.

Watershed Condition

The Roche Harbor watershed has one marina at Roche Harbor Resort, which recently expanded and provides 377 moorages for permanent, transient, and liveaboard moorage. Fuel service and pumpout facilities are available.

Roche Harbor Resort has an approved sewage treatment plant and a permit to discharge treated wastewater in Roche Harbor. A log rafting site is located at the south end of the harbor.

The watershed is primarily forested (45%) with some grass lands (25%). Land use is primarily residential and recreational. Compared to other watersheds, a significant portion of the Roche Harbor watershed is impervious or nearly impervious. Runoff from the impervious area is not treated before discharging to Roche Harbor.

Watershed Acreage	238			
Landcover Vegetation			Current Land Use*	acres
Grasses	547	15%	Agriculture	0
Dense Forest	1,158	32%	Timber Land	0
Sparse Forest	227	6%	Conservation	0
Scrub	538	14%	Residential parcels (84)	85 36%
Wetlands			Public Lands	0
Upland freshwater	3.5			
Marine and intertidal	43			
Lakes	na		Designated Growth Areas	Yes
Lakes/Freshwater Wetlands		1%	Upland Native Ecosystem	No
Streams	na		Critical Marine Habitat	Yes
Drainage runoff	na		Surface Water Resource Area	No
			Research/Education Areas	No

*Current land use information is from the County Assessor's records.

No agricultural land of significance occurs within this watershed. The land located at the core of the resort has a development potential of one-half acre per unit or more. Much of the watershed has been designated as a Master Planned Resort under the 1998 Comprehensive Plan. The remaining land in the watershed has a development potential of one-half to 2 acre per unit. Only part of the area is served by sewer at this time.

No water quality samples were taken of surface waters in the Roche Harbor watershed. As a condition of approval for expansion of the marina in 1996, water quality sampling in the harbor was required. This sampling will be used as a baseline measurement to assure that the harbor's waters are not degraded by boating activities in the future.

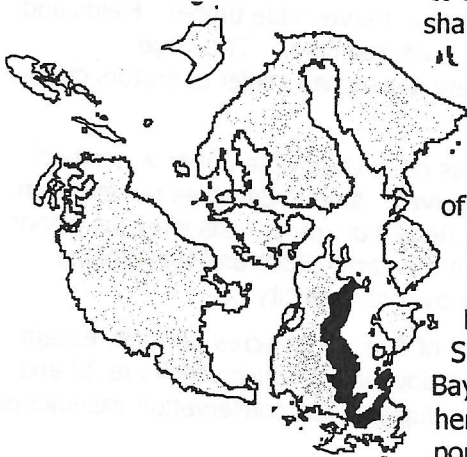


(The following table content is extremely faint and largely illegible. It appears to be a data table with multiple columns and rows, possibly detailing land use or watershed characteristics.)

Mud Bay and Hunter Bay (including Lopez Sound)

Beneficial Uses

The Mud-Hunter watershed was ranked sixth in the 1988 San Juan County Watershed Ranking Report. It includes a stretch of small drainages that feed directly into Lopez Sound. Mud Bay opens on the north to Lopez Sound. The bay is about one mile long and is quite shallow, with a depth at center of 12 to 14 feet.



Freshwater wetlands comprise a little over 3% of the watershed. There are a few inland wetlands, but many marine and intertidal wetland areas including salt marshes. The extensive salt marsh and mudflats of Mud Bay are rich with many species of birds, including Bald Eagle, Great Blue Heron, Kingfisher, Kildeer, as well as a large number of migratory and wintering shorebirds and waterfowl.

Mud and Hunter Bays have critical habitat for Pacific Herring. Substantial eel grass beds are located around the perimeter of Mud Bay, and the entire bay is a rich area for crabs, hard shell clams and herring. There is a state-certified mussel farm in the Hunter Bay portion of the receiving watershed and identified recreational

clamming areas in Mud Bay. The shoreline bordering Lopez Sound up to Spencer Spit contains eel grass and kelp beds. Much of Lopez Sound has abundant shrimp and has been a popular salmon fishing area.

The Washington State Department of Wildlife notes several Bald Eagle nests and has identified the entire area around Sperry Peninsula (privately owned) as a critical area for the Long-legged Bat. A wide diversity of plant community types are supported in the 380 acre area, including a few specimens of the Prickly Pear Cactus. The Nature Conservancy identified the area to be of national significance. Sperry Peninsula also includes the privately owned Henderson Lake, which is about 4 acres in size.

Spencer Spit State Park is located at the north end of the watershed. It is 130 acres with 45 camping units, 7,840 feet of shoreline and 16 boat mooring spots. The park provides recreational shellfish harvesting, crabbing, shrimping, fishing, swimming, and other water recreation.

Watershed Acreage	4,688			
Landcover Vegetation			Current Land Use*	acres
Grasses	928	20%	Agriculture	537 11%
Dense Forest	2,611	56%	Timber Land	610 13%
Sparse Forest	333	7%	Conservation	684 15%
Scrub	685	15%	Residential parcels (287)	1,144 24%
Wetlands			Public Lands	564 12%
Upland freshwater	161		Designated Growth Areas	No
Marine and intertidal	470		Upland Native Ecosystem	No
Lakes			Critical Marine Habitat	Yes
Class 2	4		Surface Water Resource Area	No
Lakes/Freshwater Wetlands		3%	Research/Education Areas	No
Streams		miles		
Class 4/5	3.8			
Drainage runoff		acre-feet		
		na		

*Current land use information is from the County Assessor's records.

There are five drainages to Mud and Hunter Bays total. The northernmost stream is the largest. Two tributaries feed one small creek terminating in Hunter Bay. Two very small drainages feed Mud Bay and another creek comes off of the west side of Sperry Peninsula. Several small drainages feed the shoreline north of Mud and Hunter bays, including one 2,000 foot stream.

Watershed Condition

The watershed is primarily forested (63 percent) the majority of which is harvestable timber. Fields and grasslands comprise 20 percent most of which is mowed, hayed, or pastured fields. The large agricultural areas are primarily in the upper watershed although there are some smaller operators closer to the shoreline. Residential uses dominate the shoreline.

Several of the drainages begin in the agricultural areas. Grazing was observed in the upper watershed but not near the shore. Cattle dominated but horses were also observed. Animal densities ranged from 2 to 5 animals per acre. Pasture condition was good to fair in most fields but some areas were very poor. The County has a closed landfill in the watershed that was closed in the early 1980s and is not being monitored. A septage lagoon is located at this site and is currently over its capacity.

A majority of the watershed area has a minimum residential density of five or ten acres per unit, except along the shoreline where it is two to one-half acre per unit, and portions in the north which are 20 and 40 acres per unit. The area of Sperry Peninsula is under one ownership and has conservation easements that limit the development potential.

The majority of the inland watershed has soils that have low erosion potential except for the shoreline areas and steep slopes surrounding Hunter Bay and the south end of Mud Bay. The majority of area with steeper slopes is currently covered by forest land. Septic suitability is poor throughout the watershed.

Water quality samples were taken in three locations at the south end of Lopez Island in May of 1997. These included the outlets of the northern stream leading to Hunter Bay (L13), and streams in Jasper Bay (L30) and Hughes Bay (L10). All parameters were within acceptable ranges.

From November 1997 until February of 1998, water quality was tested on six occasions at the outlet of streams entering Mud Bay (L33) and Hunter Bay (L32). Fecal coliform counts right at the outlet in Mud Bay (mixed saltwater and freshwater) exceeded 50 colonies/100 mL in four out of six samples. The outlet to Hunter Bay (freshwater) also exceeded thresholds for fecal coliforms in three out of the six samples. All other parameters measured were within acceptable ranges. (See Chapter 5, Water Quality, for more information about these samples.)

Hunter Bay is monitored for fecal coliform counts by Washington State as part of its shellfish certification program and is well within standards for shellfish areas.

West Sound

Beneficial Uses

The West Sound watershed was ranked seventh in the 1988 San Juan County Watershed Ranking Report. Historically the sound was fished heavily for commercial herring and shrimp harvests. The area contains critical habitat for Pacific Herring and River Otter and many species of migratory waterfowl, including Buffleheads, scaups, goldeneyes, grebes and scoters. The west side of West Sound is a highly active Bald Eagle nesting area. Currently, there are no identified shellfish, shrimp or crab harvesting locations in West Sound. There are sizable areas of eel grass beds and intertidal nearshore habitat. Several midden areas are found along the shores of West Sound, including White Beach Bay, which derived its name from the abundance of shell remains left by native residents.



West Sound watershed contains Schaefer Lake, a Class 2 water body of about 4 acres, a large marsh area of about 60 acres, numerous ponds and small wetlands, but no major surface water resources. There are three main drainage systems in the watershed and several smaller ones. The largest system is the Crow Valley drainage which terminates near Westsound, with an estimated annual runoff of 2,276 acre-feet, the second largest drainage basin in the county. The second largest drainage in the watershed terminates at Bayhead, near Orcas Village. The third major drainage terminates at the head of Massacre Bay.

Orcas Knob in the West Sound watershed is an important natural area with near-climax forest conditions. The south slope of Turtleback Mountain has a rare open woodland oak-savannah landscape mixed with Rocky Mountain Juniper.

Watershed Acreage	8,428			
Landcover Vegetation			Current Land Use*	acres
Grasses	2,029	24%	Agriculture	1,047 12%
Dense Forest	4,058	47%	Timber Land	2,563 30%
Sparse Forest	870	10%	Conservation	1,532 18%
Scrub	1,376	16%	Residential parcels (337)	2,582 30%
Wetlands			Public Lands	0
Upland freshwater	254			
Marine and intertidal	292			
Lakes			Designated Growth Areas	Yes
Class 2 Schaefer	4			
Streams	miles		Upland Native Ecosystem	Yes
Class 3	1.1			
Class 4/5	8		Critical Marine Habitat	Yes
Drainage runoff	acre-feet			
Crow Valley	2,276		Surface Water Resource Area	No
Victorian Valley	929			
			Research/Education Areas	No

*Current land use information is from the County Assessor's records.

Watershed Condition

The West Sound watershed has the largest area of open farmland and wet meadows on Orcas Island, including Crow Valley and Warm Valley, and receives the bulk of the drainage from the eastern side of the Turtleback range. Much of the land adjacent to the major drainage corridors through Crow Valley is wetland and is in agricultural use. There are several livestock operations that include fields for grazing and hay. Most of the stream corridors in Crow Valley have excellent vegetative cover, but some are disturbed, and animals have access to streams and wetlands in some areas. A group of residents are working to reestablish a fish run in the Crow Valley Creek. A large and valuable marsh in the eastern part of the watershed collects runoff from Mount Woolard, which is extensively forested, and drains to Bayhead, next to Orcas Village.

Orcas Village is located at the edge of West Sound, on the southeastern end of the watershed, and contains a small public dock and private marina, fuel dock, fuel storage tanks, ferry landing, and several commercial businesses. This area is served by a sewer system. Large parking areas serve the ferry dock and businesses in the Village. The village area is designated for future commercial growth as an activity center under the County's comprehensive plan. All the vehicular traffic coming to and going from Orcas Island passes through this location.

There are about 15 miles of major county roads in the West Sound watershed. Fuel service is provided at Orcas Village and West Sound Marina. In the past, fuel was available at the Westsound Store.

West Sound Marina is located near the center of the eastern shoreline of West Sound. The marina has permanent moorage for 160 boats, transient moorage, boat ramp, and full boat service including haul-outs up to 30 tons. Liveboards are allowed and pump-out facilities are available. A county dock, two private marinas, at Bayhead and White Beach, and several community docks are also located in West Sound. The area is popular as a boating rendezvous location. A large log rafting operation is located near White Beach. In the past a lime kiln operation was located in West Sound.

Two of the streams monitored between spring of 1997 and spring of 1998 showed fecal coliforms in excess of state standards. In the upper reaches of the Crow Valley Creek, 100 percent of six samples taken exceeded 50 cfu/100mL. The creek drainage from Warm Valley exceeded 50 cfu/100mL in 42 percent of the samples taken. (See Chapter 5, Water Quality, for more information about these sample results.)

Between December 1993 and October 1994, the San Juan County Conservation District conducted a survey of well water quality in 41 wells in the Crow Valley area. Out of 80 samples taken for coliforms, 16 samples were positive for fecal organisms. The wells contaminated with fecal coliforms were shallow, dug wells, generally with direct contact to surface runoff from adjacent farm activities.

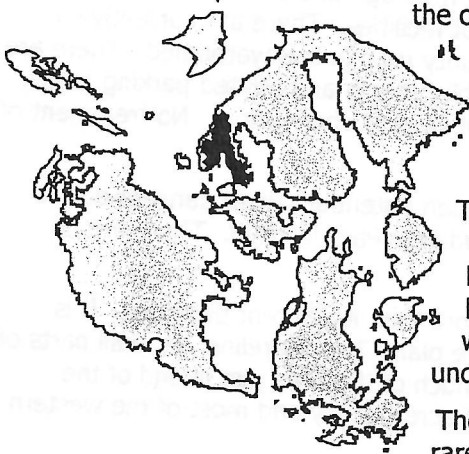
Agricultural land in Crow Valley has decreased over the last 50 years and forest is beginning to encroach on some long established pastures. Conversion of farm and forest land to residential use is reducing the number of larger landholdings.

Large areas of this watershed are currently well below the development potential designated in the county's comprehensive plan, including Turtleback Mountain, Mt. Woolard and much of Crow Valley. Crow Valley's agricultural land has a density designation of one residence per 20 acres. The upland areas of the watershed have a five or 10 acre per unit density designation. The shoreline areas have a density of two acres per unit. Orcas Village contains an urban area designated 6 units per acre, with a one-half acre per unit density for rest of the area. One of the greatest concerns for the watershed is the erosion potential of Turtleback Mountain and parts of Mount Woolard as land is converted to residential use. All but a few small areas of the watershed have severely limited soils for on-site septic systems.

Deer Harbor

Beneficial Uses

The Deer Harbor watershed was ranked eighth in the 1988 San Juan County Watershed Ranking Report. The depth of the harbor is reported to be 30 to 45 feet deep. It is known as an important habitat for the Pacific Loon. There are eel grass beds and kelp beds and several of the outer islands in the harbor are used by seals as haulouts.



There are no shellfish habitat areas and recreational and commercial fishing is minimal in Deer Harbor. Historically the area has supported a large crab population, which was commercially harvested.

The Spring Point community of 54 homes is served by a surface water supply. There are a few unique wetlands including the Deer Harbor Lagoon and the Frank Richardson wildlife preserve. The Frank Richardson Preserve is a marsh area of about 20 acres which drains to Deer Harbor. Most of the Deer Harbor Lagoon is under conservation easement with the San Juan County Land Bank.

The Ring-necked Duck is reported to nest in this wetland, one of the rare places in the San Juans this species is found. A second stream

drainage flows from two tributaries at the head of Deer Harbor Lagoon creating a unique estuary where freshwater enters this tidally influenced lagoon.

About 50 acres of cliffs and rocky soils along the west side of Deer Harbor support an understory of native grasses and mosses and an uncommon native plant called False Boxwood (*Pachistima myrsinites*). These cliffs are unusual habitat and provide protected resting areas for birds.

Deer Harbor is a popular recreation site for boaters and other vacationers, as well as residents.

Watershed Acreage	1,808			
Landcover Vegetation			Current Land Use*	acres
Grasses	403	22%	Agriculture	35 2%
Dense Forest	858	47%	Timber Land	221 12%
Sparse Forest	224	12%	Conservation	70 4%
Scrub	288	16%	Residential parcels (156)	432 24%
Wetlands			Public Lands	0
Upland freshwater	65	3%	Designated Growth Areas	Yes
Marine and intertidal	60		Upland Native Ecosystem	No
Lakes	na		Critical Marine Habitat	No
Streams	miles		Surface Water Resource Area	Yes
Class 3	0.4		Research/Education Areas	No
Class 4/5	2			
Drainage runoff	acre-feet			
	na			

*Current land use information is from the County Assessor's records.

Watershed Condition

Land use in the Deer Harbor watershed is primarily residential with some agriculture, and includes the resort development at the village of Deer Harbor. Forests dominate the land cover (60 percent of watershed). Grasslands cover about 22 percent of the watershed. Of these lands between 10 and 15 percent are in active agriculture and primarily used for grazing and haying. Animals observed were primarily cattle and horses and at densities of less than five animals per acre. Deer Harbor has two marinas and a boat repair facility. Both marinas provide permanent moorage and some liveaboards. Deer Harbor resort provides transient moorage, fuel service and pumpout facilities. There are currently six liveaboards in Deer Harbor. There are about 6.5 miles of major county road in this watershed. There are several acres of impervious areas associated with commercial establishments and related parking areas, mostly located near the shoreline areas. Fuel service is available at Deer Harbor Resort. No treatment of stormwater runoff occurs from these areas.

A large part of the watershed and all of the shoreline has high erosion potential. Road damage due to erosion occurred in the watershed between Deer Harbor Resort and Pole Pass in 1998. There are no soils suitable for septic disposal in the watershed.

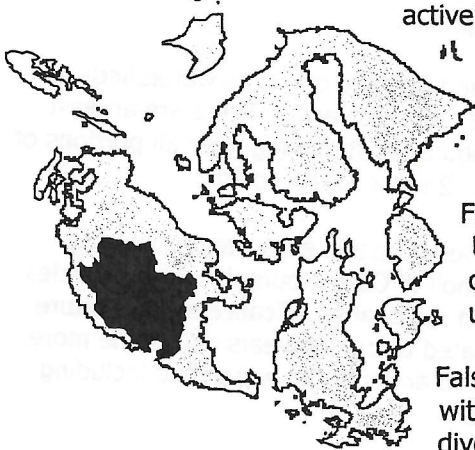
The Deer Harbor watershed is expected to develop significantly more than its current densities. It is designated as a Hamlet under the county's adopted comprehensive plan. The shoreline, as in all parts of the county is designated for one residence per one-half acre but much of the area just inland of the shoreline surrounding Deer Harbor and the lagoon is also one-half acre density and most of the western watershed has the potential to be developed into two acre parcels.

Streams in the Deer Harbor watershed were sampled in five locations as part of the initial water quality survey performed in the May of 1997. All samples were within acceptable water quality ranges with the exception of one fecal bacteria sample taken at Site *O4* and a temperature reading that was 0.2°C over the state threshold at Site *O17*. Neither condition is extreme.

False Bay

Beneficial Uses

The False Bay watershed was ranked 9th in the 1988 San Juan County Watershed Ranking Report. It contains the most extensive grassland acreage as well as the most actively used farmland in the county. It is the largest drainage basin of all the watersheds in the county and includes the water supply source for the Town of Friday Harbor. This extensive drainage system (11,697 acres) terminates in the relatively small receiving waters (232 acres) of False Bay.



False Bay is a marine biological preserve belonging to the University of Washington Friday Harbor Laboratories. The Labs own 200 acres of tidelands and uplands at the bay. This area is used extensively for research purposes.

False Bay consists of a large area of tidal flats which, in conjunction with the upland wildlife preserve, provide excellent habitat for a high diversity of plants, birds, and sea life, including many intertidal species generally found on the open coast (Giant Green Anemones, Gooseneck Barnacles, and California Mussels). False Bay has no recreational or commercial fishing or shellfish harvest. Abalone and sea

Watershed Acreage	11,697			
Landcover Vegetation			Current Land Use*	acres
Grasses	5,286	45%	Agriculture	3,741 12%
Dense Forest	3,040	26%	Timber Land	765 30%
Sparse Forest	1,030	9%	Conservation	1,173 18%
Scrub	2,106	18%	Residential parcels (414)	2,666 23%
Wetlands			Public Lands	1.35
Upland freshwater	743			
Marine and intertidal	232			
Lakes			Designated Growth Areas	No
Class 1 Trout	60			
Class 1 Lawson	12.5		Upland Native Ecosystem	Yes
Class 2 Woods	29			
Class 2 Zylstra	70		Critical Marine Habitat	Yes
Lakes and Freshwater Wetlands		6%		
Streams	miles			
Class 2	2.5		Surface Water Resource Area	Yes
Class 3	8.5			
Class 4/5	12		Research/Education Areas	Yes
Drainage runoff	acre-feet			
	3,154			

*Current land use information is from the County Assessor's records.

urchins have been harvested in the past in the outer coastal waters of the watershed. Due to its shallow nature and status as a preserve there is no boating activity.

Substantial eel grass beds and kelp beds are located at the mouth and along the coastline adjacent to the bay. Nearby areas are used as seal haul-outs. There are numerous breeding, nesting, and wintering sites for an abundance of resident and migratory birds in the watershed. These birds utilize the shoreline, tidelands, and freshwater wetlands, as well as forested uplands.

The False Bay watershed has the greatest extent of identified wetland acreage of all the watersheds in the county. A significant portion of the watershed is a surface water resource area. There are at least two streams of significance draining to False Bay with numerous tributaries stemming from all portions of the watershed. The largest creek, San Juan Creek, is the only Class 2 creek in the county.

The False Bay watershed has several notable areas that are examples of native ecosystems including grassland Oak-savannah communities and open woodlands. The knoll of Cady Mountain which provides part of the watershed boundaries has been classified as having high regional significance by the Nature Conservancy (1975). Some of the oak trees found there are estimated to be 400 years old. Some more unusual terrestrial island wildlife have important habitat in the upland areas of the watershed including the Northern Alligator Lizard, Purple Martins, and Trumpeter swans.

Trout Lake is located in this watershed and is the main water supply for the town of Friday Harbor, and supplies water to a large portion of the island's population. It is the largest Class 1 type water body on San Juan Island. Lawson Lake is a 12.5 acre Class 1 type water body that augments Friday Harbor's water supply. Wood reservoir is a 29 acre, Class 2 impoundment. Zylstra Lake is 70 acres and was created to provide irrigation water. There also are several Class 2 through 5 water bodies less than 5 acres in size.

Watershed Condition

Agricultural uses in False Bay are continuing their historical presence although more land is being converted to rural-residential use with farming occurring on smaller acreages. Livestock operations include sheep, cattle, and horses primarily. A field survey in the winter of 1997-98 revealed that most fields were in fair condition, but some overgrazing and poor management was apparent. During the winter most of the fields at the valley bottom are saturated with standing pools of water. In some cases animals are being pastured through the winter with access to the creeks and saturated areas.

Most of the length of San Juan Valley Creek is unprotected with little canopy cover. The creek flows through agriculture lands with a residential density of 40 acres per unit. The remainder of the watershed has a density potential of 5 acres per unit with some sections in the upper areas designated for 10 acres per unit.

There are upland areas with high erosion potential and on-site septic suitability is poor in all of the watershed. Traffic in the False Bay watershed is lower than in many other watersheds as there are no significant tourist destinations.

Several reaches of both streams leading to False Bay were sampled during May and June of 1997. San Juan Valley Creek, the major drainage to False Bay, was found to have fecal coliforms exceeding State standards in two locations sampled, both in the lower watershed area. One of the sites was monitored

for six weeks between November 1997 and February of 1998. During that period four of six samples exceeded 50 colonies/100mL. (See Chapter 5, Water Quality, for more information about these results.) Fecal contamination of a community water system well was documented in the upper watershed in 1999. The suspected source is a failing septic system. (SJC Health and Community Services)

The land use adjacent to San Juan Valley Creek and upstream from the sampling locations is largely agriculture. The creek runs through several agricultural fields and is unfenced for most of its route, leaving it accessible for animal use. The drainage area is highly saturated for a significant portion of the year due to runoff from the surrounding hills and the generally low-lying topography of the basin floor. In such conditions, water in the pastures can essentially be flowing through and on top of the soil. Both livestock and failing septic systems are concerns for sources of fecal contamination in this area.

Chapter 6, Descriptions of the Individual Priority Watersheds

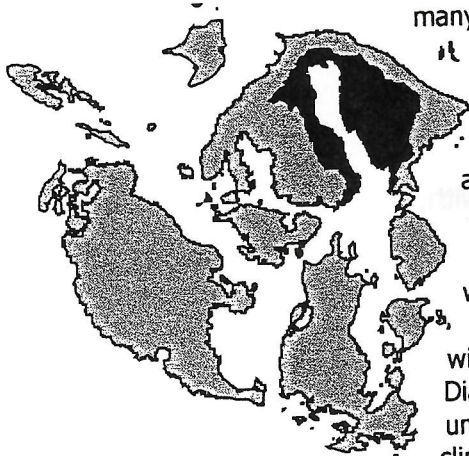
The following watersheds have been used as examples throughout this document and are described in this chapter in detail. They are the top ranked watersheds from the 1988 San Juan County Watershed Ranking Report.

1. East Sound (Orcas Island),
2. Friday Harbor (San Juan Island),
3. Westcott/Garrison bays (San Juan Island),
4. Fisherman Bay (Lopez Island),
5. Roche Harbor (San Juan Island),
6. Mud/Hunter bays and Lopez Sound (Lopez Island),
7. West Sound (Orcas Island),
8. Deer Harbor (Orcas Island), which tied for points with,
9. False Bay (San Juan Island).

East Sound

Beneficial Uses

Because of its wetlands, streams, lakes, and habitat areas, as well as large area of state parks, the East Sound watershed was ranked number one by the San Juan County Watershed Ranking Committee in its 1988 watershed ranking report. The East Sound watershed has



many of the important wetlands found on Orcas Island. These include Crescent Beach wetland, a 5.5 acre brackish marsh adjacent to Crescent Beach, Otter's Pond, one of the most diverse wetlands in the County, and the Eastsound swale, which once was a large wetland but has been greatly diminished and altered by adjacent development.

The large lakes and many ponds found in the watershed also provide wildlife habitat and scenic values. Several sites within the watershed have been inventoried by the Nature Conservancy and ranked according to their significance for maintaining biodiversity within the county. The largest site is the Woolard Mountain - Diamond Hill area. The site is noteworthy as it is mostly undeveloped with several stands of virgin hemlock, which is the climax forest species for this site. An area on Entrance Mountain,

recently purchased by the San Juan County Land Bank, was also identified as significant to the County for its unusually large stand of Sitka Spruce.

Watershed Acreage	13,933			
Landcover Vegetation			Current Land Use*	acres
Grasses	1,626	12%	Agriculture	479 3%
Dense Forest	8,947	64%	Timber Land	1,754 13%
Sparse Forest	736	5%	Conservation	1,256 9%
Scrub	1,997	14%	Residential parcels (813)	2,174 16%
Wetlands			Public Lands	3,783 27%
Upland freshwater	358		Designated Growth Areas	Yes
Marine and intertidal	517		Upland Native Ecosystem	Yes
Lakes			Critical Marine Habitat	Yes
Class 1 Cascade	172		Surface Water Resource Area	Yes
Class 1 Mountain	198		Research/Education Areas	Yes
Class 1 Martins	28			
Class 2 Summit	10			
Class 2 Ayer Res.	10			
Class 2 Flahertys	2.5			
Class 2 Fowler	9			
Class 3	3			
Lakes/Freshwater Wetlands		6%		
Streams		miles		
Class 3	4.2			
Class 4/5	9.5			
Drainage runoff		acre-feet		
Mountain Lake	1,899			

*Current land use information is from the County Assessor's records.

East Sound, itself, contains critical habitat for River Otter, Harbor seal and Pacific Herring and boasts a rich diversity of plant and animal species, including increasingly rare eel grass beds. The coastal portions of the watershed provide extensive areas of eagle habitat and many nests of Bald Eagle, Osprey, Great Blue Heron and turkey vulture are documented by Washington State's Natural Heritage Program. The depths of East Sound are fairly uniformly 90 feet throughout its six to seven mile length. State certified Oyster growing areas are actively used along Crescent Beach off of Ship Bay and the Buck Bay area has an active commercial shellfish operation. Hard-shell clams are located on the northwest and southeast portions of the sound. Areas located at the mouth and at the head of the sound on the eastern side are used for crabbing. Almost the entire sound is used for fishing. A small private fish hatchery for King salmon is operated inland about mid-way on the eastern side of the watershed.

The watershed encompasses Moran State Park which is among the largest state parks in Washington. The Class 1 Lakes, Cascade Lake (171.6 acres) and Mountain Lake (198 acres) provide recreation to the island's residents and visitors as well as drinking water for the Rosario and Doe Bay-Olga water systems. Summit Lake (10 acres), also in Moran State Park, is much smaller and shallower (only about 10 feet deep) and is a Class 2 lake. Other significant lakes in the watershed include Martin Lake (27.8 acres, Class 1), Ayer Reservoir (10.3 acres, Class 2) and Flaherty's Pond (2.5 acres, Class 2). Many small ponds are also distributed throughout the watershed which vary from Class 2 to 5.

Streams flowing to East Sound include a creek that flows from Cascade Lake to Cascade Bay, a creek that starts from Ayer reservoir and another creek that begins near the head of Crow Valley drains northeast into Judd Cove. Cascade and Cold creeks are year-round streams that support anadromous fish and have been established as a priority for Searun Cutthroat trout and Coho salmon by Washington State Department of Fish and Wildlife (1999). Many other creeks exist in the watershed, though the majority are seasonal.

Watershed Conditions

Land use in the watershed is primary residential, with some forestry and agriculture. Eastsound Village, at the head of East Sound, is the second largest town in the county but is unincorporated. Land cover in the East Sound watershed is primarily forest land (70% of watershed), with some grass (14%) and scrub (15%) lands. Much of the forest land is harvestable timber. Most of the impervious areas are located in the village of Eastsound, the Village of Orcas, and Moran State Park. Moran State Park is one of the most developed areas in the County due to its network of roads, parking lots, and camping areas. Because of the heavy tree cover in the watershed, particularly in Moran State Park, impervious area is difficult to determine for the East Sound watershed.

Eastsound, the village, has the largest concentration of impervious area on Orcas. A stormwater collection system collects surface water from the streets and parking lots and pipes it directly to East Sound with no treatment, with the exception of the parking lots from Island Market which drain in to a constructed wetland provided for stormwater treatment. Contamination of the water from the storm drain entering Fishing Bay was documented in 1996 by Parsons and Ogier. The county has purchased property and conducted the design process to build a biofiltration facility in the Eastsound drainage.

There is a log rafting operation in Judd Cove at the head of East Sound. There are two small hazardous waste generators¹ in the village of Eastsound. There is a solid waste facility with a septic pumpout (septage) disposal lagoon in the western portion of the watershed. There are two service stations in the watershed, one just east of Crescent Beach and one on the shore of Eastsound above Fishing Bay.

There are approximately 27 miles of major county roads within the East Sound watershed. These roads carry the highest traffic loads recorded in San Juan County. The Eastsound watershed has among the steepest topography found in the San Juan Islands with more than 35 percent of the area having slopes of 15 percent or greater. Many of the soils found within the watershed are ranked high for erosion

¹ Permitted through the Department of Ecology, includes such businesses as gas stations, medical facilities, etc.

potential which means that once the soil is uncovered, it has a high propensity to erode and travel down gradient, often affecting other properties, wetlands, lakes, ponds and streams. Much of the land with the greatest erosion potential is located within the state park but the southeast shore and to a lesser extent the southwest shore of East Sound are also prone to erosion. Moreover, while much of the watershed receives an estimated 7 to 9 inches of stormwater runoff per year, many of the higher elevation slopes receive between 9 and 13 inches of runoff and some areas around Mount Constitution have more than 27 inches of runoff per year. These levels of runoff indicate the necessity for measures to reduce erosion impacts.

The steep topography increases the limitations already imposed by poor soils for on-site septic systems. The majority of the watershed has poor conditions for septic suitability.

East Sound has one marina located at Rosario Resort in Cascade Bay on the east side of East Sound. The resort has 35 permanent and transient moorages available. Fuel service and a boat ramp are provided. No repair facilities are available and liveaboards are permitted. Rosario Resort also has a permit to discharge treated wastewater into East Sound.

There are few areas of active agriculture within the East Sound watershed. The majority of agricultural uses are found on the west side of the watershed, with small scale agriculture operations in other areas. Livestock are limited but do include llamas in the area of Dolphin Bay and sheep, horses, and cattle. Animals observed ranged from 1 to 2 (cattle and horse) and 3 to 7 (sheep and llama) animals per acre.

Results of the initial water quality survey of the East Sound watershed showed that most sampling locations met state water quality standards for all parameters. The locations that did not meet standards were the stormwater outlet in the village of Eastsound across from the Outlook Inn (O11), the creek to Judd Cove (O10) and two sites in the Buck Bay area (Pickett Springs, O1, and Cascade Creek, O2).

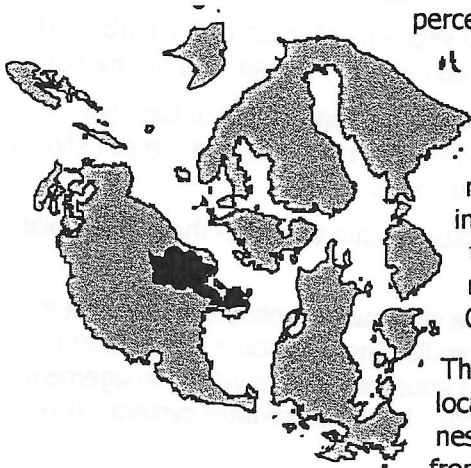
In follow-up monitoring performed during November through February (1997-1998) fecal coliforms were generally much lower but exceeded state standards in some samples. The Eastsound storm drain exceeded total suspended solids (TSS) thresholds on two occasions and one other small tributary to East Sound exceeded TSS the single time it was measured. On one occasion the Eastsound storm drain reached the upper limit (alkaline) of pH thresholds but all other results were within acceptable ranges. (See Chapter 5, Water Quality, for more information about sample results.)

In the Buck Bay area failing septic systems have been documented over the years where homes were built prior to the requirements for septic permits. Recent monitoring by the State Department of Health Shellfish Program show rising counts of coliforms in this area, although within state standards for shellfish growing.

Friday Harbor

Beneficial Uses

The Friday Harbor watershed was ranked second in the 1988 San Juan County Watershed Ranking Report. The watershed includes the Town of Friday Harbor, the only incorporated jurisdiction in the county, and the Port of Friday Harbor. Wetlands constitute over 11 percent of the Friday Harbor watershed, the largest proportion found in the county. Much of the area shown as wetland is currently in agriculture use but some small remnants of natural wetlands remain. Salmon Creek (also known as Beaverton Creek) is the largest creek draining to Friday Harbor and terminates near the UW Marine Labs. Two other small drainages terminate in Friday Harbor including the Spring Street culvert which drains the Town of Friday Harbor and a second short drainage just north of Spring Street. There are no lakes but there are several Class 3 ponds.



The harbor includes River Otter habitat. Some eel grass beds are located in the southeast portion of the harbor. Some Bald Eagle nests are documented. Historically, herring have been harvested from Friday Harbor in commercial quantities but no commercial or recreational fishing occurs now, except some crabbing and shrimp netting off the docks at the Port.

Watershed Condition

In addition to the Town and Port, the Friday Harbor watershed has five marinas, a haul-out facility, the Washington State Ferry dock, a community dock and several private docks on Brown Island. The harbor is used extensively for boat rendezvous. The Port of Friday Harbor is the largest marina in the San Juan Islands with 464 moorages. Liveaboards are permitted in most of the marinas as well as permanent and transient moorage. Liveaboards also moor in the harbor. A sewage pumpout facility is available at the

Watershed Acreage	3,505		
Landcover Vegetation		Current Land Use*	acres
Grasses	1,747 29%	Agriculture	491 14%
Dense Forest	2,227 38%	Timber Land	384 11%
Sparse Forest	570 10%	Conservation	0
Scrub	966 16%	Residential parcels (782)	913 26%
Wetlands		Town of Friday Harbor	250 7%
Upland freshwater	398 11%	Designated Growth Areas	Yes
Marine and intertidal	35	Upland Native Ecosystem	No
Lakes	na	Critical Marine Habitat	No
Streams	miles	Surface Water Resource Area	No
Class 3	0.75	Research/Education Areas	Yes
Class 4/5	7		
Drainage runoff	acre-feet		
Salmon Creek	1,476		

*Current land use information is from the County Assessor's records. Does not include commercial. Of the Town's 250 acres, 34% is commercial/industrial and 45% is vacant.

Port of Friday Harbor. Many tour boat operations utilize the Port facilities as well as seaplane service. Two marinas provide fuel service.

The largest contiguous area of impervious surfaces in the county is in Friday Harbor. Traffic levels in Friday Harbor are very high as all traffic to the island enters at this point. Many walk-on passengers from the ferries, tour boats, and small planes visit the Town, creating strains on the water and wastewater systems. The Town has chosen to limit sewer and water services to customers within its existing boundaries.

Urban, residential, and marina development has occurred along the shoreline of much of the harbor. The UW Marine Labs are located at the northeast corner of the watershed on at the entrance to the harbor.

A gravel pit is located between the south end of Friday Harbor and the north end of Griffin Bay, but closed extraction operations in the spring of 1999. The original contours of the landscape are still shown on the topography layer of the maps, but the hill shown is no longer there.

There are several permitted small hazardous waste generators¹ located within the watershed. The solid waste facility for San Juan Island is located in this watershed.

There are five service stations in town, and the county maintenance shop has a fueling station. Water and oil separators are present in some of the newer storm drain installations, and some stormwater is treated, but most drains to the harbor. The Town of Friday Harbor adopted a Stormwater Management Plan in 1997 and created a stormwater utility district to fund upgrades in the stormwater system. It is currently upgrading portions of its storm sewer system.

An investigation by Department of Ecology in 1983 concluded that fecal coliform concentrations in Friday Harbor marine waters were due to inadequate treatment of sewage discharge and improper boat waste disposal. A follow up report in 1986 cited improvements in the wastewater discharge and pointed to boat waste as a source of contamination.

Agriculture constitutes about 15 percent of the land use and is primarily pasture and hay land. Most of the lands in agriculture are located in or adjacent to wetlands. There is some harvestable timber in the watershed, mostly in the uplands. There are clearcut and thinned patches of forest evident.

Animals have access to the creek drainage at some locations. During a survey in the winter of 1997-98, animals observed were cattle, sheep, and some horses at densities of between one and four animals per acre. Ponded water was observed on many fields during the rainy season.

Much of the land outside of the Town of Friday Harbor has been designated for a high level of growth with a one-half acre density in the county's 1998 Comprehensive Plan and at this time is not built to development potential. The majority of the watershed is comprised of soils and terrain that have low erosion potential. The Town of Friday Harbor has sewer service, but much of the land with one-half to two acre development potential is not included. These lands occur in areas with poor soils for septic systems.

Water samples were taken near the outlet at Salmon Creek and at the Spring Street culvert in May of 1997. Both samples exceeded State standards for fecal coliforms and the Spring Street culvert exceeded recommended thresholds for nitrate. During subsequent sampling between November 1997 and February 1998, fecal coliform were in excess of 50 colonies/100 mL on all six sampling occasions at the Spring Street culvert. Levels of pH were close to threshold values, between 8.5 and 8.7 on all occasions, and exceeded the State freshwater standard of 8.5 in three out of seven samples. All other parameters were within acceptable ranges.

¹ Permitted through the Department of Ecology. These facilities include gas stations, medical facilities, the UW Marine Labs, etc.

At Salmon Creek, fecal coliforms thresholds were exceeded in two out of six samples. During December and January, significant amounts of foam were observed at Salmon Creek (more than all other creeks surveyed) to the extent that foam levels reached past the top of the culvert under the road leading to the UW Marine Labs. Recommended thresholds for total suspended solids were exceeded once in Salmon Creek.

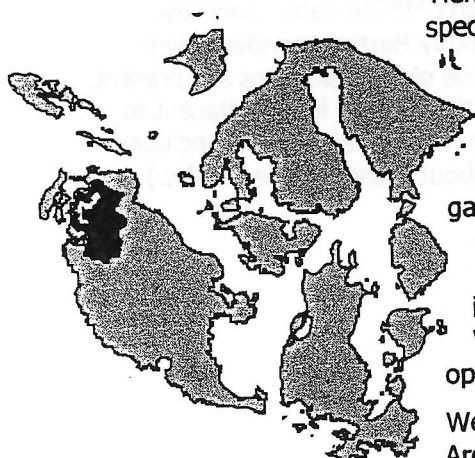
The sample site for Salmon Creek is located adjacent to the road to the UW Marine Labs. Land use upstream of the creek is agricultural and residential housing. Town of Friday Harbor provides sewer service to the majority of residential housing immediately upstream. Some older residences are present. A trailer park is located near the creek. Cattle were observed grazing in the pasture lands adjacent to some upstream stretches. This creek drains the extensive wetlands of Beaverton Valley which includes dense peat bogs. (See Chapter 5, Water Quality, for more information about these sample results.)

Westcott and Garrison Bay

Beneficial Uses

The Westcott-Garrison watershed was ranked third in the San Juan County Watershed Ranking Report of 1988. Westcott and Garrison bays have large areas of kelp beds and eel grass beds which are critical habitat for Pacific Herring and other prey fish that are essential for salmon and larger fish species.

These bays are the primary shellfish harvest areas (mussels, clams and oysters) on San Juan Island. Westcott Bay has an active sea farm and Garrison Bay, which is bordered by English Camp National Park, is a popular recreational harvesting area.



Garrison Bay is an important historic site. In recent history, the British garrison that occupied San Juan Island was located in this sheltered bay, and prior to that time native peoples inhabited the site. English Camp National Park is a popular destination for visitors to the island. Westcott Bay is an important research area for marine biologists from the University of Washington and the location of Westcott Bay Sea Farms, a gourmet shellfish operation.

Westcott Bay has been proposed for designation as a Critical Marine Habitat Area, under the county's Shoreline Master Program, due to its value as a marine biological study area, shellfish resource, and its unique intertidal habitat which includes areas of salt marsh. A draft Westcott-Garrison Marine Habitat Management Area Plan has been prepared by the county that includes recommendations for marine habitat protection strategies.

English Camp is a 529 acre park administered by the National Park Service located in the watershed, as well as Briggs pond, a Class 1, 29.1 acre water body, the source of drinking water for the Roche Harbor area.

Watershed Acreage	3,609			
Landcover Vegetation			Current Land Use*	acres
Grasses	547	15%	Agriculture	552 15%
Dense Forest	1,158	32%	Timber Land	1,256 34%
Sparse Forest	227	6%	Conservation	616 17%
Scrub	538	14%	Residential parcels (134)	260 7%
Wetlands			Public Lands	830 22%
Upland freshwater	106		Designated Growth Areas	Yes
Marine and intertidal	153		Upland Native Ecosystem	Yes
Lakes			Critical Marine Habitat	Yes
Class 1 Briggs Pond	29		Surface Water Resource Area	Yes
Class 3	10		Research/Education Areas	Yes
Class 4/5	14			
Lakes/Freshwater Wetlands		4%		
Streams	miles			
Class 4/5	4			
Drainage runoff	acre-feet			
Briggs Pond	349			

*Current land use information is from the County Assessor's records.

There is a Class 3 lake of about 10 acres and a string of Class 4 and 5 intermittent lakes, wetlands and creeks, just over 14 acres total, draining to Garrison Bay. Westcott Bay has two significant creeks and one other small drainage feeding it. The southern creek to Westcott Bay, Doe Creek, begins at Brigg's Pond. The northern creek begins as a drainage from the hills at the top of the watershed boundary.

Watershed Condition

There are no marinas or boat ramps in Westcott and Garrison Bays but both are used extensively for boating rendezvous. A boat dock is provided for park visitors at English Camp. There is no fuel service in either watershed. There are no pumpout facilities for boats in these bays. There are no significant paved areas in the watershed.

The Westcott-Garrison watershed is about 50 percent forested and about 20 percent grass lands. Much of the forest land is harvestable timber though a significant proportion is part of English Camp and is not likely to be logged. The Department of Natural Resources and Roche Harbor Resort own the balance of the major forest land and have forest management plans. These areas were logged in recent years.

There are some agricultural uses in this watershed. Agricultural uses are primarily fields for hay and grazing. Large alpaca operations are present as well as a boarding stable for horses. In the winter of 1997, alpaca densities appeared to be about 3 to 10 per acre. Other livestock operations include cattle and sheep. Most of this farm land has been divided into 10 and 20 acre parcels. Livestock have access to the lower reaches of the stream leading to Garrison Bay.

The shoreline of all of Westcott Bay and the western edge of Garrison Bay is almost fully developed with an average density of one-half acre per unit. The northern edge of the watershed is part of the Roche Harbor Master Planned Resort area and could experience significant changes as the plans for the resort are developed. The balance of the watershed has a density of five to 10 acres per unit. Much of the land which is now forest resource lands, including the DNR land can be developed to 10 acres per unit. The National Park preserves a large portion of the forested watershed.

A drinking water treatment plant is located in this watershed near the drainage to the northern creek to Westcott Bay. This plant has a permit for discharge of waste water from the treatment process into the creek at the head of the bay. There is a closed solid waste landfill, once operated by Roche Harbor Resort, in the watershed, adjacent to Roche Harbor. No testing has been conducted at the site to determine possible contaminants.

The upper part of the watershed has a high erosion potential, most of which is currently forested, and the entire area has poor soils for septic treatment.

Water was sampled at the outlet of both streams leading to Westcott Bay and at the outlet to Garrison Bay in May of 1997. On that occasion fecal coliforms thresholds were exceeded at one site at Westcott Bay. Recommended thresholds for total suspended solids were exceeded at both creeks. All parameters were within acceptable ranges for the sample taken at the outlet to Garrison Bay.

A second sample was taken in June at both Westcott Bay locations and two upstream locations at major road crossings (*SJ15* and *SJ16*). Additional samples were taken during August and then November 1997 through February 1998. New sites were added including the saltwater near the dock at Westcott Bay Oyster Farm (*SJ22*) and one-time bacterial samples were also taken from a tributary to the north stream (*SJ16A*), the Bellevue Farm Pond (*SJ17*), a ditch downstream (*SJ24*) from an alpaca operation, and an upstream location on Doe Creek (*SJ23*).

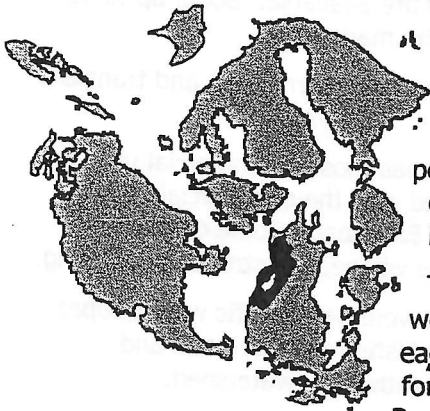
During the winter of 1997-8, both creeks to Westcott Bay exceeded 50 colonies/100mL on multiple occasions. The results indicate that runoff events are likely driving the flushing of bacterial pollution to the creeks and bays. Identification of problem areas may require frequent sampling during all stages of runoff events to assure that intermittent sources are not missed. (See Chapter 5, Water Quality, for more information on these results.)

In response to initial sample results, San Juan County Environmental Health conducted a sanitary survey of septic systems in the area during the winter of 1997-98. As a result, several failing septic systems were found in use that appeared to contribute directly to the streams with high fecal coliform counts. A program to repair these systems is currently underway.

Fisherman Bay

Beneficial Uses

The Fisherman Bay watershed was ranked seventh in the 1988 San Juan County Watershed Ranking Report. The bay consists of a narrow inlet with a mud flat barrier built up by wave action and widens to about one-half mile, forming a long, shallow, low-flushing bay between six and 24 feet deep. The west shore of the bay consists of a rocky island, which has been joined to the mainland of Lopez by a barrier beach formed through the process of accretion.



Fisherman Bay has substantial eel grass beds around the shore perimeter. The bay is no longer used for recreational hard-shell claming but historically was a local resource for shellfish. The bay has a large intertidal area which is highly valued by marine birds.

There are no fishery resources within the bay, but historically fin fish were harvested at the mouth of the bay. There are three documented eagle nests in the watershed and the bay is frequently used by eagles for hunting. Week's Wetland, purchased by the San Juan County Land Bank in 1993, lies adjacent to Lopez Village. This wetland is composed of two adjacent areas of high-salinity salt marsh. There is a channel between Fisherman Bay and the salt marsh which carries tidal waters into the wetlands producing an unusual and interesting plant community. The south end of the bay consists of a large area of tidal wetlands, shallow mudflats, and salt marsh with extensive shore- and seabird communities.

Fisherman Bay has many wetlands within its watershed which provide important wildlife habitat for wintering populations of waterfowl as well as migratory species of shorebirds. Some wetlands areas are used for agriculture.

There are two streams that connect wetlands that empty into San Juan Channel near the mouth of the bay. One other significant stream empties directly to Fisherman Bay, and there are two small drainages at the south end of the bay. This watershed overlays one of the few, large glacial aquifers in the county.

Watershed Acreage	2,070		
Landcover Vegetation			Current Land Use*
Grasses	882	42%	Agriculture
Dense Forest	846	35%	Timber Land
Sparse Forest	166	8%	Conservation
Scrub	281	13%	Residential parcels (286)
Wetlands			Public Lands
Upland freshwater	97	5%	
Marine and intertidal	310		Designated Growth Areas
Lakes	na		Upland Native Ecosystem
Streams	miles		Critical Marine Habitat
Class 4/5	2		Surface Water Resource Area
Drainage runoff	acre-feet		Research/Education Areas
	na		

* Current land use information is from the County Assessor's records.

Watershed Condition

Fisherman Bay has two marinas, two boat ramps, and is used extensively as a rendezvous location for boaters. The two marinas, Islander Lopez and Island Marine Center, are both located toward the center and on the east side of the bay.

Island Marine Center is a full service marina with 96 slips. Transient moorage is available, consisting of thirteen slips and 700 feet of breakwater. Liveboards are permitted at the marina and there are pumpout facilities. Motor repair, fiberglass repair and bottom scrubbing are available. Boats up to 15 tons can be hauled out with two travel lifts. A boat ramp is located at the marina.

The Islander Lopez Resort is adjacent to Island Marine Center and provides 50-permanent and transient moorage spaces. Fuel is available, but there is no pumpout facility.

The community of Lopez Village is near the center of the watershed. It has mostly commercial uses and adjacent housing. Impervious areas within the watershed are associated with the commercial uses in the village, the marinas, and a few businesses located along Fisherman Bay Road. Some off street parking is provided, and many, particularly the businesses located in the village, use street side parking.

Fisherman Bay has approximately 7.9 miles of major county roads. The volume of traffic within Lopez Village is the highest in the area but other highly traveled roads include Fisherman Bay Road and Hummel Lake Road. Two vehicle service stations on Lopez are located within the watershed.

About 56% of the watershed is forested with harvestable timber and about 36 percent is grass cover. Much of this land is located in the northern watershed and is in agricultural uses. Most of the fields are hayed but some are grazed at low densities (1 to 5 animals per acre).

The Fisherman Bay watershed has very low erosion potential among the watersheds in the county, and moderate runoff. Much of the watershed has soils that have severe limitations for septic suitability. The Lopez Village core has sewer service as does some of the shoreline to the north and south of the village.

Residential development of the upland areas is increasing, with suburban-type densities in much of the watershed. The Lopez Village area has been designated as an activity center under the county's Comprehensive Plan. A large area to the east and south of the village has significantly more development capacity. The inland portions of the Fisherman Bay watershed are designated at 10 and 15 acres per unit. Currently, many large parcels remain larger than 100 acres.

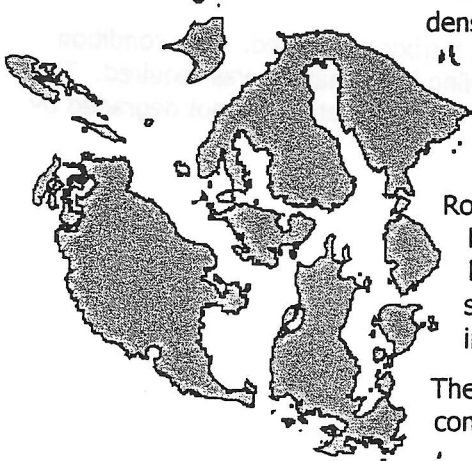
Water Quality

Three of the streams entering Fisherman Bay were sampled in early May of 1997. Water quality was good for all samples. A second sampling of the tributary to the main stream flowing direct to Fisherman Bay was sampled for bacteria in June of 1997 and, at that time, it exceeded 50 colonies/100 mL. This site and one other site, located at the south end of Lopez Sound, in saltwater, were monitored again on six occasions from November 1997 until February of 1998. Fecal coliforms standards for saltwater were exceeded once among the six samples taken of the salt water site. Fecal coliform standards for fresh water were exceeded five out of eight samples for the tributary to the creek draining to Fisherman Bay. All other parameters were in acceptable ranges.

Roche Harbor

Beneficial Uses

Roche Harbor watershed was ranked fifth in the 1988 San Juan County Watershed Ranking Report, despite its small size. This was due to concerns about impacts from potential sources of pollution, rather than beneficial uses, such as tourist-related activities and high density levels. There are no surface water resources in the Roche Harbor watershed. There is a valuable coastal lagoon adjacent to Mosquito Pass dominated by intertidal communities. There is also a small freshwater wetland at the watershed boundary with Westcott Bay.



Roche Harbor has kelp beds and extensive eel grass habitat used by Pacific Herring. The northwestern side of White Point is noted for having habitat features important to migratory waterfowl and supporting a high diversity of plants and animals. It is also an important eagle habitat area.

There is no commercial fishing resource in Roche Harbor. Crabs are common and are harvested by residents and visitors.

Watershed Condition

The Roche Harbor watershed has one marina at Roche Harbor Resort, which recently expanded and provides 377 moorages for permanent, transient, and liveaboard moorage. Fuel service and pumpout facilities are available.

Roche Harbor Resort has an approved sewage treatment plant and a permit to discharge treated wastewater in Roche Harbor. A log rafting site is located at the south end of the harbor.

The watershed is primarily forested (45%) with some grass lands (25%). Land use is primarily residential and recreational. Compared to other watersheds, a significant portion of the Roche Harbor watershed is impervious or nearly impervious. Runoff from the impervious area is not treated before discharging to Roche Harbor.

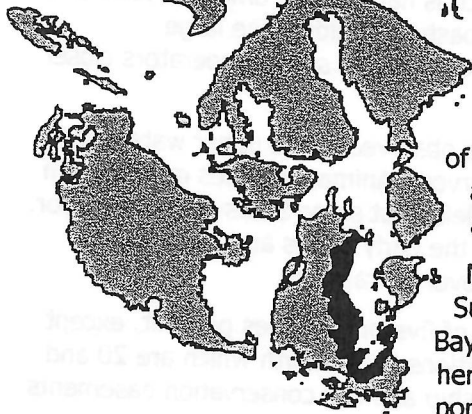
Watershed Acreage	238		
Landcover Vegetation		Current Land Use*	acres
Grasses	547 15%	Agriculture	0
Dense Forest	1,158 32%	Timber Land	0
Sparse Forest	227 6%	Conservation	0
Scrub	538 14%	Residential parcels (84)	85 36%
Wetlands		Public Lands	0
Upland freshwater	3.5		
Marine and intertidal	43		
Lakes	na	Designated Growth Areas	Yes
Lakes/Freshwater Wetlands	1%	Upland Native Ecosystem	No
Streams	na	Critical Marine Habitat	Yes
Drainage runoff	na	Surface Water Resource Area	No
		Research/Education Areas	No

*Current land use information is from the County Assessor's records.

Mud Bay and Hunter Bay (including Lopez Sound)

Beneficial Uses

The Mud-Hunter watershed was ranked sixth in the 1988 San Juan County Watershed Ranking Report. It includes a stretch of small drainages that feed directly into Lopez Sound. Mud Bay opens on the north to Lopez Sound. The bay is about one mile long and is quite shallow, with a depth at center of 12 to 14 feet.



Freshwater wetlands comprise a little over 3% of the watershed. There are a few inland wetlands, but many marine and intertidal wetland areas including salt marshes. The extensive salt marsh and mudflats of Mud Bay are rich with many species of birds, including Bald Eagle, Great Blue Heron, Kingfisher, Kildeer, as well as a large number of migratory and wintering shorebirds and waterfowl.

Mud and Hunter Bays have critical habitat for Pacific Herring. Substantial eel grass beds are located around the perimeter of Mud Bay, and the entire bay is a rich area for crabs, hard shell clams and herring. There is a state-certified mussel farm in the Hunter Bay portion of the receiving watershed and identified recreational

clamming areas in Mud Bay. The shoreline bordering Lopez Sound up to Spencer Spit contains eel grass and kelp beds. Much of Lopez Sound has abundant shrimp and has been a popular salmon fishing area.

The Washington State Department of Wildlife notes several Bald Eagle nests and has identified the entire area around Sperry Peninsula (privately owned) as a critical area for the Long-legged Bat. A wide diversity of plant community types are supported in the 380 acre area, including a few specimens of the Prickly Pear Cactus. The Nature Conservancy identified the area to be of national significance. Sperry Peninsula also includes the privately owned Henderson Lake, which is about 4 acres in size.

Spencer Spit State Park is located at the north end of the watershed. It is 130 acres with 45 camping units, 7,840 feet of shoreline and 16 boat mooring spots. The park provides recreational shellfish harvesting, crabbing, shrimping, fishing, swimming, and other water recreation.

Watershed Acreage	4,688			
Landcover Vegetation			Current Land Use*	acres
Grasses	928	20%	Agriculture	537 11%
Dense Forest	2,611	56%	Timber Land	610 13%
Sparse Forest	333	7%	Conservation	684 15%
Scrub	685	15%	Residential parcels (287)	1,144 24%
Wetlands			Public Lands	564 12%
Upland freshwater	161		Designated Growth Areas	No
Marine and intertidal	470		Upland Native Ecosystem	No
Lakes			Critical Marine Habitat	Yes
Class 2	4		Surface Water Resource Area	No
Lakes/Freshwater Wetlands		3%	Research/Education Areas	No
Streams				
Class 4/5	3.8			
Drainage runoff				
	acre-feet			
	na			

*Current land use information is from the County Assessor's records.

There are five drainages to Mud and Hunter Bays total. The northernmost stream is the largest. Two tributaries feed one small creek terminating in Hunter Bay. Two very small drainages feed Mud Bay and another creek comes off of the west side of Sperry Peninsula. Several small drainages feed the shoreline north of Mud and Hunter bays, including one 2,000 foot stream.

Watershed Condition

The watershed is primarily forested (63 percent) the majority of which is harvestable timber. Fields and grasslands comprise 20 percent most of which is mowed, hayed, or pastured fields. The large agricultural areas are primarily in the upper watershed although there are some smaller operators closer to the shoreline. Residential uses dominate the shoreline.

Several of the drainages begin in the agricultural areas. Grazing was observed in the upper watershed but not near the shore. Cattle dominated but horses were also observed. Animal densities ranged from 2 to 5 animals per acre. Pasture condition was good to fair in most fields but some areas were very poor. The County has a closed landfill in the watershed that was closed in the early 1980s and is not being monitored. A septage lagoon is located at this site and is currently over its capacity.

A majority of the watershed area has a minimum residential density of five or ten acres per unit, except along the shoreline where it is two to one-half acre per unit, and portions in the north which are 20 and 40 acres per unit. The area of Sperry Peninsula is under one ownership and has conservation easements that limit the development potential.

The majority of the inland watershed has soils that have low erosion potential except for the shoreline areas and steep slopes surrounding Hunter Bay and the south end of Mud Bay. The majority of area with steeper slopes is currently covered by forest land. Septic suitability is poor throughout the watershed.

Water quality samples were taken in three locations at the south end of Lopez Island in May of 1997. These included the outlets of the northern stream leading to Hunter Bay (L13), and streams in Jasper Bay (L30) and Hughes Bay (L10). All parameters were within acceptable ranges.

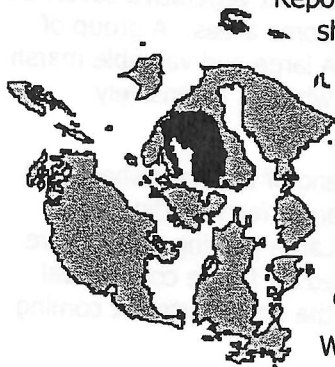
From November 1997 until February of 1998, water quality was tested on six occasions at the outlet of streams entering Mud Bay (L33) and Hunter Bay (L32). Fecal coliform counts right at the outlet in Mud Bay (mixed saltwater and freshwater) exceeded 50 colonies/100 mL in four out of six samples. The outlet to Hunter Bay (freshwater) also exceeded thresholds for fecal coliforms in three out of the six samples. All other parameters measured were within acceptable ranges. (See Chapter 5, Water Quality, for more information about these samples.)

Hunter Bay is monitored for fecal coliform counts by Washington State as part of its shellfish certification program and is well within standards for shellfish areas.

West Sound

Beneficial Uses

The West Sound watershed was ranked seventh in the 1988 San Juan County Watershed Ranking Report. Historically the sound was fished heavily for commercial herring and shrimp harvests. The area contains critical habitat for Pacific Herring and River Otter and many species of migratory waterfowl, including Buffleheads, scaups, goldeneyes, grebes and scoters. The west side of West Sound is a highly active Bald Eagle nesting area. Currently, there are no identified shellfish, shrimp or crab harvesting locations in West Sound. There are sizable areas of eel grass beds and intertidal nearshore habitat. Several midden areas are found along the shores of West Sound, including White Beach Bay, which derived its name from the abundance of shell remains left by native residents.



West Sound watershed contains Schaefer Lake, a Class 2 water body of about 4 acres, a large marsh area of about 60 acres, numerous ponds and small wetlands, but no major surface water resources. There are three main drainage systems in the watershed and several smaller ones. The largest system is the Crow Valley drainage which terminates near Westsound, with an estimated annual runoff of 2,276 acre-feet, the second largest drainage basin in the county. The second largest drainage in the watershed terminates at Bayhead, near Orcas Village. The third major drainage terminates at the head of Massacre Bay.

Orcas Knob in the West Sound watershed is an important natural area with near-climax forest conditions. The south slope of Turtleback Mountain has a rare open woodland oak-savannah landscape mixed with Rocky Mountain Juniper.

Watershed Acreage	8,428			
Landcover Vegetation			Current Land Use*	acres
Grasses	2,029	24%	Agriculture	1,047 12%
Dense Forest	4,058	47%	Timber Land	2,563 30%
Sparse Forest	870	10%	Conservation	1,532 18%
Scrub	1,376	16%	Residential parcels (337)	2,582 30%
Wetlands			Public Lands	0
Upland freshwater	254			
Marine and intertidal	292			
Lakes			Designated Growth Areas	Yes
Class 2 Schaefer	4			
Streams	miles		Upland Native Ecosystem	Yes
Class 3	1.1			
Class 4/5	8		Critical Marine Habitat	Yes
Drainage runoff	acre-feet			
Crow Valley	2,276		Surface Water Resource Area	No
Victorian Valley	929			
			Research/Education Areas	No

*Current land use information is from the County Assessor's records.

Watershed Condition

The West Sound watershed has the largest area of open farmland and wet meadows on Orcas Island, including Crow Valley and Warm Valley, and receives the bulk of the drainage from the eastern side of the Turtleback range. Much of the land adjacent to the major drainage corridors through Crow Valley is wetland and is in agricultural use. There are several livestock operations that include fields for grazing and hay. Most of the stream corridors in Crow Valley have excellent vegetative cover, but some are disturbed, and animals have access to streams and wetlands in some areas. A group of residents are working to reestablish a fish run in the Crow Valley Creek. A large and valuable marsh in the eastern part of the watershed collects runoff from Mount Woolard, which is extensively forested, and drains to Bayhead, next to Orcas Village.

Orcas Village is located at the edge of West Sound, on the southeastern end of the watershed, and contains a small public dock and private marina, fuel dock, fuel storage tanks, ferry landing, and several commercial businesses. This area is served by a sewer system. Large parking areas serve the ferry dock and businesses in the Village. The village area is designated for future commercial growth as an activity center under the County's comprehensive plan. All the vehicular traffic coming to and going from Orcas Island passes through this location.

There are about 15 miles of major county roads in the West Sound watershed. Fuel service is provided at Orcas Village and West Sound Marina. In the past, fuel was available at the Westsound Store.

West Sound Marina is located near the center of the eastern shoreline of West Sound. The marina has permanent moorage for 160 boats, transient moorage, boat ramp, and full boat service including haul-outs up to 30 tons. Liveboards are allowed and pump-out facilities are available. A county dock, two private marinas, at Bayhead and White Beach, and several community docks are also located in West Sound. The area is popular as a boating rendezvous location. A large log rafting operation is located near White Beach. In the past a lime kiln operation was located in West Sound.

Two of the streams monitored between spring of 1997 and spring of 1998 showed fecal coliforms in excess of state standards. In the upper reaches of the Crow Valley Creek, 100 percent of six samples taken exceeded 50 cfu/100mL. The creek drainage from Warm Valley exceed 50 cfu/100mL in 42 percent of the samples taken. (See Chapter 5, Water Quality, for more information about these sample results.)

Between December 1993 and October 1994, the San Juan County Conservation District conducted a survey of well water quality in 41 wells in the Crow Valley area. Out of 80 samples taken for coliforms, 16 samples were positive for fecal organisms. The wells contaminated with fecal coliforms were shallow, dug wells, generally with direct contact to surface runoff from adjacent farm activities.

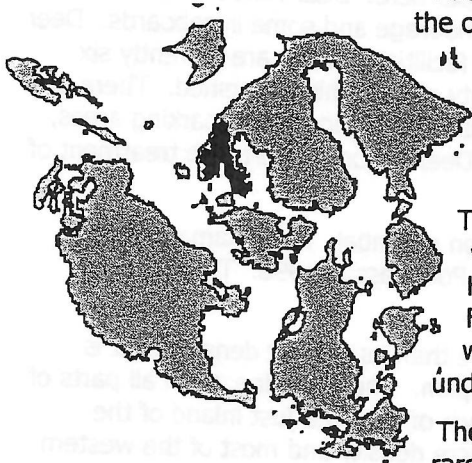
Agricultural land in Crow Valley has decreased over the last 50 years and forest is beginning to encroach on some long established pastures. Conversion of farm and forest land to residential use is reducing the number of larger landholdings.

Large areas of this watershed are currently well below the development potential designated in the county's comprehensive plan, including Turtleback Mountain, Mt. Woolard and much of Crow Valley. Crow Valley's agricultural land has a density designation of one residence per 20 acres. The upland areas of the watershed have a five or 10 acre per unit density designation. The shoreline areas have a density of two acres per unit. Orcas Village contains an urban area designated 6 units per acre, with a one-half acre per unit density for rest of the area. One of the greatest concerns for the watershed is the erosion potential of Turtleback Mountain and parts of Mount Woolard as land is converted to residential use. All but a few small areas of the watershed have severely limited soils for on-site septic systems.

Deer Harbor

Beneficial Uses

The Deer Harbor watershed was ranked eighth in the 1988 San Juan County Watershed Ranking Report. The depth of the harbor is reported to be 30 to 45 feet deep. It is known as an important habitat for the Pacific Loon. There are eel grass beds and kelp beds and several of the outer islands in the harbor are used by seals as haulouts.



There are no shellfish habitat areas and recreational and commercial fishing is minimal in Deer Harbor. Historically the area has supported a large crab population, which was commercially harvested.

The Spring Point community of 54 homes is served by a surface water supply. There are a few unique wetlands including the Deer Harbor Lagoon and the Frank Richardson wildlife preserve. The Frank Richardson Preserve is a marsh area of about 20 acres which drains to Deer Harbor. Most of the Deer Harbor Lagoon is under conservation easement with the San Juan County Land Bank.

The Ring-necked Duck is reported to nest in this wetland, one of the rare places in the San Juans this species is found. A second stream drainage flows from two tributaries at the head of Deer Harbor Lagoon creating a unique estuary where freshwater enters this tidally influenced lagoon.

About 50 acres of cliffs and rocky soils along the west side of Deer Harbor support an understory of native grasses and mosses and an uncommon native plant called False Boxwood (*Pachistima myrsinites*). These cliffs are unusual habitat and provide protected resting areas for birds.

Deer Harbor is a popular recreation site for boaters and other vacationers, as well as residents.

Watershed Acreage	1,808				
Landcover Vegetation			Current Land Use*		
Grasses	403	22%	Agriculture		
Dense Forest	858	47%	35	2%	
Sparse Forest	224	12%	Timber Land	221	12%
Scrub	288	16%	Conservation	70	4%
Wetlands			Residential parcels (156)	432	24%
Upland freshwater	65	3%	Public Lands	0	
Marine and intertidal	60		Designated Growth Areas		Yes
Lakes	na		Upland Native Ecosystem		No
Streams	miles		Critical Marine Habitat		No
Class 3	0.4		Surface Water Resource Area		Yes
Class 4/5	2		Research/Education Areas		No
Drainage runoff	acre-feet				
	na				

*Current land use information is from the County Assessor's records.

Watershed Condition

Land use in the Deer Harbor watershed is primarily residential with some agriculture, and includes the resort development at the village of Deer Harbor. Forests dominate the land cover (60 percent of watershed). Grasslands cover about 22 percent of the watershed. Of these lands between 10 and 15 percent are in active agriculture and primarily used for grazing and haying. Animals observed were primarily cattle and horses and at densities of less than five animals per acre. Deer Harbor has two marinas and a boat repair facility. Both marinas provide permanent moorage and some liveaboards. Deer Harbor resort provides transient moorage, fuel service and pumpout facilities. There are currently six liveaboards in Deer Harbor. There are about 6.5 miles of major county road in this watershed. There are several acres of impervious areas associated with commercial establishments and related parking areas, mostly located near the shoreline areas. Fuel service is available at Deer Harbor Resort. No treatment of stormwater runoff occurs from these areas.

A large part of the watershed and all of the shoreline has high erosion potential. Road damage due to erosion occurred in the watershed between Deer Harbor Resort and Pole Pass in 1998. There are no soils suitable for septic disposal in the watershed.

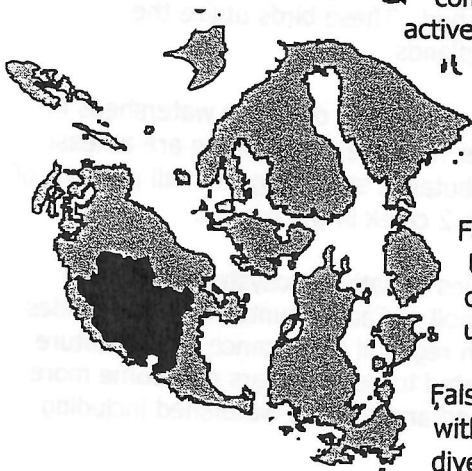
The Deer Harbor watershed is expected to develop significantly more than its current densities. It is designated as a Hamlet under the county's adopted comprehensive plan. The shoreline, as in all parts of the county is designated for one residence per one-half acre but much of the area just inland of the shoreline surrounding Deer Harbor and the lagoon is also one-half acre density and most of the western watershed has the potential to be developed into two acre parcels.

Streams in the Deer Harbor watershed were sampled in five locations as part of the initial water quality survey performed in the May of 1997. All samples were within acceptable water quality ranges with the exception of one fecal bacteria sample taken at Site *O4* and a temperature reading that was 0.2°C over the state threshold at Site *O17*. Neither condition is extreme.

False Bay

Beneficial Uses

The False Bay watershed was ranked 9th in the 1988 San Juan County Watershed Ranking Report. It contains the most extensive grassland acreage as well as the most actively used farmland in the county. It is the largest drainage basin of all the watersheds in the county and includes the water supply source for the Town of Friday Harbor. This extensive drainage system (11,697 acres) terminates in the relatively small receiving waters (232 acres) of False Bay.



False Bay is a marine biological preserve belonging to the University of Washington Friday Harbor Laboratories. The Labs own 200 acres of tidelands and uplands at the bay. This area is used extensively for research purposes.

False Bay consists of a large area of tidal flats which, in conjunction with the upland wildlife preserve, provide excellent habitat for a high diversity of plants, birds, and sea life, including many intertidal species generally found on the open coast (Giant Green Anemones, Gooseneck Barnacles, and California Mussels). False Bay has no recreational or commercial fishing or shellfish harvest. Abalone and sea

Watershed Acreage	11,697			
Landcover Vegetation			Current Land Use*	acres
Grasses	5,286	45%	Agriculture	3,741 12%
Dense Forest	3,040	26%	Timber Land	765 30%
Sparse Forest	1,030	9%	Conservation	1,173 18%
Scrub	2,106	18%	Residential parcels (414)	2,666 23%
Wetlands			Public Lands	1.35
Upland freshwater	743			
Marine and intertidal	232			
Lakes			Designated Growth Areas	No
Class 1 Trout	60			
Class 1 Lawson	12.5		Upland Native Ecosystem	Yes
Class 2 Woods	29			
Class 2 Zylstra	70		Critical Marine Habitat	Yes
Lakes and Freshwater Wetlands		6%		
Streams		miles	Surface Water Resource Area	Yes
Class 2	2.5			
Class 3	8.5		Research/Education Areas	Yes
Class 4/5	12			
Drainage runoff		acre-feet		
		3,154		

*Current land use information is from the County Assessor's records.

urchins have been harvested in the past in the outer coastal waters of the watershed. Due to its shallow nature and status as a preserve there is no boating activity.

Substantial eel grass beds and kelp beds are located at the mouth and along the coastline adjacent to the bay. Nearby areas are used as seal haul-outs. There are numerous breeding, nesting, and wintering sites for an abundance of resident and migratory birds in the watershed. These birds utilize the shoreline, tidelands, and freshwater wetlands, as well as forested uplands.

The False Bay watershed has the greatest extent of identified wetland acreage of all the watersheds in the county. A significant portion of the watershed is a surface water resource area. There are at least two streams of significance draining to False Bay with numerous tributaries stemming from all portions of the watershed. The largest creek, San Juan Creek, is the only Class 2 creek in the county.

The False Bay watershed has several notable areas that are examples of native ecosystems including grassland Oak-savannah communities and open woodlands. The knoll of Cady Mountain which provides part of the watershed boundaries has been classified as having high regional significance by the Nature Conservancy (1975). Some of the oak trees found there are estimated to be 400 years old. Some more unusual terrestrial island wildlife have important habitat in the upland areas of the watershed including the Northern Alligator Lizard, Purple Martins, and Trumpeter swans.

Trout Lake is located in this watershed and is the main water supply for the town of Friday Harbor, and supplies water to a large portion of the island's population. It is the largest Class 1 type water body on San Juan Island. Lawson Lake is a 12.5 acre Class 1 type water body that augments Friday Harbor's water supply. Wood reservoir is a 29 acre, Class 2 impoundment. Zylstra Lake is 70 acres and was created to provide irrigation water. There also are several Class 2 through 5 water bodies less than 5 acres in size.

Watershed Condition

Agricultural uses in False Bay are continuing their historical presence although more land is being converted to rural-residential use with farming occurring on smaller acreages. Livestock operations include sheep, cattle, and horses primarily. A field survey in the winter of 1997-98 revealed that most fields were in fair condition, but some overgrazing and poor management was apparent. During the winter most of the fields at the valley bottom are saturated with standing pools of water. In some cases animals are being pastured through the winter with access to the creeks and saturated areas.

Most of the length of San Juan Valley Creek is unprotected with little canopy cover. The creek flows through agriculture lands with a residential density of 40 acres per unit. The remainder of the watershed has a density potential of 5 acres per unit with some sections in the upper areas designated for 10 acres per unit.

There are upland areas with high erosion potential and on-site septic suitability is poor in all of the watershed. Traffic in the False Bay watershed is lower than in many other watersheds as there are no significant tourist destinations.

Several reaches of both streams leading to False Bay were sampled during May and June of 1997. San Juan Valley Creek, the major drainage to False Bay, was found to have fecal coliforms exceeding State standards in two locations sampled, both in the lower watershed area. One of the sites was monitored

for six weeks between November 1997 and February of 1998. During that period four of six samples exceeded 50 colonies/100mL. (See Chapter 5, Water Quality, for more information about these results.) Fecal contamination of a community water system well was documented in the upper watershed in 1999. The suspected source is a failing septic system. (SJC Health and Community Services)

The land use adjacent to San Juan Valley Creek and upstream from the sampling locations is largely agriculture. The creek runs through several agricultural fields and is unfenced for most of its route, leaving it accessible for animal use. The drainage area is highly saturated for a significant portion of the year due to runoff from the surrounding hills and the generally low-lying topography of the basin floor. In such conditions, water in the pastures can essentially be flowing through and on top of the soil. Both livestock and failing septic systems are concerns for sources of fecal contamination in this area.

Water Quality Data - San Juan Island

Watershed	ID	Date	Fecal Coliforms (cfu/100ml)	Nitrate (mg/L)	pH	Total Suspended Solids (mg/L)	Water Temperature (C)	Location Description
False Bay	SJ1	05/19/1997	460	0	7.49	15.2	17	False Bay Lagoon
False Bay	SJ13	06/02/1997	43	0.18	7.3	0.1	13.1	Kanaka Bay Culvert
False Bay	SJ18	06/02/1997	23	0.24	8	56	13.1	AUG2 Pump Station
False Bay	SJ2	05/19/1997	240	ND	7.5	5	15	SJ Valley stream - S. of Westside Rd
False Bay	SJ2	11/18/1997	3		7.7	21	5	
False Bay	SJ2	12/09/1997	150		7.9	19	4.9	
False Bay	SJ2	12/16/1997	2400		7.6	42	4.8	
False Bay	SJ2	01/06/1998	150		7.9	54	4.6	
False Bay	SJ2	01/27/1998	23		7.65	15.5	7.8	
False Bay	SJ2	02/03/1998	240		8.05	23.9	5.6	
		geometric mean	112					
False Bay	SJ21	06/03/1997			7.6	23	14.7	AUG 1 Pump Station
False Bay	SJ3	05/19/1997	3	0.13	8	20	16.6	West Side Road Stream

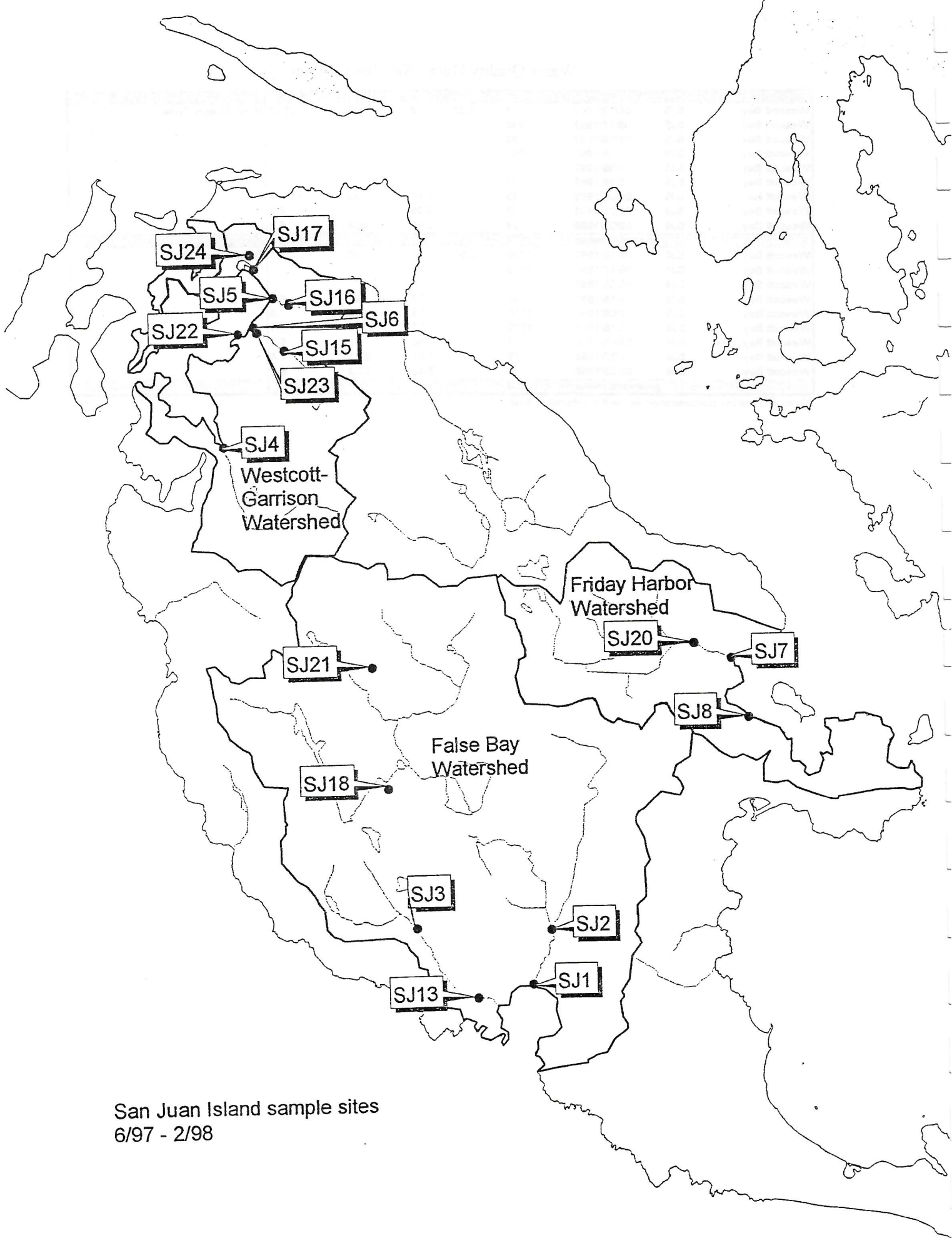
Friday Harbor	SJ20	06/03/1997			7.2	Suspect Re	15.9	Beaverton Valley Road Culvert
Friday Harbor	SJ7	05/19/1997	93	0.14	8.2	18.2	14.3	FH Creek-S. of Bridge at UW Labs
Friday Harbor	SJ7	11/18/1997	4		8.1	23.7	6.9	
Friday Harbor	SJ7	12/09/1997	9		8.2	42	6.7	
Friday Harbor	SJ7	12/16/1997	2400		7.9	67	6.1	
Friday Harbor	SJ7	01/06/1998						
Friday Harbor	SJ7	01/27/1998	4		7.63	35.2	6.7	
Friday Harbor	SJ7	02/03/1998	4		7.84	1.6	5.3	
		geometric mean	22					
Friday Harbor	SJ8	05/19/1997	1100	1.42				Spring Street Culvert
Friday Harbor	SJ8	11/18/1997	2400		8.5	18	7	
Friday Harbor	SJ8	12/09/1997	2400		8.6	25	7.2	
Friday Harbor	SJ8	12/16/1997	2400		8.4	43	6.7	
Friday Harbor	SJ8	01/06/1998	2400		8.5	38	7.2	
Friday Harbor	SJ8	01/27/1998	2400		8.7	33	7.7	
Friday Harbor	SJ8	02/03/1998	2400		8.7	No reading	8	
		geometric mean	2147					

Garrison Bay	SJ4	05/19/1997	9	ND	8.06	9	14.7	Garrison Bay Creek	
Wescott Bay	SJ15	06/02/1997	9					South Mitchell Bay Road Culvert	
Wescott Bay	SJ15	06/17/1997	2400						
Wescott Bay	SJ15	11/18/1997	4		8.1	23	6.7		
Wescott Bay	SJ15	12/09/1997	4		7.3	33	6.2		
Wescott Bay	SJ15	12/16/1997	93		8.7	54	6.6		
Wescott Bay	SJ15	01/06/1998	75		7.97	70	5.1		
Wescott Bay	SJ15	01/27/1998	3		8.11	4.8	6		
Wescott Bay	SJ15	02/03/1998	9		8.29	22.8	6		
		geometric mean	22						
Wescott Bay	SJ16	06/02/1997	43						E. side of N. Roche Harbor Rd Culvert
Wescott Bay	SJ16	06/17/1997	93						
Wescott Bay	SJ16	08/05/1997	240						
Wescott Bay	SJ16	11/18/1997	75		7.3	23	6.6		
Wescott Bay	SJ16	12/09/1997	23		7.4	28	5.1		
Wescott Bay	SJ16	12/16/1997	93		7.5	32	6		
Wescott Bay	SJ16	01/06/1998	9		3.19	48	5.2		
Wescott Bay	SJ16	01/27/1998	4		7.62	20.9	5.9		
Wescott Bay	SJ16	02/03/1998	43		7.62	28.2	5.6		
		geometric mean	40						
Wescott Bay	SJ16A	02/03/1998	3					Ditch at SJ16	
Wescott Bay	SJ17	06/02/1997	23					Bellevue Farm Pond Wescott Bay	
Wescott Bay	SJ22	12/09/1997	3					Wescott Bay Sea Farm Dock	
Wescott Bay	SJ22	12/16/1997	93						
Wescott Bay	SJ22	01/06/1998	3						
Wescott Bay	SJ22	01/27/1998	3						
Wescott Bay	SJ22	02/03/1998	3						
		geometric mean	6						
Wescott Bay	SJ23	01/27/1998	9					Ditch Wescott Bay Estates	
Wescott Bay	SJ24	01/27/1998	23					Ditch at Alpaca Ranch	

Water Quality Data - San Juan Island

Wescott Bay	SJ5	05/19/1997	3	0.23	7.8	175	11.02	North Stream Outlet
Wescott Bay	SJ5	06/17/1997	240					
Wescott Bay	SJ5	08/05/1997	93					
Wescott Bay	SJ5	11/18/1997	240					
Wescott Bay	SJ5	12/09/1997	9					
Wescott Bay	SJ5	12/16/1997	39					
Wescott Bay	SJ5	01/06/1998	43		7.67	48	4.8	
Wescott Bay	SJ5	01/27/1998	23		8.05	23.1	6.3	
Wescott Bay	SJ5	02/03/1998	23		8.19	45.6	5.3	
geometric mean			37					
Wescott Bay	SJ6	05/19/1997	1100	0.56	8.3	90	11	South Stream Outlet
Wescott Bay	SJ6	06/17/1997	1100					
Wescott Bay	SJ6	08/05/1997						
Wescott Bay	SJ6	11/18/1997	43		7.7	104	6.3	
Wescott Bay	SJ6	12/09/1997	1100		7.5	278	6	
Wescott Bay	SJ6	12/16/1997	1100		7.7	323	5.1	
Wescott Bay	SJ6	01/06/1998	93		7.68	142	5.2	
Wescott Bay	SJ6	01/27/1998	15		8.42	22.7	5.8	
Wescott Bay	SJ6	02/03/1998	4		8.42	22.3	6.1	
geometric mean			156					

Note: ND means concentration below the detectable limit.



San Juan Island sample sites
6/97 - 2/98

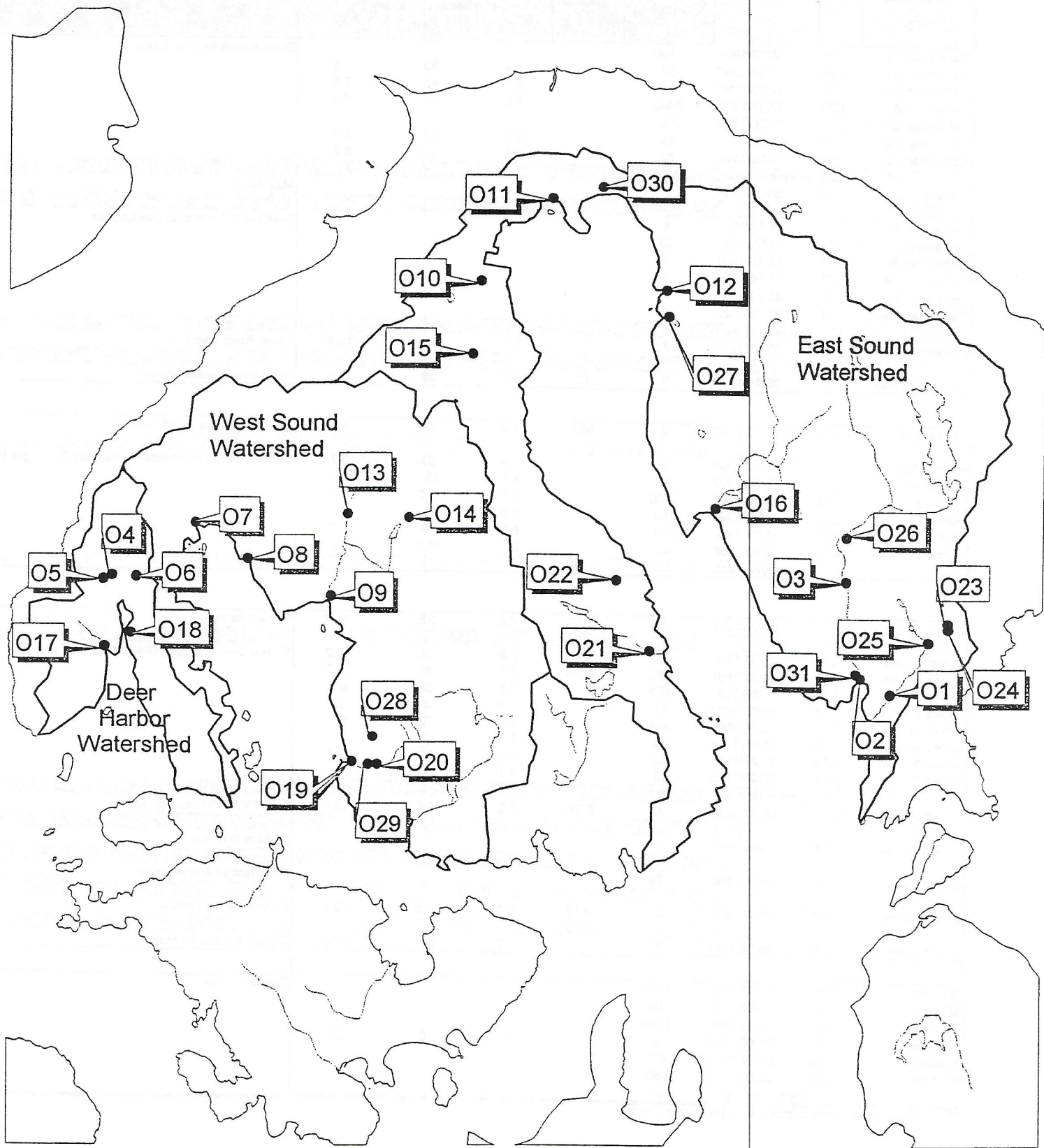
Water Quality Data - Orcas Island

Watershed	ID	Date	Fecal Coliforms (cfu/100mL)	Nitrate (mg/L)	pH	Total Suspended Solids (mg/L)	Water Temperature (C)	Location Description	
Buck Bay	O1	05/14/1997	1100	0.26	7.9	73	11.1	Obstruction Pass Road Substation	
Buck Bay	O1	06/16/1997	1100						
Buck Bay	O1	09/09/1997	2400						
Buck Bay	O1	11/17/1997	240						
Buck Bay	O1	12/08/1997	15		8.0	35	6.7		
Buck Bay	O1	12/15/1997			8.1	34.1	6.2		
Buck Bay	O1	01/05/1998	2400		8.0	36	6.1		
Buck Bay	O1	01/20/1998	1100		8.1	23.2	5.6		
Buck Bay	O1	01/26/1998	43		7.5	31.1	7.8		
Buck Bay	O1	02/02/1998	43		7.9	33	7.1		
		geometric mean	333						
Buck Bay	O2	05/14/1997	43	0.4	8.0	0.1	11.4	Cascade Creek culvert N. side- incoming	
Buck Bay	O2	09/09/1997	23						
Buck Bay	O2	11/17/1997	43		8.1	39	7.1		
Buck Bay	O2	12/08/1997	93		8.1	38	6.8		
Buck Bay	O2	12/15/1997			8.3	56	6.7		
Buck Bay	O2	01/05/1998	43		8.2	123	6.7		
Buck Bay	O2	01/26/1998	9						
Buck Bay	O2	02/02/1998	43		8.4	ND	6.4		
		geometric mean	35						
Buck Bay	O3	05/14/1997	43	0.34	7.8	ND	10.9	Kaboo Hill Road, Cascade Creek Culvert	
Buck Bay	O23	06/10/1997	23	ND					Pickett spring
Buck Bay	O24	06/10/1997	93	ND					Pioneer hill stream - driveway to farm
Buck Bay	O25	06/10/1997	2400	ND					S. of Rd. at Bohems
Buck Bay	O26	06/10/1997	2400	ND					Moran Park, Cascade Creek/ dam & spillway
Buck Bay	O31	01/20/1998	93						Ditch from Artworks
Deer Harbor	O18	05/27/1997	43	ND					Deer Harbor Lagoon
Deer Harbor	O4	05/14/1997	93	ND	8.1	1.5	11.6		Cormorant Bay Rd culvert S. end
Deer Harbor	O5	05/14/1997	4	0.16	7.7	35	15.8		Cookston Stream entering O4 Cormorant Bay Rd
Deer Harbor	O6	05/14/1997	43	0.23	8.0	22	15.3		Cormorant Bay Rd. stream
Deer Harbor	O17	05/27/1997	39	ND	8.3	15	16.2	Richardson Wildlife Preserve Below Conners Rd	
East Sound	O10	05/14/1997	150	0.27	8.2	25	17.1	Indralaya, stream under Rd.	
East Sound	O11	05/14/1997	1100	0.23	8.5	2.8	18.9	Stormwater culvert across frm Outlook Inn	
East Sound	O11	11/17/1997	460						
East Sound	O11	12/08/1997	7		8.1	45	6.7		
East Sound	O11	12/15/1997			8.2	122	6.8		
East Sound	O11	01/05/1998	43		8.1	68	6.7		
East Sound	O11	01/20/1998	15		8.2	8146	6.4		
East Sound	O11	01/26/1998	43		8.1	31.8	7.7		
East Sound	O11	02/02/1998	93		8.2	18.9	7.0		
		geometric mean	71						
East Sound	O12	05/14/1997	4	0.18				Coon Hollow Culvert	
East Sound	O15	05/20/1997	23	ND				Golf course stream	
East Sound	O16	05/20/1997	4	ND				Orcas Rosario Upper Loop Rd.	
East Sound	O21	05/27/1997	3	0.16				Ayer stream / pond system	
East Sound	O22	05/27/1997			7.8	80	13.8	Dolphin Bay Rd. culvert W. side of Stream	
East Sound	O27	06/10/1997	3.6	ND	9.1	3.6		Fish hatchery culvert	
East Sound	O30	08/17/1997	290					Crescent Beach Culvert- N. of Road	
East Sound	O30	11/17/1997	9		7.1	19.3	6.7		
East Sound	O30	12/08/1997	150		7.3	24.1	6.4		
East Sound	O30	12/15/1997			7.4	22.2	6.5		
East Sound	O30	01/05/1998	23		7.3	33	6.6		
East Sound	O30	01/20/1998	4		7.2	21.5	6.5		
East Sound	O30	01/26/1998	9						
East Sound	O30	02/02/1998	7		7.1	ND	7.6		
		geometric mean	22						

Water Quality Data - Orcas Island

West Sounc	O13	05/20/1997	2400					Crow Valley to Horseshoe West Creek
West Sounc	O13	11/17/1997	240					
West Sounc	O13	12/08/1997	150		7.7	45	5.3	
West Sounc	O13	12/15/1997			7.9	22	5.0	
West Sounc	O13	01/05/1998			7.8	32	6.2	
West Sounc	O13	01/20/1998	93		7.8	26	6.0	
West Sounc	O13	01/26/1998	240		7.8	84.4	7.2	
West Sounc	O13	02/02/1998	93		7.8	115.2	6.0	
		geometric mean	237					
West Sounc	O14	05/20/1997	3					Crow Valley - off Horseshoe Hwy. stream 2
West Sounc	O19	05/27/1997	2400	0.27	8.1	88	12.2	Milk and Honey Cove
West Sounc	O19	11/17/1997	23					
West Sounc	O19	12/08/1997	4					
West Sounc	O19	12/15/1997			8.1	45	7.0	
West Sounc	O19	01/05/1998	240		8.0	32	7.2	
West Sounc	O19	01/20/1998	93		8.0	5	7.9	
West Sounc	O19	01/26/1998	43		8.0	84.4	7.5	
West Sounc	O19	02/02/1998	43		8.0	54.3	6.7	
		geometric mean	71					
West Sounc	O20	05/27/1997	460	0.16	7.9	112	13.3	Warm Valley Farm Stream
West Sounc	O28	06/16/1997	460	0.23				WS Exton Road drainage stream
West Sounc	O29	06/16/1997	2400	0.27				Nutt Stream down frm Exton Rd.
West Sounc	O7	05/14/1997	9	0.2	8.1	10	17.6	Head of WS N. of road/ Massacre Bay
West Sounc	O8	05/14/1997	3	0.49	7.3	0.5	10.5	Massacre Bay Stream off Turtleback
West Sounc	O9	05/14/1997	460	0.26	8.1	28	14.6	Stream frm Crow Valley
West Sounc	O9	06/10/1997	75					
West Sounc	O9	11/17/1997	28					
West Sounc	O9	12/08/1997	15		8.0	56	5.9	
West Sounc	O9	12/15/1997			8.0	48	5.9	
West Sounc	O9	01/05/1998	43		8.0	32	5.9	
West Sounc	O9	01/20/1998	43		8.0	32.6	6.0	
West Sounc	O9	01/26/1998	23		8.1	41.9	6.9	
West Sounc	O9	02/02/1998	93		8.0	26.4	6.3	
		geometric mean	52					

Note: ND means concentration below the detectable limit.

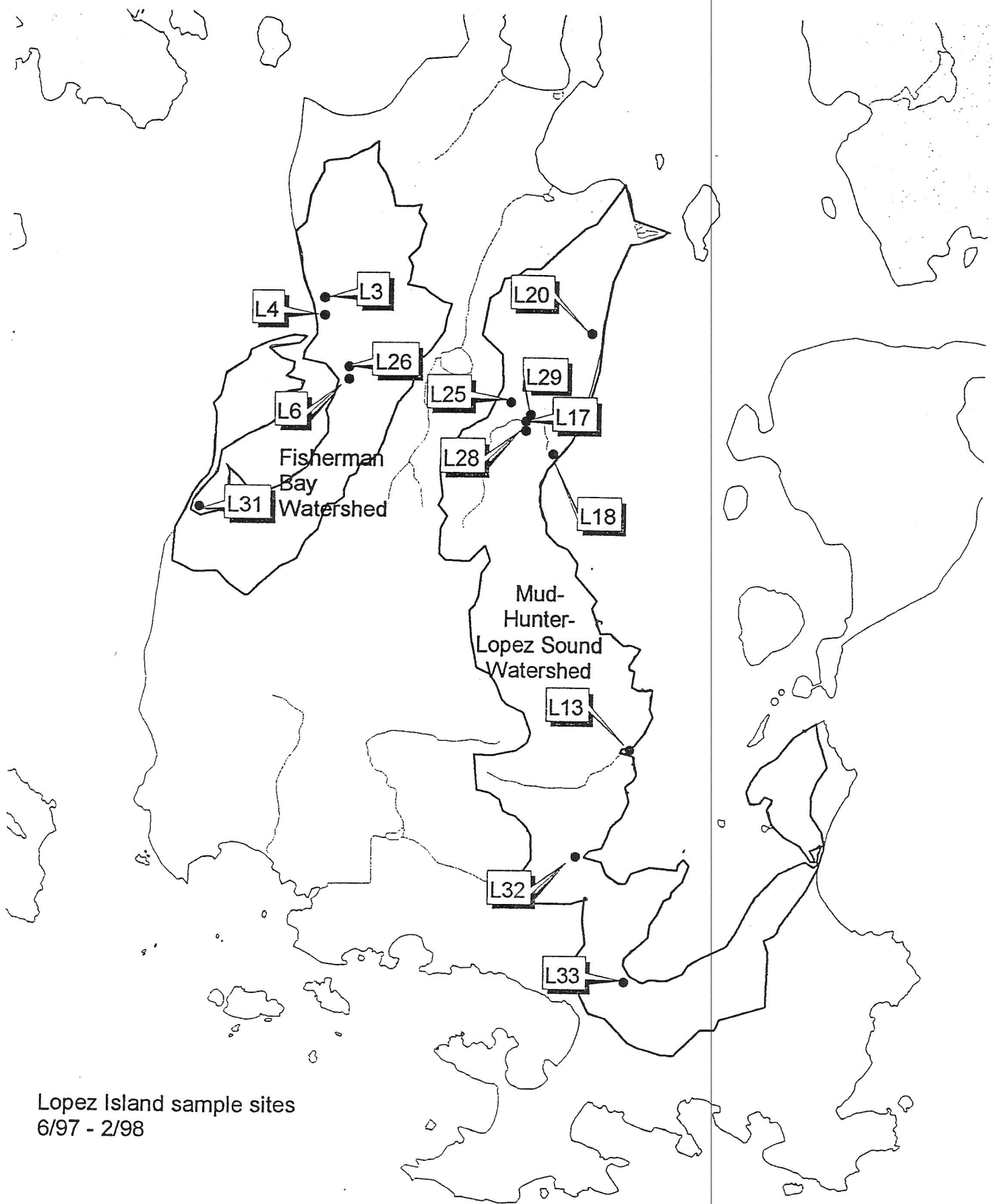


Orcas Island sample sites
6/97 - 2/98

Water Quality Data - Lopez Island

Watershed	ID	Date	Fecal Coliforms (cfu/100mL)	Nitrate (mg/L)	pH	Total Suspended Solids (mg/L)	Temperature (C)	Location Description
Fisherman Bay	L26	06/03/1997	1100					Ditch/culvert recycle center
Fisherman Bay	L26	11/18/1997	93		7.9	33	7.8	
Fisherman Bay	L26	12/09/1997	150		8.1	45	7.6	
Fisherman Bay	L26	12/16/1997	2400		8.0	57	7.4	
Fisherman Bay	L26	01/06/1998	240					
Fisherman Bay	L26	01/27/1998	39		8.2	37	8.0	
Fisherman Bay	L26	02/03/1998	23		8.1	32.7	8.2	
		L26 geometric mean	187					
Fisherman Bay	L3	05/01/1997	2					Main road
Fisherman Bay	L31	11/18/1997	4					South end Fisherman Bay Lagoon
Fisherman Bay	L31	12/09/1997	23					
Fisherman Bay	L31	12/16/1997	3					
Fisherman Bay	L31	01/06/1998	3					
Fisherman Bay	L31	01/27/1998	3					
Fisherman Bay	L31	02/03/1998	3					
		L31 geometric mean	4					
Fisherman Bay	L4	05/01/1997	7		7.6	44.7	12.5	Down Road from L3
Fisherman Bay	L6	05/01/1997	3	ND	7.3	26	15.5	Pond near transfer station
Hunter Bay	L13	05/13/1997	4	ND	7.4	1.9	9.6	USGS gage sta pond .4ft
Hunter Bay	L32	11/18/1997	3		7.9	33	5.7	Stream private residence-Hunter Bay Rd. (right fork)
Hunter Bay	L32	12/09/1997	23		8.1	35.1	5.3	
Hunter Bay	L32	12/16/1997	1100		8.2	8.2	5.1	
Hunter Bay	L32	01/06/1998	150		8.0	37.1	5.6	
Hunter Bay	L32	01/27/1998	240		8.0	36	7.0	
Hunter Bay	L32	02/03/1998	43		8.1	41.2	7.3	
		geometric mean	70					
Lopez Sound	L17	05/07/1997	150	0.13	7.8	3.5	16.4	Pond Ellis farm
Lopez Sound	L18	05/07/1997	460		7.5	35	12.2	S. side Johnson Lane (Private Rd.)
Lopez Sound	L18	06/03/1997	460	0.29	7.7	92	12.7	
Lopez Sound	L18	11/18/1997	460		7.8	33	6.2	
Lopez Sound	L18	12/09/1997	43		7.7	47	5.7	
Lopez Sound	L18	12/16/1997	2400		7.8	72	5.6	
Lopez Sound	L18	01/06/1998	460		7.7	57	5.9	
Lopez Sound	L18	01/27/1998	23		7.9	50	7.3	
Lopez Sound	L18	02/03/1998	23		8.1	34	6.6	
		geometric mean	199					
Lopez Sound	L20a	05/07/1997	4	0.28	7.2	9.5	13.4	
Lopez Sound	L20b	05/07/1997	2					Stream in ravine
Lopez Sound	L25	06/03/1997	120					Third test pit frm entrance
Lopez Sound	L28	05/07/1997	2	0.12	6.8	0.5	12.4	Culvert by road inflow
Lopez Sound	L29	05/07/1997	2		7.5	34.7	17.8	Culvert outflow by road
Mud Bay	L33	11/18/1997	1100					Tideland Area
Mud Bay	L33	12/09/1997	15					
Mud Bay	L33	12/16/1997	1100					
Mud Bay	L33	01/06/1998	4		7.0	0	8.2	
Mud Bay	L33	01/27/1998	93					
Mud Bay	L33	02/03/1998	460					
		geometric mean	121					

Note: ND means concentration below the detectable limit.



Lopez Island sample sites
6/97 - 2/98

Appendix B. Maps of San Juan County watershed characteristics

Figures B-1, B-1a, B-1b, B-1c. San Juan County jurisdictional boundaries, roads, contours, and streams.

Figure B-2. Landcover vegetation.

Figure B-3. Upland, wetland and estuarine habitat.

Figure B-4. Coastal wetlands, intertidal areas, and marine habitat.

Figure B-5. Soil characteristics: limitations and suitability.

Figure B-6. Current land use.

Figure B-7. Parcels with residential development.

The maps of San Juan County characteristics were developed using geographic data from several sources. The information sources vary and, for the most part, are not comprehensive and provide a level of detail that can be used only as a general guide to the current conditions in the county. There are large gaps in the digital information available for natural areas, wetlands, and terrestrial and marine flora and fauna. Most of the inventories used for the maps of natural areas were conducted at least 20 years ago and limited in coverage. Soil maps are based on a scale that does not show areas smaller than five acres. Wetland maps are derived from aerial photos and satellite images that do not show forested wetlands, or wetlands in certain grassland conditions. Current land use maps are based on a parcel database developed for tax assessment purposes, which has some limitations when used as a geographic display.

Soils: Soil maps were developed from digital data produced by Washington State Department of Natural Resources, based on the 1963 USDA Soil Survey for San Juan county. Soil characteristics for septic suitability and erosion were mapped based on the 1973 Huxley College of Environmental Studies, San Juan Islands Soil Suitability Analysis. Soil characteristics for forestry suitability were mapped based on the Washington State Department of Natural Resources State Soil Survey (abridged for San Juan County). Soil characteristics for aquifer recharge and prime agricultural lands were mapped according to San Juan County Critical Areas Ordinance, adopted 1995.

Habitat: Upland terrestrial habitat was mapped from Washington State Department of Fish and Wildlife Natural Heritage Program digital data which includes wetlands, natural ecosystems, and flora and fauna listed as priority species under state and federal regulations (endangered, threatened, and species of concern). Upland wetlands, streams and lakes were mapped using US Geological Survey streams and National Wetlands Survey data distributed by Washington State Department of Natural

Resources. Wetland data from the San Juan County Wetland Survey, 1991, was used as well.

Land Use: Land use was derived from parcel data developed by the San Juan County Assessor's office. Assessments are revised every three years.

Note: The scale of the maps presented here are county-wide. These maps will be made available at the county's internet website so that those interested can zoom-in on specific watersheds and areas for a better picture of local conditions.

Appendix C. San Juan County Characterization Report References

- Washington Department of Ecology Office of Technical Services Water Supply Bulletin No. 46 1975. Geology and Water Resources of the San Juan Islands. Olympia, WA
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BEST MANAGEMENT PRACTICES REFERENCE GUIDE

Appendix D

Agriculture

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Irrigation Management Practices to Protect Ground Water and Surface Water Quality, State of Washington, Peter Canessa, Washington Department of Ecology and WSU, 1994

NRCS Publications

Tips for small acreages in Oregon:

- Fact Sheet 2, January 1999, Protecting Your Watershed
- Fact Sheet 4, January 1999, Protecting Streambanks from Erosion
- Fact Sheet 5, January 1999, Managing Streamside Areas with Buffers
- Fact Sheet 7, January 1999, Managing Pastures
- Fact Sheet 8, January 1999, Managing Weeds in Pasture
- Fact Sheet 9, January 1999, Providing Stockwater in Fields and Near Streams
- Fact Sheet 10, January 1999, Designing a Fence
- Fact Sheet 11, January 1999, Managing Manure and Mud in Oregon
- Fact Sheet 12, January 1999, Fertilizing for profit
- Fact Sheet 13, January 1999, Protecting Your Land from Erosion
- Fact Sheet 14, January 1999, Planning and Managing Irrigation

WSU Publications

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Which Test is Best? Customizing Dairy Manure Nutrient Testing, PHW0505, 1997
Horse Waste and Land Management Manual, EM4806, 1998
Sustainable Agricultural Resource Guide for Oregon and Washington, OREM8531, 1993
Maximizing Stocking Rates with Common-use and Proper-use Grazing, EB1356

Forest

WSU Extension Resources

Forest Stewardship Planning Workbook, PNW0490, 1995
Forest Stewardship: A Handbook for Washington Forest Landowners, MISC0155, 1998
Managing Forestlands in Washington, MISC0138, 1991
Managing Your Timber Sale, EB1818, 1996
Plant Your Trees Right, PNW0033, 1986
Thinning, An Important Timber Management Tool, PNW0184, 1985
Trees of Washington, EB0440, 1997
Coastal Douglas-Fir Forests and Wildlife, MISC0168, 1995
Is There a Place for Fish and Wildlife in Your Woodland?, MISC0132, 1995

NRCS Publications

Tips for small acreages in Oregon:

Fact Sheet 15, January 1999, Managing Sustainable Forests
Fact Sheet 16, January 1999, Enhancing Wildlife Habitat
Fact Sheet 17, January 1999, Constructing a Pond

Small landowner

NRCS & NACD Backyard Conservation Series Includes:

Backyard Conservation
Composting
Pest Management
Nutrient Management
Wildlife Habitat
Mulching
Water Conservation
Terracing
Backyard Pond
Wetland
Tree Planting

Stormwater runoff

DOE

Water Quality Guide; Recommended Pollution Control Practices for Homeowners and Small Farm Operators

NRCS Publications

Tips for small acreages in Oregon:

Fact Sheet 15, January 1999, Managing Sustainable Forests
Fact Sheet 16, January 1999, Enhancing Wildlife Habitat
Fact Sheet 17, January 1999, Constructing a Pond
Fact Sheet 19, January 1999, After You Buy: Wells, Septic Systems, and a Healthy Homesite

WSU

Properly managing your Septic Tank System, EB1671, 1994
Protect your Groundwater Survey your Home Environment, EB1631, 1994

APPENDIX D

Natural Resource Conservation Service BEST MANAGEMENT PRACTICES

Best Management Practices (BMP's) consist of sustainable approaches to land planning and management that protect soil and water resources against degradation. Resource management agencies, groups and educators identify and promote BMP's in varying ways. This appendix provides information on BMP's recommended by the Natural Resource Conservation Service (NRCS). The NRCS defines Best Management Practices in their Field Office Technical Guides according to the following criteria:

Conservation Practice – A structural measure, a vegetative measure or a management activity used to protect, enhance or manage, soil, water, air, plant or animal resources

Conservation Practice Standard – A set of statements that defines a practice; identifies the purposes and applicability of the practice; establishes criteria to support each purpose; lists special concerns useful in planning, designing, and constructing the practice; and establishes installation, operation and maintenance requirements.

Conservation Practice Specifications – Site specific documents that establish the technical details and workmanship required to install the practices in accordance with the requirements of the practice standard.

The following is a partial list of current NRCS practices that apply to San Juan County. The definitions given are summaries taken from the Conservation Practice Standard pages for each practice in Field Office Technical Guide 4. In creating conservation plans, planners recommend that combinations of these practices be implemented in concert to achieve desired results and improve water quality.

Bedding (310) – Plowing, blading, or otherwise elevating the surface of flat land into a series of broad, low ridges separated by shallow, parallel channels to provide improved surface drainage, minimize water ponding, permit efficient operation of tillage and harvesting equipment, and eliminate sources of mosquito production.

Brush Management (314) – Removal, reduction, or manipulation of non-herbaceous plants to restore natural plant community balance; create a desired plant community; reduce competition for space, moisture, and sunlight between desired and unwanted plants; manage woody plants; restore vegetation cover to protect soils, control erosion, reduce sediment, improve water quality and enhance stream flow, maintain or enhance wildlife habitat, protect from wildfire hazards, and improve visibility and access for handling livestock.

Channel Vegetation (AC) (322) – Establishment and maintenance of plants on channel banks, berms, spoils, and associated areas to stabilize channel banks and adjacent areas and reduce erosion and sedimentation.

Chiseling and Subsoiling (324) – Loosening the soil, without inverting and with a minimum of mixing of the surface soil, to shatter restrictive layers below the normal plow depth that inhibit water movement or root development.

Commercial Fishponds (397) – A water impoundment constructed and managed for commercial aquaculture production to provide a favorable water environment for producing, growing, harvesting and marketing aquaculture crops and to control water quality.

Composting Facility (317) – A facility for the biological stabilization of waste organic material to treat waste biologically by producing a hums-like material that can be recycled as a soil amendment and fertilizer substitute or otherwise utilized in compliance with all laws, rules and regulations.

Conservation Cover (327) – Establishing and maintaining perennial vegetative cover to protect soil and water resources on land retired from agricultural production to reduce soil erosion and sedimentation, improve water quality, and create or enhance wildlife habitat.

Conservation Crop Rotation (328) – Growing crops in a re-occurring sequence on the same field to reduce sheet and rill erosion, reduce irrigation induced erosion, maintain or improve soil organic content, manage plant nutrients, improve water use efficiency, manage saline seeps, manage plant pests, provide food for domestic livestock and provide food and cover for wildlife.

Constructed Wetland (656) – A wetland that has been constructed for the primary purpose of water quality improvement.

Contour Farming (AC) (330) – Farming sloping land in such a way that preparing land, planting, and cultivating are done on the contours to reduce erosion and control water.

Contour Orchard and Other Fruit Area (331) – Planting orchards, vineyards, or small fruits so that all cultural operations are done on the contour to reduce soil and water loss, better control and use water, and operate farm equipment more easily.

Controlled Drainage (335) – The control of surface and subsurface water through the use of drainage facilities and water control structures to conserve water and maintain optimum soil moisture, optimize infiltration, increase plant root zone depth, improve surface water quality, reduce nitrates in drainage water, reduce subsidence and wind erosion, and provide water for wildlife.

Cover Crop (340) - A crop of close-growing grasses, legumes, or small grains grown primarily for seasonal protection and soil improvement. This crop is usually grown for 1 year or less, except where there is permanent cover as in orchards.

Critical Area Planting (342) – Planting vegetation, such as trees, shrubs, vines, grasses, or legumes, on highly erodible or critically eroding areas to stabilize the soil, reduce damage from sediment and runoff to downstream areas, and improve wildlife habitat and visual resources.

Cross Wind Ridges (589A) –Ridges formed by tillage or planting and aligned across the prevailing wind erosion direction to reduce soil erosion from wind.

Cross Wind Strip Cropping (589B) – Growing crops in strips established across the prevailing wind erosion direction, and arranged so that strips susceptible to wind erosion are alternated with strips having a protective cover that is resistant to wind erosion.

Cross Wind Trap Strips (589C) – Herbaceous cover resistant to wind erosion established in one or more strips across the prevailing wind erosion direction to reduce erosion from wind, protect growing crops from damage by wind-borne particles, and provide food and cover for wildlife.

Fence (382) – Enclosing or dividing an area of land with a suitable permanent structure that acts as a barrier to livestock, big game, or people to protect areas from grazing, regulate access and protect new seedlings.

Field Border (386) – A strip of permanent vegetation established at the edge or around the perimeter of a field to reduce erosion from wind and water, protect soil and water quality, manage harmful insect populations and provide wildlife food and cover.

Filter Strip (393) – A strip or area of vegetation for removing sediment, organic matter, and other pollutants from runoff and wastewater.

Fish Stream Improvement (395) – Improving a stream channel to make a new fish habitat or to enhance an existing habitat to increase the production of desired species of fish.

Floodwater Diversion (400) – A graded channel with a supporting embankment or dike on the lower side constructed on lowland subject to flood damage to improve the crop-growing environment of lowlands and improve water quality.

Forage Harvest Management (511) – The timely cutting and removal of forages from the field as hay, green-chop, or ensilage to optimize economic yield, promote vigorous plant regrowth, maintain desired species composition, control insects and disease and improve wildlife habitat.

Forest Harvest Trails and Landings (655) – Laying out, constructing and using forest harvest trails and landings to allow for removal of a forest product while minimizing onsite and offsite damage to resources.

Forest Site Preparation (490)- Treating areas to encourage natural regeneration of desirable trees and shrubs or to permit artificial regeneration by planting or direct seeding.

Forest Stand Improvement (666) – To manipulate species composition and stocking by cutting or killing selected trees and understory vegetation.

Grazing Land Mechanical Treatment (548) – Modifying physical soil and/or plant conditions with mechanical tools by treatments such as; pitting, contour furrowing, and ripping or subsoiling to fracture compacted soil layers and improve soil permeability, reduce water runoff and increase infiltration, increase plant vigor and produce greater yields.

Heavy Use Area Protection (561) – Protecting heavily used areas by establishing vegetative cover, by surfacing with suitable materials, or by installing needed structures.

Hedgerow Planting (422) – Establishing a living fence of shrubs or trees in, across, or around a field to delineate field boundaries, serve as fences, establish contour guidelines, provide wildlife food and cover, provide screens, or improve the landscape.

Hillside Ditch (423) – A channel that has a supporting ridge on the lower side constructed across the slope at definite vertical intervals and gradients, with or without a vegetative barrier, to control water flow in non-cultivated sloping areas by diverting runoff to a protected outlet, thus minimizing erosion, conserving water and improving water quality.

Irrigation Field Ditch (388) – A permanent irrigation ditch constructed to convey water from the source of supply to a field or fields in a farm distribution system to prevent erosion or loss of water quality or damage to land.

Irrigation Storage Reservoir (436) – An irrigation water storage structure made by constructing a dam to conserve water by holding it in storage until it can be beneficially used to meet crop irrigation requirements, provide incidental water for livestock, fish, wildlife, recreation, and fire control.

Irrigation Water Conveyance (428) – A pipeline and appurtenances installed in an irrigation system to prevent erosion, prevent a reduction of water quality, damage to land due to water logging, and to make possible proper management of irrigation water and reduce water conveyance losses.

Land Clearing (460) – Removal of trees, stumps, and other vegetation from wooded areas to achieve needed land use adjustments and to provide improvements in the interest of soil and water conservation.

Land Smoothing (466) – Removing irregularities on the land surface by use of special equipment to improve surface drainage, obtain more uniform planting depths and facilitate contour cultivation.

Mole Drain (482) – An underground conduit constructed by pulling a bullet shaped cylinder through the soil to establish a system of subsurface channels for removal of trapped surface and shallow subsurface water from low gradient land.

Mulching (484) – Applying plant residues or other suitable materials not produced on the site to the soil surface to conserve moisture, prevent surface compaction and crusting, reduce runoff and erosion, control weeds and help establish plant cover.

Nutrient Management (590) – Managing the amount, form, placement, and timing of applications of plant nutrients to optimize forage and crop yields, minimize entry of nutrients to surface and groundwater, and maintain or improve chemical and biological conditions of the soil.

Obstruction Removal (500) – Removal and disposal of unwanted, unsightly or hazardous buildings, structures, vegetation, landscape features, trash, and other materials.

Pasture and Hay Planting (512) – Establishing and reestablishing long-term stands of adapted species of perennial, biennial, or reseeding forage plants to reduce erosion, produce high quality forage, and to adjust land use.

Pest Management (595A) – Managing agricultural pest infestations to reduce adverse effects on plant growth, crop production and environmental resources in order to develop a pest management system that is both consistent with selected crop production goals and is environmentally acceptable.

Pond (378) – A water impoundment made by constructing a dam or an embankment or by excavating a pit or dugout to provide water for livestock, fish and wildlife, recreation, fire control, crop and orchard spraying, and other related uses and to maintain or improve water quality.

Pond Sealing or Lining (521) – Installing a fixed lining of impervious material or treating the soil in a pond mechanically or chemically to impede or prevent excessive water loss.

Precision Land Forming (462) – Reshaping the surface of land to planned grades to improve surface drainage, provide land forming operations for drainage and erosion control, improve moisture conservation, help leaching uniformity, and improve water quality.

Prescribed Burning (338) – Applying controlled fire to predetermined areas to control undesirable vegetation, prepare sites for planting or seeding, control plant disease, reduce wildfire habitat, improve forage production quantity or quality, remove slash and debris,

enhance seed and seedling production and facilitate the distribution of grazing and browsing animals.

Prescribed Grazing (528A) – The controlled harvest of vegetation with grazing or browsing animals managed to improve or maintain the health and vigor of selected plants and to maintain a stable and desired plant community, provide or maintain food, cover and shelter for animals of concern, improve or maintain animal health and productivity, maintain or improve water quality and quantity and reduce accelerated soil erosion and maintain or improve soil condition for sustainability of the resource.

Range Planting (550) – Establishment of adapted perennial vegetation such as grasses, forbs, legumes, shrubs, and trees to restore a plant community similar to its historic climax, provide or improve forage for livestock, provide or improve habitat for wildlife, reduce erosion and improve water quality and quantity.

Recreation Area Improvement (562) – Establishing grasses, legumes, vines, shrubs, trees, or other plants or selectively reducing stand density and trimming woody plants to improve an areas attractiveness and usefulness for recreation and to protect soil and plant resources.

Recreation Land Grading and Shaping (566) – Altering the surface of the land to meet the requirements of recreation facilities to permit effective uses of the land area for recreation, improve surface drainage for recreation use and obtain more uniform soil depths.

Recreation Trail and Walkway (568) – A pathway prepared especially for pedestrian, equestrian, and cycle travel to provide users of recreation areas with travel routed for such activities, prevent erosion on or along pathways, and to preserve and protect soil, plant, animal, and visual resources.

Regulating Water in Drainage Systems (554) – Controlling the removal of surface or subsurface runoff, primarily through the operation of water control structures to establish and encourage the growth of desired field or forest plants, reduce soil subsidence and erosion and provide water for wildlife.

Residue Management (329) – Managing the amount, orientation, and distribution of crop and other plant residue on the soil surface year-round, while growing crops where the entire field surface is tilled prior to planting to reduce erosion, conserve soil moisture and provide food and escape cover for wildlife.

Restoration and Management of Declining Habitats (643) – Restoring and conserving rare or declining native vegetated communities and associated wildlife species.

Riparian Forest Buffer (391A) – An area of trees and/or shrubs located adjacent to and up-gradient from water bodies to create shade, lower water temperatures, improve habitat for aquatic organisms, provide a source of detritus and large woody debris for aquatic

organisms and habitat for wildlife and reduce excess amounts of sediment, organic material, nutrients and pesticides in surface water.

Roof Runoff Management (558) – A facility for collecting, controlling, and disposing of runoff water from roofs to prevent roof runoff water from flowing across concentrated waste areas, barnyards, roads and alleys, and to reduce pollution and erosion, improve water quality, prevent flooding, improve drainage and protect the environment.

Row Arrangement (557) – Establishing a system of crop rows on planned grades and lengths primarily for erosion control and water management.

Runoff Management System (570) – A system for controlling excess runoff caused by construction operations at development sites, changes in land use, or other land disturbances to regulate the rate and amount of runoff and sediment from development sites.

Soil Salinity Management-Non Irrigated (571) – Management of land, water, and plants to control harmful accumulations of salts on the soil surface or in the root zones on non-irrigated areas.

Streambank and Shoreline Protection (580) – Treatments (vegetative and erosion control) used to stabilize and protect banks of streams or constructed channels and shorelines of lakes, reservoirs, or estuaries.

Stripcropping, Contour (585) – Growing crops in a systematic arrangement of strips or bands on the contour to reduce water erosion. The crops are arranged so that a strip of grass or a close-growing crop is alternated with a strip of clean-tilled crop or fallow or a strip of grass is alternated with a close-growing crop.

Stripcropping, Field (586) – Growing crops in a systematic arrangement of strips or bands across the general slope (not on the contour) to reduce water erosion. The crops are arranged so that a strip of grass or a close-growing crop is alternated with a clean tilled crop or fallow.

Surface Drainage, Field Ditch (607)- A graded ditch for collecting excess water in a field to drain surface depressions, collect or intercept excess surface water from natural or graded land surfaces, and convey excess water to an outlet.

Surface Roughening (609) – Roughening the soil surface by ridge or clod-forming tillage to reduce wind erosion on cultivated land.

Tree/Shrub Establishment (612) – to establish woody plants by planting or seeding to provide forest products, control erosion, reduce air pollution, beautify an area, protect a watershed and provide wildlife habitat.

Tree/Shrub Pruning (660A) – Removing all or parts of selected branches from trees and shrubs to improve the intended function of the plant, improve appearance of trees and shrubs, improve the quality of the wood product and reduce a safety hazard.

Underground Outlet (620) – A conduit installed beneath the surface of the ground to collect surface water and convey it to a suitable outlet, to dispose of excess water from terraces, diversions, subsurface drains or other concentrations without causing damage by erosion or flooding.

Upland Wildlife Habitat Management (645) – Creating, restoring, maintaining or enhancing areas for food, cover, and water for upland wildlife and species which use upland habitat for a portion of their lifecycle.

Use Exclusion (472) - Excluding animals, people, or vehicles from an area to protect, maintain, or improve the quantity and quality of the plant, animal, soil, air, water and aesthetic resources and human health and safety.

Waste Management System (312) – A planned system in which all necessary components are installed for managing liquid and solid waste, including runoff from concentrated waste areas, in order to minimize degradation of air, soil and water resources and protect public health.

Waste Storage Facility (313) – A waste impoundment made by constructing an embankment and/or excavating a pit or dugout or by fabricating a structure to temporarily store wastes such as manure, wastewater, and contaminated runoff as a function of an agricultural waste management system.

Waste Treatment Lagoon (359) – An impoundment made by excavation or earthfill for biological treatment of animal or other agricultural waste to biologically treat organic waste and to reduce pollution and protect the environment.

Water and Sediment Control Basin (638) – An earth embankment or a combination ridge and channel generally constructed across the slope and minor watercourses to form a sediment trap and water detention basin to reduce watercourse and gully erosion, trap sediment, reduce and manage onsite and downstream runoff, and improve downstream water quality.

Water Harvesting Catchment (636) – A facility for collecting and storing precipitation to provide water for livestock, fish and wildlife, recreation, or other purposes.

Wetland Creation (658) – A wetland that has been created on a site location which historically was not a wetland or is a wetland but the site will be converted to a wetland with a different hydrology, vegetation type, or function than naturally occurred on the site.

Wetland Enhancement (659) – The modification or rehabilitation of an existing or degraded wetland, where specific functions and/or values are modified for the purpose of meeting project objectives.

Wetland Restoration (657) – The rehabilitation of a degraded wetland to restore both the hydrologic conditions and the hydrophytic plant community that occurred on site before modification.

Wetland Wildlife Habitat Management (644) – Retaining, developing or managing habitat for wetland wildlife to maintain, develop, or improve habitat for waterfowl, fur-bearers, or other wetland associated flora and fauna.

Wildlife Watering Facility (648) – Develop, improve, or modify watering places and systems for wildlife to provide adequate drinking water during critical periods, to create or expand suitable habitat for wildlife and to improve water quality.

Appendix E. Letters of Concurrence and Resolution of Adoption by the San Juan County Board of Commissioners

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RESOLUTION ADOPTING THE SAN JUAN COUNTY WATERSHED MANAGEMENT ACTION PLAN
AND TRANSMITTING TO DEPARTMENT OF ECOLOGY FOR APPROVAL

RESOLUTION NO. 72 -- 2000

WHEREAS, Section 400-12 WAC, the "Nonpoint Rule" establishes criteria for ranking watersheds and developing and implementing watershed management action plans;

WHEREAS, San Juan County developed a Watershed Ranking Report, adopted in 1988, designating priority watersheds for future nonpoint action planning;

WHEREAS, San Juan County established the Watershed Management Committee in 1996 to proceed with the nonpoint action plan;

WHEREAS, all the requirements for planning under Section 400-12 WAC have been met and are ready for submittal to Department of Ecology;

WHEREAS, workshops were held to present nonpoint issues and the draft plan to the public;

WHEREAS, a SEPA Determination of Nonsignificance was made by the San Juan County Planning Department, and hearings held with the Planning Commission on February 18 and March 17, 2000;

WHEREAS, public hearings were held on April 18 and May 3, 2000, where revisions were made to the draft Watershed Management Action Plan;

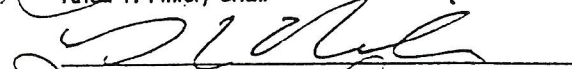
WHEREAS, following the public hearings, the Watershed Management Committee met and revised the draft Plan;


NOW, THEREFORE, BE IT RESOLVED, that the San Juan County Board of Commissioners hereby adopts the San Juan County Watershed Management Action Plan, Exhibit 1 to this Resolution, and submittal to the Washington State Department of Ecology for approval.

DONE THIS 21st day of June, 2000.

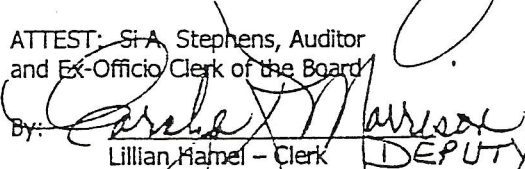
BOARD OF COUNTY COMMISSION
SAN JUAN COUNTY, WASHINGTON


Rhea Y. Miller, Chair


Darcie L. Nielsen, Member


John B. Evans, Member

ATTEST: Si A. Stephens, Auditor
and Ex-Officio Clerk of the Board

By: 
Lillian Hamel - Clerk DEPUTY

APPROVED AS TO FORM ONLY

RANDALL K. GAYLORD
San Juan County Prosecuting Attorney

By: Karen Medder Gillespie



STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

Northwest Regional Office, 3190 - 160th Ave S.E. • Bellevue, Washington 98008-5452 • (425) 649-7000

RECEIVED
AUG 29 2000
HEALTH & COMMUNITY
SERVICES

August 24, 2000

Mark Tompkins
Environmental Health Manager
San Juan County Health & Community Services
PO Box 607
Friday Harbor, WA 98250

Dear Mr. Tompkins:

Congratulations for completing the San Juan County Watershed Management Action Plan and Characterization Report. The watershed characterization provides an excellent overview of water quality related issues in the San Juan Islands and a foundation for the action strategies that follow. Based on Ecology's involvement and review, the plan and the process meet the requirements of WAC 400-12-545, Phase 4 - Action plan review and approval. It is truly fortunate and commendable to be in the position of adopting strategies to prevent water pollution problems, rather than trying to correct them after the fact.

Please find our response to the specific action strategies that involve Ecology following the strategy summaries, below.

County-Wide Action Strategies

*WQ6: Train county personnel and interested parties in wetland identification.
Implementing agencies: San Juan County Health and Community Services, Permit Center, and Conservation District.
Participating agency: Department of Ecology.*

Concur. The Department of Ecology's wetland staff would be happy to participate in training programs for San Juan County personnel and interested parties, time and resources permitting.

*WQ9: Complete a computerized geographic information system (GIS) of watershed characteristics for all of San Juan County and continue to develop resource information to complete a watershed management database for resource technicians and planners, permit staff, developers, conservation groups, and citizens of the county.
Implementing agency: San Juan County GIS.
Participating agencies: Department of Ecology along with several other agencies.*

Concur. Ecology will share its GIS database with San Juan County and assist as resources allow.

OS12: Continue to pursue funding for sanitary surveys in areas of the county with high risk for septic failure, such as: areas where water quality monitoring shows elevated levels of fecal contamination and areas where older subdivisions and septic systems have a direct impact on the shoreline or drainage.

Implementing agency: San Juan County Health and Community Services.

Participating agencies: San Juan County Conservation District and Department of Ecology.

Concur. San Juan County may apply for Ecology Water Quality Financial Assistance grants to fund sanitary surveys. The grant ranking system awards points given to proposals supported by watershed action plans; however, the San Juan County proposals must compete with projects from all over the state. Ecology will fund San Juan County projects that rank competitively, within the limitations of available funding.

LC2: Ensure implementation of BMPs for clearing and grading are instituted for all land development, including single family residences.

Implementing agency: San Juan County Permit Center.

Participating agencies: SJC Public Works and Department of Ecology.

Concur. Developments greater than five acres require an NPDES construction stormwater permit from Department of Ecology, which requires BMP implementation. If county staff observe impacts to water quality due to runoff problems from permitted or unpermitted (those less than 5 acres) construction sites, they should notify Ecology and we will respond appropriately. Due to staff and funding limitations, Ecology must rely on local personnel to observe and report problems when local efforts to gain voluntary compliance fail.

LC3: Develop and insure implementation of Small Parcel Drainage plans for land development, including single family residences.

Implementing agency: San Juan County Permit Center.

Participating agencies: SJC Public Works and Department of Ecology

Small Parcel Drainage plans are no longer an item in Ecology's stormwater manual. If erosion and impacts to water quality during development are the primary concern, the response to LC2, above, applies. Otherwise, this is a local issue.

LC5: Inform developers, realtors and property owners on all issues surrounding land conversions (i.e., "ConversionGram" and newsletters).

Implementing agency: San Juan County Permit Center.

Participating agency: Department of Ecology

Concur. Ecology will share our existing educational material on issues surrounding land conversions. All conversions (Type 4 Forest Practice Permits) greater than 5 acres require an NPDES stormwater permit.

AP4: Develop and activate a Memorandum of Understanding (MOU) between the Department of Ecology and San Juan County to clarify the various agencies' roles and responsibilities in preventing water quality degradation from farming activities.

Implementing agency: Department of Ecology.

Participating agencies: San Juan Conservation District, Permit Center.

There is an existing Memorandum of Agreement (MOA) between Ecology and the Conservation Commission, signed by San Juan County Conservation District before June 1991. The agreement still covers Ecology's and the Conservation District's complaint response and referral procedures for non-dairy agricultural activities. If the Conservation District and/or San Juan County have questions about the existing agricultural compliance MOA, Ecology would be happy to meet to discuss it.

Priority Watershed Action Strategies

Most of the Priority Watershed Action Strategies that list Ecology as an implementing agency involve water quality monitoring. We understand your need and desire for water quality monitoring as you implement this watershed plan. Unfortunately, the Department of Ecology has constraints on resources that limits our ability to respond to requests for monitoring projects. San Juan County's requests for monitoring will be considered as our resources allow.

To avoid repetition of the above statement, specific responses to Priority Watershed Action Strategies are only provided to selected strategies listed below.

East Sound Watershed:

ES1: Identify sources of contamination at East Sound (Fishing Bay), Coon Hollow and Buck Bay, and develop remedial actions. (DOE, HCS)

ES6: Request that DOE (Ecology) investigate sources of low DO and high nutrient levels in East Sound. (DOE)

West Sound Watershed:

WS4: Request that DOE establish an ambient monitoring station in West Sound. (DOE)

Ecology has eight to 12 rotating marine ambient monitoring stations. These stations rotate between north, central, and south Puget Sound every third year. In 1997, East Sound and Lopez Sound were two of the stations selected for the north Puget Sound rotation. In 2000, north Puget Sound monitoring is being done in Drayton Harbor, Bellingham Bay, and several bays on the Strait of Juan de Fuca. Monitoring locations are selected on the basis of current water quality concerns and local requests. The next round of ambient monitoring in north Puget Sound will be in 2003. This monitoring could include the San Juan Islands, particularly if the local government makes its needs known to Department of Ecology Environmental Assessment Program in advance.

Deer Harbor Watershed:

DH3: Long term monitoring of water quality in Deer Harbor. (HCS, DOE)

Friday Harbor Watershed:

FH4: Recommend state and federal funding for improvements to the Town of Friday Harbor's wastewater treatment plant, including water conservation measures. (EPA, DOE)

Municipal wastewater treatment is beyond the usual scope of a non-point watershed action plan. Incorporating water conservation and reuse measures can be considered a non-point strategy and should be encouraged. The Town of Friday Harbor may apply for Ecology grants to cover the costs of needed wastewater treatment plant improvements. Based on the grant application ranking process, municipal treatment plant improvements and water conservation/reuse measures will be funded as resources permit.

Westcott-Garrison Bay Watershed:

WG6: Ensure adequate stream flow to maintain beneficial uses within the watershed. (DOE, HCS)

Concur. There are pending water right applications in Westcott-Garrison Bay watershed that require review by Ecology's Water Resources Program. To support this review and watershed planning efforts, requests for stream flow studies have been submitted to Ecology and Washington Department of Fish and Wildlife. The studies will focus on stream flow requirements to maintain beneficial uses in the watershed and sustain the ecology of Westcott-Garrison Bay.

WG8: Establish baseline and long term water quality and stream flow monitoring and modeling of stormwater runoff to determine the cumulative impact of conversions upland in the watershed. (DOE)

Roche Harbor Watershed:

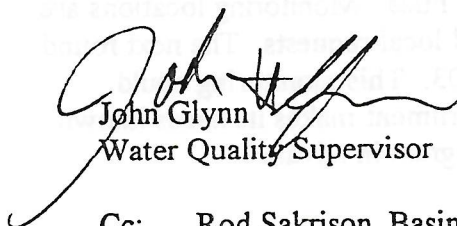
RH1: Ongoing monitoring of water quality in the Harbor. (DOE, HCS)

Fisherman Bay Watershed:

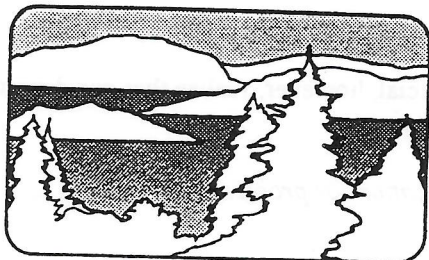
FishB2: Set up ongoing water quality monitoring in the bay. (DOE, HCS)

Thank you and all the participants for your hard work on this watershed action planning process. We look forward to working with you through plan implementation. If you have any questions about this letter, please call Joanne Polayes at (425) 649-7269.

Sincerely,


John Glynn
Water Quality Supervisor

Cc: Rod Sakrison, Basin Lead



Health & Community Services
San Juan County

P.O. Box 607 • 145 Rhone, Friday Harbor, WA 98250
Phone: (360) 378-4474 Fax: (360) 378-7036

April 14, 2000

Vicki Heater
San Juan County Health & Community Services
PO Box 607
Friday Harbor, WA 98250

Re: Watershed Management Action Plan
Review and Statement of Concurrence

Dear Mrs. Heater:

Our department concurs with all strategies where we are identified as the implementing or participating agency. Many of these strategies, including WQ2, WQ6, WQ9, OS1, OS2, OS4, OS5, OS6, OS7, OS9, OS10, and SH5, have been or are in the process of being implemented by our department. In order to implement several of the other strategies additional resources, including staff and funding, will be required. Comments on the strategies not currently being implemented are as follows:

WQ1: Develop and fund a long-term monitoring program.....

Concur. A long-term monitoring program is currently being developed by Western Washington University. Implementing the program will be dependent on funding.

WQ8: Utilize an early warning threshold of no more than 10% of the samples used to calculate the geometric mean exceed 10 cfu/100ml.....

Concur. This will be an excellent way to identify potential hotspots before serious degradation occurs. However, additional resources (staff) will be required to implement the strategy.

WQ10: Work with the San Juan County Land Bank to establish a watershed based priority rating system for land acquisition...

Concur.

WQ12: Establish water resource protection areas or districts for drinking water sources.

Concur.

OS3: Facilitate workshops with septic tank pumpers and maintenance provider about contracting with homeowners groups...

Concur. Facilitating workshops may be beneficial, however, realize that our department is not in the position to require contracts or set prices.

OS8: Take enforcement action against/revoke certification for problem contractors.....

Concur.

OS11: Provide adequate funding to maintain an effective O&M program.....

Concur.

OS12: Continue to pursue funding for sanitary surveys in areas

Concur.

LC6: Develop resource management overviews for county staff, developers, property owners, and homebuyers using existing data and technology.

Concur, in supporting role.

MR3: Pursue obtaining funding to develop additional pump-out facilities, either portable or at marinas.....

Concur in supporting role. Our department will help and support any agency in identifying and apply for funding for pump-out facilities.

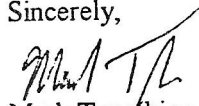
SH1: Inventory and evaluate all unregulated landfills.

Concur, provided additional funds and staff are allocated.

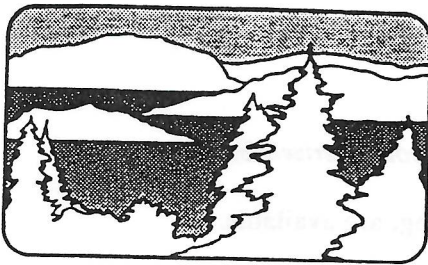
In regards to our department acting as the lead agency, we concur. We agree that our involvement with the plan development makes us the logical choice for lead agency. However, in order to provide effective oversight and carryout the task identified for the lead agency additional resources, staff and funding, will be required. We look forward to working with the Citizen's Review and Implementing Committee on seeing the plan implemented. We are confident that implementing the plan will maintain the pristine water quality currently seen throughout San Juan County.

Thank you for the opportunity to comment on the Action Plan. The Citizen Advisory Committee and you are to be praised for developing a terrific pollution prevention plan. Please feel free to contact me, if you have any questions.

Sincerely,



Mark Tompkins
Environmental Health Manager



SAN JUAN COUNTY Permit Center

135 Rhone Street • P.O. Box 947 • Friday Harbor, Washington 98250
(360) 378-2354 • (360) 378-2116 • FAX (360) 378-3922
permits@co.san-juan.wa.us • www.co.san-juan.wa.us

April 11, 2000

Vicki Heater
San Juan County Health & Community Services
PO Box 607
Friday Harbor, WA 98250

Re: Watershed Management Action Plan
Review and Statement of Concurrence

Dear Mrs. Heater:

Thank you for the opportunity to review and comment on the San Juan County Watershed Action Plan. I would like to commend the citizens advisory committee on a job well done. The plan is comprehensive, well organized and easy to follow.

In regards to the action strategies, San Juan County Permit Center was identified as the implementing and/or participating agency for a total of 18 strategies (11 implementing and 7 participating). The Permit Center generally concurs with all the strategies provided adequate resources, staff and funding, are made available. Specific comments on strategies are as follows:

WQ2: Inform Realtors, Developers, Regulators, Decisions Makers, Contractors, Planners, and property owners about wetlands and non-point sources of pollution....

Concur. As the permitting authority, we continually inform property owners, developers, and Realtors about setbacks and mitigating measures needed to protect critical areas including wetlands.

WQ4: Require jurisdictional wetland delineation's, pursuant to county and federal regulations, be completed and submitted on all land development permits on properties with wetlands and/or hydric soils.

Do not concur. Requiring wetland delineations would provide excellent information on wetlands throughout San Juan County. However, the cost to benefit ratio may not warrant requiring delineations for all land development permits. Currently, all development permits are reviewed to insure compliance with critical area setbacks including wetlands. Waivers can be granted to single family residences, simple land divisions, and subdivisions, provided sufficient information exists for staff to estimate the boundaries of the wetlands. In addition, larger buffers are required as part of a qualifying waiver.

WQ5: Update and maintain the county's wetland inventory in a computerized GIS format...

Concur, provided sufficient resources, staff and funding, are available.

WQ6: Train county personnel and interested parties in wetland identification.

Concur. Strategy has been implemented. Staff received training in 1999.

WQ9: Complete a computerized geographic information system (GIS) of watershed characteristics...

Concur. Strategy has been implemented. Many layers already exist and are used by Permit Center staff in reviewing development permits. We agree that the system must be maintained and updated with current information. The GIS department is currently sorting out how the updates should be done and by whom.

OS4: Develop and implement an effective on-site septic system operation and maintenance program for San Juan County.

Concur. We work with Health and Community Services on a variety of issues and will assist as necessary.

LC2: Insure implementation of BMPs for clearing and grading are instituted for all land development, including single family residences.

Concur, provided adequate resources, staff and funding, are available. In addition, the Unified Development Code (UDC) will need to be changed to remove the exemption for single family residences.

LC3: Develop and insure implementation of Small Parcel Drainage plans for land development, including single family residences.

Concur. Strategy is already being implemented. The UDC requires drainage plans for land development activities including single family residences.

LC5: Inform developers, Realtors, and property owners on all issues surrounding land conversions.

Concur, provided adequate resources, staff and funding, are available.

LC6: Develop resource management overviews for county staff, developers, property owners, and homebuyers using existing data and technology.

Concur. GIS data is currently available to developers, contractors and property owners on the county's web site. In addition, the data has been made available to various contractors throughout San Juan County.

SW1: Improve enforcement of stormwater control measure, through inspection, to insure their effectiveness.

Concur, provided adequate resources, staff and funding, are available.

SW2: Require contractors that construct stormwater facilities be certified by the Department of Transportation or other

Concur. This will require a change to the Unified Development Code (UDC).

SW3: Require an as-built drawing and operation and maintenance manual be completed and submitted on all new and revised permanent stormwater facilities.

Concur. This will require a change to the Unified Development Code (UDC).

AP4: Develop and activate a Memorandum of Understanding (MOU) between the Department of Ecology and San Juan County to clarify the various agencies... ..

Do not concur. The Permit Center has no authority over water quality pollution from farming activities. DOE is the enforcement authority.

AP5: Remove agricultural lands from the categorical exemption for storm water drainage standards in the UDC.

Concur. This will require a change to the Unified Development Code (UDC).

FP1: Inform landowners and loggers of the requirements of the forest practice rules and benefits of BMPs. Develop and implement a program to present information to

Concur, provided adequate resources, staff and funding, are available.

FP5: Require wetland delineations be completed on properties with wetlands and/or hydric soils, as part of the forest practice permit applications.

Concur.

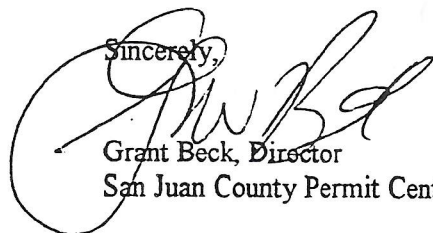
FP6: Develop and utilize a computer tracking system, which includes mapping of activities, for forest practice applications and subsequent land development.

Concur, provided adequate resources, staff and funding, are available.

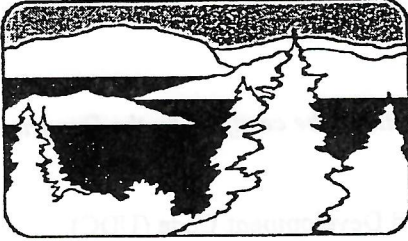
As indicated above, the Permit Center concurs with a majority of the strategies where we are listed as the implementing or participating agency. However, in order to implement the strategies additional resources, staff and funding, will be required. Based on the number of new programs identified we estimate that a fulltime resource technician will be require to effectively implement all the strategies.

Again, thank you, for the opportunity to comment on this valuable plan. Please feel free to contact me, if you have any questions.

Sincerely,



Grant Beck, Director
San Juan County Permit Center



Assessor

Paul G. Dossett

San Juan County

P.O. Box 1519 Friday Harbor, Washington 98250

(360) 378-2172

March 16, 2000

To: Vicki Heater

From: Paul Dossett

Re: San Juan County Watershed Management Action Plan

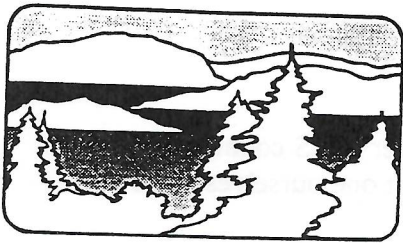
Thank you for providing a copy of the Action Plan for the Assessor's Office review.

I have reviewed the Plan and more specifically AP3 and FP3 as you have suggested. The reference to Best Management Practices (BMPs) in regard to the state Open Space Farm and Agriculture program and the two current use forest programs may be beneficial if I knew what they were. It would be helpful for the lay person to have a discussion what a BMP is for each use such as agriculture and forest land.

I can support the Management Action Plan provided the Plan does not impede the primary use of property enrolled in the state current use programs. As mentioned in the Plan, there may be legislation promoted to address these issues and how they relate to the state current use programs.

I noticed in FP3 the sentence refers to Timber Open Space but I presume you want to refer to Designated Forest Land as well. Also, the term 'designated' should be changed to 'classified' which is the appropriate language for open space.

If you want DFL land represented in the sentence, I would suggest the following language after "timber management" to sayfor land classified as Open Space Timberland and designated as Forest Land (DFL).




Planning Department San Juan County

P.O. Box 947 • Friday Harbor, WA 98250
(360) 378-2393 • Fax (360) 378-3922

July 12, 2000

Memorandum

To: Vicki Heater
From: Laura Arnold 
Re: Concurrence with the Final SJC Watershed Action Plan

I've reviewed the items for which the Planning Department is assigned as implementing agency. Of course I concur, to the extent that competing priorities for Planning Department resources allow. This is to offer the following comments:

WQ2 – Disseminate information about wetlands and nonpoint pollution – Y1 – We still have a ton of wetlands brochures that can be made available again. These address wetland functions and values; what could be added is a flier about county rules for wetland protection. The PSAT booklet, *the Puget Sound Shoreline Stewardship Guidebook*, is an excellent and user-friendly guide that includes information about avoiding nonpoint pollution from residential activities.

WQ4 – Review/revise ESA regulations about wetlands for best management practices – Y2 – We don't have any indication that the existing regulations are not adequate; the problem more likely lies in how we use information. The best bet would seem to be using the presence of hydric soils as an indicator to prompt on-site investigation for the presence of wetlands and to have someone update the inventory used in the GIS when new delineations are made. That would be most likely done by the Permit Center or by Central Services – Planning never sees project applications.

WQ10 – Work with the Land Bank to establish priorities for acquisition and have the PBRS encourage wetland/riparian area preservation – Y1 – The PBRS already does this for open-open space and the Planning Commission is working on incorporating habitat and water-quality factors into the considerations given to timber-open space applications. Perhaps the Planning Commission can invite the Land Bank to a workshop on priorities in conservation within the context of watershed management goals. First, it would be useful to have a summary of watershed acquisition priorities based on the assessment report.

WQ11 – Marine Habitat Management Area designations – Y3 – Westcott/Garrison is pending (we just need time); others (Mud/Hunter Bays and Blind Bay) are dependent on funding to conduct characterizations and assessments and on staff time to handle the public process. I'd like to see this model used as a form of marine protected area that

local government can establish and that we can offer to other NWS counties and to the gulf islands. That will probably need to wait until we adopt one ourselves and begin implementing strategies for it.

LC1 – Review/revise the clearing and grading regs for best management practices – Y 2
– The code has been in effect for so little time we haven't got information to tell us it's inadequate. What should we be looking for? Does the assessment report indicate "hot spots" we need to be looking out for? It's expected that the new SMP rules may introduce some higher standards to be met for vegetation management we could consider adding to the code for shorelines and to some extent for non-shoreline riparian areas. Monitoring FP conversions (with the Permit Center entering them into the GIS) could help target locations for water quality testing over time so we can evaluate how effective our standards are.

LC4 – Develop incentives for density reduction, especially in areas with densities higher than 5 acres per unit – Y3 – The county's response to the GMHB Order will go a long way toward addressing this for rural and resource areas in Y1 – other areas are not a priority for density reduction.

LC7 – Develop and implement ways to assess cumulative impacts of land conversion and development on a watershed basis – Y2 – We've been trying to do this for years and progress has been by the millimeter. Conservation design requirements for subdivision, if adopted as part of the Comp Plan 2000 implementation, will accomplish much toward this. Monitoring, though, is key to evaluating how well our standards and practices are working over time and that will take a commitment to funding and outcomes. A place to start would be logging in (sorry) FP conversions and mapping active farms.

LC8 – Conservation design for subdivisions – Y2 – This is proposed as part of Comp Plan 2000 implementation.

SW4 – Disseminate information about best management practices for stormwater, etc. – Y2 – The PSAT probably has the best and most accessible material on this for property owners, realtors, etc.

AP3 – Review/revise Agriculture provisions in UDC 4.2 for water quality – Y2 – Currently, only the Assessor has authority and responsibility to require agriculture management plans associated with the Ag-open space tax program and he doesn't recognize UDC requirements. Other county personnel are apparently without authority to apply UDC standards to farm plans that are solely subject to the assessor's review and acceptance. Addressing the applicability of the UDC to that program will be an issue that goes beyond Y2.

FP4 – Develop best management practices for water quality associated with timber-open space and DFL – Y2 - see comments on AP3. The issue of applicability to DFL is the same as for Ag-open space. For timber-open space, the Planning Commission is working on habitat and water-related protection standards.

FP6 – Review/revise UDC 3.6.8.d(1) for best management practices – Y2 – This refers to the fact that the state FPA supersedes any county authority to regulate forest practices to protect wetlands except through Class IV general and COHP permitting. Short of legislative fiat the only way for this to happen in Y2 is for the DNR to reach some agreement with the county that all of the county is an “area likely to convert” and thus making all non-exempt forest practices Class IV generals and subject to SEPA through the Permit Center. With FP7, however, it could be hard for DNR to ignore the presence of a wetland if our information says there is one on an FPA site.

FP7 – Establish an MOU with DNR to provide DNR with county GIS information – Y1 – Planning can help to negotiate an agreement but the Permit Center is more aptly the implementing agency.

MR1 – Facilitate a survey at marinas, etc., to determine the numbers of boats and the use of pump-outs – Y1 – The MRC can prepare a survey protocol and perhaps can enlist the SJ Stewardship Network or other local organization to conduct and report on the survey.

MR2 – Develop educational materials for boaters on discharges, etc. – Y2 – The PSAT probably already has this, or possibly Soundkeepers or other NGOs. The MRC can be charged with collecting such material and finding an organization to distribute it appropriately.

cc. Board of County Commissioners
Grant Beck



TOWN OF FRIDAY HARBOR
Post Office Box 219 • Friday Harbor, Washington 98250
(360) 378-2390 • FAX: (360) 378-5339

April 7, 2000

Vicki Heater
SJC Health & Community Services
PO Box 607
Friday Harbor, WA 98250

**Re: San Juan County Watershed Management
Action Plan dated 12/14/99**

Dear Vicki,

After Mark Tompkin's presentation regarding the above-mentioned plan at their regularly scheduled meeting on April 6, the Town Council has indicated its willingness to concur with the following tasks assigned to the Town of Friday Harbor:

SW1	SH2
SW2	SH3
SW3	SH4

In addition they agreed with the recommended action strategies for the Friday Harbor and False Bay watersheds.

Thank you for the extended opportunity to review the Action Plan.

Sincerely,

C. King Fitch, Town Administrator

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APR 11 2000

HEALTH & COMMUNITY SERVICES



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APR 14 2000

HEALTH & COMMUNITY
SERVICES

**Friday Harbor Laboratories
University of Washington**

620 University Road
Friday Harbor, WA 98250
April 12, 2000

Health and Community Services
San Juan County Environmental Health
P. O. Box 607
Friday Harbor, WA 98250

Thanks for the opportunity to comment on the 12/14/99 draft of the San Juan Count Watershed Management Action Plan.

I made more detailed comments on earlier drafts, most recently August 31, 1999.

I would like to add here my support for the effort to protect water supplies and natural resources, including wildlife, that depend on quality of watersheds. The characterization and monitoring of water resources of the County and the educational and regulatory efforts are necessary steps in reducing the impacts of an increasing human population on the county watersheds.

I hope that the plan will be adopted and also hope that this letter can serve as my comment in favor of the action plan. I regret that I will be unable to attend the April 18 hearing.

Sincerely,



Richard Strathmann

SAN JUAN COUNTY

HEALTH AND COMMUNITY SERVICES ADVISORY BOARD

April 17, 2000

Board of County Commissioners
350 Court Street
Friday Harbor, WA 98250

Commissioner Rhea Miller, HCSAB liaison
Commissioner Darcie Nielsen
Commissioner John Evans

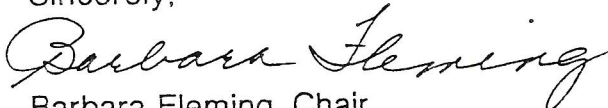
The Health and Community Services Advisory Board has discussed and reviewed the "Agency and Public Review Draft" of the San Juan County Watershed Management Action Plan. As a board concerned with the health and welfare of the citizens of this County, we encourage the adoption of this plan.

Each of the strategies outlined in the plan are important to the quality of our waters. With the majority of the County residents on wells and septic systems, there are broad public health implications in the Water Quality, On-site Sewage System, Storm water Runoff, Agricultural Practices, Forest Practices and Solid and Hazardous Waste Strategies. We also acknowledge the responsibility of local boat owners and marina operators in the Marinas and Recreational Boating Strategies. This committee has supported many of the On-site Sewage System strategies in the past and agrees with the Draft that an effective operation and maintenance program as well as survey program as cited in OS11 and OS12 are wise courses of action.

We agree with the premise that it is more cost effective to implement the strategies listed in the document than it is to clean up problems that will surely arise in the future with added growth. We recommend that you adopt this Action Plan.

We would like to thank the San Juan County Watershed Management Committee and the staff involved in this document for their diligence and patience in pursuit of this plan.

Sincerely,



Barbara Fleming, Chair
Health and Community Services Advisory Board

cc. Betty Gilson, chair San Juan County Watershed Management Committee
Mark Tompkins, San Juan County Staff

Vicki Heater

Marine Resources

From: Jim Slocomb [jslocomb@rockisland.com]
Sent: Wednesday, February 16, 2000 1:51 PM
To: Vicki Heater; Laura Arnold; Mark Billington
Subject: FW: watershed report

Laurie

-----Original Message-----

From: Terrie Klinger [mailto:tklinger@fish.washington.edu]
Sent: Tuesday, February 15, 2000 2:23 PM
To: Slocomb, Jim
Subject: watershed report

Hi Jim:

The watershed report looks pretty good to me. My only comment/suggestion is this: In King County and in some cities (i.e., Lake Forest Park), protection has been afforded to streams and wetlands by passing city or county ordinances that exclude certain activities in stream buffers and in wetlands. In the SJC draft, I didn't see any references to the use of ordinances as a protective device.

Terrie

San Juan Co. Hazardous Waste Program

April 5, 2000

MEMO TO: Vicki Heater
San Juan County Health and Community Services

FROM: Helen Venada, 378-3421 or *venada@reckistand.com*

RE: SJC Watershed Management Action Plan

Congratulations, Vicki, to you and all the staff and members of the citizen committee for this excellent, and timely, plan. I'm impressed and delighted with the thoroughness of the work; the Summary alone is an education. Well done job!

As Hazardous Waste Manager for the county, and as interested citizen, I do have a few comments and questions:

- Will MONITORING include any testing for chemical pollutants (e.g. in Port/marina waters or town stormdrain outfalls)?
- [p. 11, l, last•]: Will existing septic systems within wetlands and buffers be identified and closed?
- [p. 14, last 2 "problem statements"]: I would add to the 1st, after "improper," "use, storage, and...". A very big risk to the environment and public health is that many households and businesses do not practice safe use (e.g. overuse of garden chemicals or application just before rains) and safe storage (e.g. packaging can easily deteriorate in our marine climate; old containers rust, crack, and leak).

I'd love to hear any ideas for increased haz waste facilities.

Under "Strategies"...

WQ1: Could high monitoring costs be reduced by using trained citizen volunteers, e.g. through Stewardship Network, UW Labs, or Land Bank?

WQ2: ...add hazardous chemical use, storage, disposal.

WQ7: e.g. Stewardship Network et al.?

MR2: After "discharges" add "particularly" (since illegal discharges apply to all U.S. waters).

SH1: Any ideas on HOW to inventory and evaluate illegal landfills on private property? Abandoned vehicles?

SH2: We'd welcome any ideas on additional funding for increased services.

SH3: How could we reach the agricultural operations, besides providing brochures, etc. at the County Extension Office and County Fair?

SH4: How is the Conservation District involved in recycling?

SH5: Would the Solid Waste Division and Hazardous Waste Project be participants?

And, I'd like to suggest an "SH6" that we've been trying to fit in somewhere! Something like: "Require that building/demolition contractors fill out a waste management plan BEFORE projects are begun." [We believe this could encourage reuse and recycling of materials. Could it be part of the building permit?]

p. 48, 4th ¶, last line: delete "Household and."
5th ¶, 3rd line: s.b. "solid," not "sold."

p. 49, 2nd ¶, 4th line: add after "Federal," Resource. (otherwise known as RCRA).

p. 50, 1st ¶, 2nd line: add after "properly" used, stored, and....
, 5th line: add "or in burn barrels or piles."

2nd ¶, add "and others" or add to list, "marinas, boat maintenance sites, printers and photoprocessing facilities."

p. 54: Of course, I'd like to see some mention here of illegal outdoor burning (per the WA Clean Air Act). It doesn't take very much plastics burning, for example, to pollute a neighborhood's air...and cumulative impacts REALLY stink! E.g., burning green wood or smoldering fires create significant dioxin pollution.

P.S. I wonder how many islanders purchase/i.e. import their drinking water? It would seem to be a large number.



STATE OF WASHINGTON

DEPARTMENT OF HEALTH

OFFICE OF FOOD SAFETY & SHELLFISH PROGRAMS

7171 Cleanwater Ln., Bldg. 4 • PO Box 47824 • Olympia, Washington 98504-7824

(360) 236-3330 • TDD Relay Services 1-800-833-6388

February 9, 2000

Vicki Heater
San Juan County Environmental Health
Health and Community Services
Post Office Box 607
Friday Harbor, WA 98250

Dear Ms. Heater:

RE: San Juan County Watershed Action Plan

Thank you for the opportunity to review the draft San Juan County Watershed Action Plan. We appreciate the foresight and effort involved in developing a comprehensive plan to address your county's watershed issues.

The Washington State Department of Health, Office of Food Safety and Shellfish Programs is asked to implement element WQ8. This element addresses our "early warning threshold" of fecal coliform bacteria in shellfish growing waters. In 1997, we began to provide an annual report of every shellfish growing area to your county. Each year we provide a narrative summary of the sanitary conditions in the area, a map, and a table with a summary of the last 30 water quality samples.

Where we have identified marginal shoreline sanitary conditions or where fecal coliform levels were approaching closure levels, we described the area as "meeting standards but threatened with a downgrade." The fecal coliform levels set for the "threatened" description are where (1) the geometric mean of the last 30 samples exceeds six or (2) the 90th percentile of the last 30 samples exceeds 30. Closure levels for the geometric mean are 14 and for the 90th percentile are 43.



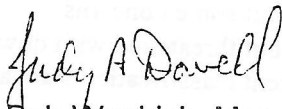
Vicki Heater
San Juan County Environmental Health
Health and Community Services
February 9, 2000
Page Two

Because we do not calculate percentages over 10 cfu / 100ml as you recommend in WQ8, your suggestion would require our Office to use a different calculation method for San Juan County. We would suggest that instead your county use our data that we now provide annually, but set your "local warning threshold" as you see fit.

For example, rather than using our threshold 90th percentile of 30, you could set your threshold at 10 or 20. We will continue to provide your county the summary for all shellfish growing areas in San Juan County. It should be easy for you to select those areas where your "local warning threshold" is exceeded. To illustrate this idea, I have attached one of the annual reports sent to San Juan County last year.

I hope you find this helpful. If you have any questions or concerns regarding this letter, please contact me at (360) 236-3329. For your information, I will be on vacation from February 9th through February 22nd. Thank you.

Sincerely,


Bob Woolrich, Manager
Water Quality

BW:mka

Attached

WASHINGTON STATE DEPARTMENT OF HEALTH
OFFICE OF SHELLFISH PROGRAMS

ANNUAL GROWING AREA REVIEW

PREPARED BY: Jerry Lukes, Environmental Specialist

AREA: Buck Bay - San Juan County

YEAR ENDING: 1998

CLASSIFICATION: Approved

ACTIVITIES IN THE GROWING AREA IN CURRENT YEAR:

Each sample station was sampled 6 times using the Systematic Random Sampling method for evaluation purposes.

ANALYTICAL RESULTS OF WATER SAMPLES

All stations within the growing area have sufficient water data to be classified and are well within the standards for Approved growing areas.

CHANGE IN ACTUAL POLLUTION SOURCES THAT IMPACT THE GROWING AREA:

None.

CLASSIFICATION STATUS:

- Well within the classification standards
- Meets standards, but some concerns
- Meets standards, but threatened with downgrade in classification
- Fails to meet current classification standards

REMARKS ABOUT CLASSIFICATION STATUS:

None.

RECOMMENDATIONS:

The area is correctly classified and should remain classified as Approved.

February 22, 1999

MARINE WATER DATA (SRS)
BUCK BAY

SUBAREA: NONE

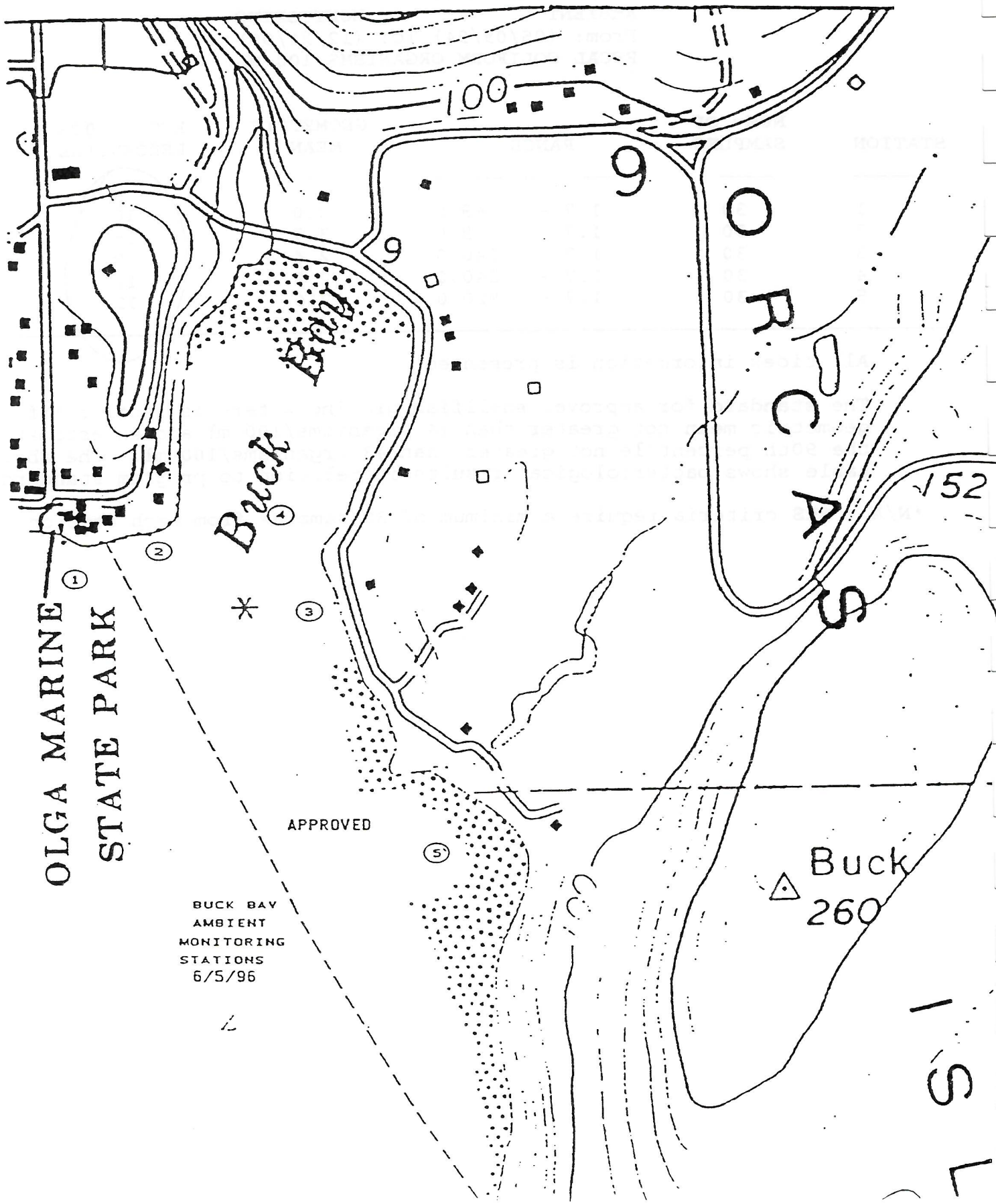
AMBIENT MONITORING
From: (05/09/94) To: (12/21/98)
FECAL COLIFORM ORGANISMS/100 ML

STATION	NUM OF SAMPLES	RANGE	GEOMETRIC MEAN	EST 90TH PERCENTILE	MEET STL
1	30	1.7 - 49.0	3.0	10	YES
2	30	1.7 - 79.0	3.7	15	YES
3	30	1.7 - 240.0	2.4	9	YES
4	30	1.7 - 240.0	2.8	11	YES
5	30	1.7 - 920.0	2.6	12	YES

All tides information is presented

The standard for approved shellfish growing waters is fecal coliform geometric mean not greater than 14 organisms/100 ml and an estimate of the 90th percentile not greater than 43 organisms/100 ml. The above table shows bacteriological results in relation to program standards.

*N/A - SRS criteria require a minimum of 30 samples from each station.



OLGA MARINE
STATE PARK

BUCK BAY
AMBIENT
MONITORING
STATIONS
6/5/96

APPROVED

Buck

ORCASS

Buck
260

100

152

151
L

San Juan County Conservation District

350 Court Street, #10 Friday Harbor, WA 98250 Telephone 360-378-6621 Fax 360-368-2444

RECEIVED

February 11, 2000

FEB 14 2000

HEALTH & COMMUNITY SERVICES

Mark Tompkins
San Juan County Health and Community Services
P.O. Box 607
Friday Harbor, WA
98250

Re: San Juan County Watershed Management Action Plan

Dear Mr. Tompkins,

The San Juan County Conservation District would like to offer its support of the San Juan County Watershed Management Action Plan. The Conservation District is in concurrence with the recommended action strategies to prevent, reduce and eliminate non-point sources of pollution, and has agreed to act as lead and participating agency for many of the actions, subject to funding availability. The District's work plans currently include many of the tasks identified in the Action Plan. We will continue to pursue the implementation of these strategies in order to promote good stewardship of natural resources within the County.

Sincerely,



Jerry Kasparek, Chair
Board of Supervisors



WASHINGTON STATE DEPARTMENT OF
Natural Resources

JENNIFER M. BELCHER
Commissioner of Public Lands

February 15, 2000

Vicki Heater
San Juan County Environmental Health
P.O. Box 607
145 Rhone
Friday Harbor, WA 98250

RECEIVED

FEB 16 2000

HEALTH & COMMUNITY
SERVICES

Re: San Juan County Watershed Action Plan

Dear Ms. Heater,

In response to your letter requesting concurrence with San Juan County's draft Watershed Action Plan, I would like to congratulate the Watershed Management Committee, county officials and staff on all the effort put into the draft document. With respect to the department's concurrence on those items noted in the draft where the department is identified as the implementing entity, we will only be able to concur in instances where the department either has a regulatory requirement, or has the resources to implement non-regulatory programs.

The department does address and/or have programs which target many of the issues listed in your strategy statements. Specifically, the department's efforts to address FP1 are through the Forest Stewardship program, Timber-Fish-Wildlife (TFW) cooperator meetings and presentations, and through the Forest Practices Application program which includes an extensive list of BMPs contained in the Forest Practices Board Manual. (One point of clarification, the department does not regulate clearing activities. Such activities are considered forest land conversion activities which are regulated by the local government.)

FP3. As noted above for FP1, the department currently has BMPs contained in the Forest Practices Board Manual. The Board Manual, in concert with the Forest Practices Rules (WAC 222), is intended to protect habitat and water quality. In addition, new rules are being developed by the Forest Practices Board which include provisions to acquire conservation easements for 50 years along riparian zones under specific circumstances (these rules are part of the Forestry Module designed to comply with the Endangered Species Act). This may include land designated as Timber Open Space.

FP4. The department agrees that implementation monitoring is an important tool. As part of a new emergency rule package that will go into effect March 20, 2000, the department will be initiating a monitoring effort to determine how well the new rules are working on the ground. We

NORTHWEST REGION ■ 919 N TOWNSHIP ST ■ SEDRO-WOOLLEY, WA 98284-9395

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also agree with your statement that the department is limited due to staffing levels.

FP5. The department is always interested in using better information when assessing the potential impacts from a proposed forest practices application. It would be worthwhile exploring the sharing of information. With respect to delineation requirements, a detailed delineation is required only under specific circumstances and not just for timber removal unless filling of wetlands are involved or where a wetland management zone requires detailed delineation. As noted previously, the Forest Practices Rules determine what the department may require.

As always, we look forward to working with San Juan County on these and other issues in the future. Please give me a call should you need clarification on any of the above statements. Again, congratulations and thank you for the opportunity to comment.

Sincerely,



Jim Cahill, Forest Practices Coordinator
Department of Natural Resources, Northwest Region

cc: Nancy Joseph, Assistant Region Manager
Dan Pugmire, District Manager
Loren Wheeler, Islands Forester
file

Filed 2-15-00 JK

Vicki Heater

From: Dennis Shaffer [dennis@rockisland.com]
Sent: Monday, March 06, 2000 9:12 AM
To: Vicki Heater
Subject: Re: Watershed Management Action Plan, concurrence request

Vicki: I am sorry I did not reply sooner to your request. The timing with the Land Bank Commission's meetings did not work. We just met last Friday (our February meeting was the annual retreat). The only area where we would like to suggest some clarification is to the section on County-Wide Action Strategies WQ10. The strategy currently states "Work with the SJC Land Bank to establish a watershed based priority rating system for land acquisition which includes riparian and wetland protection as well as habitat preservation. It is important that the language be clear that such a priority rating system for watersheds represents one of the purposes for which the Land Bank was established. Our purpose states in part to preserve areas in the County that have environmental, agricultural, aesthetic, cultural, scientific, historic, scenic or low-intensity recreational value, and to protect existing and future sources of potable water. I suggest WQ10 read something like "Work with the San Juan County Land Bank to establish a priority rating system for watershed based land acquisition, which includes.... The Land Bank Commission is concerned that there be no confusion about our stated purpose and priority lands. We look forward to working with you and others to implement the plan. Nice work! Please call me if you have questions.
Dennis Shaffer

Vicki Heater

From: Wolfe, Dona [Dona.Wolfe@parks.wa.gov]
Sent: Friday, February 18, 2000 4:36 PM
To: Vicki Heater (E-mail)
Cc: James Horan (E-mail); Petersen, Deb
Subject: San Juan County Watershed Action Plan

In response to your request for comments for your watershed plan Marina and Recreational Boating Strategies Deb Peterson asked me to let you know what our agency is doing.

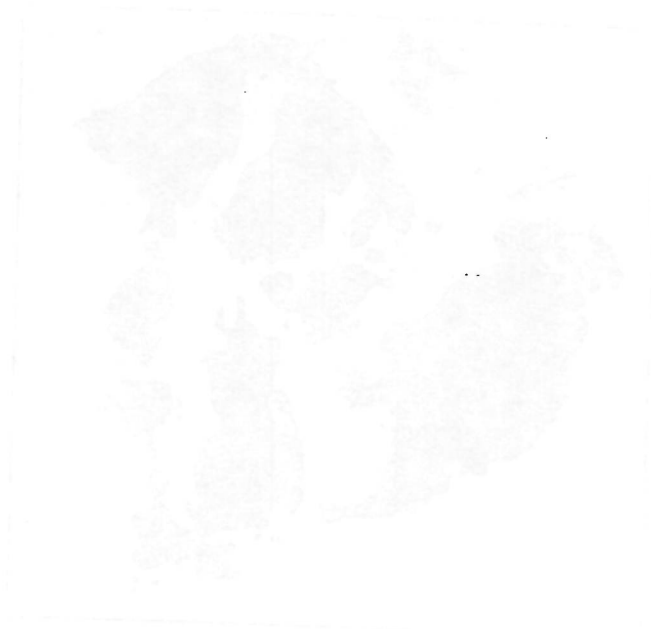
MR1- Boater Survey - We are currently working with the Interagency Committee for Outdoor Recreation to conduct a state wide recreational boat facility inventory along with a survey of boaters opinions and interested in access.

MR2 - I will send you our brochure "How to Pumpout" which discusses the effects of boater sewage on sensitive waters, what boaters can do to eliminate this problem, what boaters can do to use pumpout equipment correctly, and how to use several different types of pumouts. It also includes a map of all public pumpout locations in Washington.

MR3 - Our Clean Vessel program has funding available to repair, replace or put in new pumpouts and other boater sewage disposal facilities. This is a federally funded program which will cover up to 75% of the costs of such projects. It is especially directed toward funding this equipment at private marinas which are open to the public.

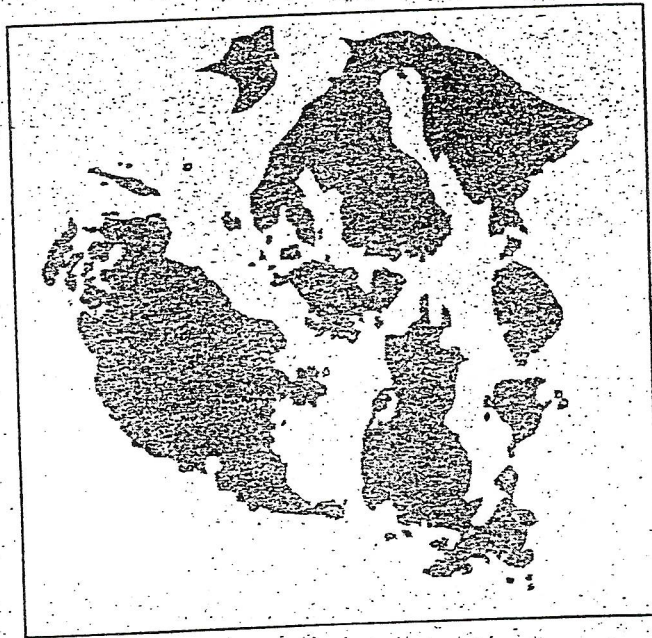
I hope that this information will be of assistance to you. I will be out of the office until March 1. If you have any questions contact James Horan, Boating Law Administrator for assistance. His phone number is 360-902-8580.

Appendix F. San Juan County Monitoring Project Draft Final Report, 1999-2000, Chapter 5, Results and Discussion



The map shows the geographical boundaries of San Juan County, New Mexico. The terrain is depicted with varying shades of gray, suggesting elevation changes and geographical features like mountains and valleys. The map is oriented with North at the top.

San Juan County Monitoring Project DRAFT Final Report



Chad Wiseman, Robin Matthews, and Joan Vandersypen
Institute for Watershed Studies
Huxley College of Environmental Studies
Western Washington University *

June 14, 2000

*Funding for this project was provided by the San Juan County Health Department through a grant from the Department of Ecology. We thank Judy Kincaid King, Annie Chapman, Sara Waddell, Ryan Toohey, and Mike LeMoine from Western Washington University for assistance with this project. We also thank the landowners that permitted access to the sampling sites. Mark Tompkins and Vicki Heater from the San Juan County Health and Community Services provided essential logistical support.

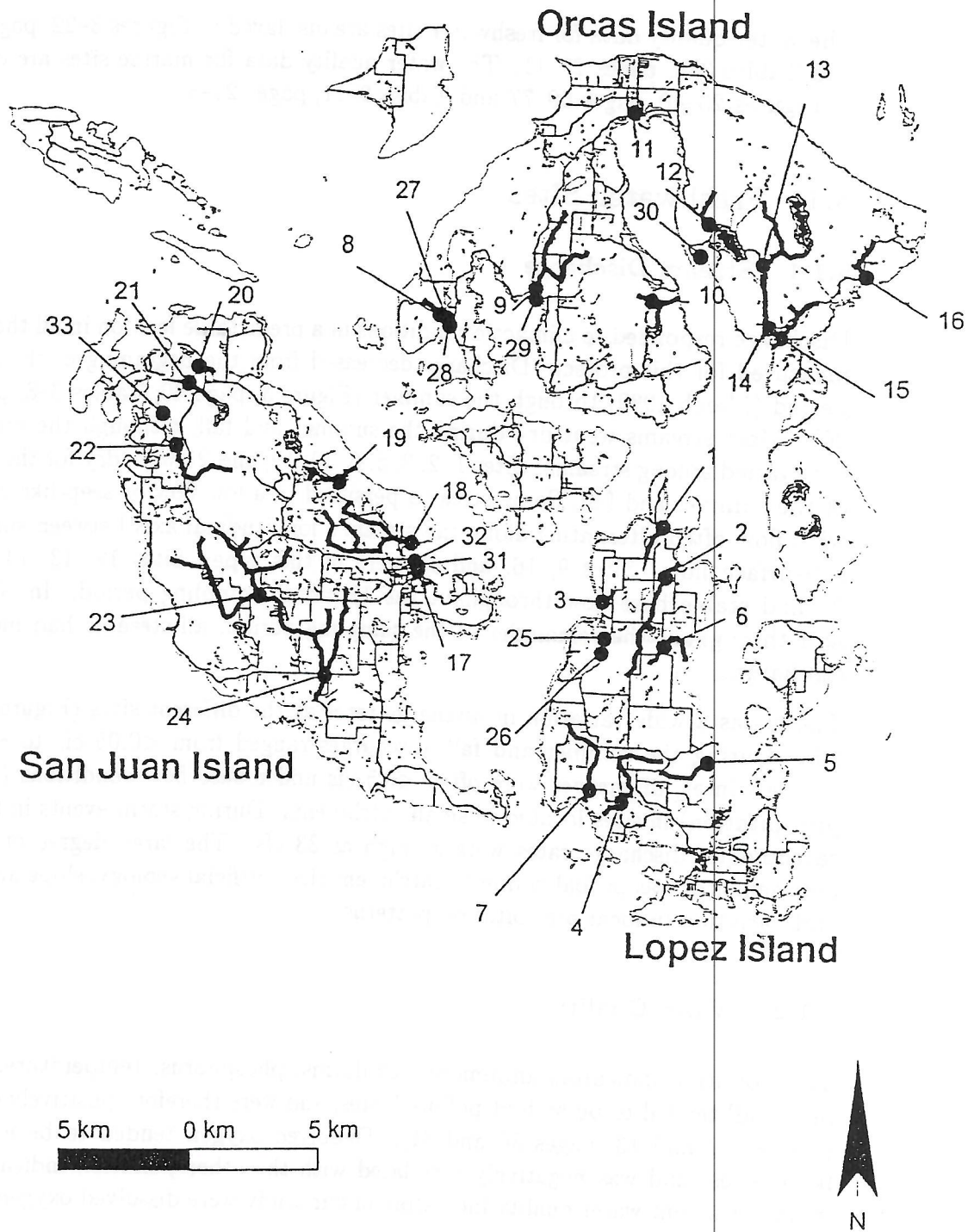


Figure 2: Locations of monitoring sites on in San Juan County.

5 Results and Discussion

The water quality data for freshwater sites are displayed in Figures 3-22, pages 40-59 and Tables 3-8, pages 27-11. The water quality data for marine sites are displayed in Figures 23-40, pages 60-77 and Tables 9-11, pages 21-8.

5.1 Freshwater Sites

5.1.1 Stream Discharge

Discharge responded to climactic conditions in a predictable fashion in all the streams measured for this project. Discharge decreased from the beginning of the sampling period (March 1999) through the summer (Figure 3, page 40; Tables 3-8, pages 21-26). Most streams went dry during the summer and fall, although the duration of flow varied among streams. Sites 1, 2, 3, 5, 6, 10, 19, and 21 were dry for the majority of the summer and fall. Some streams persisted in a low flow or seep-like condition, with flow often alternating along the stream's longitudinal axis between surface and subsurface flow. Sites 9, 16, and 18 were of this type. Sites 12, 13, 14, 23, and 24 had stable base flow throughout the 12-month sampling period. In November, and throughout the remainder of the sampling period, all streams had measurable discharges.

There was a wide variation in discharge rates at the different sites (Figure 13, page 50). During the summer and fall, discharges ranged from <0.05 cfs to ~ 0.50 cfs. In the winter, discharges were often <0.5 cfs under base flow conditions (no recent precipitation) in sites located in small catchments. During storm events in the larger catchments, discharge rates were as high as 33 cfs. The large degree of variation between sites was probably due to catchment size, surficial geology, slope and aspect, and variation in local precipitation patterns.

5.1.2 Water Quality

The pollution indicators ammonia, coliforms, phosphorus, temperature, and turbidity all tended to be high at polluted sites, and were therefore positively correlated (Tables 12 and 13, pages 30 and 31). Dissolved oxygen tended to be low at polluted sites, and was negatively correlated with the other pollution indicators. The most consistent water quality indicators in our study were dissolved oxygen and fecal coliforms.

Water temperatures increased in the summer and early fall at the freshwater sites (Figure 4). Dissolved oxygen solubility is negatively related to temperature, so dis-

solved oxygen decreased in the summer and early fall (Figure 7). The remaining water quality parameters showed no specific seasonal trends.

San Juan County streams do not have specific Washington State Department of Ecology WAC 173-201A-130 water quality classifications. The receiving marine waters in the county are classified as AA marine waters; therefore, San Juan County streams are designated Class AA by default. Fecal coliform bacteria, temperature, and dissolved oxygen in many of the streams failed to meet the WAC criteria (Table 14, page 32). There was seasonal and site to site variation associated with compliance to these criteria (Tables 15-18, pages 33-36). Class AA standards were exceeded most often in the summer and early fall. During this time, Class A dissolved oxygen may actually reflect natural conditions more accurately than Class AA. Some sites (1, 18, 19, 23 and 24) exceeded temperature and dissolved oxygen classifications to the extent that it probably reflects impacted rather than natural conditions.

5.2 Marine Sites

Water temperatures decreased in October (Figure 23, page 60). Dissolved oxygen decreased in September and October, falling below Class AA standards (Figure 26, page 63). The period of low oxygen coincided with an increase in nitrate/nitrite (Figure 28, page 65) which suggests that there may have been an upwelling in the San Juan County region in late September and October. Upwelling from the lower strata of the Puget Sound Basin or via the Strait of Juan de Fuca would advect nutrient rich, cold, low-oxygen water to the surface of San Juan County marine waters. These results concur with Newton (1995a), who found that regional dissolved oxygen concentrations in the 5-7 mg/L range was due to upwelling, particularly in the late summer.

Most sites had water quality similar to other samples collected in the Puget Sound area (Shannon Point Marine Center web site, www.ac.wvu.edu/spmc/). Sites 30 and 33, however, had distinctive water quality, characterized by high dissolved oxygen and low nitrate/nitrate and soluble phosphate (Figures 35, 37, and 38, pages 72, 74, and 75; Tables 9-11, pages 27-29). These two sites were located in Roche Harbor (Site 30) and Westcott Bay (Site 33). Low flushing rates and the large biomass of macroalgae that we observed could explain these anomalous conditions. The shallow bathymetry lends these sites well to macroalgae production. Although the low nutrient concentrations suggests low anthropogenic nutrient pollution, we sampled during the daytime and at the peak algal growing season. Photosynthetic supersaturation of oxygen and rapid nutrient uptake could mask anthropogenic pollutant loading.

Friday Harbor met the Class AA water quality standards for fecal coliforms, which suggests that bacterial contamination may have decreased since the late 1970's and 1980's (Singleton and Joy 1983; Determan and Kendra 1986). Clearly, more sampling

is needed to substantiate this apparent trend.

Dissolved oxygen concentrations in Cascade Bay, East Sound were much higher than the depleted conditions reported by Newton (1995a). Fecal coliform counts only met Class B standards, suggesting possible anthropogenic pollution.

6 Site Discussions

In the following qualitative site descriptions, statements describing "low" and "high" values are relative to each parameter mean (Tables 3-11, pages 21-29). When applicable, Chapter 173-201A WAC classifications are included in the site descriptions.

6.1 Freshwater Sites

SITE 1: Land use designations at this site included rural farm forest and agriculture. The site was dry from April through December. It met Class AA standards for pH and temperature. Water quality problems included high fecal coliform counts (Class B), chronically low dissolved oxygen concentrations (Class C and lower), and high total phosphorus and ammonia concentrations.

SITE 2: This site was located in the Hummel Lake drainage. Land use designations included agriculture and rural farm forest. The site was dry from June through December, 1999. It met Class AA standards for pH and temperature. Water quality problems included high fecal coliform counts (Class C or lower), low dissolved oxygen concentrations (Class B in November, 1999), and high total phosphorus concentrations.

SITE 3: This site drains wetlands and runs just north of Lopez Village. The land use designations included agriculture, rural farm forest, and village. The site was dry from April through December, 1999. It met Class AA standards for pH and temperature. Water quality problems included high fecal coliform counts (Class C or lower), low dissolved oxygen concentrations (Class B in November, 1999), and high total phosphorus concentrations.

SITE 4: Land use at this site included agriculture, rural farm forest, and forest. The duration of stream flow is unknown. It met Class AA standards for temperature. Water quality problems included high fecal coliform counts (Class C or lower), Class

C pH designation in May, 1999, and chronically low dissolved oxygen concentrations (Class B to below C).

SITE 5: Land use designations included rural farm forest and forest. This site was dry from July through November, 1999. It met Class AA standards for pH and temperature. Water quality problems included high fecal coliform counts (Class B), occasional low dissolved oxygen concentrations (Class A or B), and high nutrient concentrations in the late fall.

SITE 6: Land use designations included rural farm forest and agriculture. This sites was dry from April through December. It met Class AA standards for pH and temperature. Water quality problems included high fecal coliform counts (Class B), low dissolved oxygen concentrations (Class B in March 1999), and high total phosphorus concentrations in the late fall, 1999.

SITE 7: The land use designations at this site included agriculture and rural farm forest. The duration of stream flow is unknown. This site met Class AA standards for pH and temperature and Class A standards for coliforms and dissolved oxygen. Nitrate/nitrite concentrations and total phosphorus concentrations were somewhat elevated.

SITE 8: This site was located in a stream that drains a series of wetlands, some cleared land, and areas with low density residential housing. Land use designations included rural farm forest and hamlet. The duration of stream flow is unknown. This site met Class AA standards for pH, temperature, and coliforms, and Class A standards for dissolved oxygen.

SITE 9: This site was located in a stream that drains Crow Valley. Much of the watershed is cleared. Land use designations included forest, agriculture, rural industrial, and rural farm forest. The duration of stream flow is unknown. The site met Class AA standards for pH and temperature. Water quality problems included high fecal coliform counts (Class C or lower), low dissolved oxygen concentrations (Class C), high ammonia concentrations, and high turbidities.

SITE 10: This site was located in a stream that drains a pond. Land use designations include forest and rural farm forest. This site was dry from June through November. It had chronically high nitrate/nitrite concentrations, which were probably caused by the presence of nitrogen-fixing alders (*Alnus rubra*) in the watershed.

The site met Class AA standards for coliforms, pH, temperature, and dissolved oxygen.

SITE 11: This site was located in a stream that drains the East Sound area. The stream is ponded, enters a culvert, and discharges onto the beach. Land use designations included village, rural farm forest, and forest. The duration of flow at this site is unknown. It met Class AA standards for pH and temperature. Water quality problems included high fecal coliform counts (Class C or lower), slightly low oxygen concentration (Class A), and high conductivities.

SITE 12: Land use designations at this site included conservancy, rural farm forest, and rural industrial. This stream flowed throughout the sampling period. It met Class AA standards for coliforms, pH, and temperature, but had relatively low oxygen concentrations (Class A or B).

SITE 13: This site was located in Cascade Creek where it exits Moran State Park. The land use designation at this site was conservancy. This stream flowed throughout the sampling period. The site met Class AA standards for coliforms, pH, and temperature, and Class A for dissolved oxygen.

SITE 14: This site was located at the mouth of Cascade Creek. Land use designations included conservancy, forest, rural farm forest, and hamlet. This stream flowed throughout the sampling period. It met Class AA standards for pH and temperature, and Class A standards for dissolved oxygen. Water quality problems included high fecal coliform counts (Class B).

SITE 15: Land use designations included conservancy, forest, and rural farm forest. The duration of flow at this site is unknown. It met Class AA standards for pH and temperature, and Class A standards for coliforms. Water quality problems included low oxygen concentrations (Class B).

SITE 16: Land use designations included hamlet, rural farm forest, forest, and conservancy. This stream flowed throughout the sampling period, although discharge rates were very low and irregular during late summer and fall, 1999. It met Class AA standards for pH and temperature. Water quality problems included high fecal coliform counts (Class C or lower), low dissolved oxygen concentration (Class A or B), and high nitrate/nitrite concentrations in the fall of 1999.

SITE 17: This site was located at the Spring Street outfall into Friday Harbor. The duration of flow at this site is unknown. It met Class AA standards for pH and temperature, and Class A standards for dissolved oxygen. Water quality problems included chronically high fecal coliform counts (below Class C), high concentrations of nutrients, and high turbidities.

SITE 18: This site was located in a stream that drains Beaverton Valley. Land use designations included agriculture, rural farm forest, and natural. This stream flowed throughout the sampling period, although discharge rates were very low during the late summer and fall. It met Class AA standards for pH and temperature. Water quality problems included high fecal coliform counts (Class B) and variable oxygen concentrations (Class A to C).

SITE 19: This site was located in a stream that drains Sportsman's Lake. Land use designations included rural farm forest. The duration of flow at this site is unknown. It met Class AA standards for coliforms, pH and temperature. Water quality problems included chronically low dissolved oxygen (Class B to below C) and high ammonia concentrations.

SITE 20: Land use designations included rural farm forest and rural industrial. The duration of flow at this site is unknown. It met Class AA standards for pH and temperature, and Class A standards for coliforms and dissolved oxygen. Water quality problems included high total phosphorus in May and June, 1999.

SITE 21: This site was located in the Roche Harbor Reservoir outlet stream. Land use designations included rural farm forest. This stream was dry from July through November, 1999. It met Class AA standards for coliforms, pH and temperature, and Class A standards for dissolved oxygen. Water quality problems included a high nitrate/nitrite concentration in December, 1999.

SITE 22: This site was located in a stream that drains the Garrison Bay watershed. Land use designations included forest, rural farm forest, and agriculture. The duration of flow at this site is unknown. It met Class AA standards for pH. Water quality problems included high fecal coliform counts (Class B), high water temperatures (Class A and B), and low dissolved oxygen (Class B).

SITE 23: This site was located in San Juan Valley Creek, about 0.5 miles upstream from Zylstra Lake. Land use designations included forest, natural, rural farm forest,

and agriculture. This stream flowed throughout the sampling period. It met Class AA standards for pH. Water quality problems included slightly elevated fecal coliform counts (Class A), high temperatures (Class A and B), and low dissolved oxygen concentrations (Class B and C).

SITE 24: This site was located in San Juan Valley Creek near False Bay. Land use designations included forest, natural, rural farm forest, and agriculture. This stream flowed throughout the sampling period. It met Class AA standards for pH. Water quality problems included chronically high fecal coliform counts (below Class C), high temperatures (Class A to below C), chronically low dissolved oxygen concentrations (Class C and below), high total phosphorus concentrations and high turbidities.

6.2 Marine Sites

SITE 25: This site was located in Fisherman's Bay, Lopez Island. This site met Class AA standards for fecal coliforms and pH, and Class A standards for temperature and dissolved oxygen.

SITE 26: This site was located in Fisherman's Bay, Lopez Island. This site met Class AA standards for fecal coliforms and pH, and Class A standards for temperature and dissolved oxygen.

SITE 27: This site was located in Deer Harbor, Orcas Island. This site met Class AA standards for fecal coliforms and pH, and Class A standards for temperature and dissolved oxygen.

SITE 28: This site was located in Deer Harbor, Orcas Island. This site met Class AA standards for fecal coliforms and pH, and Class A standards for temperature and dissolved oxygen.

SITE 29: This site was located in West Sound, Orcas Island. This site met Class AA standards for fecal coliforms and pH, and Class A standards for temperature and dissolved oxygen.

SITE 30: This site was located at Cascade Bay, East Sound, Orcas Island. This site had Class AA pH values and Class A temperature and dissolved oxygen values in

the late summer and early fall. Water quality problems included high coliform counts (Class B). Nitrate/nitrite and soluble phosphorus concentrations were extremely low.

SITE 31: This site was located in Friday Harbor, San Juan Island. This site met Class AA standards for fecal coliforms and pH, and Class A standards for temperature. Water quality problems included low dissolved oxygen concentrations (Class B)

SITE 32: This site was located in Friday Harbor, San Juan Island. This site met Class AA standards for fecal coliforms and pH, and Class A standards for temperature. Water quality problems included low dissolved oxygen concentrations (Class B)

SITE 33: This site was located in Garrison Bay, San Juan Island. This site met Class AA standards for fecal coliforms and pH, and Class A standards for temperature and dissolved oxygen. Nitrate/nitrite and soluble phosphate concentrations were extremely low at this site.

7 Water Quality Monitoring Recommendations

The design of a long-term sampling regime should be contingent upon the goals of that program. We recommend that San Juan County set specific goals to which their sampling regime would be associated.

The following outline described one possible long-term monitoring scenario.

Identify problem areas: Stream water quality in our 1999-2000 study can be categorized as good, marginal, or obviously impaired based on Table 14 (page 32).

- Sites 8, 10, 12, 13, 20, and 21 had good water quality;
- Sites, 2, 3, 5, 6, 7, 14, 15, 18, 22, and 23 had marginal water quality;
- Sites 1, 4, 9, 11, 16, 17, 19, and 24 had at least one parameter that was obviously beyond acceptable limits.

The sites with obvious impairment should be ranked highest as candidates for restoration and continued monitoring. The marginal sites should be ranked next. Within

this marginal group, sites could be prioritized by more specific water quality concerns, or by presence of sensitive freshwater or receiving marine habitat.

Many of the marginal and obviously impaired watersheds identified in our study overlap with the "priority" watersheds identified in previous studies. All impacted watersheds identified in Verburg and Associates (1988) were also identified as impacted in our study. Similarly, many of the impacted watersheds identified by the San Juan County Health and Community Services (SJCHCS, 2000) overlapped with many of our impacted sites. Our study identified several additional impacted watersheds that were not listed by the county, including Swifts Bay (Site 2), Lopez Sound (Site 6), Mackaye Harbor/Davis Bay (Site 4), Shoal Bay (Site 1), Doe Bay (site 16), and San Juan Channel (Site 19) as impacted. The Deer Harbor watershed (Site 8) was unimpacted according to our data, but listed as impacted by the county.

The majority of the marine sites in our study had good water quality. However, we recommend that East Sound should be monitored because it has a history of low dissolved oxygen (Joy 1995), high fecal coliform counts in recent sampling (WSDHS, 1998), and high fecal coliform counts in the present study. Similarly, Friday Harbor, which had good water quality in this study, should nevertheless be monitored because the municipal outfall discharging into Friday Harbor had very poor water quality. Westcott/Garrison Bay (currently good water quality) should be monitored because this water body has a low flushing rate, high boat traffic, and a tributary (Site 22) with marginal water quality. Shoal Bay should be monitored because Washington State Department of Health sampling (WSDHS, 1998) yielded high fecal coliform counts. In addition, Site 1 had poor water quality and discharges into Shoal Bay. Buck Bay should be monitored because Washington State Department of Health sampling (WSDHS, 1998) yielded high fecal coliform counts. In addition, Site 15 had marginal water quality and discharges into Buck Bay.

Identify the source of pollution: Our study did not attempt to identify specific sources of pollution. Source identification would require much more frequent sampling, possible targeting specific high priority watersheds. Direct field observations in the priority watershed could help identify discrete pollution sources. Working with the community could also help identify specific pollution sources.

Develop and implement specific restoration action plans and goals: The use of "best management practices" should be encouraged, particularly on dairy farms and other commercial lands that may contribute high concentrations of nutrients and fecal coliform bacteria. Programs that assist citizens with developing and maintaining best management practices should be instituted.

Pollution prevention should be encouraged when evaluating methods of treatment for

drainages with non-point pollution problems. The elimination of pollutants before they can be introduced to surface water has proven to be more effective and less expensive than the "end-of-the-pipe" treatment of polluted waters. Pollution prevention also tends to save the public sector from paying for the pollutants introduced by individual polluters. Planners and landowners can refer to existing documents on pollution control practices (WSDOE 1994) and water quality management (WSDOE 1999).

Specific restoration projects such as tree plantings, bank stabilization, and the fencing off of riparian zones should be initiated. We recommend that the agricultural tributaries upstream from Sites 4, 9, and 24 be at the top of the list for this type of stream restoration.

Monitor restoration sites and identify new problem areas: Within our stream sites, there were many seasonal similarities in the water quality. In addition, we found that dissolved oxygen concentrations and fecal coliform bacteria were consistent indicators of poor water quality. Depending upon the desired balance between watershed coverage and sampling periodicity, a quarterly sampling regime that included (at least) temperature, dissolved oxygen, and fecal coliform counts may suffice. The sampling regime should include sampling events at the beginning and end of the low flow period (May through October), and during the high flow period (November through April). Timing of sampling should be customized for many of the streams due to the heterogeneity in flow periods. Although logistically difficult, storm event sampling may be a good compliment to this sampling regime.

It is important to keep in mind that our study was not comprehensive and did not include all archipelago watersheds and marine water bodies. In addition, we did not sample all kinds of pollutants. New sampling sites should be rotated into the sampling regime periodically to identify previously undisclosed problem areas. We also recommend a more comprehensive list of analytes be include on a regular basis, particularly if the county elects to use just coliforms and oxygen as water quality indicators.

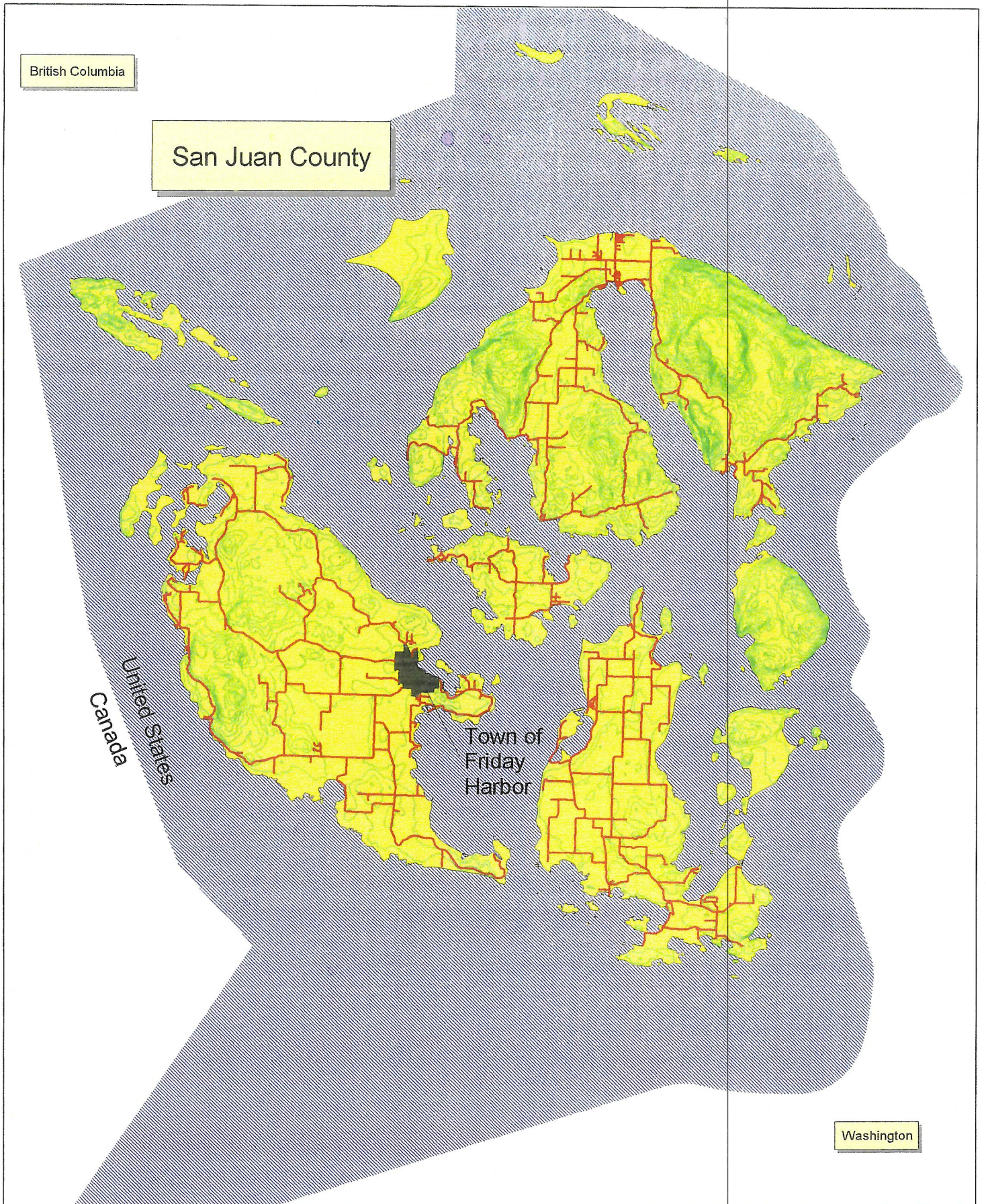


Figure B-1. San Juan County jurisdictional boundaries, including county roads and topographic contours (100' intervals).

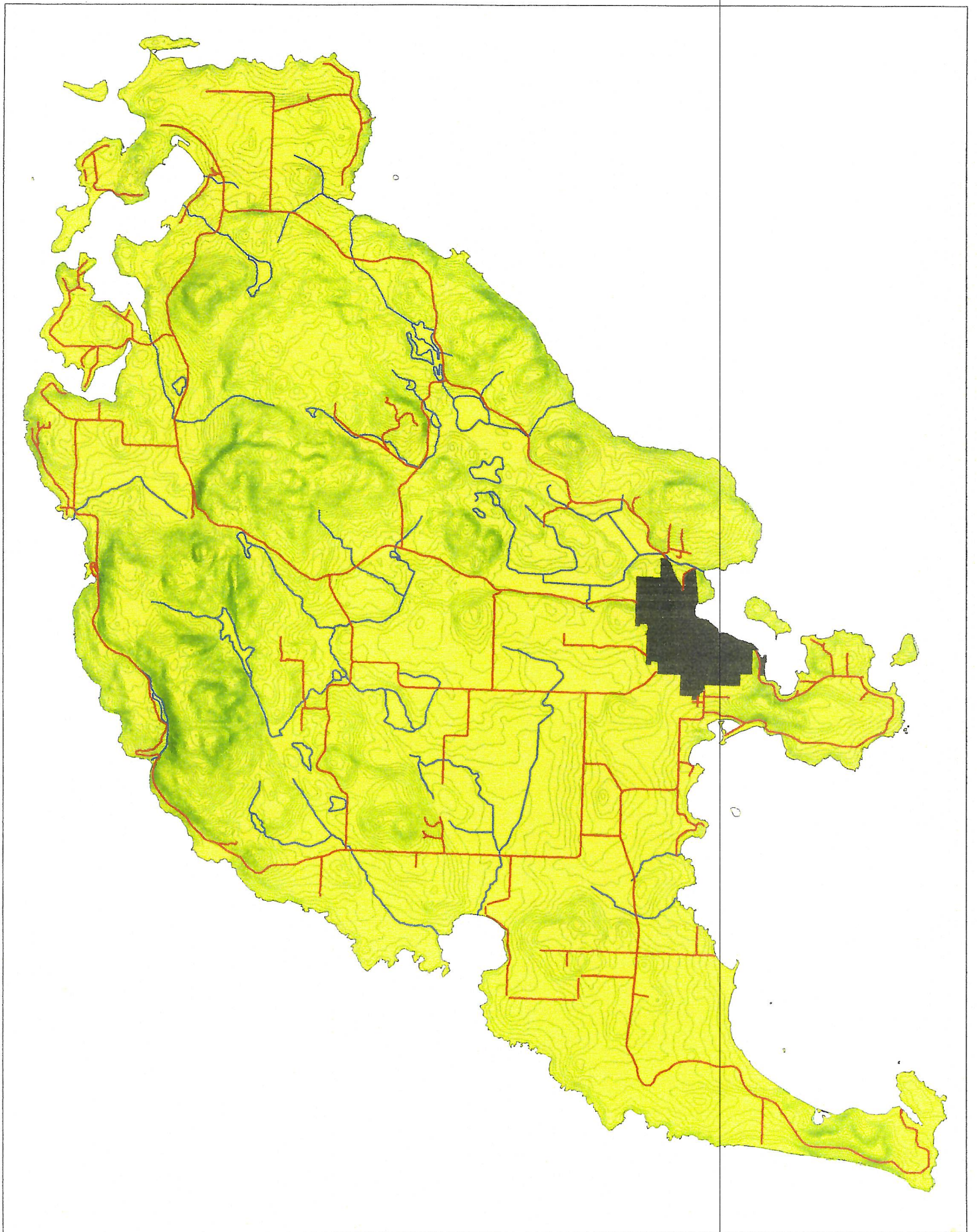


Figure B-1a: San Juan Island. Streams, contours, county roads
(20' contour intervals)

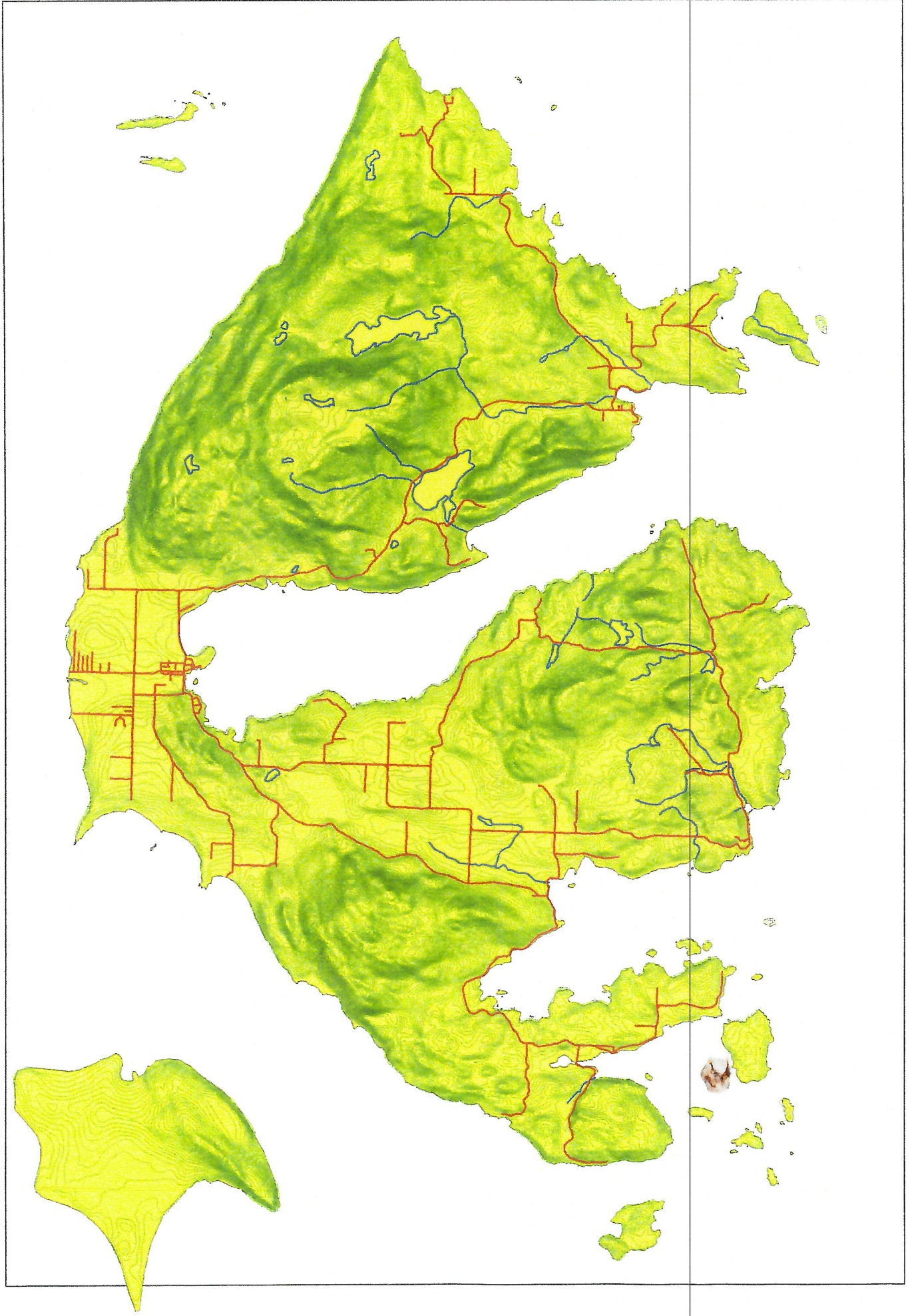


Figure B-1b. Orcas Island. Streams, contours, county roads
(20' contour intervals)

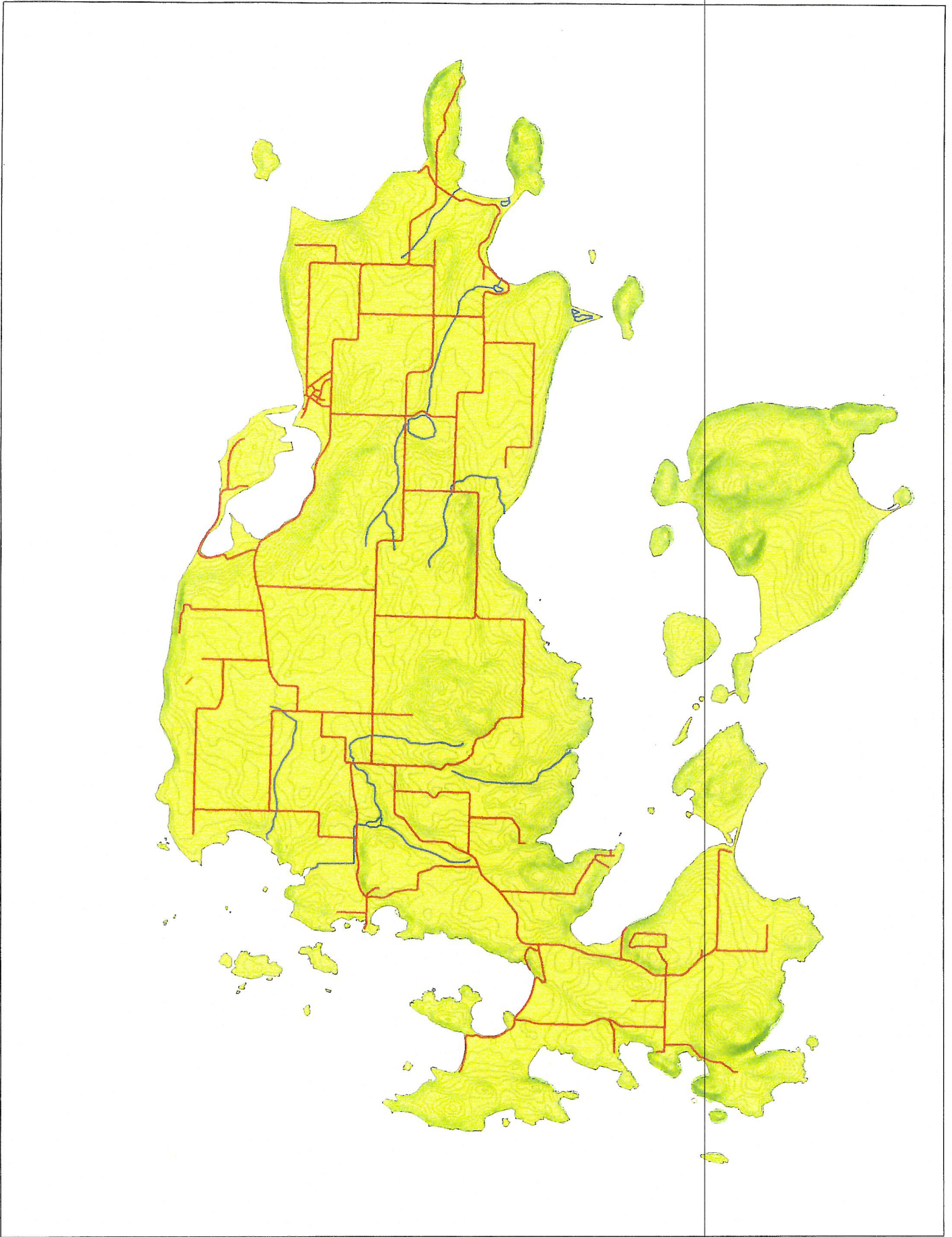


Figure B-1c: Lopez Island. Streams, contours, county roads
(20' contour intervals)

San Juan County Land Cover Vegetation

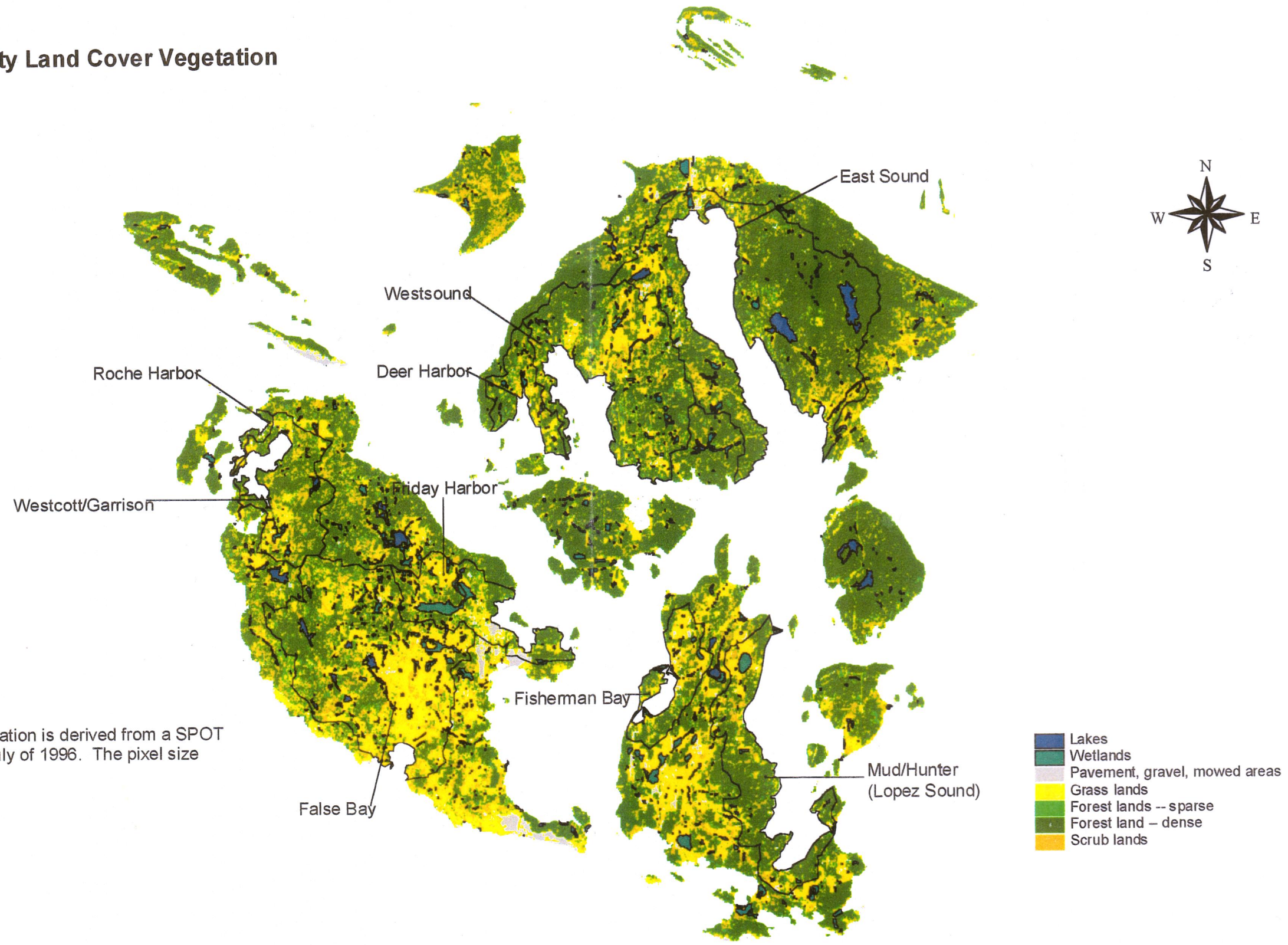
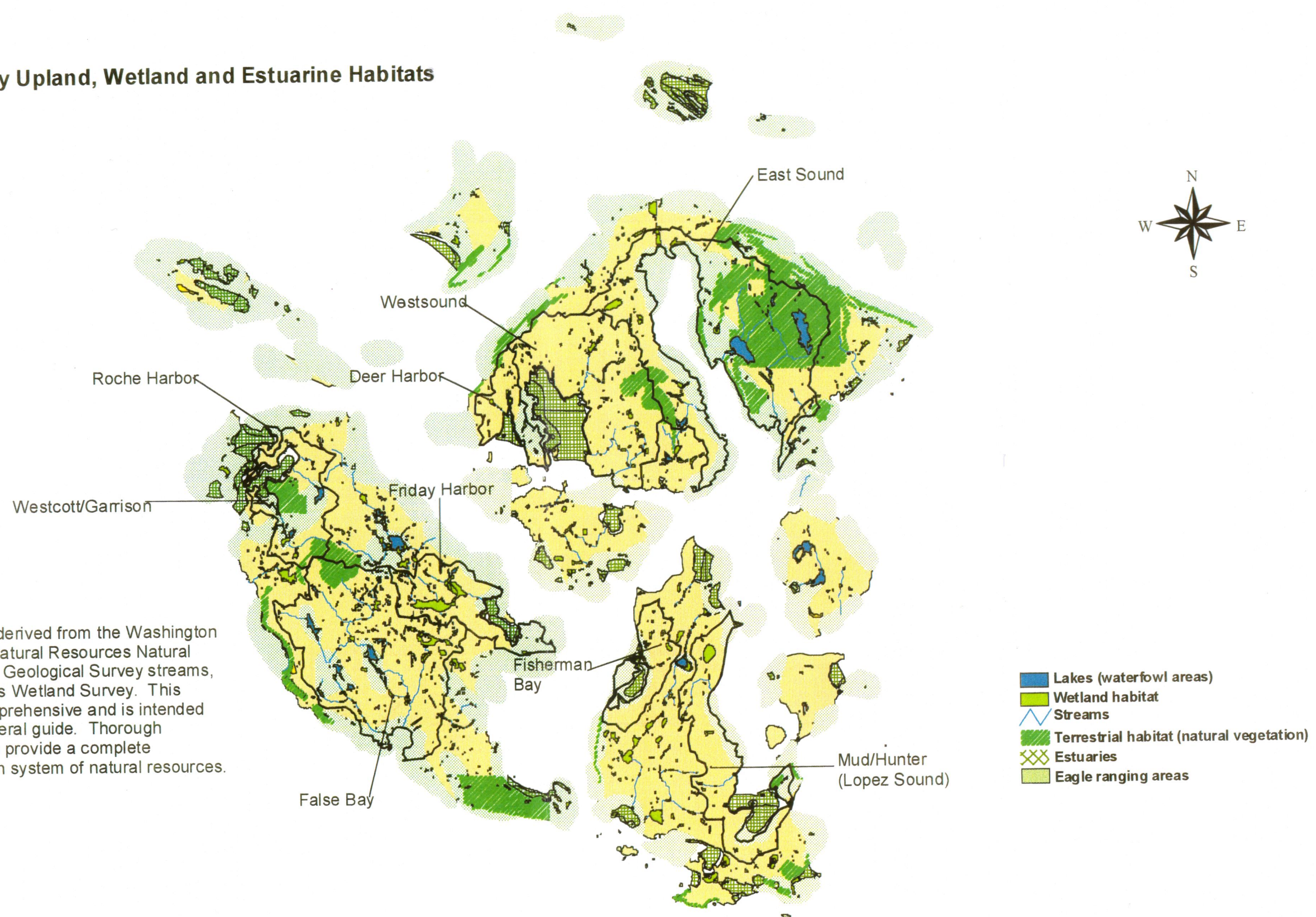


Figure B-2

San Juan County Upland, Wetland and Estuarine Habitats

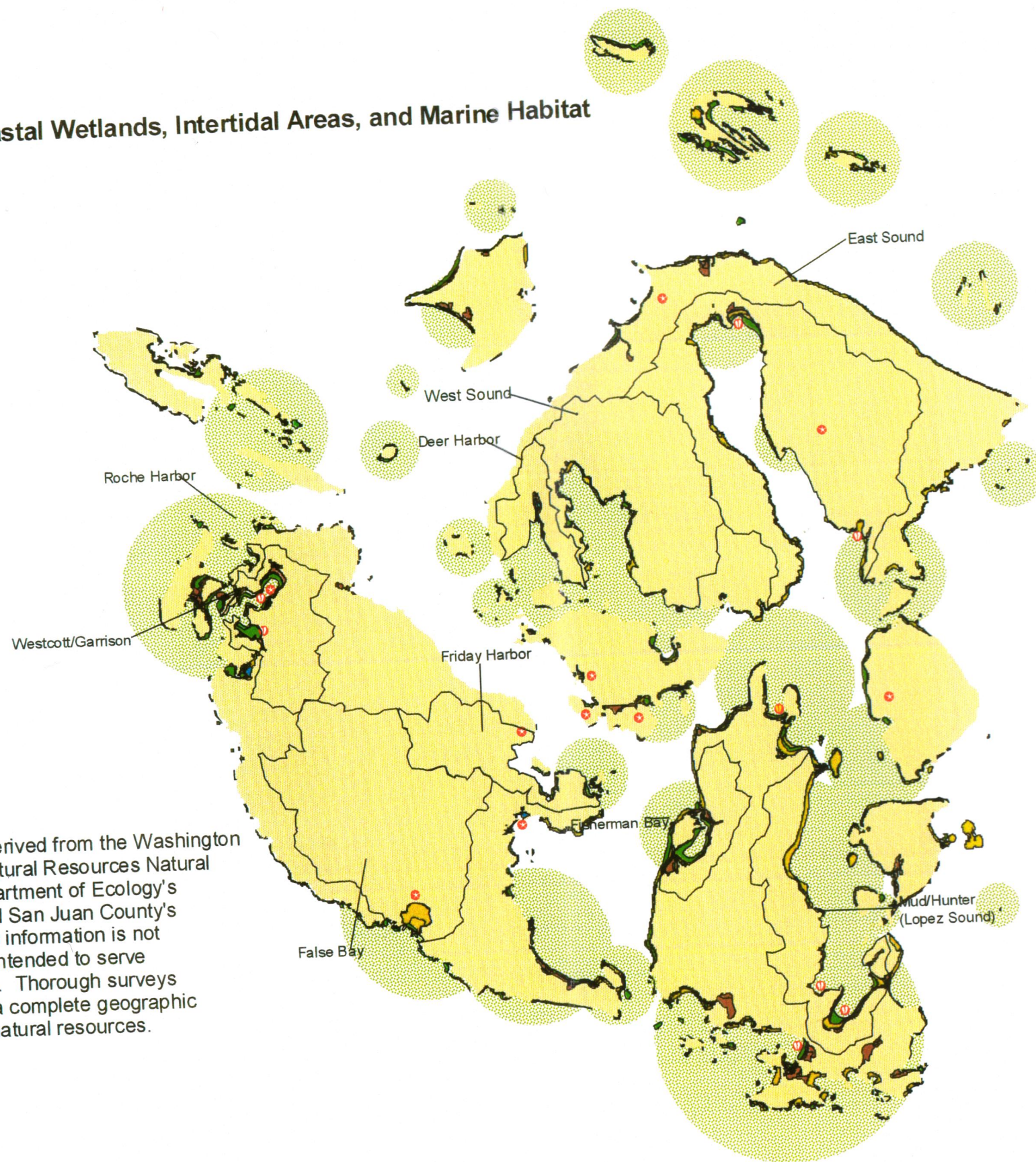


Habitat information is derived from the Washington State Department of Natural Resources Natural Heritage Program, US Geological Survey streams, and San Juan County's Wetland Survey. This information is not comprehensive and is intended to serve only as a general guide. Thorough surveys are needed to provide a complete geographic information system of natural resources.

- Lakes (waterfowl areas)
- Wetland habitat
- Streams
- Terrestrial habitat (natural vegetation)
- Estuaries
- Eagle ranging areas

Figure B-3

San Juan County Coastal Wetlands, Intertidal Areas, and Marine Habitat



Habitat information is derived from the Washington State Department of Natural Resources Natural Heritage Program, Department of Ecology's Coastal Zone Atlas, and San Juan County's wetland inventory. This information is not comprehensive and is intended to serve only as a general guide. Thorough surveys are needed to provide a complete geographic information system of natural resources.

- Shellfish harvest, commercial and recreational
- Marine research and education
- Eel grass beds
- Kelp beds
- Private oysterlands
- Marine wetlands, shoreline substrate
- Coastal freshwater marshes, salt marshes
- Rich intertidal; seabird and marine mammal breeding and nesting areas

Figure B-4

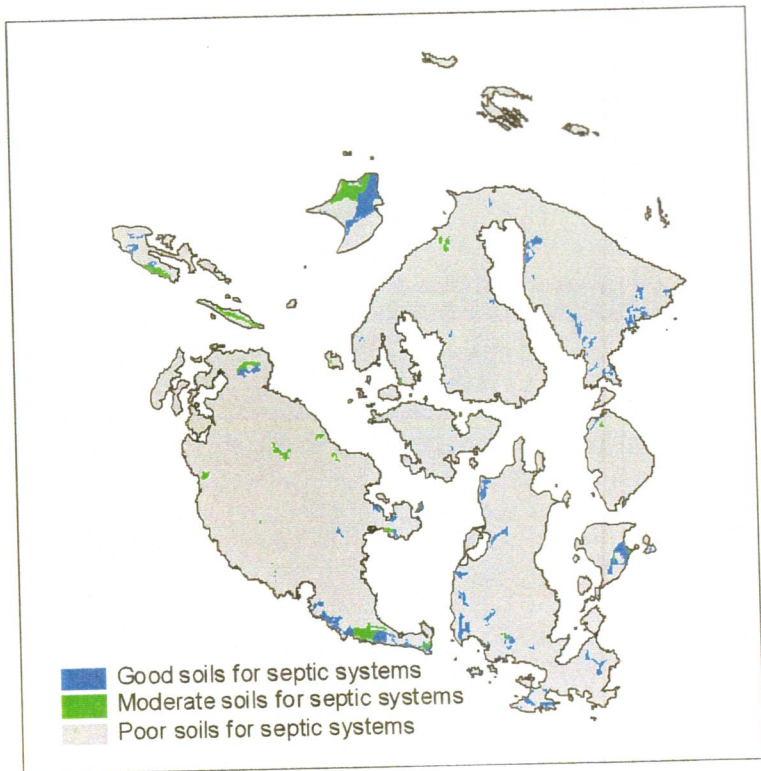
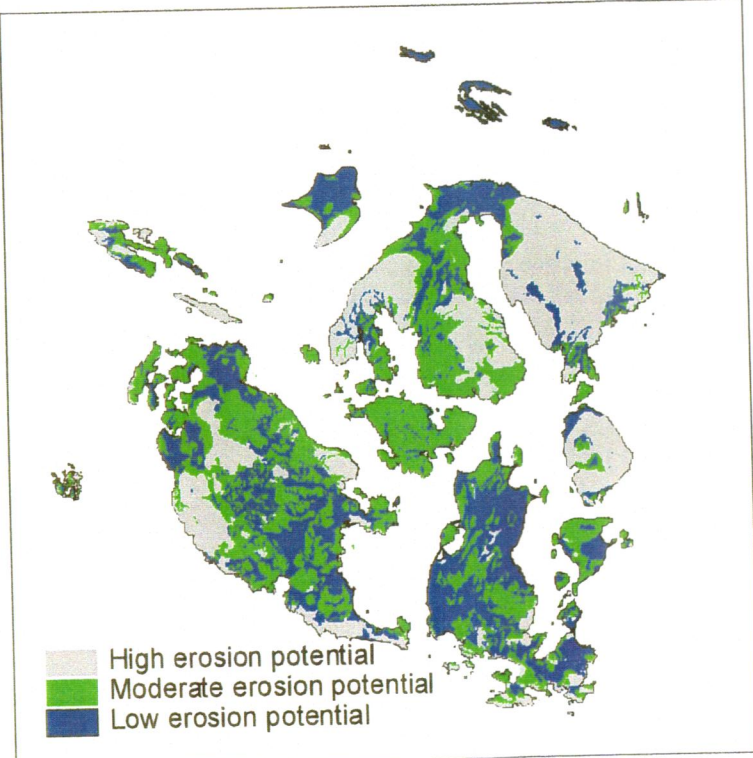
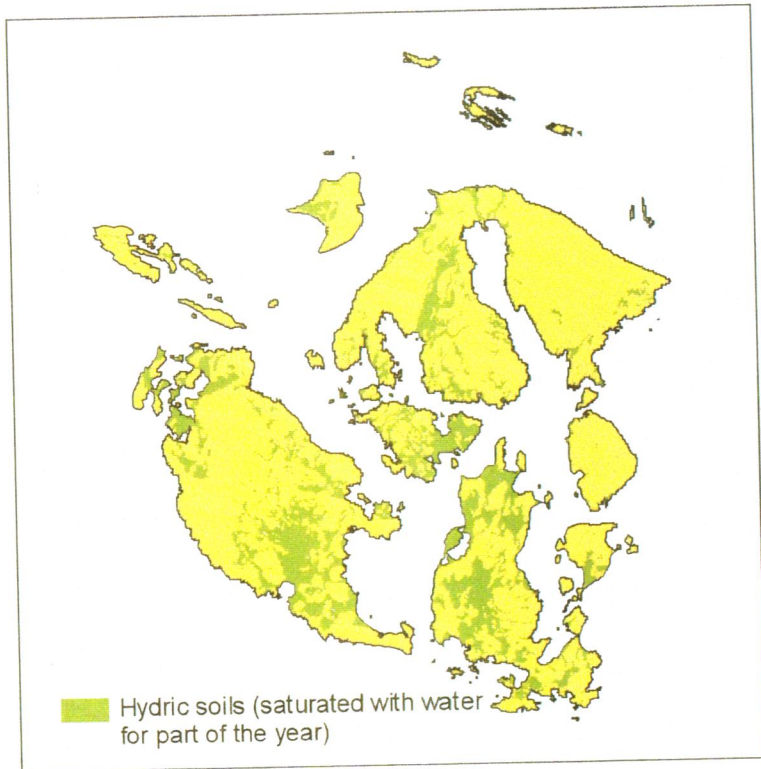
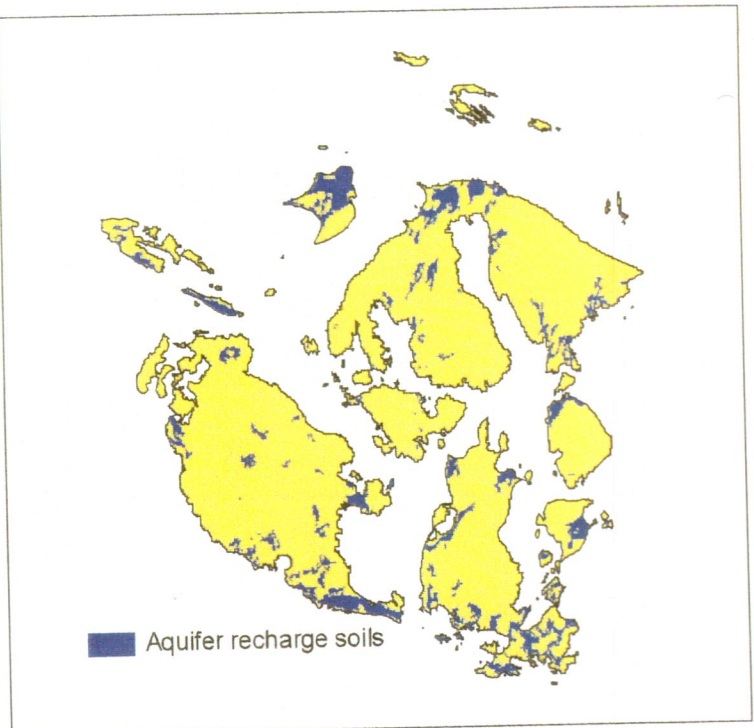
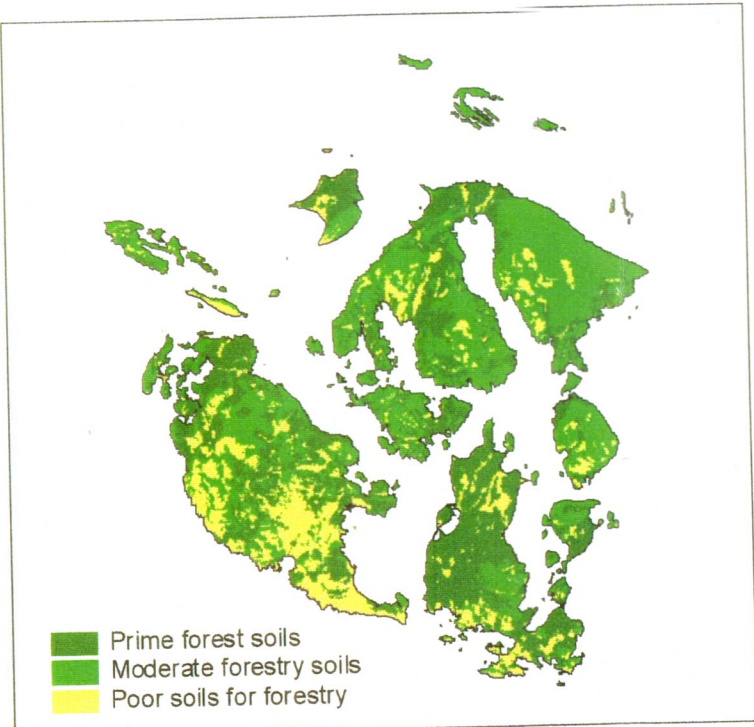
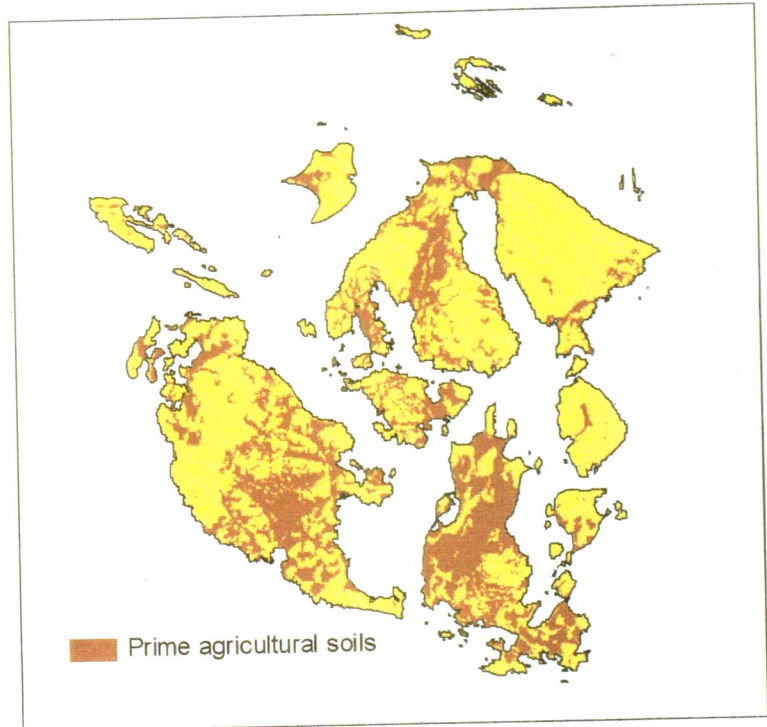
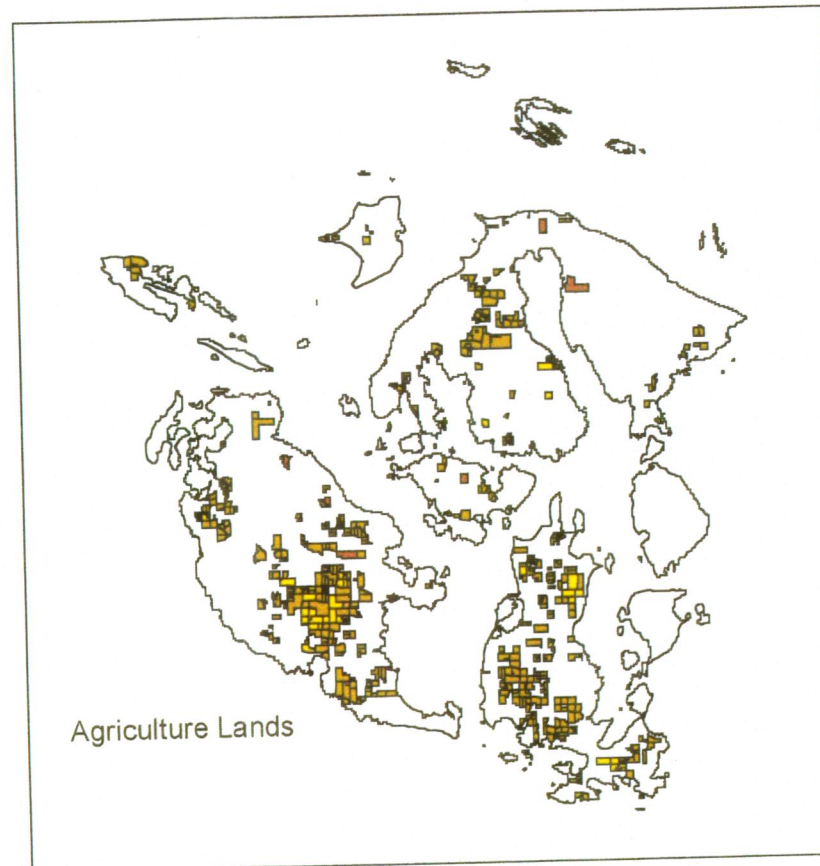
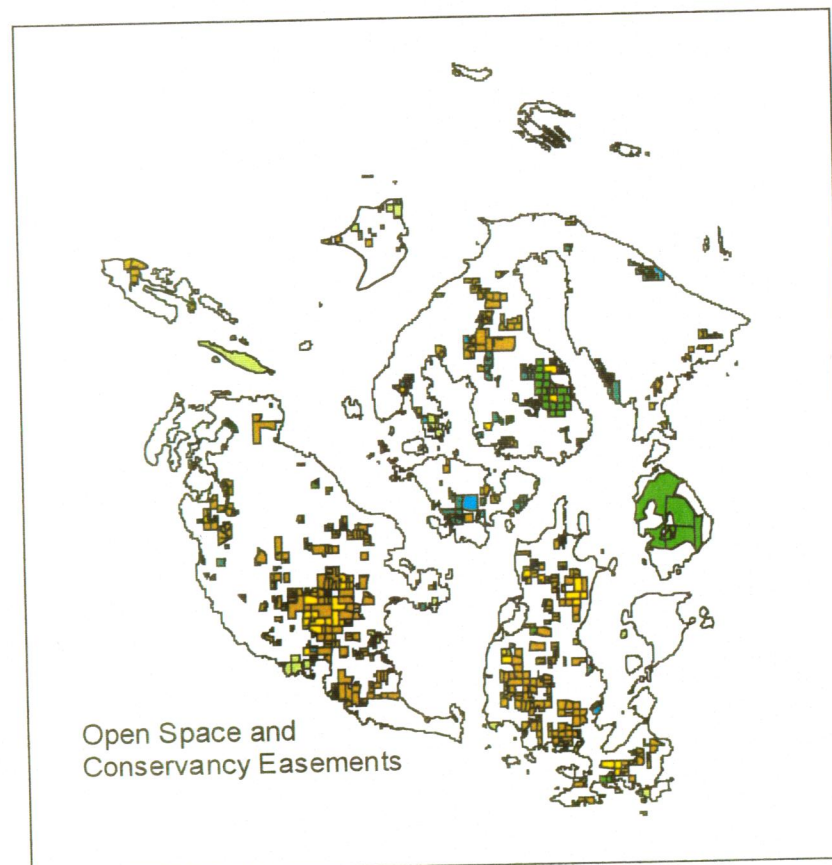
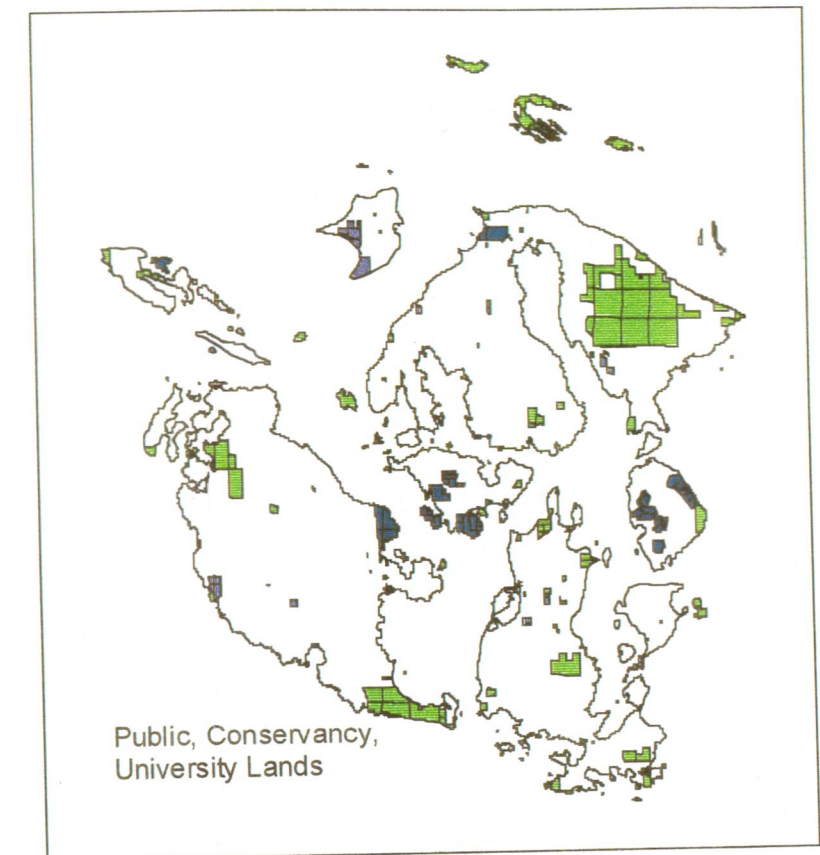
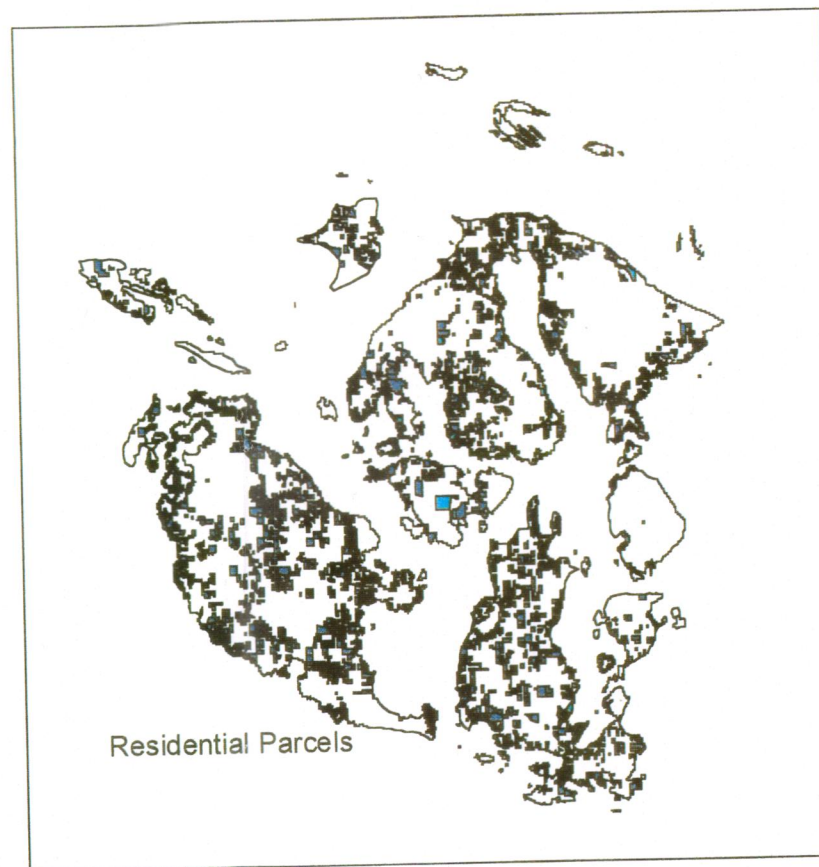
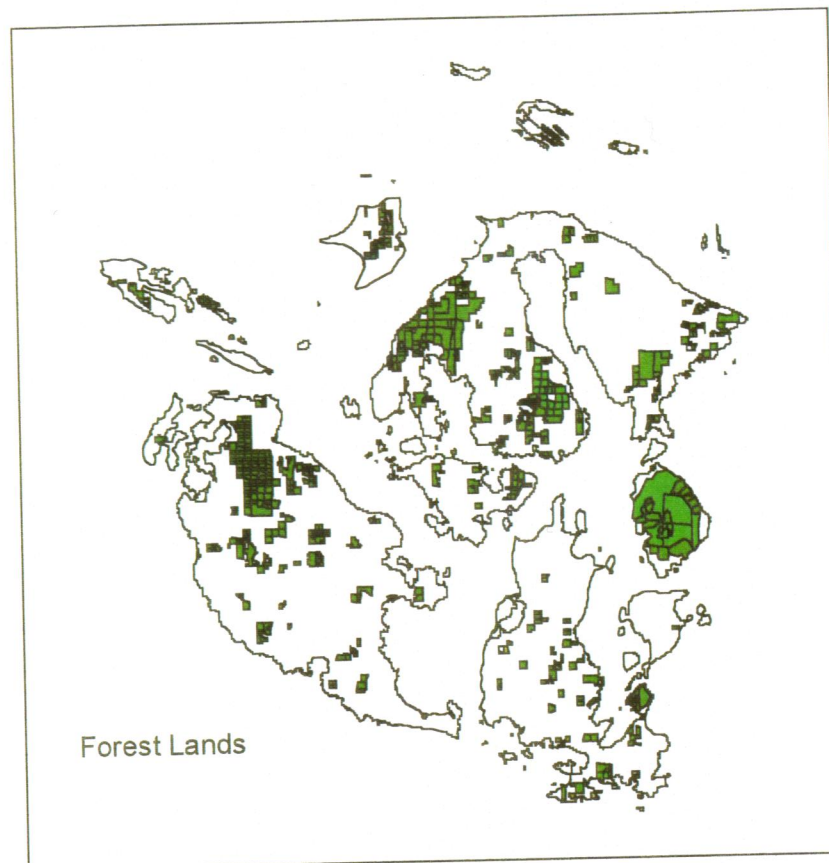


Figure B-5 Soil Suitability



Land Use for San Juan County Parcels from
Current Use Tax Assessments

- Forest Lands
- Timber Open Space
- Forest Lands w/Conservation
- Parcels w/Residential Development
- Residential w/Conservation
- Parks and Public Lands
- University Lands
- Conservancy Lands
- Recreational Open Space
- Other Open Space or Conservation
- Agriculture Lands
- Agriculture Open Space
- Agriculture Open Space w/Conservation

Source: San Juan County Assessor

Figure B-6

San Juan County Residential Development by Parcel

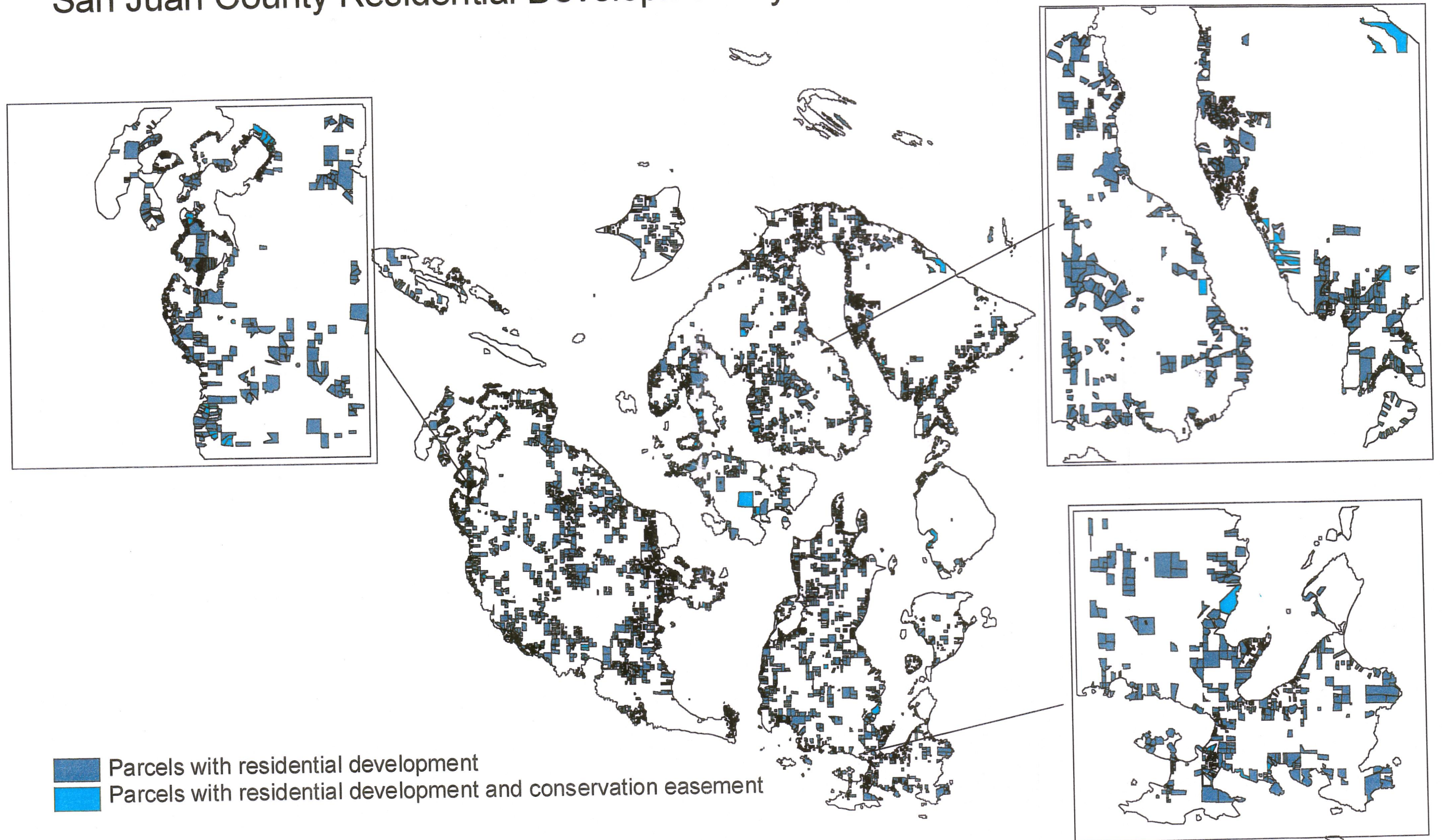


Figure B-7