SNOHOMISH RIVER WATERSHED INITIAL ASSESSMENT

DRAFT

May 1995

With our multitudes of lakes, streams, and rivers, Washington State seems to have an abundance of water. However, the demand for water resources has steadily increased each year, while the water supply has stayed the same, or in some cases, declined. This increased demand for limited water resources has made approving new water uses complex and controversial.

The purpose of this assessment is to evaluate existing data on water to make decisions about pending water right applications. It does not affect existing water rights.

To expedite decisions about pending water right applications, it is vital that we accurately assess the quality and quantity of surface and ground water. The Washington State Department of Ecology recognizes that water right decisions must be based on accurate scientific information. Ecology is working with consultants to conduct special studies called Initial Watershed Assessments throughout the state.

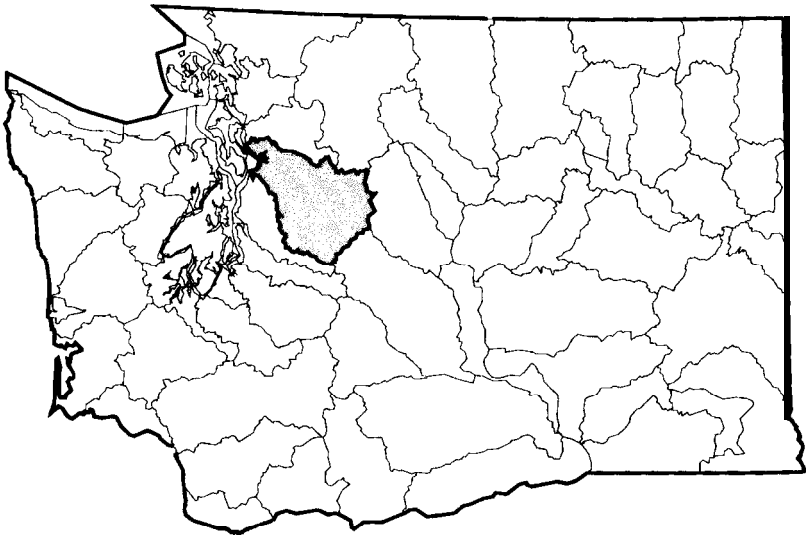
The assessments describe existing data on water rights, stream flow, precipitation, geology, hydrology, water quality, fisheries resources, and land use patterns. Some assessments provide straightforward results, allowing immediate water management decisions. In watersheds with little existing information, further studies will be necessary to acquire new data. In watersheds where major public policy conflicts exist, or where significant land use impacts are expected, water management decisions will be coordinated with local and regional planning processes.

This report summarizes information presented in the detailed Ecology Open-File Technical Report No. 95-06. It also presents some actions that could be taken in response to the results of this assessment.

Pacific Groundwater Group, Inc. and Associated Firms

Prepared in cooperation with the
Washington Department of Ecology

Snohomish River Watershed



What are the water allocation issues?

- Ecology needs to make decisions on 87 pending water rights applications.
- Instream flow requirements that were established by rule for a number of river segments are often not met in the late summer and early fall. In addition, other stream segments have been closed to new water uses.
- Fish stocks have been affected by low flows at a number of places along the rivers and streams in the watershed.
- Ground water and surface water are interconnected within the watershed. Additional pumping of ground water will cause reductions in streamflows and/or reduced ground water discharge to Puget Sound.

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What is a watershed?

A watershed is an area of land where topographic features such as hills and valleys cause water to flow toward a single major river or other body of water.

Where does the water come from?

Ultimately, all of the streams, lakes, springs and other surface and ground water in the watershed comes from rain or snowmelt. Some of this water evaporates or is used by plants, some flows into the streams and rivers, and the rest infiltrates into the soil to become ground water. Some segments of streams and rivers gain water from ground water that seeps into the channel. Other segments lose water that leaks through the streambed into the ground.

Average annual precipitation is 87 inches per year. About 30 inches per year falls on the coastal areas and over 160 inches per year falls on high elevation areas within the Cascades Mountains. Based on rainfall records at Snoqualmie Falls, over 70 percent of precipitation falls between October and March and about 10 percent falls between June and August.

What are the major surface water sources?

The Snoqualmie and Skykomish rivers are the major surface water sources in the watershed. These two rivers converge to become the Snohomish River approximately 20 miles upstream of Puget Sound. Other major tributaries include the Tolt, Sultan and Pilchuck rivers. Several smaller drainages empty directly into Puget Sound (see map on right).

Surface water resources in the watershed have been developed primarily through the construction of two dams. The South Fork Tolt Reservoir supplies water for more than a million people in Seattle and nearby communities. The Spada Lake Reservoir on the Sultan River supplies water to Everett, neighboring industries, and a number of small municipalities.

What are the major ground water sources?

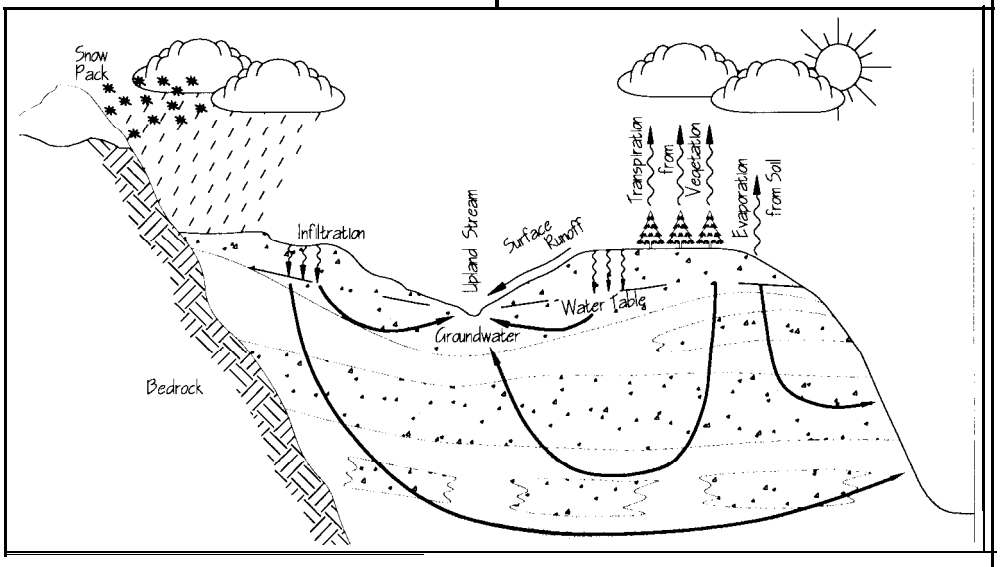
Over 1,200 feet of glacial sediments underlie the western portions of the watershed. Layers of these sediments which yield usable amounts of water are known as aquifers. Sand and gravel deposits along major rivers and streams also make good aquifers. Most of the wells in the Snohomish watershed are developed in the layered sediments or the shallow stream deposits. Shallow bedrock in the eastern portions of the watershed yields only small amounts of water to wells from joints and fractures. Water yields from the bedrock are substantially lower than from the glacial sediments and shallow sand and gravel deposits along streams.

How are surface and ground water connected?

In areas where both surface water and ground water are used, the connections between the two sources become important. In some instances, ground water flows from the aquifer to the surface water body, while in others the reverse occurs. Ground water provides the total flow in the rivers and creeks when there is no rain, snowmelt, or dam releases to contribute to the flow.

In the Snohomish watershed, there is a relatively direct connection between shallow aquifers and local rivers and streams. Deeper aquifers tend to be connected on a more regional scale to the major drainages, such as the Snoqualmie and Skykomish rivers, and to Puget Sound.

The connections between streams and aquifers are most obvious during periods of low flows, when most of the flow in streams comes from ground water. Studies by the U.S. Geologic Survey have shown that the Snoqualmie River loses and gains streamflow along its course due to seepage through the streambed. Comparable geology along other rivers in the watershed suggests similar connections between streams and aquifers. Where ground and surface water are strongly connected, pumping of additional ground water will reduce river flows or discharge to Puget Sound.



The hydrologic cycle in the Snohomish Watershed

SNOHOMISH WATERSHED

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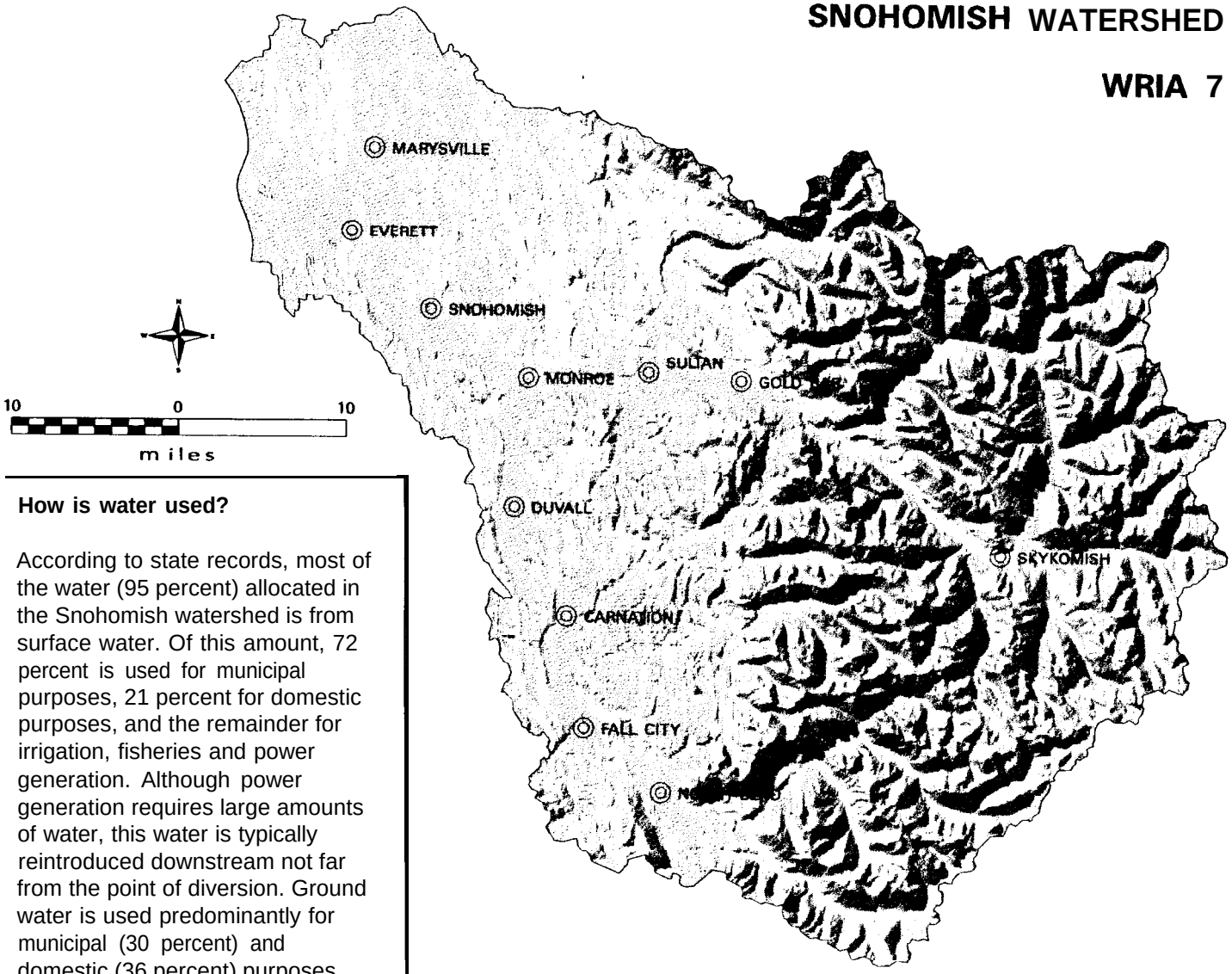


How is water used?

According to state records, most of the water (95 percent) allocated in the Snohomish watershed is from surface water. Of this amount, 72 percent is used for municipal purposes, 21 percent for domestic purposes, and the remainder for irrigation, fisheries and power generation. Although power generation requires large amounts of water, this water is typically reintroduced downstream not far from the point of diversion. Ground water is used predominantly for municipal (30 percent) and domestic (36 percent) purposes, with lesser amounts used for irrigation and other purposes.

How does land use affect water?

Land use affects water availability by changing the demand for and use of water. Some land uses, such as municipal, industrial, and irrigated agriculture require large amounts of water. Other land uses, such as timber production require less water.

Eighty-eight percent of the Snohomish watershed is covered by natural vegetation. Surface water bodies, agriculture, and developed areas each cover between two and three percent. Municipal and industrial areas are concentrated along the western part of the major rivers and in and around the City of Everett.

Specific land use practices can have significant effects on surface water and ground water availability. For example, municipal land use, while covering only a small portion of the watershed, is associated with relatively large surface water and ground water withdrawals. Recharge of ground water supplies is reduced by paving of land surfaces associated with municipal and industrial development, and by logging of steep slopes.

Population is growing rapidly within western portions of the watershed. Population in the Everett water service area is expected to grow by 30 percent between 1995 and 2020. To serve this additional population, increased withdrawal from surface water and ground water sources is likely. Increasing development also tends to increase pollution from "non-point" sources, such as lawns, septic tanks and roads.

What are the water quality issues?

Water quality is closely tied to water quantity. Water supplies must be of high quality for drinking water use and to support fish and wildlife. At the same time, water quality may depend on maintaining large quantities of clean water to reduce the adverse effects of pollutants and increased surface water temperatures. Removing streamside vegetation tends to raise water temperatures to levels that may be harmful to fish and other aquatic animals, insects and plants.

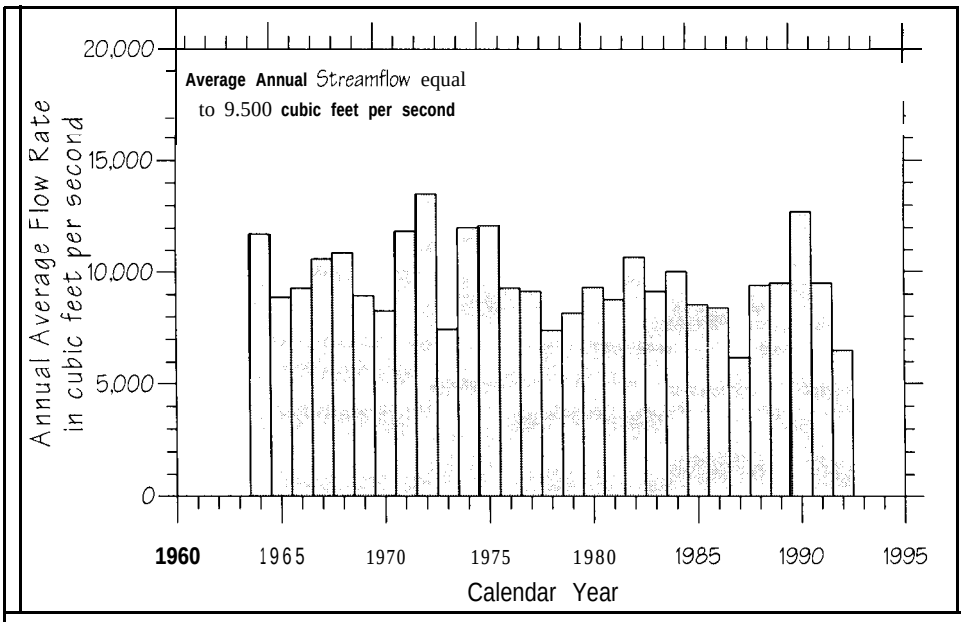
The Snohomish, Skykomish and Snoqualmie rivers and some other streams in the watershed experience some problems with water quality. Problems include PCBs, phenols, high temperature, fecal coliform and dissolved oxygen on the Snohomish River; and high temperature and fecal coliform on portions of the Snoqualmie, Skykomish and Pilchuck rivers. High temperature, fecal coliform and/or dissolved oxygen were also reported on several smaller creeks in the watershed.

Ground water in the Snohomish watershed is generally of good quality. Locally, pollution and naturally occurring concentrations of iron, manganese and arsenic may limit some ground water development. Significant development along the coast could result in seawater intrusion.

Are fish resources stable?

Much of the information on fishery issues in the Snohomish watershed is found in the "SASSI" report (the State Salmon and Steelhead Stock Inventory), prepared by the Washington State Departments of Fisheries and Wildlife, with assistance from 23 Indian Tribes and tribal organizations. According to the SASSI report, the Snohomish watershed supports chinook, coho, pink and chum salmon as well as steelhead. Of the 19 stocks reported to spawn in the watershed, 12 are reported to be "healthy," meaning escapement, run size, and survival levels are within normal ranges.

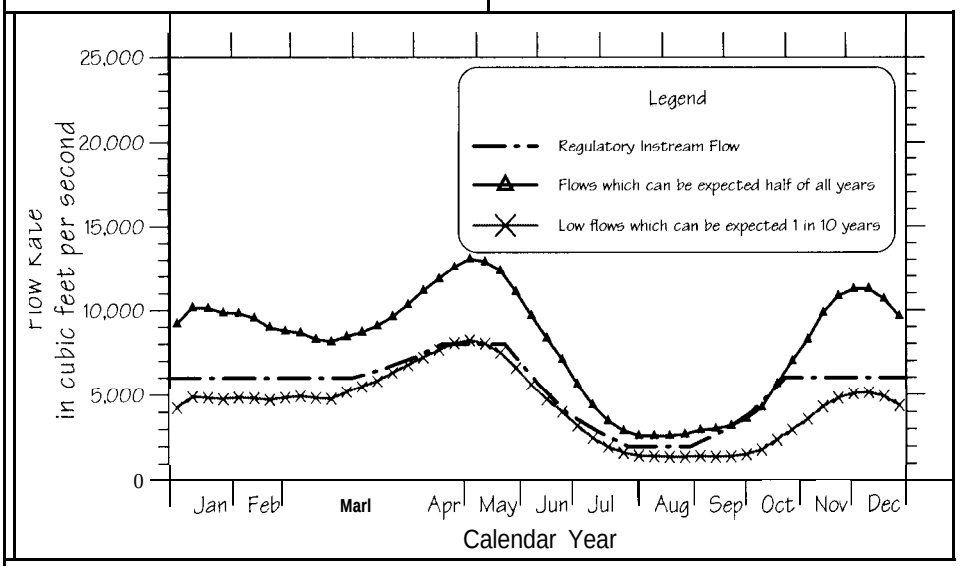
The conditions of three stocks, Bridal Veil Creek fall chinook, Snoqualmie fall chum, and North Fork Skykomish summer steelhead, are "unknown" as too little information exists to assess stock status. The Snohomish summer and fall chinook, Snohomish coho and Tolt summer steelhead are considered "depressed," meaning they are close to or below the population size where permanent loss of distinct genetic material is at risk. The Tolt summer steelhead stock has also been listed at a high risk of extinction. The watershed also supports a number of other fish species whose survival is of concern, including bull trout, sea-run cutthroat and pygmy whitefish.



Annual streamflow in the Snohomish River at USGS gaging station near Monroe

How have streamflows changed?

Flow in the watershed's rivers and streams occurs partly from overland runoff generated by storms, and partly from ground water seepage through the streambed. Dam releases also augment summer flows on some rivers. The U.S. Geological Survey operates stream gage stations throughout the watershed which measure the amount of water that flows through a river at a certain point. These gages are found on rivers and streams of varying size, and have historic data records of varying length.



Flow probabilities versus minimum instream flow requirements on the Snohomish River at Monroe. Most of the river's flow occurs in winter and spring, when demand is lowest and fisheries habitat is least critical.

Annual streamflow in the watershed varies widely from one year to the next in a pattern which reflects annual precipitation. This high variability is demonstrated by the annual flow record on the Snohomish River at Monroe (see graph at left). Long-term trends in annual streamflow will be affected by trends in precipitation, water consumption and land use practices. Recent analysis of annual streamflow trends, adjusted for precipitation, is inconclusive but suggests a possible reduction in streamflow over time.

To protect senior water rights and instream uses, such as critical fish habitat, Ecology set instream flows and year-round closures for the Snohomish River and its tributaries in 1979. The instream flows apply only to water rights issued after the regulation was established. Water rights issued before flows were set are not affected.

Instream flow requirements exist at ten locations along streams within the watershed, seven of which are have relatively long-term stream gage records. Streamflow trends were analyzed at these seven gages as part of this assessment. Instream flow requirements are not met during portions of the year at most of these seven gages. For instance, since the regulation was established, instream flows on the Snohomish River near Monroe have typically not been met an average of 121 days per year, especially between mid-July and mid-October.

The graph on the left shows flow probabilities for the Monroe stream gage compared to instream flow requirements. Minimum flows are not met during the month of October in half of all years, and are not met during most of the year (except May and early June) in one of ten years. Diversions for water supply are highest during the summer months when stream flows are naturally low.

In general, comparison of early and recent data shows little change in the number of days per year that instream flows are not met. Changes in reservoir storage and operating practices on the Sultan River have helped to meet instream flow requirements since 1985. On the Snohomish River near Monroe and the Snoqualmie River at Snoqualmie Falls, the number of days flow requirements have been met has been declining since 1985. Existing data are insufficient to provide definite clues to the cause(s) of the changes.

What are water rights?

A water right is a legal authorization to use a certain amount of public water for specific beneficial purposes.

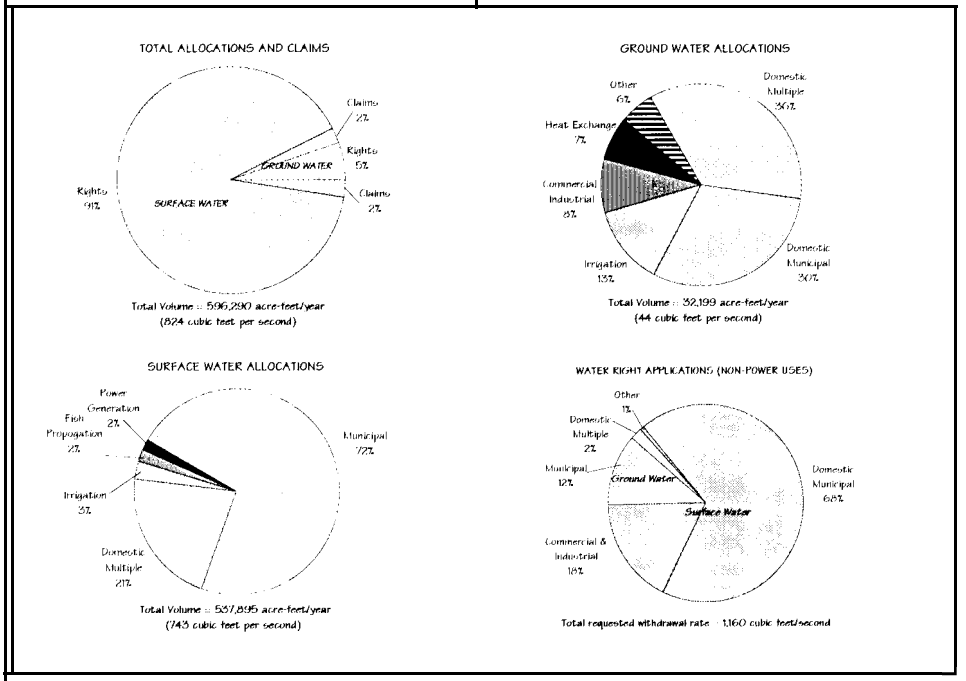
State law requires every user of streams, lakes, springs and other surface waters to obtain a water right permit before using these waters. People who use ground water also need a water right permit unless they use 5,000 gallons or less each day for one or more of the following purposes: watering stock, watering a lawn or garden less than one-half acre in size, or for a single or group domestic or industrial water supply.

What are water right claims?

A water right claim is just that, a claim for a right to use water. A water right claim on file with Ecology may or may not represent a valid water right. The validity of a claim can only be established through a Superior Court determination of water rights. A total of 6,272 water right claims have been filed within the watershed. There are 1,592 surface water claims for an equivalent flow of 20 cfs, and 4,680 ground water claims for an equivalent flow of 17 cfs.

Why are water rights important?

The basis for water rights is “first in time, first in right.” This means people with older, or senior, rights get to use the water first when there is not enough for everyone. The water rights program ensures that



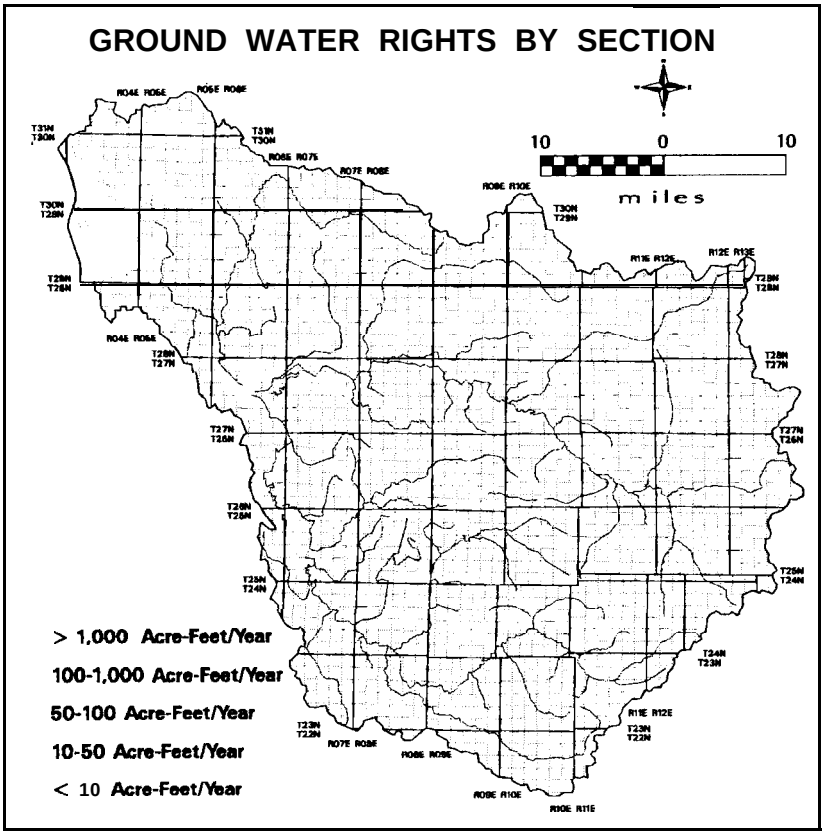
Distributions of water rights in the Snohomish watershed by use and by category (permits/certificates, claims, and applications).

Washington's water resources are appropriately allocated and managed. By effectively managing allocation of new water rights, Ecology can protect senior water rights and benefit the overall public good.

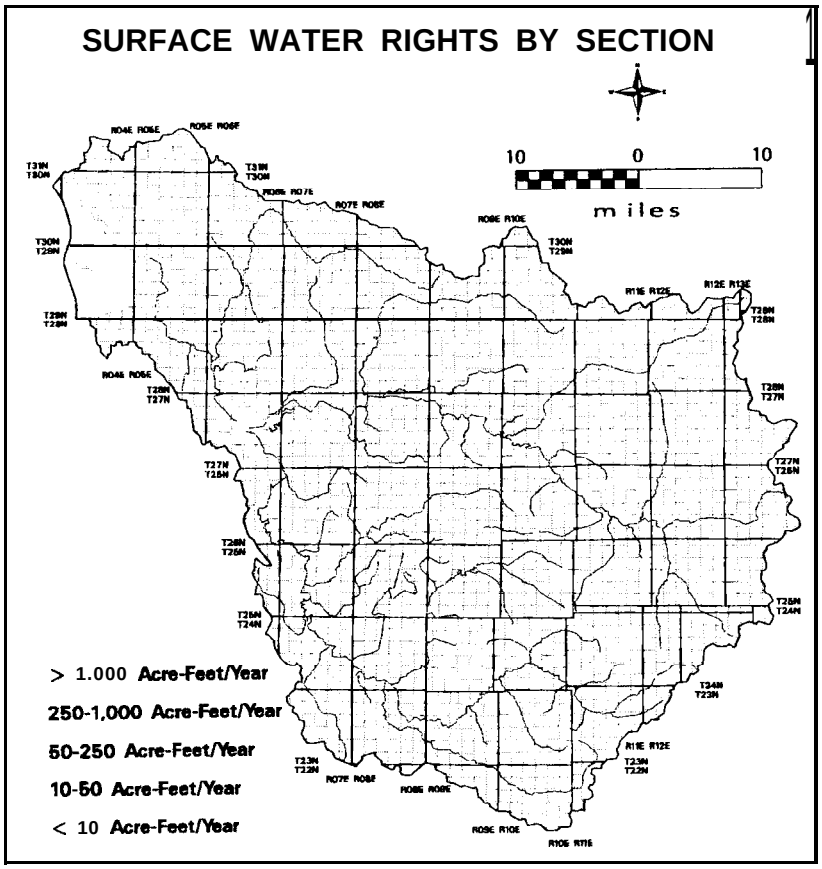
How **is water currently allocated and what new uses are proposed?**

Ninety-five percent of the water allocated in the Snohomish River watershed is surface water. The 901 surface water rights issued by Ecology are equivalent to a flow of 743 cfs, and the 454 ground water rights are equivalent to a flow of 44 cfs.

Future water resource development continues to emphasize surface water sources. Ecology currently has applications for 26 surface water rights and 61 ground water rights. Applications are filed for specific pumping rates and diversion flows, however allowable annual withdrawal volumes may be less. Surface water applications (excluding those for power generation) are requesting approximately 1,000 cfs, largely for municipal uses. Ground water applications are requesting 164 cfs, again mostly for municipal uses.



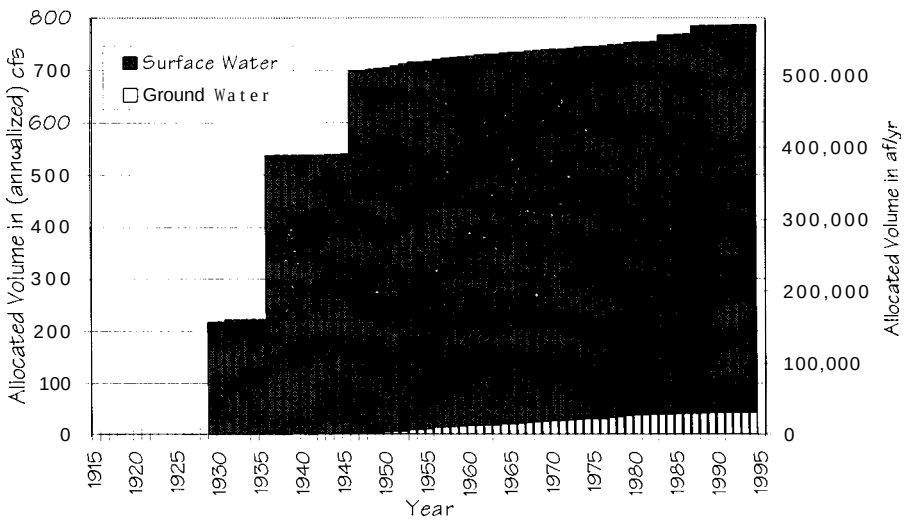
Ground water rights in the Snohomish watershed.



Surface water rights in the Snohomish watershed

Distributions of water rights and applications by use and category are shown on the previous page. The geographic distribution of water rights is shown on the figures above and to the left.

The amount of water allocated probably exceeds the amount actually used. This assessment indicates that ground water use in the Snohomish River watershed is about 50 percent of ground water rights issued, and that municipal surface water use is about 40 percent of municipal surface water rights issued. Allocations represent the volumes legally available for use if all water rights are exercised. Presumably, the balance of surface water allocated to municipalities will be used as Seattle and Everett continue to develop their existing rights. If the amount of water used approaches the amount allocated, further streamflow reductions are likely to occur.



Annualized water rights quantities versus time in the Snohomish watershed

What are the conflicts?

In the Snohomish watershed, instream flows are not met during much of the late summer and fall, yet an increasing number of water right applications are filed each year (see graph, above). Water use conflicts occur when the available water supply is insufficient to fulfill existing water rights and claims, including maintaining instream flows. In addition, future conflicts could occur between existing rights and proposed new uses. Before issuing future ground water rights, Ecology must consider the potential adverse effects on other users.

Current and requested allocations comprise only one fifth of total annual streamflow, however most of the annual streamflow occurs in the winter months and is not available for meeting the high summer demands. Annual flow in the Snohomish River averages about 9,580 cfs at Monroe, and flow at the mouth of the Snohomish River is likely somewhat higher. Water rights and claims in the watershed are equivalent to a flow of 823 cfs. A portion of these water rights, while not currently in use, will be put to use at a later date. Current applications request nearly an additional 1,164 cfs, not including requests for power generation (where the water is returned to the stream).

Where do we go from here?

While Ecology is mandated by law to protect instream water use and existing water rights, Ecology also is responsible for making decisions on applications for new water rights. The public's opinion is important to Ecology in making program decisions related to water use. Ecology invites public input on what steps should be taken next. We will also work with people who have applied for new water rights in the area to discuss options for processing their applications.

What additional information is available?

If you would like to learn more about water issues in the Snohomish watershed, the following studies and technical reports are available:

AFS. 1991. "Pacific Salmon at the Crossroads: Stocks at Risk from California, Oregon, Idaho, and Washington," March:April 1991. Fisheries. American Fisheries Society.

Ecology. 1979. Instream Resources Protection Program — Snohomish River Basin, Water Resources Inventory Area (WRIA 7). Chapter WAC 173507.

Ecology. 1995 Initial Watershed Assessment, Water Resource Inventory Area 7, Snohomish Watershed. Open File Technical Report 95-06, Washington Department of Ecology.

U.S. Geological Survey. (In Press). Geohydrology and quality of ground water in East King County Washington. USGS Water-Resources Investigations Report, Prepared in cooperation with Seattle-King County Department of Public Health.

WDF & WDW. 1993. 1992 Washington State Salmon and Steelhead Stock Inventory. Washington Departments of Fisheries and Wildlife.

For more information ...

Contact Steve Hirschey at (206) 649-7066 (voice), (206) 649-4259 (TDD), or write to the Department of Ecology, 3190-160th Ave. SE, Bellevue, Washington 98008-5452.

Ecology does not discriminate in its services. If you have special communications needs, contact Lisa Newman at (360) 407-6604 (voice) or (360) 407-6006 (TDD).

What do we know about the Snohomish watershed?

This assessment found that in areas where the ground and surface water are directly connected, ground water pumping reduces streamflow. Streamflow is lowest in the late summer and early fall when water use is greatest. These periods of low stream flow are having adverse effects on aquatic habitat and fish. As the population and water use continues to grow, there may not be sufficient water to fulfill existing water rights and claims, as well as proposed future uses. Because of these findings, the Snohomish watershed is classified as "high risk" by Ecology. Ecology must consider potential impairments to existing water rights and instream resources when making decisions on pending water right applications.

What actions can be taken?

Based on the risk, Ecology could take a number of actions. Usually, a combination of actions needs to be taken to effectively manage water resources. The list below describes some actions that could address issues raised in this report. This list is not comprehensive. Ecology wants to hear your opinions on the actions listed here, and any other ideas you have about water management.

Encourage water conservation. changes and transfers of water riahts. water reuse. and pipeline interconnections to allow efficient use of water.

Pro: May meet new water use demand without an adverse impact on streamflow and senior water rights.

Con: May only be applicable to municipalities or other large water users, and may not meet all demands through these mechanisms.

Increase storaae of water durina periods of high stream flow for use during periods of low stream flow.

Pro: Allow for additional water rights to be issued without an adverse impact on water resources during critical flow periods.

Con: Potentially expensive, may be difficult to find suitable site, may require cooperation of others.

Approve aoolications for new water riahts subject to instream flows; or where acceptable mitiaation is proposed: or where source is not tributarv to closed surface water and impairment of existina riahts would not occur.

Pro: Some applicants would get approvals; surface waters and existing rights would be protected.

Con: No criteria exist for "acceptable mitigation"; water may not be available throughout the year (subject to instream flow regulations); applicants would have to determine that the source is "non tributary"; could be expensive and time consuming.

Denv aoolications for new water riahts where source is tributary to closed surface water.

Pro: Applicants would get decisions now; surface waters and existing rights would be protected.

Con: Applicants would not get the decisions they want.

Expand local water manaaement efforts to a reaional watershed planning committee which could resolve conflicts about water with the greatest participation bv residents.

Pro: Consolidation and cooperation between water interest would allow more flexible solutions and cost-effective approaches to water issues. Activities could include increases to storm water retention areas, improvement of aquatic habitat and water quality, interconnection of water suppliers, and additional collection of hydrogeologic and water use data. A regional perspective could be used to meet new water uses.

Con: Would require time, money, and political consensus to create and carry out the plan. Availability of funding is uncertain.