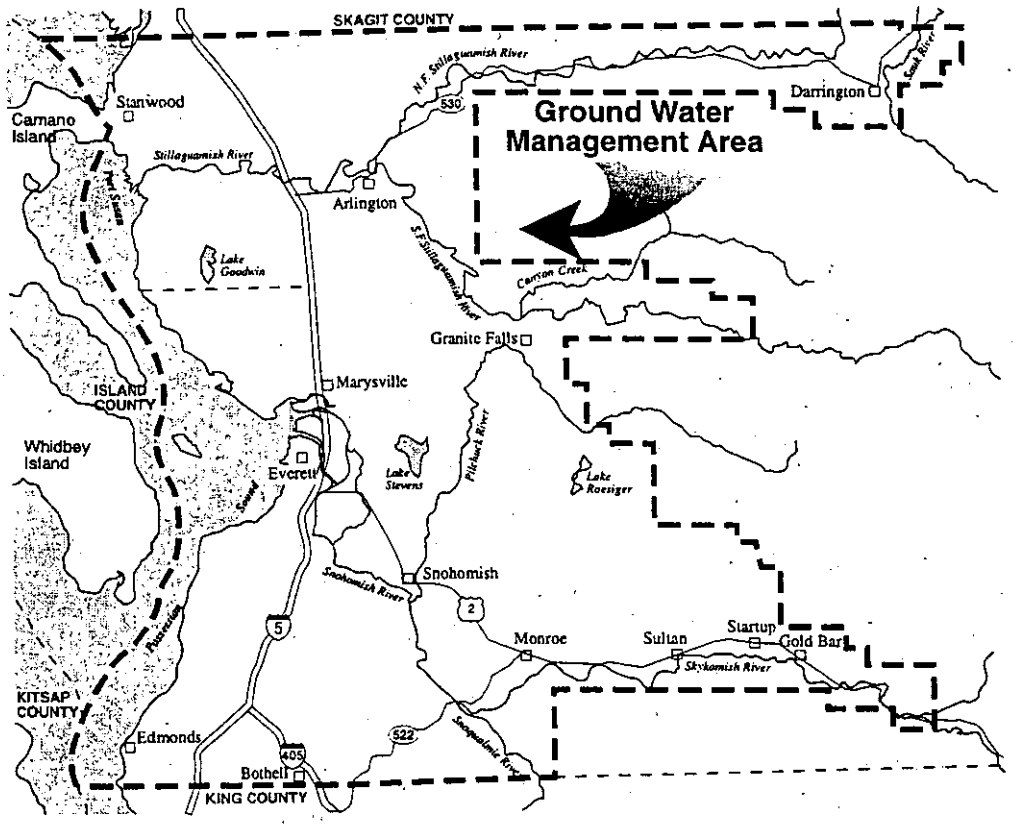
Snohomish County
ground water
management plan

Snohomish County Ground Water Management Plan

Prepared under the Direction of the Snohomish County Ground Water Advisory Committee



GROUNDWATER
YOUR TREASURE DOWN UNDER

Snohomish County

Golder Associates

May 1999

Funding provided by the
Washington State
Department of Ecology
Centennial Clean Water Fund

WASHINGTON STATE DEPARTMENT OF ECOLOGY

SNOHOMISH COUNTY
GROUND WATER MANAGEMENT PLAN

MAY 1999

Prepared under the Direction of:

The Snohomish County Ground Water Advisory Committee

Prepared by:

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Redmond, Washington

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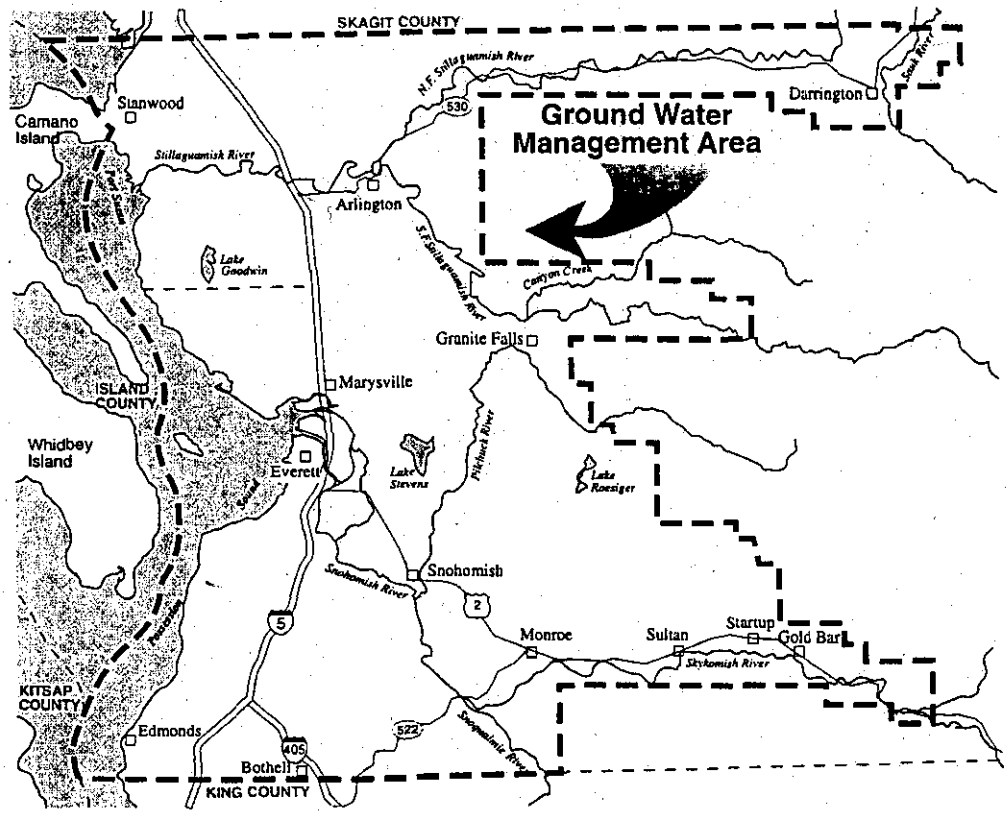
Snohomish County Ground Water Management Plan

Project Summary

Prepared under the Direction of the Snohomish County Ground Water Advisory Committee



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Snohomish County

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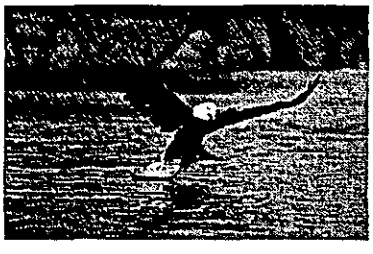
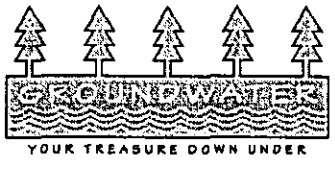
Prudent action now can and will protect Snohomish County's ground water resources.

Snohomish County has ample supplies of generally good quality ground water.





SNOHOMISH COUNTY GROUND WATER MANAGEMENT PLAN EXECUTIVE SUMMARY

A plan has been prepared for managing and protecting ground water resources in Snohomish County, in accordance with Washington State Administrative Code. To develop the plan, a committee composed of local citizens, business and environmental interests, and representatives of governmental agencies has been meeting for over four years to identify and address issues concerning ground water quantity and quality. This plan provides the framework for continued protection of ground water resources in Snohomish County and is intended to be used at the planning level by all jurisdictions in the County.

As the population in the Puget Sound area continues to increase rapidly, ground water resource issues are important, both locally and regionally. The Snohomish County Ground Water Advisory Committee believes that prudent action now can and will conserve Snohomish County's ground water resources, protect existing and future ground water users, and prevent future overuse and contamination problems. These findings are based on a regional study conducted by the U.S. Geological Survey (1997) and additional technical analysis of local ground water conditions by Golder Associates (1996). The key element of these findings is that the focus of ground water management should be on preventative measures.

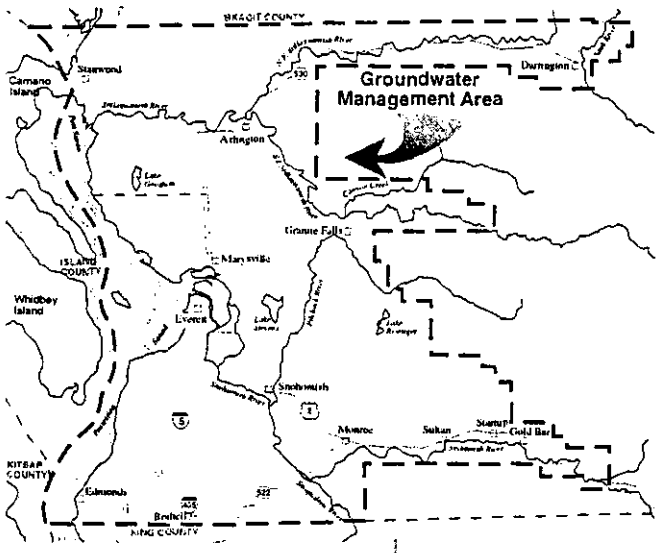
Snohomish County has ample supplies of generally good quality ground water that provide drinking water to the population and enhance environmental quality. In portions of the western half of the county, where development exists and will continue, there are indications of actual and/or potential problems with ground water quality and quantity. Some of the County's population (18% in 1995) is totally dependent on ground water as their source of supply. These primarily rural residential areas do not have sufficient development intensity to warrant public water supply systems tied to the regional surface water supply system. Therefore, it is essential that ground water be developed and protected to meet specific supply needs in particular areas. Ground water discharge also provides a significant component of flow to surface water throughout the County. These rivers, streams and lakes support fish populations, some of which are now declining and at risk of being listed under the Federal Endangered Species Act.

The Ground Water Advisory Committee identified a number of actions that would, if implemented, improve the management and protection of ground water resources in the plan area and engaged in a process to identify and select management alternatives. Recognizing limitations on resources, an initial list of over 80 alternatives was reduced to a list of 41 "preferred" alternatives. The Committee intentionally avoided assigning priorities or rankings to the list of alternatives, so that all issues are given due process in their assessment. However, the Committee did initiate a public information and education program as one of the highest priority elements. The management alternatives address a wide range of existing and potential problems with ground water usage and ground water quality in the area. The final list of "preferred" alternatives is presented in a summary table (in the plan) to assist the Snohomish County Council, other implementing agencies, and management area residents in evaluating them. The original slate of alternatives is included in the plan and may be re-evaluated in future updates. Although priorities have not been assigned, key elements to the success of ground water management in Snohomish County will begin with efforts to establish an agency to coordinate implementation of the plan, designate critical aquifer recharge areas, and collect and manage data.

Technical analyses provided a basis to identify ways to resolve present and future ground water resource management issues.

Background of the Ground Water Management Plan

The Ground Water Management Plan was prepared according to guidelines established by the Washington Department of Ecology (Ecology) under the Washington Administrative Code (WAC Chapter 173-100). The plan was funded through a grant to Snohomish County Department of Planning & Development Services by Ecology. After local review and acceptance (termed concurrence), the plan will be submitted to Ecology for certification according to the WAC 173-100. Following certification, state agencies and affected local governments may adopt or amend regulations, ordinances, and/or programs to implement the provisions of the groundwater management program.



The technical basis for the Groundwater Management Plan is provided in reports prepared by the U.S. Geological Survey (1997) and by Golder Associates (1996), a consulting firm contracted to assist the Ground Water Advisory Committee. The U.S. Geological Survey conducted field monitoring and sampling of wells throughout the western half of the County to evaluate regional ground water conditions in the County. Golder Associates conducted further technical analysis, using the USGS data in conjunction with land use and water supply data, to evaluate the potential implications to ground water caused by continued economic growth and development in the County. These technical analyses provided a basis for the Committee to identify alternative ways to resolve present and future ground water resource management issues.

Development of management alternatives was aided by a series of discussion papers prepared by the Ground Water Advisory Committee. These discussion papers were intended to identify problems and potential management objectives, summarize pertinent policies and programs, summarize the consequences of taking no further action, and suggest possible management actions.

Description of Ground Water Management Area

Present and future land uses generated by population increases affect the availability of ground water quantity and its quality.

The Snohomish County Ground Water Management Area (GWMA) encompasses about 850 square miles between the Cascade Mountains and Puget Sound. Area boundaries are the Puget Sound shoreline on the west, Skagit County border to the north, Cascade foothills on the east, and King County border to the south. A variety of activities such as agriculture, industry, general commerce, and residential living occur within the GWMA. Population centers are located primarily in the west and southwest areas with rural residential areas and forest lands in the eastern half. In 1992, the County population was 494,300 mostly within the GWMA.

To address future growth and development and comply with State laws, Snohomish County has adopted a Growth Management Act Comprehensive Plan, prepared a Future Land Use Map and conducted a land capacity analysis. The total county population capacity under the Future Land Use Map is estimated to be 835,984 people (610,996 within urban growth areas and 224,988 within rural areas).

Present and future land uses generated by population increases affect the availability of ground water quantity and its quality. Most of the population is concentrated in the southwest county area. Other population concentrations are around Lake Stevens, and the cities of Snohomish, Marysville, Arlington,

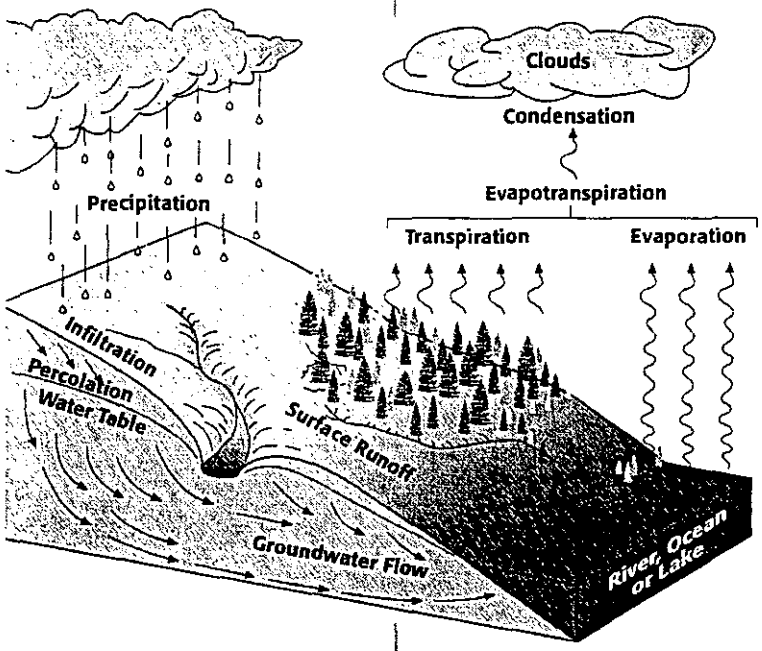
Geology and soil properties can strongly influence the amount of precipitation that infiltrates. Land use also influences the recharge rate.

Monroe, Stanwood, Granite Falls, and Darrington, plus parts of the Skykomish River valley.

Overview of Ground Water in Snohomish County

Ground Water Occurrence and Recharge

Glaciers overlying and moving across the GWMA thousands of years ago defined the local surface geology and related local occurrence of ground water in underlying aquifers. The most extensive aquifers occur below plateau areas, such as southwest county, the Tulalip Reservation, and the area surrounding Lake Stevens. The aquifers in these areas are overlaid by an impermeable layer, which provides natural protection from contamination above on the land surface. Other aquifers occur in the Skykomish, Snohomish, and Stillaguamish River valleys, and the Marysville Trough, (located between Marysville and Arlington). In these aquifer areas, the ground water is shallow, within a few feet of land surface. The surface soils are also sandy and consequently wastes or chemicals released there can migrate to the water table very easily and are most vulnerable to contamination.



The primary source of recharge or resupply for ground water is precipitation that infiltrates and percolates to the water table. Other sources of recharge are seepage from surface water bodies such as streams and lakes, lateral subsurface inflows of ground water within unconsolidated materials along the boundary of the study area, and the lateral and upward flow of ground water from adjacent bedrock units. The amount of ground water recharge from precipitation varies throughout the area and depends on several factors including mean annual precipitation, surficial geology and soil properties, vegetation, and land use. Surface geology and soil properties can strongly influence the amount of precipitation that infiltrates.

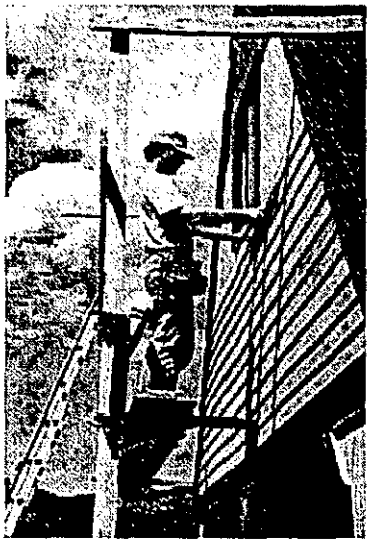
Recharge is higher within the eastern parts of the area because of higher precipitation, and areas where coarse-grained materials are present at the surface. Average annual recharge for the entire GWMA from precipitation is estimated to be about 24 inches or 1,090,000 acre-feet, which is about one-half of the precipitation that falls in the area. Land use also influences the recharge rate. Development and urbanization increases the amount of impervious surfaces, which reduces recharge areas. Densely urbanized areas are present in the southwestern portion of the county.

Ground Water Discharge and Use

Discharge from the ground water system occurs naturally to streams, lakes, marshes, and Puget Sound. It also discharges as springs and seepage along slopes or from one aquifer to another. Ground water can also be removed naturally in areas where the water table is near the surface by evaporation from the ground or by transpiration from vegetation (collectively referred to as evapotranspiration).

Understanding and evaluating how uses of ground water can affect stream flow is important to preserving fish habitat. An estimated 88% of the total ground water recharge ultimately discharges to surface waters.

Some areas may experience decreasing water levels in wells and reduced discharge to surface water as development continues.



Ground water quality is generally good with no appreciable widespread contamination. However, localized contamination has been documented.

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Ground water withdrawn from wells is used to supply water for domestic, industrial, agricultural, and mining purposes. Ground water withdrawals within the ground water management area during 1992 were estimated to be 19,630 acre-feet. This quantity represents total withdrawal and does not take into account return flow (i.e. recharge) to the ground water from septic systems (drainfields), irrigation water, or water that is used in sand and gravel mining. Of the total annual withdrawal, about 15,210 acre-feet (77%) is used for public water systems and private domestic supplies, while 4,350 acre-feet (22%) is used for irrigation and livestock. Only 70 acre-feet was estimated to be used for mining activities (primarily sand and gravel operations).

The magnitude of ground water discharge to streams is not well known, and can be highly variable. However, ground water can provide a significant portion of streamflow during times when there is no surface runoff from rainstorms or snowmelt. Consequently, understanding and evaluating how uses of ground water can affect stream flow is important to preserving fish habitat. An estimated 88 percent of the total ground water recharge ultimately discharges to surface waters.

Ground Water Movement and Water Level Changes

The direction of ground water flow can be determined by mapping the elevations of water levels measured in wells. Ground water flows from areas of higher to lower water-level elevation. In the shallow ground water system flow follows the surface topography and moves from higher areas towards stream and river valleys. Typically, flows parallel the surface topography with a primarily horizontal component of flow, but with a downward component in recharge areas, and an upward component in discharge areas.

On a regional scale, the general direction of ground water flow within the area is from east to west. Locally, the direction of flow varies depending on a number of factors, including local topography, and subsurface geology. For example, ground water mounds occur under the Tulalip, Getchell, and Lakes Plateaus and flow is radially outward from the center of the mounds towards the edges of the plateaus.

Ground water levels fluctuate with changes in recharge and discharge. The fluctuations reflect seasonal changes in the amount of water stored in the soil. During the winter, precipitation is relatively high and ground water recharge exceeds discharge which results in a seasonal increase in water levels (increase in ground water storage). During the summer, precipitation is relatively small and discharge exceeds recharge, which results in declining water levels (decrease in ground water storage).

The magnitude of seasonal water level changes ranges from 4 to 10 feet in shallow wells, 3 to 4 feet in moderate-depth wells, and an extremely small variation in deep wells. Limited analysis by the U.S. Geological Survey did not find any areas of widespread long-term water declines. However, work by the Committee's consultant has identified some areas where, based on projected land-use and population, the ratio of consumptive ground water use to recharge may become high. This suggests that some areas may experience decreasing water levels in wells and reduced discharge to surface water as development continues.

Ground Water Quality

Based on sampling of wells by the Geological Survey (1997), the ground water quality within the ground water management area is generally good

Future supply potential was evaluated for the year 2012 population.

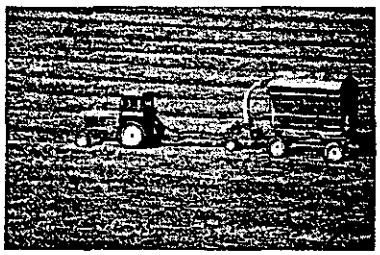
with no appreciable widespread contamination. The most common ground water quality problems, such as high iron, manganese and arsenic, were attributed to natural causes. Although ground water quality appears good on a regional level, there are localized occurrences of contamination within the ground water management area. In some samples high levels of nitrate were detected, suggesting local contamination by septic systems, fertilizer or livestock waste. Traces of pesticides have been found in a few wells, though not at levels that exceed state and federal standards. The USGS study included a few analyses for organic compounds, but the sampling effort was not adequate to assess possible organic contamination at a regional scale. However, petroleum spills, landfills, and hazardous waste sites are present within Snohomish County and localized contamination has been documented.

Future Ground Water Utilization and Vulnerability in Snohomish County

A number of technical issues were addressed in the geohydrology memorandum related to the utilization and vulnerability of ground water resources in Snohomish County. Ground water uses studied in the GWMA include water supply, discharge of wastewater, discharge of storm water, and water storage. Future supply potential was evaluated for the year 2012 population, as presented in Snohomish County's land capacity analysis. For most parts of the GWMA, the consumptive use is a small proportion (less than 5%) of the ground water recharge. This condition suggests impacts to stream flow would be small in most areas. In a few watersheds, however, consumptive use was a higher proportion (up to 25%) of ground water recharge, suggesting greater potential for impacts to surface water. Local impacts to specific streams were not included in this analysis.

Potential contaminant sources considered were: stormwater infiltration facilities; leaching of agricultural chemicals (pesticides and fertilizers); wastewater infiltration; spills at commercial and industrial facilities; spills related to transportation of hazardous materials on roads, rail, and in pipelines; chemicals used to maintain right-of-way areas; and spills related to sand and gravel mining.

Several areas are predicted to attain elevated nitrate concentrations, though not in excess of drinking water standards.



The technical analysis led to findings/conclusions regarding the potential vulnerability of ground water to contamination and overuse in the management area. Several areas are predicted to attain elevated nitrate concentrations, though not in excess of drinking water standards. The nitrogen sources were septic tank discharges, lawn fertilizer, agricultural fertilizer and livestock. It is also noteworthy that, within the GWMA, there were 3,616 Critical Material Users, 362 leaking underground storage tanks, and 122 sites on Ecology's Confirmed and Suspected Contaminated Sites list, as of March 1996. Most of the commercial and industrial land use areas occur where ground water is vulnerable to contamination.

Three key indicators of ground water vulnerability were developed for the Plan in the geohydrology memorandum. These are:

- A map of ground water vulnerability depicting high, medium, and low vulnerability. This map was developed by the USGS and was based on soil type, depth to ground water and ground water recharge rate. At a planning level, this map can be used to identify potentially critical ground water areas.

- An analysis, by sub-basin, of ground water consumptive use as a percentage of ground water recharge. This analysis was performed by the hydrogeologic consultant using USGS data and the Snohomish

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The Ground Water Advisory Committee identified over 80 management alternatives to address potential ground water impacts and problems.

County GIS. At a planning level, this analysis can be used to identify sub-basins where ground water use is potentially excessive.

- An analysis, by sub-basin, of nitrate loading and estimated ground water nitrate concentration. This analysis was performed by using USGS recharge data and future land-use data in the Snohomish County GIS. At a planning level, this analysis can be used to identify sub-basins where nitrate loadings are potentially excessive.

These three analyses, while they do not exclude or minimize the importance of other issues or analyses, provide the most "regional" perspective on ground water use and quality. Therefore, they should be considered as initial starting points for planning-level allocation of resources and for focusing future monitoring efforts.

Management Alternatives and Implementation

The Ground Water Advisory Committee identified over 80 management alternatives to address potential ground water impacts and problems. The list was then reduced to 41 "preferred" alternatives through discussion and balloting. The Committee intentionally avoided assigning priorities or rankings to the list of alternatives, so that all issues were given due process in their assessment. Each alternative was assessed by the Committee, with assistance from the technical consultant, with respect to the appropriate lead agency, participating agencies, overall feasibility, potential conflicts with existing plans, funding needs and availability, funding sources, implementation schedule, and ease of implementation. Appropriate entities were contacted regarding implementing activities and cost estimates for implementation. A goal of three years (until 2001) was set for implementation of the preferred management alternatives.

A goal of three years (until 2001) was set for implementation of the preferred management alternatives.

The preferred alternatives address a wide range of existing and potential problems with ground water usage and quality in the area, and include a number of administrative issues. After much discussion by the Committee, a prioritized list of alternatives was not prepared. The Committee feels that all of the alternatives warrant attention and resources over the life of the ground water management program. The original slate of 80 alternatives has been preserved in the Plan and should be re-evaluated in future updates of the plan.

Under the implementation strategy, Snohomish County Public Works Surface Water Management Division will be the lead agency responsible for administering the implementation of the ground water management plan. Eleven other agencies or organizations will have lead roles in implementing specific elements of the plan.

Although management priorities have not been explicitly assigned, there is agreement within the Committee that the key elements to the success of sound ground water management in Snohomish County will begin with efforts to establish an agency to coordinate implementation of the plan, designate critical aquifer recharge areas, and collect and manage data.

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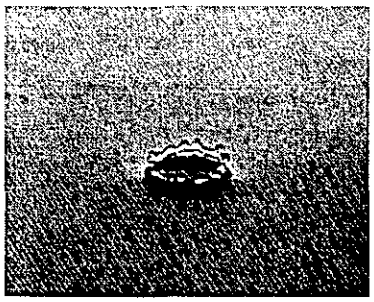
Ground Water Advisory Committee Member Roster



Member	Alternate	Representing
Ken Baxter	Ken Winckler	City of Marysville
Bill Beckman	Susan Banel	City of Stanwood
Janet Carroll	Kathy Thornburgh	Snohomish County Public Works – Surface Water Management
Jon Cleveland	Cas Hancock	Evergreen Rural Water of Washington
Peg Ferm	Gottlieb Ribary	People for Preservation of Tualco Valley/Stillaguamish Citizens Alliance
Scott Fowler	Deane Hayes	Washington State Drilling & Groundwater Association
John Gintz	Roger Findley	Snohomish County Cattlemen's Association
Jay Hagen	Bob Lundvall	Snohomish County Farm Bureau
Gary Hajek	Wayne Lawrence	Cross Valley Water District
Wendel Johnson	Chuck Lindsay	Professional Consultants of Snohomish County
Pam Liester	Ellen Gray	Pilchuck Audubon Society
Pat Magnuson	Connie Dunn	City of Sultan
Roy Metzgar	Dan Thompson	City of Everett
Jim Miller	John Spangenberg	Master Builders Association
Robin Nelson	Ken Coats	Snohomish County Aggregate Producers
Michael Noll		Citizen
Mike Pattison	Russ Hokanson	Snohomish County – Camano Association of Realtors
Kevin Plemel	Brent Raasina	Snohomish Health District
John Postema	Melinda Anthony	Washington State Nurseryman's Association
Guillemette Regan	Mark Spahr	Snohomish County PUD
Steve Roy		Citizen
Larry Springer	Tom Niemann	Snohomish County Planning & Development Services
Jeannie Summerhays		Washington Department of Ecology
Bill Wiselogle	Gary Hasseler	City of Bothell

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Additional information on the Snohomish County Ground Water Management Program may be obtained from the Snohomish County Department of Planning and Development Services, phone (425) 388-3311 (ext. 2203)

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1. PROJECT SUMMARY

The Snohomish County Ground Water Management Plan (GWMP) represents 4 years of dedicated effort by agencies and citizens of Snohomish County to protect the valuable ground water resources of the County. This plan provides a template for the continued management of ground water in Snohomish County, and also represents the process of ground water management undertaken by the Ground Water Advisory Committee in developing the program. The Ground Water Advisory Committee (GWAC) was formed in 1993 with about 35 members representing local (cities, towns, businesses, and citizens), tribal, county, and state interests. Since that time, the GWAC has met to discuss ground water issues and concerns and, in particular, to develop discussion papers on specific potential impacts to both ground water quantity and ground water quality.

Consistent with the Washington Administrative Code (WAC), Chapter 173-100, the Snohomish County Ground Water Management Program was developed according to guidelines promulgated by the Washington Department of Ecology (Ecology) through WAC 173-100. The plan is organized into 3 sections as follows:

> Section I: Area Characterization. This section has been consolidated from the Geohydrology Memorandum (Golder, 1996) submitted to the GWAC in November 1996. This section summarizes the technical hydrogeological information from which management strategies were developed.
>
> Section II: Management Alternatives. This section discusses the problems, issues, and alternatives discussed by the GWAC between January and November of 1997. During this period, numerous comments and alternatives were incorporated into a management alternatives report. The report presented in this document is essentially what was submitted to the GWAC on November 5, 1997 as the "Revised Alternatives Memorandum." Over 80 management alternatives were considered and brought forward in the Management Alternatives Report.
>
> Section III: Preferred Alternatives. This section summarizes the recommended alternatives selected by the GWAC from the alternatives presented in Section II. In selecting the preferred alternatives, the GWAC, through a balloting procedure, reduced the number of management alternatives from 80 to 41, in an effort to focus on a manageable number of issues and alternatives that were most appropriate to be advanced in the planning process. Section III discusses the detailed implementation issues for each preferred alternative. This section, in accordance with the guidelines of WAC 173-100, identifies, for each preferred alternative, the parties responsible for initiating the action and the schedule for implementation. This plan also identifies funding needs and opportunities for implementation. The preferred alternatives were formally selected by the GWAC in December of 1997.

The following sections provide an overview of the ground water management plan.

1.1 Section I: Area Characterization

Ground Water Management Area (GWMA)

The GWMA includes about 850 square-miles in the western county area. A variety of activities occur within the GWMA including agriculture, industry, general commerce, and residential living. The population centers are located primarily in the west and southwest areas. The eastern half includes most of the rural residential areas and also forest lands. In 1992, the county population was 494,300, most of which occurs within the GWMA.

The County has adopted a Growth Management Act Comprehensive Plan (GMA Plan). To support the GMA Plan, the County has prepared a Future Land Use Map and has also conducted a land capacity analysis (Snohomish County, 1995). The total county population capacity under the Future Land Use Map is estimated to be 835,984 persons. Within UGA areas, the population capacity is estimated to be 610,996 persons. Within rural areas, the population capacity is estimated to be 224,988 persons.

Ground Water Occurrence

Ground water occurs in a few different aquifers within the GWMA. The most extensive aquifers occur below the plateau areas, such as the southwest county area, the Tulalip plateau east of Marysville, and the area surrounding Lake Stevens. The aquifers in these areas are overlain by a layer of glacial till, which provides some natural protection from contamination at the land surface. Other aquifers within the GWMA occur in the major river valleys of the Skykomish, Snohomish, and Stillaguamish Rivers, and also in the Marysville Trough, located between the Cities of Marysville and Arlington. In these aquifer areas, the ground water is shallow, within a few feet of land surface. The surface soils are also sandy and, consequently, wastes or chemicals released there can migrate to the water table very easily. These areas have been assigned medium and high vulnerability classifications.

Ground Water Recharge/Discharge

It is estimated that a total of 2,090,000 acre-ft of water enters the GWMA as precipitation. Of this quantity, about half, or 1,090,000 acre-ft, infiltrates the soil and provides a source of recharge to the ground water aquifers. Based on conditions in 1992, it was estimated that 19,630 acre-ft of ground water is withdrawn annually (gross withdrawal). A total of 15,210 acre-ft is estimated to be withdrawn from water wells for public water systems and private domestic supplies. A total of 4,350 acre-ft is withdrawn and used for irrigation and livestock. Only 70 acre-ft of ground water was estimated to be used for mining activities, which would primarily be sand and gravel operations. A portion of the withdrawn ground water is known to re-infiltrate the soils and return to ground water, such as from septic drainfields and irrigation return flows, but these quantities were not estimated.

Aquifers of the plateau areas normally discharge to local tributary streams, such as North Creek, the Pilchuck River, and Mission Creek. These tributary streams

form an important component of the salmon spawning habitat in the GWMA. Consequently, understanding and evaluating how uses of ground water can affect stream flow is important to preserving the habitat. In the Phase One study, it was estimated that 88 percent of the total ground water recharge ultimately discharged to streams which in turn discharge to Puget Sound.

Ground Water Quality

A total of 297 wells and 13 springs were sampled during the Phase One study (Thomas, et al., 1997) for a variety of chemical constituents. Based on these data, the ground water quality within the GWMA is generally good with no appreciable widespread contamination. The most common ground water quality problems identified were attributed to natural causes. In some of the samples, septage-related compounds (nitrate, ammonia, boron) were detected at levels that indicated local contamination by septic systems. Septic systems have not caused any appreciable widespread ground water contamination. Arsenic levels were also observed to be high in the eastern part of the GWMA and in proximity to Granite Falls. The arsenic concentrations are derived from natural deposits. Analyses for organic compounds were completed in a limited number of samples and although these compounds were not detected, the sampling effort was not comprehensive to the GWMA.

Ground Water Utilization

Ground water uses studied in the GWMA include water supply, discharge of wastewater, discharge of stormwater, and water storage.

1. Ground water supply potential was evaluated for the year 2012 population, as presented in Snohomish County's land capacity analysis. The results indicate that in most parts of the GWMA the consumptive use is a small proportion (less than 5%) of the ground water recharge. This condition suggests impacts to stream flow would be small in most areas. In a few watersheds, however, consumptive use was a higher proportion (5% to 25%) of ground water recharge, suggesting greater potential for impacts to surface water.

2. Stormwater and wastewater discharges to ground water were considered as potential uses of the ground water resource. A mapping analysis was completed to identify those areas in the GWMA that would be suitable for these practices. The suitability of the soils for wastewater or stormwater infiltration was evaluated based on estimated infiltration capacities. In general, till soils with low infiltration capacity occur over large areas of the GWMA, thus restricting the use of stormwater infiltration facilities. Wastewater systems in these areas would also likely require an alternative design to allow for low infiltration rates. Site specific analyses are needed to assess the full range of conditions which may affect design of a wastewater- or stormwater-facility.

3. The storage of water underground was evaluated in a general manner as another use of the ground water resources. This practice is gaining increasing importance to water supply managers in the U.S. and normally involves the injection of treated drinking water underground. The same water is later withdrawn and used for municipal purposes. One advantage of this practice is the volume of storage

that can be achieved underground, which is typically 10 to 100 times greater than can be achieved in above ground facilities. Not all areas, however, can be used for aquifer storage and site-specific evaluations are necessary. A map of general areas where aquifer storage may be possible in the GWMA was developed (Golder, 1996).

Ground Water Vulnerability

A number of potential contaminant sources were considered including: stormwater infiltration facilities; leaching of agricultural chemicals (pesticides and fertilizers); wastewater infiltration; spills at commercial and industrial facilities; spills related to transportation of hazardous materials on roads, rail, and in pipelines; chemicals used to maintain right-of-way areas; and spills related to sand and gravel mining.

1. The Phase One Study developed an aquifer vulnerability on a ranking method that considered soil type, depth to ground water, and ground water recharge rate. The entire GWMA was classified according to three vulnerability classes: low, medium, and high. The medium and high vulnerability areas generally correspond to the major river valleys where the water table is shallow and sandy soils occur at land surface. Medium and high vulnerability areas also occur in the eastern part of the GWMA due to the higher ground water recharge rates that occur in this area. The low vulnerability areas occur mostly where till soils are present.

2. The infiltration of stormwater to the subsurface should not have adverse impacts to ground water quality on a sub-basin scale. It is possible that localized impacts could occur. One of the more important risks associated with stormwater infiltration is the occurrence of chemical spills. Spilled chemicals may enter infiltration facilities and travel quickly to ground water.

3. A number of pesticides are used in the GWMA for residential and agricultural purposes. These chemicals are regulated by state and federal laws and, if used properly, should not result in contamination of ground water. However, over-application of pesticides on residential and agricultural land overlying vulnerable aquifers could result in pesticides entering ground water.

4. Discharge of wastewater to the subsurface is practiced in the unsewered areas of the GWMA. Nitrogen loading to ground water is the most important potential impact from these discharges. Based on the GMA Future Land Use map, several of the sub-basins in the GWMA are predicted to acquire elevated nitrate concentrations, though not in excess of the State MCL of 10 mg/L. Note that this analysis also included nitrogen sources from lawn fertilizers, agricultural fertilizers, and livestock.

5. Three thousand, six hundred, and sixteen Critical Material Users (CMUs) were identified in the GWMA. The CMUs include industrial and commercial facilities that are known to handle hazardous materials based on Standard Industry Code (SIC) assignments. Based on the State of Washington Department of Ecology (Ecology) database, there were 362 leaking underground storage tanks in Snohomish County as of March 1996. There were 122 sites on DOE's Confirmed and Suspected Contaminated Sites list, also as of March 1996. Within the

GWMA, most of the commercial and industrial land use areas occur where ground water is vulnerable to contamination.

6. Right-of-way maintenance practices appear to be shifting toward mechanical methods, such as mowing, rather than chemical methods. In parts of the GWMA, pesticides may be used to control weeds and other undesirable plants and many utility right-of-ways in the GWMA pass through vulnerable aquifer areas where pesticides might be applied.

7. Transportation of hazardous materials occurs throughout the GWMA and major transportation corridors were identified to cross areas of vulnerable aquifer. Snohomish County is serviced by organizations with modern spill response capability to deal with spills. However, spill response chain-of-command at present does not include notification to ground water users located in proximity to a spill scene.

8. Existing and undeveloped designated mineral resource lands in the GWMA total about 9,000 acres. Existing operations in these areas include sand and gravel excavation and rock quarrying. Of the total acreage, 4,699 acres of mineral resource lands overlie areas where the aquifer is highly vulnerable. Approximately 3,211 acres of mineral resource lands overlie medium vulnerability aquifer. The remaining 1,097 acres overlie low vulnerability aquifer. NPDES permits regulate discharges from sand and gravel mining operations. However, petroleum spills may occur and could result in contamination of ground water. In addition, pit reclamation materials, if contaminated, could result in degradation of ground water. In some hydrogeologic settings, it is also possible for mining to physically remove aquitard materials, causing drawdown of confined aquifers and exposing the aquifer to sources of contamination.

Potential Impacts To Ground Water

One of the goals of the Geohydrology Memorandum (Golder, 1996) was to provide a prioritization of potential impacts. The prioritized list could then be used as a guide in the selection of management recommendations. It is realized that any prioritization of the impacts is in part subjective, based on opinion and not necessarily supported by hard facts. For this reason, it was decided that the impacts be ranked by the consultant using professional judgment as needed. The GWAC selected management strategies based on the following geohydrologic impacts ranked by the consultant:

Regional Impacts Classification	Rank
R.1 Consumptive Use	1[1]
R.2 Hydrologic Monitoring	2
R.3 Impervious Surfaces	3
R.4 Nitrogen Loading from Agricultural Lands	1[1]
R.5 Nitrogen Loading from Domestic Fertilizers	3
R.6 Nitrogen Loading from Sanitary Wastewater Discharges	1[1]
R.7 Pesticide Loading	3
R.8 Public Education	2
R.9 Stormwater Infiltration	3

[1] Rank is based on analyses in Geohydrology Memorandum (Golder, 1996) and applies to those areas identified with the largest potential impact. These areas include those with a consumptive use/recharge ratio exceeding 5% and areas where the nitrate concentration exceeds 2.5 mg/l as N.

Local Impacts Classification	Rank
L.1 Leaching of Mine Wastes and Fill Materials	3
L.2 Improperly Constructed Water Wells	3
L.3 Mining and Excavation through an Aquitard	2
L.4 Spills at Commercial and Industrial Facilities	1[1]
L.5 Spills at Mining and Excavation Sites	3
L.6 Stormwater Infiltration Facilities	2
L.7 Transportation Spills from Pipelines	2[2]
L.8 Transportation Spills on Railroads	2[2]
L.9 Transportation Spills on Roads	1[3]
L.10 Underground Storage Tanks	3

[1] Rank is based on those facilities handling chlorinated organic solvents and which are located in medium and high aquifer vulnerability areas, and within designated wellhead protection areas of water supply wells.

[2] Intermediate rank is assigned because of an assumed low probability for the spill event to occur, however, should a spill occur, impacts could be substantial, particularly if the spill occurs in a wellhead protection area for a public water system.

[3] This rank pertains to the lack of notification to nearby water supplies when a spill occurs. The ability to respond to spills on roadways in the GWMA presently meets modern standards.

1.2 Section II: Management Alternatives

This section identifies existing programs that address potential ground water problems (regulatory, voluntary, and educational); identifies issues, or gaps, in the existing programs; and develops alternatives to address the issues.

Management strategies were evaluated for a number of specific categories including:

1. General Alternatives (programmatic issues)
2. Ground Water Use and Influence on Surface Water
3. Stormwater Impacts
4. Nitrogen in Ground Water
5. Pesticides in Ground Water
6. Well Construction and Decommissioning
7. Surface Mining and Excavation
8. Illegal Dumping

9. Commercial and Industrial Chemicals
10. Transportation Spills
11. Underground Storage Tanks

For each category, specific details are discussed including:

1. Goals: Goal statements are provided for each section of the document. In most cases, the goal statements were taken from discussion papers prepared by the GWAC. In cases where goal statements were not directly obtainable from discussion papers, they were provided by the consultant to indicate the overall intentions of the information and alternatives presented.

2. Problem Statement: Problem statements used in this document were developed based on the technical analyses presented in the Phase One Study report prepared by the U.S. Geological Survey (1997) and the Geohydrology Memorandum (Golder, 1996) summarized in Section I.

3. Existing Programs: Existing programs were identified by the GWAC during the development of the management alternatives.

4. Issues and Alternatives: A total of 47 issues were identified within the management categories.

    - More than 7 management issues were identified in the Stormwater (9), Surface Mining and Excavation (9), and General/Programmatic Alternatives (7) categories.

    - Between 3 and 5 issues were identified in the Nitrogen in Ground Water (4), Pesticides in Ground Water (5), Commercial and Industrial Chemicals (5), Transportation Spills (3), and Ground Water Use and Influence on Surface Water (3) categories.

    - Fewer than three issues were identified for the Well Construction and Decommissioning (1), Illegal Dumping (1), and Underground Storage Tanks (0) categories.

Over 80 different management alternatives (including no immediate action) were identified to address these issues.

1.3 Section III: Preferred Alternatives and Implementation

Chapter 173-100 WAC, the Washington Department of Ecology's procedural standards for development of Ground Water Management Programs, requires that alternative management strategies be developed for addressing each of the ground water quality and quantity problems identified in the Problem Definition portion of the Area Characterization Section (Section I) of the Snohomish County Ground Water Management Program. From these alternative management strategies, the Ground Water Advisory Committee must select a set of recommended alternatives which will become the "Preferred Alternatives" of the Ground Water Management Program. The process used by the Ground Water Advisory Committee in selecting the Preferred

Alternatives of the Snohomish County Ground Water Management Program is described below.

A draft version of Section II (Management Alternatives) of the Snohomish County Ground Water Management Program was released in July 1997 containing over 80 proposed alternative management strategies (excluding no action alternatives) to address identified problems and potential problems relating to ground water quantity and quality. However, after careful consideration by the Ground Water Advisory Committee, it was concluded that the 80 alternative management strategies represented more actions than could be reasonably implemented within the foreseeable future. In order to reduce the alternatives to a more manageable number, Ground Water Advisory Committee members were asked to identify the alternatives that they felt were of the highest priority. Each member was provided with an "Alternatives Selection Sheet," similar to a ballot, on which they could designate 35 of the 80 alternatives that they felt were most appropriate to be advanced in the planning process.

The selections of all participating Ground Water Advisory Committee members were tallied. By agreement between the committee and the consultant, the highest ranked 41 alternatives were advanced for further review and evaluation as potential Preferred Alternatives of the Ground Water Management Program. Note that many of the alternative management strategies that were not advanced for further review will be reconsidered by the Ground Water Advisory Committee when the Ground Water Management Program is updated, approximately three years after certification of the program by the Department of Ecology.

Questionnaires were developed regarding the 41 highest ranked alternative management strategies and were distributed to potential lead and participating implementers, agencies and organizations with apparent responsibility for implementation of the management strategies. The questionnaires were intended to:

- Ascertain their interest in undertaking responsibilities associated with implementation;
- Help establish the cost and feasibility of implementation;
- Identify potential sources of funding for implementation activities; and
- Identify significant impediments to implementation.

Based on the responses to the questionnaires, the 41 alternative management strategies were evaluated in accordance with the following criteria as stipulated in Chapter 173-100 WAC: feasibility, effectiveness, cost, time and difficulty to implement, and degree of consistency with local comprehensive plans and water management programs.

The preferred alternatives address 32 of the 47 issues identified in the Management Alternatives Report (Section II). The issues and preferred alternatives are summarized in Table 1. A summary of proposed implementers developed for the alternatives are as follows :

1. *Snohomish County Department of Public Works:* Lead implementer for GWMP implementation. Lead implementer for 9 preferred alternatives and participatory in 7 preferred alternatives.

2. *Snohomish County Planning and Development Services:* Lead implementer for 14 preferred alternatives and participatory in 5 preferred alternatives.

3. *Snohomish Health District:* Lead implementer for 6 preferred alternatives and participatory in 12 preferred alternatives.

4. *Snohomish County Conservation District:* Lead implementer for 1 preferred alternative and participatory in 3 preferred alternatives.

5. *Snohomish County Department of Emergency Management:* Lead implementer for 2 preferred alternatives and participatory in 1 preferred alternative.

6. *Washington State University Cooperative Extension Service of Snohomish County:* Lead implementer for 5 preferred alternatives and participatory in 2 preferred alternatives.

7. *Snohomish County Sheriff's Department:* Lead implementer for 1 preferred alternative.

8. *Washington Department of Ecology:* Participatory in 8 preferred alternatives.

9. *Washington State Department of Agriculture:* Lead implementer for 2 preferred alternatives.

10. *Washington Aggregate and Concrete Association:* Lead implementer for 1 preferred alternative and participatory in 1 preferred alternative.

11. *Ground Water Advisory Committee:* Lead implementer for 2 preferred alternatives.

12. *Burlington Northern Santa Fe Railway:* Lead implementer for 1 preferred alternative.

Implementation of the Preferred Alternatives will require significant amounts of funding, and that funding will need to be obtained from a variety of sources. Total funding requirements of nearly 2 million dollars are identified over a three year period through the year 2002. Most of the individual funding requirements for specific agencies are less than $10,000, though several exceed $100,000. Table 2 summarizes the funding needs and sources identified. The major sources of funding that appear in the funding plan include:

1. **Existing Sources:** Implementation with existing funding generally is possible when the action proposed in the alternative is similar to or would integrate easily with current activities of an implementer that are already funded through fees or some other source.

2. **Grant Sources:** A number of grants are potentially available to support initial implementation of portions of the Ground Water Management Program. However, because grants are limited in duration, they cannot provide for on-going, long-term operation of a Ground Water Management Program. Some of the grants that may be suitable to fund implementation include:

   - Centennial Clean Water Fund, administered by the Washington Department of Ecology, provides financial assistance to state and local governments for planning, design, acquisition, construction, and/or improvement of water pollution control facilities, as well as for undertaking water pollution control activities.

   - Department of Ecology Coordinated Prevention Grants provides funds to local health jurisdictions to support solid waste enforcement and management activities, and to solid waste agencies to support solid and moderate risk waste management activities.

   - Department of Ecology Watershed Management Grants, established by the Washington State Legislature through passage of Substitute House Bill (SHB) 2054 in 1997 and House Bill 2514 in 1998. Phase I of the grants program allows for up to $50,000 for each Water Resource Inventory Area (WRIA) to support watershed planning efforts.

   - The Washington Department of Community, Trade, and Economic Development (DCTED) has, in the past, administered a grants program to support Growth Management Act (Chapter 36.70A RCW) implementation.

   - PIE/EPA Education Grants. The Puget Sound Water Quality Action Team periodically awards Public Involvement and Education (PIE) Fund grants to support projects that will contribute to the environmental quality of Puget Sound and its watersheds. The U.S. EPA also provides annual Environmental Education Grants for projects involving public and industry education.

3. **Dedicated Funds:** A number of the Preferred Alternatives are proposed to be financed by what are referred to in the Implementation and Funding Plan as "dedicated funds," or non-grant sources of funding for the Ground Water Management Program. Such funding would likely come from one or more of the following three sources: the Snohomish County General Fund, an increase in the County's Surface Water Management Fee, or voter creation of a special revenue district known as an Aquifer Protection Area.

A summary of new funding needed to implement the Preferred Alternatives of the Snohomish County Ground Water Management Program apportioned by potential funding sources is presented in Table 2.

1.4 Concurrence and Certification Process

Chapter 90.44 RCW and Chapter 173-100 WAC stipulate the process for concurrence and certification of a Ground Water Management Program. In accordance with that

process, upon completion of the Draft Snohomish County Ground Water Management Program, the Department of Ecology (Ecology) will hold a public hearing at a location within the Snohomish County Ground Water Management Area for purpose of taking testimony on the proposed program.

Within 90 days following the public hearing, Ecology and each affected local government are required to prepare "findings" regarding the Ground Water Management Program. The purpose of such findings is to evaluate the program's technical soundness and economic feasibility, and to assess the consistency of the program with applicable federal, state, and local laws. The findings must identify any needed revisions to the program and contain a statement of concurrence or nonconcurrence with the program. If necessary, Ecology is authorized to extend the 90-day concurrence period for an additional 90 days.

The lead agency for development of the Ground Water Management Program, Snohomish County Planning and Development Services, will consolidate the findings of concurrence and nonconcurrence prepared by Ecology and the affected local governments and present them to the Ground Water Advisory Committee. The committee must resolve any statements of nonconcurrence and incorporate any revisions to the Ground Water Management Program necessary to achieve resolution.

The Ground Water Management Program will then be submitted to Ecology for certification that the program is consistent with the aforementioned RCW and WAC. Following certification, participating state agencies and affected local governments will be required to adopt or amend regulations, ordinances, or programs as needed to implement those portions of the Ground Water Management Program that are within their respective jurisdictional authorities.

1.5 Periodic Review and Update of Ground Water Management Program

The Implementation and Funding Plan for the Snohomish County Ground Water Management Program addresses the three-year period following certification of the program by the Department of Ecology, currently anticipated to occur in mid- to late-1999. During that three-year period, the Snohomish County Ground Water Advisory Committee (GWAC), in conjunction with the designated lead agency for Ground Water Management Program implementation, the Snohomish County Department of Public Works (DPW), will monitor implementation progress.

The principal implementers identified in the Implementation and Funding Plan will be responsible for providing direct feedback to the GWAC concerning the relative level of accomplishment of the Preferred Alternatives for which they have been assigned responsibility. This will involve submitting at least one report to the GWAC during each of the three years after certification concerning the implementation status of their Preferred Alternatives. Implementation status will be judged, as appropriate, by the following types of indicators:

- Achievement in procuring funding;
- Completion and results of feasibility studies;
- Development of memorandums of agreement or informal agreements;

- Completeness of revisions to policies, standards, or programs; and
- Performance of educational efforts.

Based upon feedback provided by the lead implementers, the GWAC will re-evaluate Preferred Alternatives for which implementation is lagging or unsuccessful to determine whether the alternatives can be modified to alleviate unanticipated problems with political or public acceptance, and/or be restructured to minimize the need for additional sources of funding.

Once a Preferred Alternative has been successfully implemented, the lead implementers will provide the Ground Water Advisory Committee with an evaluation of the implemented alternative's effectiveness in providing for protection and/or management of ground water resources. Lead implementers for alternatives involving educational activities should consider conducting initial opinion or attitude surveys of target audiences before implementing educational activities, then comparing results of the initial survey with results obtained from similar surveys conducted after the educational activities have been implemented.

At the end of the initial three-year implementation period, approximately September 2002, the GWAC and DPW will initiate a general update of the Ground Water Management Program incorporating modifications made as a result of feedback from lead implementers. The Ground Water Management Program update will be subject to the process for concurrence and certification stipulated in Chapter 173-100 WAC.

1.6 Unfinished Agenda

An additional task of the Ground Water Management Program update will be to address the "unfinished agenda" of the initial Ground Water Management Program. This will include reconsideration of alternative management strategies contained in Section II of the Ground Water Management Program that were initially evaluated by the GWAC but not selected as Preferred Alternatives. Addressing the unfinished agenda will also include consideration of potential issues and concerns that were not addressed in the current Ground Water Management Program, including:

- Management of solid wastes,
- Pesticide applications associated with forest practices and potential "downstream" impacts of such applications,
- Possible expansion of the geographic boundaries of the Snohomish County Ground Water Management Area,
- A more comprehensive approach to ground water monitoring that will provide better definition of possible locations for monitoring, and
- Identification of lead implementer and securing adequate funding for completion of an inventory and mapping of agricultural pesticide use.

1.7 Post Certification GWAC Membership and Organization

Within three months after certification of the Ground Water Management Program by the Department of Ecology, the Ground Water Advisory Committee (GWAC) will convene to address issues concerning post-certification operation. The lead agency for Ground Water Management Program implementation, Snohomish County Department of Public Works (DPW), will poll members of the GWAC concerning their desire to continue with the committee through the initial three-year implementation period. If needed, a mechanism for replacement of members will be developed by DPW and the GWAC.

The GWAC will develop a general schedule for reviewing progress of Ground Water Management Program implementation, including the status of each of the individual Preferred Alternatives of the program. The schedule will be conveyed to the lead implementers of each of the Preferred Alternatives.

The GWAC will consider various strategies to minimize burdens on committee members associated with monitoring Ground Water Management Program implementation, such as use of various subcommittees to evaluate implementation of assigned subsets of the Preferred Alternatives, and/or use of an executive committee. The use of subcommittees or an executive committee would serve to minimize the need for meetings of the GWAC as a whole. The GWAC could also consider use of a revolving membership scheme.

2. ACKNOWLEDGEMENTS

This plan is the product of many hours of work by the Ground Water Advisory Committee; the U.S. Geological Survey; and the GWAC's consultant team of Golder Associates Inc., Adolfson Associates, Marshall and Associates Inc., and the Hightower Group. The members of the GWAC are listed below.

Snohomish County Ground Water Advisory Committee

Member	Alternate	Representing
Ken Baxter	Ken Winckler	City of Marysville
Bill Beckman	Susan Banel	City of Stanwood
Janet Carroll	Kathy Thornburgh	Snohomish County Public Works – Surface Water Management
Jon Cleveland	Cas Hancock	Evergreen Rural Water of Washington
Peg Ferm	Gottlieb Ribary	People for Preservation of Tualco Valley/ Stillaguamish Citizens Alliance
Scott Fowler	Dean Hayes	Washington State Drilling & Groundwater Association

John Gintz	Roger Findley	Snohomish County Cattlemen's Association
Jay Hagen	Bob Lundvall	Snohomish County Farm Bureau
Gary Hajek	Wayne Lawrence	Cross Valley Water District
Wendel Johnson	Chuck Lindsay	Professional Consultants of Snohomish Co.
Pam Liester	Ellen Gray	Pilchuck Audubon Society
Pat Magnuson	Connie Dunn	City of Sultan
Roy Metzgar	Dan Thompson	City of Everett
Jim Miller	John Spangenberg	Master Builders Association
Robin Nelson	Ken Coats	Snohomish County Aggregate Producers
Michael Noll		Citizen
Mike Pattison	Russ Hokanson	Snohomish County – Camano Assoc. of Realtors
Kevin Plemel	Brent Raasina	Snohomish Health District
John Postema	Melinda Anthony	Washington State Nurseryman's Association
Guillemette Regan	Mark Spahr	Snohomish County PUD
Steven Roy		Citizen
Larry Springer	Tom Niemann	Snohomish County Planning & Development Services
Jeannie Summerhays		Washington Department of Ecology
Bill Wiselogle	Gary Hasseler	City of Bothell

3. GLOSSARY

Technical Terms

Several of the technical terms used are defined in this section. The definitions are intended to represent the meaning of the term as it is used in the memo.

Absorption The actual intake of water (like in a sponge) into the soil, or the intake of a contaminant into the structure of a soil mineral.

Adsorption The process by which a contaminant adheres to the surface of a soil particle. Desorption normally follows adsorption and refers to the process by which a contaminant is freed from the surface of a soil particle.

Aerobic Liquid A liquid, normally water, which contains dissolved oxygen.

Anaerobic Liquid A liquid, normally water, in which dissolved oxygen is not present.

Aquifer Storage and Recovery A water management method in which water is injected into a ground water aquifer and stored for periods of months to years. The same water is later withdrawn (e.g., recovered) and put to beneficial use, such as in a public water system.

Aquitard A layer of geologic material, such as clay, which impedes the flow of ground water.

Basin The land area which, due to topography, forms the catchment of a surface water body. Precipitation falling into the basin contributes to the surface- and ground-waters of the basin. The term basin is normally applied to large river systems that ultimately discharge to the ocean, such as the Snohomish River Basin and the Stillaguamish River Basin.

Consumptive Use The uses of ground water that permanently remove water from the basin. Water pumped from a well and allowed to evaporate to the atmosphere is a consumptive use, whereas, water pumped from a well and allowed to re-infiltrate to ground water is not. Water pumped from a well and put into a pipeline and transported away from the basin is also a consumptive use.

Environmental Fate The processes that can affect a contaminant in the environment causing it to change from its original form and/or reduce its mass quantity.

Evapotranspiration The natural process by which liquid water undergoes a phase change to water vapor (gaseous water). The sources of liquid water include vegetative moisture (crops, plants, trees, etc.), soil moisture, and open water bodies.

Geohydrology The study of underground water which occurs within the void spaces of geologic materials, such as pore spaces and fractures. Same as hydrogeology.

Ground Water Recharge The replenishment of underground water, normally by infiltration of precipitation; however, it can also occur by leakage from surface water.

Hydraulic Continuity The exchange of water between surface water, such as a lake or stream, and ground water. Ground water discharge may occur to surface water, or vice versa.

Hydraulic Conductivity A physical property which accounts for frictional forces that occur as water flows in a soil or rock. Large values of hydraulic conductivity are associated with coarse-grained sand and gravel materials in which ground water flows freely (low friction). Very low values of hydraulic conductivity are associated with silt and clay materials.

Hydrogeology The study of underground water which occurs within the void spaces of geologic materials, such as pore spaces and fractures. Same as geohydrology.

Infiltration Rain water or snow melt which drains into the soil and does not evapotranspire.

Nitrate Loading The mass of nitrate per unit time (e.g., pounds per year) that is put into a ground water system, normally due to on-site wastewater disposal and agricultural practices, such as manure spraying and fertilization. Nitrate is the common form of nitrogen that occurs in the environment when oxygen is present.

Non-point Pollution The occurrence of pollutants in sources that are distributed over an area. Urban runoff is a non-point source of pollution. Run-off from agricultural lands can be a non-point source of pollution. Chemical spills related to an industrial site or an underground storage tank would be considered point-sources.

Percolation The drainage of water through the soil, normally in a vertically downward direction.

Seawater Intrusion Due to withdrawal of fresh ground water near a saline waterbody, such as Puget Sound, seawater may flow as ground water inland. In extreme cases, wells withdrawing ground water can be contaminated by seawater.

Solvents Liquids that are very good at dissolving materials. Many organic solvents are used to clean grease and oil from mechanical equipment.

Stormwater Infiltration The act of intentionally draining direct runoff of precipitation into the subsurface, such as through the use of dry wells and infiltration ponds.

Sub-Basin The area that forms the catchment for a tributary stream to a larger river. Precipitation falling in the sub-basin contributes to the surface- and ground-waters of the sub-basin. The sub-basin is part of a basin.

Turbidity An indirect measure of the quantity of small particles present in a water sample. Turbidity is measured by passing light through a sample and measuring how it is reflected by particles. High turbidity corresponds to a cloudy water sample and vice versa.

Volatilization The process by which a contaminant undergoes a phase change from a liquid to a gas (same as evaporation). Gasoline fumes result from the volatilization of compounds occurring in gasoline.

Wastewater As used in this report, wastewater consists of water drained from sinks, toilets, baths, showers, etc.

Wastewater Infiltration Refers to subsurface discharge of wastewater, such as from a septic drainfield.

Acronyms

BMP – Best Management Practice
CARA – Critical Aquifer Recharge Area
CUP – Conditional Use Permit
DCTED – Washington Department of Community Trade and Economic Development
DOE – Washington Department of Ecology
DOT – Washington Department of Transportation
Ecology – Washington Department of Ecology
EPA – Environmental Protection Agency
FTE – Full time equivalent [employee]
GMA – Growth Management Act
GWAC – Ground Water Advisory Committee
GWMA – Ground Water Management Area
GWMP – Ground Water Management Plan
HPA – Hydraulic Project Approval
LUST – Leaking Underground Storage Tank
MCL – Maximum Contaminant Level
MRW – Moderate Risk Waste
NPDES – National Pollutant Discharge Elimination System
NRCS – U.S. Natural Resources and Conservation Service
PUD – Snohomish County Public Utility District
SCAP – Snohomish County Aggregate Producers
SCCD – Snohomish County Conservation District
SCEM – Snohomish County Department of Emergency Management
SCPW – Snohomish County Department of Public Works
SCPW/SWMD – Snohomish County Department of Public Works Solid Waste Management Division
SCPW/SWM – Snohomish County Department of Public Works Surface Water Management
SCPDS – Snohomish County Planning and Development Services
SCSD – Snohomish County Sheriff Department
SHD – Snohomish Health District
UGA – Urban Growth Area
WAC – Washington Administrative Code
WACA – Washington Aggregate and Concrete Association
WDNR – Washington Department of Natural Resources
WDOE – Washington Department of Ecology
WDOH – Washington Department of Health
WSDA – Washington State Department of Agriculture

TABLES

TABLE 1

Summary of Preferred Management Alternatives

Alternative Name	Statement	Geohydro Class	Preferred Alternative	Estimated Cost	Lead Implementer
ADMIN-1	Need to identify oversight entity.	N/A	Snohomish County Department of Public Works (SCPW) recommended lead agency.	$146,000 per year for full time program mgr.	SCPW
ADMIN-4	No centralized database.	R2	SHD and Snohomish County should develop database.	$ 72,800 (SCPW) $ 8,400 (SHD)	SCPW
USE-2	Present data are inadequate to support resource management actions.	R1, R2	Snohomish County and Ecology should prepare sub-basin plans.	$200,000 (SCPW) $100,000 (SCPW) $ 8,400 (WDOE)	SCPW
STORM-5	Older infiltration facilities may allow hazardous releases as the result of spills.	R3, L6, L4, L5, L9, R9	Snohomish County and Jurisdictions should inventory infiltration facilities to determine locations relative to vulnerable aquifer areas. Inventory forms basis for facility upgrades. Snohomish County Department of Emergency Management should use inventory in spill response	$ 25,000; $500 per facility inspection (SCPW) $250,000; $25,000 per facility upgrade (SCPW) $ 8,400 (SCPDS)	SCPW
PEST-1	Collection of unwanted pesticides is limited.	R7	SCPW and WSDA should investigate feasibility of seasonal or permanent agricultural pesticide collection site.	$ 8,400 (SCPW) $ 8,400 (WSDA)	SCPW WSDA
MINE-4	The chemical quality of proposed backfill materials is not evaluated for the reclamation of surface mining excavations.	R2, L1	SCPW, SHD, and Ecology should develop sampling and analysis standards for mining backfill materials. WDNR should then add provisions to reclamation permits that require these standards be applied in demonstrating that backfill is clean and inert.	$ 5,600 (SCPW) $ 8,400 (SHD) $ 8,400 (Ecology)	SCPW

Note: Alternatives sorted by lead agency.

Alternative Name	Statement	Geohydro Class	Preferred Alternative	Estimated Cost	Lead Implementer
MINE-5	The chemical quality of proposed backfill materials is not evaluated for the reclamation of surface mining excavations.	R2, L1	SCPW should provide WACA with educational materials that stress importance of demonstrating that backfill is clean and inert.	$ 5,000 (SCPW) $ 1,500 (WACA)	SCPW
DUMP-1	Vacant lands exist which are or can become sites for illegal dumping.	R2	SCPW should compile data regarding the location of abandoned surface mining sites.	$ 16,800 (SCPW) $ 8,400 (SCPDS) $ 1,100 (EPA) $ 1,100 (SHD) $ 1,100 (Ecology)	SCPW
SPILL-2	Loading dock areas may be constructed with insufficient containment to manage chemical spills.	L4	Snohomish County should consider developing requirements for loading dock BMP's that ensure spill containment in CARA's.	$ 5,000 (SCPW)	SCPW
ADMIN-2	No designated Critical Aquifer Recharge Area (CARA).	N/A	Snohomish County and Cities should identify Interim Ground Water Protection Area (IGPA).	$ 7,000	SCPDS
ADMIN-3	No criteria for designating CARA.	N/A	Snohomish County and Cities should develop criteria for defining CARA.	$ 35,000 (SCPDS) $ 5,600 (SCPW)	SCPDS
STORM-1	PDS may not grant approval of pervious surface technologies or encourage infiltration facilities.	R3, L6	SCPDS and SCPW should coordinate approaches to stormwater management and ground water recharge.	$ 35,000 (SCPDS) $ 7,000 (SCPW)	SCPDS
STORM-2	No incentives exist to use pervious surface technologies.	R3, L6, R9	Snohomish County should develop an incentive program.	$ 10,000 (SCPDS) $ 7,000 (SCPW)	SCPDS
STORM-3	Site development review process does not necessarily reduce the coverage by impervious surface.	R3, L6, R9	Snohomish County, through zoning code, should require site development designs to minimize impervious surface and/or maximize ground water recharge.	$ 35,000 (SCPDS) $ 2,800 (SCPW)	SCPDS

Note: Alternatives sorted by lead agency.

Alternative Name	Statement	Geohydro Class	Preferred Alternative	Estimated Cost	Lead Implementer
MINE-1	Geohydrologic evaluations are not necessarily required for proposed surface mining sites.	R2, L3	SCPDS should amend Conditional Use Permitting process for surface mining to require geohydrologic evaluations that identify position of relevant aquitards.	$ 5,000 (SCPDS)	SCPDS
MINE-3	Surface mining operators may not have training to identify when aquifer breaching conditions are encountered.	R8, L3	SCPDS should consider adding a provision to Conditional Use Permits that requires periodic inspections of surface mining operations by qualified hydrogeologists.	$ 6,000 (SCPDS)	SCPDS
MINE-6	SCPDS and WDNR do not coordinate the permitting process for surface mining operations.	L1	SCPDS should consider amending all Conditional Use Permits so that 1.) No excavation is allowed until a WDNR reclamation permit has been provided to SCPDS and that 2.) applicant will adhere to 78.44 RCW regarding reclamation schedule.	$ 7,000 (SCPDS)	SCPDS
MINE-7	SCPDS and WDNR do not coordinate the permitting process for surface mining operations.	L1	SCPDS and WDNR should prepare an MOU identifying reciprocal responsibilities.	$ 5,000 (SCPDS) $ 2,800 (DNR)	SCPDS
MINE-8	Older mining sites exist that have not been reclaimed and could be developed under a County grading permit.	L1	SCPDS should amend the grading permit process for historic mining sites to include a provision requiring that backfill is clean and inert.	$ 5,000 (SCPDS)	SCPDS
MINE-9	It is not necessary to evaluate the presence of water supply wells in proximity to existing or proposed surface mining sites.	R2	SCPDS should consider a requiring surface mining CUP applications to include a well inventory for water supply wells.	$ 7,000 (SCPDS) $ 1,400 (SHD)	SCPDS

Note: Alternatives sorted by lead agency.

Alternative Name	Statement	Geohydro Class	Preferred Alternative	Estimated Cost	Lead Implementer
MINE-10	It is not necessary to evaluate the presence of water supply wells in proximity to existing or proposed surface mining sites.	L1, L5	SCPDS should consider a revision to the zoning code to require a contingency plan for replacement of potable water supplies if ground water is detrimentally affected.	$ 8,000 (SCPDS) $ 1,400 (SHD)	SCPDS
SPILL-3	Urban and commercial land uses that are not served by sewers exist within the Urban Growth Areas (UGA).	L6, R9, R6	SCPDS and SCPW should identify commercial and industrial facilities within the UGA that are outside of planned sewer service areas and try to extend sewer services or develop management programs that protect ground water.	$ 5,000 (SCPDS) $ 25,000; $5,000 plus $200 per site (SCPW) $ 2,200 (SHD)	SCPDS
TRANS-1	The location of water supply wells in proximity to pipelines, roads and highways are not presently mapped.	L7, L8, L9	SCPDS should identify well locations and provide maps for distribution to SCEM and major chemical transporters. The maps should be used to assist incident response commanders.	$ 10,000 (SCPDS) $ 8,000 (SCEM) $ 2,200 (SHD)	SCPDS
MINE-11	There are no procedures by which well owners are notified of NPDES/SWD General Permit violations.	L5	Ecology and SHD should develop an MOA regarding protocols for notification of well owners in the event of NPDES/SWD General permit violations.	--	SHD
USE-1	Conservation programs do not reach Group B and individual well systems.	R1	WDOH, SHD, and WSDGA should make conservation information available.	$ 8,400	SHD
WELL-1	Well owners are generally not aware of potential for ground water contamination from poor well seals or old abandoned wells.	R8, L2	SHD should include educational materials on well seals and well decommissioning with other materials sent to on-site sewage system permit holders.	$ 5,000 (SHD)	SHD

Note: Alternatives sorted by lead agency.

Alternative Name	Statement	Geohydro Class	Preferred Alternative	Estimated Cost	Lead Implementer
SPILL-1	Inspections of businesses for compliance with existing regulations is completed at low frequency.	L4	SHD should seek to add provisions to the Moderate Risk Plan for inspections of facilities located in CARA's.	$ 73,000/year (SHD)	SHD
SPILL-4	Regulations pertaining to the handling and storage of hazardous wastes are complex, may overlap, or be in conflict with each other.	L4, L5	SHD and IRAC should annually review and update their booklet concerning small business regulatory requirements.	--	SHD
NITRATE-2	Inappropriate waste management practices in dairy and chicken operations may result in direct discharge of pollutants.	R4	Snohomish Conservation District and WSUCE should work to establish a soil amendment brokerage.	$291,000 – 2 years (SCCD) $ 30,000 (WSUCE)	SCCD WSUCE
TRANS-2	Spill incidents are not necessarily reported to owners of nearby water supply wells.	L7, L8, L9	SCEM should develop procedures by which well owners are notified of possible impacts from spills.	TBD	SCEM
TRANS-3	Spill response coordination is an essential element of programs to project public water supply wells.	L7, L8, L9	SCEM and SCLEPC should provide assistance to local purveyors in conducting spill response coordination planning.	TBD	SCEM SCLEPC
PEST-2	Pesticide applications in Snohomish County are not presently inventoried or mapped.	R7	WSUCE should evaluate the feasibility of conducting an inventory of agricultural pesticide use and develop a scope of work and budget for such an inventory.	$ 5,500 (WSUCE)	WSUCE
PEST-3	Commercial pesticide users may not be trained in the use of best management practices for pesticide applications.	R7	WSDA should modify recertification requirements and initial certification for commercial pesticide applicators to include ground water and watershed protection education.	TBD	WSDA

Note: Alternatives sorted by lead agency.

Alternative Name	Statement	Geohydro Class	Preferred Alternative	Estimated Cost	Lead Implementer
ADMIN-5	No single organization to lead education efforts.	R8	WSUCE should seek funding and develop program.	$ 60,000	WSUCE
PEST-5	Pesticides are most commonly misused in residential applications.	R7	WSU Cooperative Extension Service should apply to EPA or Ecology for grant for educational program on BMP's for pesticide applications.	$ 42,400 (WSUCE)	WSUCE
PEST-6	Pesticides are most commonly misused in residential applications.	R7	WSUCE should make existing materials on pesticide applications available at a major retailer as part of a pilot program which, if successful, should be expanded.	$ 12,600 (WSUCE)	WSUCE
MINE-2	Surface mining operators may not have training to identify when aquifer breaching conditions are encountered.	R8, L3	WACA, SCAP, Ecology, and WDNR should develop a program for routine dissemination of educational materials regarding aquifer breaching.	$ 1,500 (WACA) $ 5,000 (Ecology)	WACA Ecology
PEST-4	Burlington Northern Santa Fe Railroad has not incorporated integrated pest management (IPM) protocols into its program for trackside vegetation management within Snohomish County.	R7	GWAC should request that Burlington Northern Santa Fe Railroad incorporate requirement for use of IPM protocols into future contracts with local vegetation control firms.	N/A	Burlington Northern Santa Fe Railroad
STORM-4	No means for County to require infiltration system best management practices, unless NPDES or HPA permits required.	R3, L6, R9	GWAC supports Title 24 (Stormwater Ordinance) revisions currently under development.	--	GWAC

Note: Alternatives sorted by lead agency.

Alternative Name	Statement	Geohydro Class	Preferred Alternative	Estimated Cost	Lead Implementer
NITRATE-1	Fertilizer is most likely to be misused in residential applications.	R5, R8	GWAC should implement second element of early implementation strategy that includes dissemination of BMP information on residential fertilizer use.	$ 10,000	GWAC
DUMP-2	Vacant lands exist which are or can become sites for illegal dumping.	R2	SCSD will be provided with a map demonstrating the location of abandoned sites that have or could be used for illegal dumping. In its routine patrols, SCSD should observe the identified sites and report illegal dumping activities to the Department of Ecology and Snohomish Health District, as appropriate.	--	SCSD

Explanation

Geohydro Class refers to the impacts classification presented in the Geohydrology Memorandum (Golder, 1996). No prioritization is implied in the summary of alternatives.

BMP – Best Management Practice
CARA – Critical Aquifer Recharge Area
DCTED – Washington Department of Community Trade and Economic Development
Ecology – Washington Department of Ecology
EPA – Environmental Protection Agency
GWAC – Ground Water Advisory Committee
IRAC – Inter-agency Regulatory Assessment Committee
SCAP – Snohomish County Aggregate Producers
SCD – Snohomish Conservation District
SCEM – Snohomish County Department of Emergency Management
SCPW – Snohomish County Department of Public Works
SCPDS – Snohomish County Planning and Development Services
SCSD – Snohomish County Sheriff Department
SHD – Snohomish Health District
WACA – Washington Aggregate and Concrete Association
WDNR – Washington Department of Natural Resources
WDOH – Washington Department of Health
WSDA – Washington State Department of Agriculture
WSDGA – Washington State Drilling and Groundwater Association
WSUCE – Washington State University Cooperative Extension Service

Note: Alternatives sorted by lead agency.

TABLE 2

Funding Plan Summary Matrix

Total New Funding Needs Identified For 3-Year Implementation Period

POTENTIAL SOURCE OF NEW FUNDING	AMOUNT
County general fund (1)	$438,000
Dedicated funds (2)	$925,600
Centennial Clean Water Fund (3)	$224,300
Department of Ecology Watershed Planning Grants (SHB 2054 and HB 2514) (4)	$200,000
Department of Ecology Coordinated Prevention Grants	$28,500
Department of Community, Trade and Economic Development Planning and Development Review Grants (5)	$57,600
Puget Sound Water Quality Public Involvement and Education (PIE) and U.S. EPA Environmental Education Grants (6)	$92,600
TOTAL	**$1,966,600**

(1) This funding is for a full-time ground water program manager ($146,000 per year for three years including all direct and indirect costs) to be assigned to Snohomish County Department of Public Works. Should another source of hard funding be identified during the three-year implementation period, funding for this position will be shifted to that source.

(2) Dedicated funds are hard money or non-grant sources of funding. Dedicated funds could include Snohomish County general fund monies, revenues generated through creation of a Ground Water Management Fee similar to the County's Surface Water Management Fee, or revenues created through establishment of an Aquifer Protection Area under Chapter 36.36 RCW.

(3) The total amount of a Centennial Clean Water Fund Grant for implementation of a Ground Water Management Program can be up to $250,000. Thus, an additional approximately $25,000 in funding needs could be shifted to the Centennial Grant from other potential funding sources, if needed.

(4) Some portion of the approximately $200,000 that could be allotted to Snohomish County by the Department of Ecology to conduct watershed planning for WRIAs 5 and 7 could be useful in providing basic data to support sub-basin planning efforts.

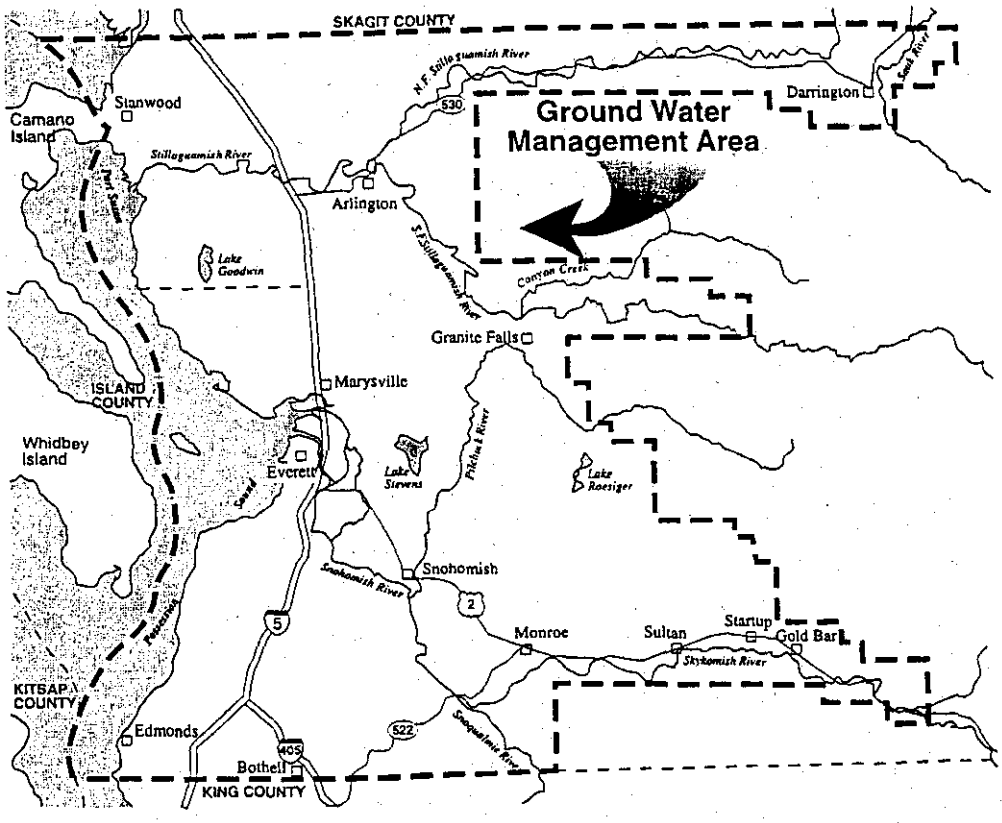
(5) Money is not currently available in the Department of Community Trade and Economic Development's Planning and Development Review Grant Fund. If additional resources are not made available through this fund during the implementation period, up to $25,000 of the amount needed could potentially be obtained through the Centennial Clean Water Fund grant discussed above. The remainder would need to be supplied from dedicated funds.

(6) The amount shown represents the total from separate grants for multiple projects.

Snohomish County Ground Water Management Plan

Section I: Area Characterization

Prepared under the Direction of the Snohomish County Ground Water Advisory Committee



GROUNDWATER
YOUR TREASURE DOWN UNDER

Snohomish County

Golder Associates

May 1999

Funding provided by the
Washington State
Department of Ecology
Centennial Clean Water Fund

WASHINGTON STATE DEPARTMENT OF ECOLOGY

SECTION I

AREA CHARACTERIZATION

1. INTRODUCTION

This section provides an overview of the land use and hydrogeology within the GWMA. The summary of hydrogeological conditions provided in this section is based on the USGS Phase One Study (Thomas, et al., 1997), and the Geohydrology Memorandum (Golder, 1996). This section does not provide all the technical details that exist. Readers desiring greater detail regarding the hydrogeology and area characteristics are referred to the above reports and others referenced in the bibliography.

2. PROJECT DATABASE

Published and unpublished data played an important role in the technical analyses completed for the GWMP. In identifying these data, both local and regional sources were investigated. This section summarizes most of the information sources. These and other sources are cited within the Geohydrology Memorandum (Golder, 1996).

2.1 Reports and General Information

Hydrogeology The U.S. Geological Survey (USGS) completed the Phase One Study (Phase One Study) for the Snohomish County GWMP. This work was comprehensive within the GWMA and involved data collection and technical analyses. The work was published in "Ground-Water Resources of Western Snohomish County, Washington," U.S. Geological Survey Water-Resources Investigations Report (presently in press and unnumbered) by B. E. Thomas, J. M. Wilkinson, and S. S. Embrey (Thomas, et al., 1997). In summary, this work included: field location and water level monitoring of 1,330 wells; bimonthly water level monitoring of 40 wells over a 2-year period; ground water sampling of 297 wells; technical analyses on geology, aquifers, and aquitards; analysis of ground water withdrawals; analysis of ground water recharge; aquifer vulnerability mapping; and evaluations of ground water quality. An extensive Geographic Information System (GIS) database was constructed as part of the project. The Phase One Study report constitutes a major component of the Snohomish County GWMP and was used extensively in the preparation of this memorandum.

Commercial and Industrial Facilities General information regarding the risks posed to ground water by handling chemicals at commercial and industrial facilities was obtained from the U.S. Environmental Protection Agency (EPA) (EPA, 1990). Listings of hazardous waste cleanup sites and leaking underground storage tank sites in Snohomish County were obtained from the State of Washington Department of Ecology (Ecology). Data regarding the numbers of commercial and industrial facilities in Snohomish County, grouped by standard industry code (SIC), were obtained from the State of Washington Department of Revenue. A listing of chemicals handled by commercial and industrial facilities according to SIC code was obtained from Spokane County (Miller, 1995).

Emergency Spill Response Emergency spill response chain-of-command and capabilities in Snohomish County was obtained from the Northwest Contingency Plan (DOE, 1995) and through personal communications. Individuals were contacted at Ecology, Washington State Department of Transportation, Snohomish County Emergency Management, and fire departments of the City of Everett, the City of Lynnwood, and the City of Seattle.

Livestock Nitrogen loading attributed to livestock was characterized based on data published in "Livestock Waste Management with Pollution Control" (Miner and Smith, 1975), which presents a cooperative project by agricultural experiment stations in 12 Midwestern states and Alaska. A U.S. Geological Survey publication focusing directly on nitrogen loading to ground water, and which addressed livestock contributions, was also used (Frimpter, et al., 1990). The Snohomish Conservation District was also contacted.

Pesticides and Fertilizers Information regarding application rates, active ingredients, and environmental fates of pesticides and fertilizers was obtained from local, state, and regional sources. Pesticide and fertilizer retailers in Monroe and Snohomish were contacted to develop a listing of the most common pesticides and fertilizers in those areas related to both residential and agricultural uses. The Snohomish County Cooperative Extension Service Office was contacted and questioned in regard to agricultural chemical usage in the County. State publications provided detailed statistics regarding crop acreage, pesticide usage, and potential impacts to water quality in the State of Washington and Snohomish County (Washington Agricultural Statistics Service, 1994; Larson, et al., 1993; Larson, 1996). Other published data was used which provided information on pesticide use and environmental fate, including the "Farm Chemicals Handbook 1996" (FCH, 1996) and the "Handbook of Environmental Fate and Exposure Data For Organic Chemicals" (Howard, 1991). Data on application rates and environmental fate of nitrogen as related to fertilizers was obtained from a U.S. Geological Survey study (Frimpter, et al., 1990).

Right-of-Way Maintenance Data regarding maintenance practices for right-of-way areas was obtained primarily through personal communications. Personal communications were made with individuals at Snohomish County, Snohomish County Public Utility District No. 1, Washington State Department of Transportation, and the City of Everett Departments of Public Works and Parks and Recreation.

Sand and Gravel Mining Information regarding sand and gravel mining was obtained from State of Washington reports and permit information. A DOE technical document focusing on sand and gravel mining in Thurston County provided a general overview of potential impacts to ground water (Mead, 1995). DOE also produced a stormwater National Pollutant Discharge Elimination System (NPDES) general permit for sand and gravel operations, which identified water quality constituents of concern and discharge limits. DOE also prepared a special report on a recent impact to ground water occurring as a result of mining through an aquitard in Snohomish County near the City of Monroe (Garland and Lizak, 1995).

Stormwater A few sources of data were reviewed to obtain information on stormwater quality (e.g., the water quality of direct runoff). The National Urban Runoff Program (NURP) report (EPA, 1983) provided data on a large number of constituents measured in urban areas throughout the U.S. A recent text also provided a comprehensive review of stormwater constituents based on the earlier NURP data and more recent data (Wanielista and Yousef, 1993). The City of Portland Environmental Services (personal communication) provided stormwater quality data that was collected during the early 1990s in regard to the City's NPDES stormwater permit.

Wastewater Data collected in regard to wastewater focused specifically on nitrogen due to the importance and common association of this contaminant with on-site wastewater systems. Recent work by the U.S. Geological Survey was used to characterize nitrogen loading concentrations from these waste disposal systems (Frimpter, et al., 1990).

2.2 Digital Mapping Data

Digital, or computerized, mapping data formed an important aspect of the work completed. Two sources, the USGS and Snohomish County, provided these data. In both cases, the data were already organized into GIS data sets using the ARC/INFO software produced by Environmental Systems Research Institute, Inc. (Redlands, CA). The data were generally used in the original format, without alteration and without translation to other formats. Each of the GIS data sets are technically called a "coverage" and this terminology is used throughout the report. For those unfamiliar with GIS, a coverage may be envisioned simply as an individual map theme, such as roadways, county boundaries, or land use designations.

2.2.1 U.S. Geological Survey

Technical analyses and mapping utilized the Phase One Study GIS database. The coverages that were used included the following:

Geology A surface geological map for the GWMA was compiled for the Phase One Study. This coverage contains mapping information showing the locations of the different geological formations as they occur at the land surface. The coverage was prepared based on existing maps, which were entered into a digital format by the USGS. No field mapping was completed for the Phase 1 Study;

Ground Water Infiltration Recharge Infiltration recharge to ground water was determined for the GWMA as part of the Phase One Study. The infiltration recharge rate was determined at all locations in the GWMA based on existing data for precipitation, evapotranspiration, land use, and soils. The rates were grouped into several zones with each zone assigned a range of recharge rates (e.g., a minimum and a maximum). The USGS entered the zone boundaries into a digital format creating the GIS coverage. To facilitate completion of the work, a single recharge rate value was assigned to each zone which was equal to the average of the zone range (e.g., average = [minimum+maximum]/2);

Vulnerability of the Water Table Vulnerability of the water table was determined to assess the ease with which contaminants released at ground surface could travel to ground water (e.g., the water table). The USGS applied a ranking procedure during the Phase 1 Study to determine water table vulnerability throughout the GWMA. The results of the ranking procedure were categorized into three classes: low-, medium-, and high-vulnerability. The vulnerability classes were assigned to land areas within the GWMA and the results of the analysis were entered into a digital format creating a GIS coverage.

2.2.2 Snohomish County

Snohomish County maintains a GIS database for planning and management purposes. The County GIS database includes an extensive array of coverages. The coverages used for the GWMP included the following:

Watershed Sub-Basins The GWMA includes several major rivers and many tributary streams. Each of these occur in a sub-basin which can be delineated based on topographic boundaries. Snohomish County maintains a GIS coverage that depicts the sub-basin boundaries. This coverage was used as a basis for several of the technical analyses presented in later sections.

Future Land Use Preparation of the Snohomish County Growth Management Act (GMA) Comprehensive Plan: General Policy Plan (Summer 1995) included development of a Future Land Use GIS coverage for the area. The Future Land Use designations provided in this GIS coverage were used in technical analyses related to ground water use and nitrogen loading, which are described in later sections.

Future Sewer System Boundaries Sanitary sewer service areas are served by a collective system and wastewater treatment plant and, consequently, do not use on-site waste disposal systems. The future sewered areas have been mapped by the County and exist in a GIS coverage. The GIS coverage is consistent with the recent GMA Comprehensive Plan (Summer 1995). The future sewered areas include all lands within Urban Growth Boundaries (UGBs) plus any existing sewered areas outside the UGBs. The sewer service areas were used in analyses regarding ground water use and nitrogen loading to ground water.

Future Water System Boundaries The County maintains a GIS coverage of public water system service areas. The GIS coverage contains service area boundaries based on planning data provided by the respective utilities, thus the service area boundaries represent possible future conditions, not necessarily existing service areas. This mapping information, along with information regarding the sources of supplies, was used in an analysis of ground water use.

SCS Soil Mapping The Soil Conservation Service (SCS), now called the Natural Resource Conservation Service, has conducted detailed surface soil mapping throughout the western County area, which covers about 99% of the GWMA. This coverage is included in the County GIS, although it was not created by the County and has not been field verified for the present project. The SCS soils coverage was used in the present project in analyses regarding stormwater- and wastewater-infiltration.

Transportation Major, secondary, and minor roadways and railroad right-of-ways located throughout the GWMA were provided in a GIS coverage. This coverage was used to assess ground water vulnerability to right-of-way maintenance and chemical spills resulting from transportation of hazardous materials.

Utilities A utilities coverage maintained by the County shows the locations of major water transmission pipelines, power transmission lines, and natural-gas and petroleum pipelines. This coverage was used in work related to right-of-way maintenance and hazardous material spills.

Mineral Resource Lands Sand, gravel and rock are the primary mined resources that exist in the GWMA. In the GMA Comprehensive Plan, the County identified and designated mineral resource lands that are not characterized by urban growth and that have long term commercial significance for the extraction of minerals. This GIS coverage was used to overlay mineral resource mining areas (existing and potential) and aquifer vulnerability.

3. AREA CHARACTERIZATION

This section provides an overview of the physical setting of the Snohomish County Ground Water Management Area (GWMA). Information regarding land use, climate, geology, hydrogeology, ground water quality, and ground water use within the GWMA is presented in this section. Much of this information was obtained from general planning data for the County and from the Phase One Study completed by the U.S. Geological Survey. This section is intended to provide a general overview of the area characterization and is based on a more detailed description of the GWMA provided in the Geohydrology Memorandum (Golder, 1996) submitted to the GWAC in November 1996.

3.1 Description of Ground Water Management Area

The Snohomish County GWMA encompasses 850 square miles between the Cascade Mountains and Puget Sound (Figure I-3-1). The boundaries of the study area are the shoreline of Puget Sound on the west, the border with Skagit County to the north, the Cascade foothills on the east, and the border with King County to the south. The elevation of the study area ranges from sea level to about 3,000 feet, with about 90% of the study area below 800 feet.

Western Snohomish County has a temperate marine climate with cool and wet winters and warm and dry summers. Temperatures are moderated by the Pacific Ocean and by Puget Sound. The average annual precipitation varies according to altitude and distance from Puget Sound. Average annual precipitation ranges from about 30 inches near Puget Sound to about 90 inches along parts of the eastern boundary of the GWMA.

The Snohomish County GWMA contains several plateaus that are separated by river valleys. This topography is typical of the Puget Sound region, reflecting glacial and river activity of the past. The primary river valleys within the GWMA are oriented in an east-west direction and are occupied by the Snohomish River, the North and South Forks of the Stillaguamish River, and the Skykomish River. Other significant lowland areas include the Pilchuck River valley and the Marysville trough, both of which are primarily oriented in a north-south direction.

The population of Snohomish County was about 494,300 in 1992 (Thomas, et al., 1997). Most of the population is concentrated in the southwest county area. Other areas of moderate population density include the Lake Stevens area, and the Cities of Snohomish, Marysville, Arlington, Monroe, Stanwood, Granite Falls, and Darrington. Parts of the Skykomish river valley also include moderate population densities. Like many areas of the Puget Sound, Snohomish County is experiencing significant population growth. Figure I-3-2 shows the jurisdictional boundaries of municipalities within the GWMA including the boundaries of state, federal, and tribal lands.

3.2 Land Use

Land within the GWMA is used for a variety of activities. Land usage includes agricultural activities, industrial and commercial uses, residential use, transportation (roads and railroads) and other uses such as state parks, government and private forest lands, and other types of open space. Agricultural activities include crop production, dairy farming, livestock production, and forestry. Many types of industrial activities are represented within the GWMA and include aircraft manufacturing, shipping, food processing, sand and gravel mining, and pulp and paper milling. A variety of commercial activities are represented including shopping malls, service stations, hospitals, etc. Most of the commercial and industrial activities are concentrated within the southwestern portion of the GWMA.

Residential land use occurs both in urban and rural parts of the GWMA. Urban residential densities are highest within the southwestern part of the GWMA and typically range from 4 to 24 residential units per acre (Snohomish County GMA Comprehensive Plan, 1995). Rural residential densities typically range from 1 to 2 dwellings per acre to less than one dwelling per 20 acres (Snohomish County GMA Comprehensive Plan, 1995).

Figure I-3-2 shows future land use throughout the GWMA as designated by the Snohomish County GMA Comprehensive Plan. It is important to note Figure I-3-2 reflects potential future land use and does not depict the actual present land use in the County, as much of the land area within the GWMA is presently undeveloped or is developed at a lesser intensity than that of the plan. Table I-3-1 summarizes the land use areas throughout the GWMA. Rural residential land uses (R2 and R5) are designated for 302.3 square-miles of the GWMA (35.5% of the total land area). Other important land uses based on total area include commercial forest (FC), which is designated for 159.1 square-miles (18.7%) and riverway agriculture (AR), which is designated for 91.0 square-miles (10.7%).

Snohomish County conducted a land capacity analysis for the present GMA Comprehensive Plan. The capacity analysis presents capacities based on the effective density of development under the land use designations of the twenty-year (year 2012) GMA Future Land Use Map. The total County population capacity is estimated to be 835,984 persons in 2012. Within Urban Growth Areas (UGAs), the population capacity is estimated to be 610,996 persons and within rural areas, the population capacity is estimated to be 224,988 persons.

3.3 Hydrogeology

The geology within the GWMA has been formed by processes related to glaciers and mountain building in western Washington. Many of the recent deposits within the study area are the result of continental glacial ice that advanced into the Puget Sound region several times during the Pleistocene Epoch (between 2 million and 10,000 years ago). The most recent period of glaciation, the Vashon Stade, began about 15,000 years ago.

Materials deposited during the Vashon glacial period are generally well-preserved and represent the principal hydrogeologic units within the GWMA in terms of their importance as the primary aquifer and confining layers for ground water supply purposes. Although ground water occurs in all of the hydrogeologic units, ground water is more readily transmitted within aquifer units, which are saturated permeable geologic units capable of transmitting a usable quantity of water. Confining units restrict the movement of ground water.

Seven principal hydrogeologic units were defined within the GWMA by the Phase One Study (Thomas, et al., 1997). The hydrogeologic units were defined based on the lithology of the unconsolidated materials and the stratigraphic and hydrologic relations between adjacent units. In general, the aquifers are comprised of coarse-grained deposits and the confining layers are comprised of fine-grained, well-compacted deposits. The unconsolidated geologic deposits (which include all the glacial and inter-glacial deposits) were classified into four aquifers and two confining beds and the underlying bedrock was classified as a confining layer that is present at the base of the ground water system.

Figure I-3-3 shows the surficial extent of the principal geologic units mapped within the GWMA. With the exception of the organic deposits, these geologic units correspond to the seven principal hydrogeologic units within the GWMA. A general geologic cross-section is provided in Figure I-3-4 to show the typical vertical sequence of these units.

The two upper aquifers are the alluvium (Qal) and the Vashon Recessional Outwash (Qvr). In many areas these two units are hydrologically continuous and act as a single aquifer. The confining unit underlying the recessional outwash is the Vashon Till (Qvt). Underlying the till is the Vashon Advance Outwash (Qva), which is the principal aquifer in the study area in terms of areal extent and ground water usage. The Transitional Beds (Qtb) are the confining unit that underlies the Advance Outwash. Below the transitional beds is a unit of Undifferentiated Sediments (Qu). The Undifferentiated Sediments are heterogeneous and are not well-defined, but are generally coarse-grained and have been lumped together as a single aquifer unit. At the base of the Undifferentiated Sediments is the bedrock (Tb), which acts as a confining layer below the unconsolidated deposits. The bedrock consists of a variety of rocks including volcanic, conglomerate, sandstone, limestone, and other types.

3.3.1 Ground Water Recharge and Discharge

The primary source of recharge to the ground water system is precipitation that infiltrates and percolates to the water table. Other sources of recharge are seepage from surface water bodies such as streams and lakes, lateral subsurface inflows of ground water within unconsolidated materials along the boundary of the study area, and the lateral and upward flow of ground water from adjacent bedrock units.

The amount of recharge to the ground water system from precipitation varies throughout the study area and depends on several factors including mean annual precipitation, surficial geology and soil properties, vegetation, and land use. Surface geology and soil properties can strongly influence the amount of precipitation that infiltrates. Relatively

coarse-grained materials such as alluvium and glacial outwash typically have high infiltration rates compared with more fine-grained materials such as till, lakebed deposits, and organic deposits. Recharge is also strongly influenced by precipitation and is relatively higher in areas with high precipitation. Land use can also influence the recharge rate. Development and urbanization increases the amount of impervious surfaces which may reduce ground water recharge.

Ground water recharge is higher within the eastern parts of the study area because of higher precipitation, and is also higher over areas where coarse-grained materials such as alluvium and outwash are present at the surface. Recharge is limited in densely urbanized areas such as in the southwest county area and in other urbanized areas. Average annual recharge over the study area from precipitation is estimated to be about 24 inches or 1,090,000 acre-feet. Figure I-3-5 shows the estimated areal distribution of ground water recharge throughout the study area.

Discharge from the ground water system occurs naturally or as a result of pumping from ground water wells. Ground water is naturally discharged to surface water bodies such as streams, lakes, marshes, and Puget Sound, to springs, and to seepage faces along slopes. Ground water can also be removed naturally in areas where the water table is near the surface by evaporation from the ground or by transpiration from vegetation (collectively referred to as evapotranspiration). Within the ground water system, ground water discharge also occurs from one aquifer to another.

Ground water withdrawn from wells is used as water supply for domestic, industrial, agricultural, and mining purposes. Ground water withdrawals within the study area during 1992 were estimated for the following water-use categories (Thomas, et al., in press): public supply, individual private wells, irrigation, livestock, and mining. Total ground water withdrawals for 1992 were estimated to be 19,630 acre-feet. This quantity represents gross withdrawal and does not take into account return flow to the ground water from septic systems (drainfields), the return flow of irrigation water, or the return of water that is used in sand and gravel mining.

3.3.2 Ground Water Movement and Water Level Variation

The direction of ground water flow can be determined by mapping the elevations of water levels measured in wells. The Phase One Study (Thomas, et al., 1997) prepared these types of maps for the aquifer units in the GWMA. The maps have not been included in this report and the reader is referred to the Phase One Study for more detail.

Ground water flows between the external boundaries of the system which are the bedrock units, Puget Sound, the water table, and surface water bodies within the study area such as streams and lakes. Ground water flows from areas of higher water-level elevation to areas of lower water-level elevation. In the shallow ground water system of the GWMA, ground water flow follows the surface topography and moves from higher altitude areas towards stream and river valleys. Ground water typically flows parallel to the surface topography with a primarily horizontal component of flow. Ground water

flow has a vertically downward component in recharge areas, such as the plateaus, and has a vertically upward component in discharge areas, such as along the channels of the Snohomish, Skykomish and Stillaguamish Rivers.

On a regional scale, the general direction of ground water flow within the study area is from east to west. The direction of ground water flow locally within the GWMA is variable depending on a number of factors, including local topography. Ground water mounds occur under the Tulalip, Getchell, and Lakes Plateaus and ground water flows radially outward from the center of the mounds towards the edges of the plateaus or toward stream and river valleys. The direction of ground water flow is also controlled by the subsurface geology. For instance, low permeability bedrock may form a barrier to horizontal ground water flow in certain locations within the GWMA. Similarly, low permeability confining layers reduce the component of vertical ground water flow.

Ground water levels fluctuate over time as a function of the relative quantities of recharge and discharge to the system. The water level fluctuations reflect changes in the amount of water that is stored in the soil. As water levels rise, more water is stored; and as water levels fall, water is removed from storage.

Ground water levels fluctuate seasonally because of the natural variations in recharge and discharge during the year. During the winter, precipitation is relatively high and ground water recharge exceeds discharge which results in a seasonal increase in water levels (increase in ground water storage). During the summer, precipitation is relatively small and ground water discharge exceeds recharge which results in declining water levels (decrease in ground water storage).

The magnitude of seasonal water level changes observed during the Phase One Study ranged from 4 to 10 feet in shallow wells, 3 to 4 feet in moderate-depth wells, and an extremely small variation in deep wells. Trend analysis of water level data evaluated during the Phase One Study showed that there does not appear to be any areas of widespread long-term water level decline within the GWMA. The data available for trend analysis, however, were limited to a few areas and therefore are not conclusive to the GWMA in general. Future monitoring efforts may benefit from long-term measurements of ground water-level and stream-flow at selected sites.

3.3.3 Water Budget

A water budget is used to quantify the distribution of precipitation within a watershed during an average year. On a long-term basis, the inflows and outflows of water from the watershed are equal and there is no appreciable change in the amount of water in storage. Table I-3-2 provides an approximate water budget for the 850-square mile GWMA and was developed by the Phase One Study (Thomas, et al., 1997). The reader is referred to the Phase One Study for more detail regarding the water budget analysis.

Based on an average annual precipitation of 46 inches, roughly 18 inches returns to the atmosphere by evapotranspiration, 4 inches provides direct surface runoff to streams, and 24-inches recharges the ground water. Of the quantity of water that provides ground water recharge, it is estimated that 21 inches is discharged to streams, 2.6 inches is naturally discharged to features such as lakes, seepage faces, Puget Sound, etc., and 0.4 inches is withdrawn by wells. As mentioned previously, the estimated

withdrawal by wells (0.4 inches or 19,630 acre-feet) represents the total withdrawal. The net withdrawal of water from wells is substantially smaller because of return flows to the ground water (e.g., excess irrigation water, flow from septic systems).

About three-fourths of the total ground water withdrawals (by volume) during 1992 were used for public supply or individual private well purposes. The remaining ground water withdrawals were used for irrigation, livestock, or mining purposes.

3.4 Ground Water Quality

Part of the Phase One Study involved water quality sampling and analysis. A total of 297 ground water and spring samples were collected and analyzed for the constituents listed in Table I-3-3. As documented by the Phase One Study, ground water quality within the GWMA is generally good with no widespread contamination. Contaminants that are associated with seawater intrusion, agriculture, industry, commercial activities, and septic systems were investigated, and only isolated occurrences were found. The most common and widespread ground water quality problems identified were attributed to natural causes. High iron and manganese concentrations are fairly common in the ground water and are the result of natural geochemical processes. These constituents do not have associated health effects, but are a concern for aesthetic reasons, commonly causing water to have an earthy taste and also resulting in staining of laundry and plumbing fixtures. Relatively high arsenic concentrations are also present within the ground water, mostly in the vicinity of Granite Falls and along the South Fork of the Stillaguamish River up to Arlington. The presence of the arsenic is also the result of natural geochemical processes.

Based on the results of water quality sampling, the Phase One Study concluded that agricultural activities do not appear to have caused any widespread ground water contamination from fertilizers or animal waste. Concentrations of nitrate and ammonia were generally low throughout the study area and bacteria were detected in relatively few ground water samples. A few isolated samples had elevated nitrate or ammonia concentrations, which suggests the source was probably local and was specific to each well.

No pesticides or associated compounds were found in the Phase One Study ground water samples. A total of 9 samples were analyzed for pesticide constituents including herbicides and insecticides. It is emphasized that a very small number of samples were collected and, although the results are encouraging, they do not represent a comprehensive evaluation of pesticides potentially present in ground water within the GWMA.

The Phase One Study also concluded that septic systems have not caused any appreciable widespread ground water contamination. Regionally, nitrate and ammonia concentrations were generally low throughout the GWMA and there were no large areas with consistently high concentrations. However, the results are not indicative of more localized impacts related to septic systems.

Seawater intrusion, which is the movement of saltwater into a freshwater aquifer, does not appear to currently pose a water quality problem in the GWMA based on the results of the Phase One Study. The historical evidence of seawater intrusion within the study area is isolated and inconsistent. The most common cause of seawater intrusion is ground water withdrawals from wells. Small areas near Puget Sound may exist where seawater intrusion has occurred, but data are not available to document these incidents.

4. GROUND WATER UTILIZATION

This section summarizes a technical analysis of ground water utilization that is presented in the Geohydrology Memorandum (Golder, 1996). It specifically focuses on: 1) water supply; 2) infiltration of stormwater; 3) infiltration of wastewater; and 4) storage of treated surface water. Most of the analyses presented in this section rely in part on digital mapping provided by the USGS and Snohomish County GIS.

4.1 Ground Water Supply

A technical analysis was performed to evaluate the utilization of ground water in the GWMA for water supply based on the projected population in 2012. The analysis was performed at a sub-basin scale. The GWMA was divided into 64 sub-basins using surface water drainage boundaries (e.g., based on topography) that were provided in a GIS coverage (Figure I-3-6). The total annual ground water recharge within each sub-basin was calculated using the coverages for ground water recharge (Figure I-3-5) and sub-basins. The consumptive use of ground water within each sub-basin was computed based on future land use designations for the GWMA (Figure I-3-2) while considering the sources of water supply, surface- or ground-water, and the distribution of sanitary sewers.

Future water use in each sub-basin was estimated based on the GMA Future Land Use Map (Figure I-3-2), assuming build out of the area to the estimated 2012 population. Each land use designation was assigned a water use rate based on published data. A total of 25 land use designations were included in the analysis. A GIS coverage delineating water service areas and the sources of supply was used to determine the percentage of the total water demand obtained from ground water. Table I-3-4 provides a summary of the 24 water service areas contained in the GIS coverage and indicates the percentage of surface water and ground water used in each. Most of the service areas rely solely on surface water, especially the City of Everett and the water districts in the southwest county that purchase water from Everett. Those land areas outside of the water service areas are assumed to rely solely on ground water and include individual residences and small (Group B) water systems. In most cases, the areas that are located outside of the main water service areas are zoned for a low density population such as agriculture, rural residential, or undeveloped lands.

The extent of future sewered areas was used to distinguish between areas where wastewater is conveyed off-site to a treatment facility and areas where wastewater is treated on-site using a septic tank and drainfield system. The consumptive use of ground water is higher within areas that are served by a sewer because wastewater does not return to ground water through a drainfield. Rather, it is conveyed to a wastewater treatment plant and discharged to surface water.

Table I-3-5 presents consumptive use data according to each of the designated land uses in the GMA Future Land Use Map. The largest consumptive uses (by volume) are associated with the land use designations for City (CI), Medium Density Rural 2.3 (R2), and Urban Low Density Residential (UL). The overall annual consumptive use of ground water within the GWMA in 2012 is estimated to be 14,830 acre-feet, which represents about 1.4 percent of the estimated ground water recharge in the GWMA in 2012 (1,054,000 acre-feet).

The consumptive use of ground water was computed for each of the GWMA sub-basins and is summarized in Table I-3-6. The consumptive use quantities were divided by the total ground water recharge rate to compute consumptive use as a proportion of recharge. This ratio is shown for each sub-basin in Table I-3-6 and on Figure I-3-6. Based on the assumptions of the analysis, it is possible to interpret this ratio as a measure of the maximum steady-state reduction in stream baseflow due to the consumptive use of ground water. Applying this interpretation to the analysis results indicates that most of the GWMA, under the assumptions of the analysis, will have less than or equal to a 5% impact on stream baseflows on an annual average basis. Sub-basins with the highest relative ground water consumptive use and, therefore, the highest potential reduction in stream baseflow, are areas that: 1) have a moderately dense population; 2) depend on ground water for water supply; and 3) are served by sanitary sewers. These results are based on the GMA Future Land Use Map (June 1995). Increases in dwelling density, or reduced lot size, will tend to increase consumptive use and, therefore, increase the potential reduction in stream baseflow. Reducing dwelling density, or increasing lot size, will have the opposite effect.

4.2 Stormwater Infiltration

According to the Washington State Department of Ecology (DOE), the infiltration of stormwater is the preferred method of stormwater management in the Puget Sound Basin in terms of runoff treatment (DOE, 1992). However, for runoff treatment to be successful, site conditions must be suitable to accept seasonally high volumes of water and provide a satisfactory level of water quality treatment. Site specific conditions such as soil type, surficial geology, slope, and seasonal water table fluctuations should all be considered before a site is selected for stormwater infiltration.

The infiltration capacity of site soils is one of the most important factors when considering site suitability for stormwater infiltration. The infiltration rate should be sufficiently high to accept the anticipated stormwater volumes, but must also allow sufficient residence time to allow an acceptable level of treatment. The classification of soils through the use of hydrologic soil groups, which are based on infiltration rate, can be used to determine the suitability of soils for stormwater infiltration. Hydrologic soil groups, which are based on infiltration rate, include four categories as follows:

- Group A - Soils having high infiltration rates, which typically consist of coarse-grained materials such as sand and gravel;
- Group B - Soils having moderate infiltration rates, which typically consist of moderately fine to moderately coarse textures;
- Group C - Soils having slow infiltration rates, which typically consist of moderately fine to fine textures; and

- Group D - Soils having very slow infiltration rates, which typically consist of clay soils, soils with a hardpan or a clay layer near the surface, or shallow soils which overlay a low permeability layer.

According to DOE (1992), the most suitable soils for the treatment of stormwater runoff are the Group B soils. Some of the Group C soils may also be suitable, particularly those that are at least 3 feet above a low permeability layer such as till. Shallow Group C soils that mantle till-covered plateau areas may not be suitable for stormwater infiltration. Group A soils are excessively well-drained and typically do not provide sufficient water quality treatment. Group D soils are not suitable because they drain too slowly and are typically located in low areas with a high water table. Additionally, DOE recommends that the base of all infiltration facilities be located at least three feet above the seasonal high water table, bedrock, till, or any other low permeability layer.

The Geohydrology Memorandum (Golder, 1996) presents a map showing areas within the GWMA that are generally suitable for the infiltration of stormwater. A GIS coverage containing detailed soil mapping was used to identify the extent of suitable soils throughout the GWMA for stormwater infiltration. Based on the guidelines provided by DOE, soils with moderate infiltration rates (Group B) and soils with slow infiltration rates (Group C) that do not directly cover till are considered suitable for infiltration and treatment of stormwater. Much of the GWMA is mapped as being potentially unsuitable for stormwater infiltration, primarily because many of these areas are covered by soils with slow infiltration rates (Group C soils) that directly overlay glacial till. The suitability of these areas depends on site specific conditions that include infiltration rate, depth to the till, and depth to the water table. Areas covered by soils with excessively high infiltration rates (Group A) are also considered unsatisfactory for stormwater infiltration, although some sites may be suitable if pre-treatment is provided. Additionally, some areas that were mapped as suitable for stormwater infiltration may be situated in topographic depressions that are susceptible to a high water table. It is emphasized that the map should be used as a general guide to areas that are potentially suitable for stormwater infiltration. An investigation of site-specific conditions is necessary before determining the suitability of a site for stormwater infiltration.

4.3 Wastewater Infiltration

The criteria used to determine the suitability of a site for wastewater infiltration are similar to those used to determine site suitability for stormwater infiltration. The most suitable soils for conventional on-site wastewater systems are the Group B soils and the Group C soils that do not directly overlie till. However, many areas that are covered by either Group A soils or by Group C soils over till may be acceptable for wastewater infiltration if an alternative system is used. Unacceptable conditions for wastewater disposal are typically encountered where soils with very slow infiltration rates (Group D soils) are present.

The Geohydrology Memorandum (Golder, 1996) presents a map showing areas within the GWMA that are generally suitable for the infiltration of wastewater from on-site systems. General suitability for on-site wastewater infiltration was determined using soils mapping data with surface geologic mapping to identify areas where till is present

near ground surface. Most areas within the GWMA may be suitable for on-site wastewater infiltration if the proper system is used. Areas covered by Group B soils, or by Group C soils that do not directly overlay till, are generally suitable for standard (gravity distribution) on-site wastewater systems. Areas covered by Group A soils, or by Group C soils that directly overlay till are generally suitable for wastewater infiltration if an alternative system is used. Only a relatively limited area of the GWMA that is covered by Group D soils or that is unclassified (e.g., surface water bodies, bedrock outcrop areas) appears to be unsuitable for wastewater infiltration. It is emphasized that the map should be used as a general guide to areas that are potentially suitable for wastewater infiltration. An investigation of site-specific conditions, which includes an investigation of soil type, surface geology, slope, and seasonal water table fluctuations is necessary before determining the suitability of a site for wastewater infiltration.

4.4 Aquifer Storage and Recovery

A water supply management strategy that is likely to see increasing use in the Pacific Northwest in the future is Aquifer Storage and Recovery (ASR). ASR typically refers to the injection and storage of surface water underground for a period of months to years. The same water is later withdrawn (recovered) for use by a water system, typically during periods of high demand and/or emergencies. In this application, ASR provides beneficial storage for drinking water and other uses and typically much larger storage volumes are possible than in many above-ground reservoirs. A successful ASR system requires a transmissive, bounded aquifer, and an aquifer with sufficient water storage capacity. The aquifer should also be protected from contamination by an overlying low-permeability layer.

Within the GWMA, the Vashon Advance Outwash (Qva) appears to provide the most potential for use in an ASR system. The Advance Outwash has sufficient permeability, it is encountered over a large areal extent of the GWMA, and is typically overlain by till (the till acts as a low-permeability barrier to contamination). The most suitable areas for ASR should be located under the relatively higher elevation features within the GWMA. In particular, the Tulalip, Getchell, Lakes, Intercity, and East Stanwood Plateaus appear to provide the most promising conditions for ASR. A field investigation program is needed for specific projects aimed at developing an ASR system.

5. GROUND WATER VULNERABILITY

A ground water vulnerability analysis was performed to determine the potential for impacts to ground water quality in the GWMA. A ground water system can become contaminated by substances related to man's activities on the land surface. These activities may include stormwater and wastewater infiltration, commercial and industrial activities, agriculture, sand and gravel mining, right-of-way maintenance, and transportation of hazardous materials. A summary of the evaluation of these activities is provided in this section. The reader is referred to Section 5 of the Geohydrology Memorandum (Golder, 1996) for a more detailed discussion of the ground water vulnerability analysis.

5.1 Water Table Vulnerability Mapping

The Phase One Study included the development of a water table vulnerability map. This map depicts the vulnerability of the water table to contamination (e.g., the potential for contamination of the first ground water encountered). The vulnerability has been grouped into three categories, low, medium, and high, as shown on Figure I-3-8. The two factors that were used by the USGS to assess the relative vulnerability of the ground water system were: 1) the average annual ground water recharge rate; and 2) the depth to the water table below ground surface. Ground water recharge rate affects vulnerability because as the recharge rate increases, there is more water available to transport contaminants to ground water. The depth to the water table affects vulnerability because as the depth increases, it takes longer for water to percolate to ground water. A longer travel time provides a greater opportunity for contaminants to undergo chemical, biological, or mechanical (mixing) transformation to a less hazardous state.

The results of the Phase One Study vulnerability map are consistent with the GWMA surface geology (Figure I-3-3) and ground water recharge rates (Figure I-3-5). The low vulnerability areas correlate closely with areas underlain by till, which is of low permeability and has lower ground water recharge rates. The medium- and high-vulnerability areas occur in the river valleys where sand and gravel occurs at the land surface and toward the east side of the GWMA where the recharge rates increase to their maximum level.

5.2 Stormwater

Stormwater typically contains constituents from dispersed and relatively uncontrolled sources known as nonpoint sources. Nonpoint sources include atmospheric fallout, surface runoff, and residual chemicals and sediment that release pollutants to the water system over relatively long periods of time (Wanielista and Yousef, 1993). A discussion of constituents typically encountered in stormwater including stormwater quality data from several studies is provided in the Geohydrology Memorandum (Golder, 1996).

An evaluation of the vulnerability of ground water to selected constituents in stormwater was performed quantitatively using a loading and mixing analysis. In conducting the analysis, it was assumed that stormwater could be infiltrated only in areas that have suitable soil conditions as discussed in Section 2.5.2. The analysis was limited to nitrate, nitrogen, copper, and zinc because these constituents are considered to have the greatest chance of causing an impact to ground water. Ground water vulnerability to stormwater was evaluated separately for each of the 64 sub-basins based on land-use and stormwater-runoff data. The potential constituent concentrations in ground water were estimated by assuming the complete mixing between infiltrated stormwater and total annual ground water recharge to the sub-basin. Greater dilution is achieved in sub-basins where the annual volume of ground water recharge is large relative to the volume of infiltrated stormwater.

Based on the analysis, the estimated constituent concentrations in ground water are well below the State of Washington Maximum Contaminant Levels (MCLs) for drinking water and for fisheries (surface water aquatic life MCLs) for nitrate, zinc, and copper. Regional ground water quality impacts from these constituents would not be anticipated. However, the analysis is based on several assumptions that should be considered. The analysis assumes uniform mixing between infiltrated stormwater and ground water recharge. By this assumption, the predicted contaminant concentrations will be lower than would occur in the immediate vicinity of a stormwater infiltration facility. In addition, the analysis method assumes that processes such as biological and chemical degradation and adsorption do not occur. In the natural system, these processes will be active to varying degrees and will tend to reduce contaminant concentrations in ground water relative to the concentrations encountered in stormwater prior to infiltration.

5.3 Agriculture

Agriculture encompasses a wide range of activities within the GWMA which include crop production and livestock activities. Crop production occurs at a variety of scales, and includes both farms and nurseries. Livestock raised within the GWMA includes beef and dairy cattle, hogs, horses, chickens, and mink.

Agricultural activities can impact ground water in a variety of ways. Substances that are applied to agricultural areas, such as pesticides and fertilizers, can leach to ground water if they are used excessively or improperly. Animal wastes can also impact ground water when not properly managed. This section summarizes the potential impacts to ground water from agricultural activities and evaluates the general vulnerability of ground water to agriculture.

A detailed discussion of pesticides and fertilizers is provided in the Geohydrology Memorandum (Golder, 1996). Pesticides and fertilizers are used within the GWMA for a variety of purposes. Pesticides and fertilizers are commonly associated with residential yard maintenance, agriculture/nursery operations, and public right-of-way upkeep. In addition to the benefits that pesticides and fertilizers can provide, there are some potential environmental impacts that can occur. Under certain conditions, some pesticides and fertilizers can become mobile within the soil and can migrate to ground water. At sufficient concentrations, pesticides and fertilizers within the ground water can pose a risk to the environment and to human health.

The potential impacts of pesticides to ground water are difficult to quantify because the fate and transport processes vary from one pesticide to another. Additionally, detailed information (application frequency and quantities) on pesticide usage within the GWMA has not been compiled.

Fertilizer usage within the GWMA is identified according to the following categories: residential, agricultural, nursery, and public right-of-way. The most common fertilizer nutrients are nitrogen, phosphorus, and potassium. Of these, nitrogen presents the largest potential threat to ground water because it is often present in the form of nitrate, which is mobile in the environment.

Fertilizer usage in residential areas is highly variable. In rural areas, fertilizer usage is typically associated with agricultural applications and includes large-scale farming operations and nurseries. The application rates of fertilizer for agricultural purposes will vary depending on crop type and soil type. However, because of the large scale of many agricultural operations, there appears to be a significant economic incentive to not apply excess fertilizer. As a result, the percentage of nitrogen per acre that leaches to ground water in agricultural areas may be smaller than it is in residential areas.

Animal wastes associated with agricultural operations can also be a source of contamination to ground water. Animal waste contains significant quantities of nitrogen that are converted to the nitrate form following deposition and exposure to the atmosphere. Many of the problems associated with animal wastes occur because of poor farm management practices, such as the improper storage and disposal of animal wastes and unrestricted livestock access to streams, ponds, and wetlands. These problems can be significant depending on the number and density of animals at a given location.

Because a large amount of waste can be generated by livestock, the proper storage and handling of wastes often represents one of the most important best management practices related to agricultural operations. Best management practices for wastes typically involve the collection and storage of wastes followed by application of the wastes to agricultural lands. Wastes that are applied to agricultural lands provide a source of nutrients to plants and, thereby, provide a mechanism for consuming these nutrients.

A qualitative evaluation of the vulnerability of ground water to agriculture was performed by mapping agricultural lands onto the water table vulnerability map. The agricultural lands were identified based on the GMA future land use plan, as shown on Figure I-3-2. The Geohydrology Memorandum (Golder, 1996) shows the distribution of agricultural lands located over medium- and high-water table vulnerability areas. Based on a total area of 97 mi^2 that are designated agriculture, 73 mi^2 (75%) occur over high vulnerability areas; 19 mi^2 (20%) occur over medium vulnerability areas; and 5 mi^2 (5%) occur over low vulnerability areas. A majority of the agricultural areas are located over high vulnerability areas because most of the agricultural lands are located within river valleys.

Major river valleys within the GWMA were typically classified as high vulnerability areas because ground water recharge is high and the depth to ground water is shallow. However, it is noteworthy that very little of the agricultural land overlies the Vashon Advance Outwash (Qva), which is the primary aquifer in the GWMA.

5.4 Wastewater

Wastewater is a combination of the liquid or water-carried wastes removed from residences, institutions, and commercial and industrial establishments. In Snohomish County, wastewater infiltration to ground water occurs primarily from the use of single residence, on-site waste disposal systems in areas that are not serviced by a public sewer district.

The most common type of on-site wastewater treatment system consists of a septic tank and a drainfield. On-site wastewater treatment systems can impact ground water depending on a number of factors that include the type and concentration of constituents discharged to the drainfield, the surrounding soil characteristics, and the depth to ground water. Potential contaminants from on-site wastewater treatment systems that are most commonly encountered include bacteria, phosphorus and nitrate.

Bacterial contamination of ground water can be significant because it may present a health hazard to humans and other animals. However, studies show that when on-site wastewater systems are properly designed and located, harmful bacteria are typically not present more than several feet below the drainfield and, therefore, do not threaten ground water. Phosphorus is easily retained in soils due to chemical changes and adsorption. Nitrogen in septic tank effluent exists primarily in the ammonium form and is transformed to nitrate in the drainfield. Nitrate is, therefore, the primary constituent of concern from on-site wastewater treatment systems.

An evaluation was performed to assess the vulnerability of ground water to nitrate using a loading and mixing analysis that considered nitrate sources from wastewater, lawn fertilizers, and agricultural sources (fertilizers and animal wastes). Nitrate loading from residential, commercial, and industrial wastewater sources was determined on a per unit area basis using published values (Frimpter, 1990) of nitrate concentrations in wastewater effluent from on-site disposal systems. The total nitrate load from residential sources is a function of the number of residences per acre. The total nitrate load from commercial and industrial sources is estimated based on land use designation. Urban commercial/industrial land uses are assumed to contribute a higher nitrate load relative to rural commercial/industrial land uses.

The potential loading of nitrate from agricultural activities was considered for three sources: residential yard maintenance, agricultural (farm) fertilizer applications, and animal wastes generated from agricultural areas. Nitrate loading from fertilizer application on agricultural areas and residential lawns was estimated based on the recommended fertilizer application rates for the most common crops grown in the GWMA and the acreage of each crop (including lawns).

Nitrate loading from animal wastes was estimated using information regarding the manure production of the most common types of livestock within the GWMA. In terms of manure production, the most significant livestock within the GWMA are cattle, horses, and chickens. Manure production for these animals was estimated based on the head count of each animal (Washington Agricultural Statistics Service, 1994) and published data on the nitrogen production of each. The amount of nitrate from animal waste that reaches the ground water will depend largely on the practice used to manage manure. The management of animal wastes within the GWMA is expected to vary considerably. An estimate of the potential nitrate loading from animal wastes was obtained by assuming that a typical management practice consists of storage in a lagoon followed by land application.

A total nitrate loading for each of the 64 sub-basins in the GWMA was determined based on the GMA Future Land Use Map and assuming build-out to the estimated 2012 population. The "complete mix" nitrate concentration for each sub-basin was computed by dividing the total nitrate loading (summed within the sub-basin for all land uses) by the total ground water recharge rate within the sub-basin. In this approach, it is assumed that natural ground water recharge provides dilution of the nitrate loading. Estimated complete mix nitrate concentrations for each of the GWMA sub-basins are presented in Table I-3-7. It is important to realize when interpreting these results that: 1) the analysis is averaged over the entire sub-basin and higher or lower concentrations of nitrate may occur locally; 2) the input data are based on assumptions and existing data obtained in part from other locations; and 3) attenuation mechanisms that would lead to reduced nitrate concentrations were not included.

Nitrogen loading results are presented according to land use in Table I-3-8. The largest nitrogen loading occurs in riverway agricultural lands and is attributed to the use of fertilizers and manure spraying. Rural land uses account for the next three highest nitrogen loadings and in these cases, the loadings are attributed to on-site waste disposal systems and to a lesser degree the use of fertilizers. In most cases, the nitrate loading for unsewered areas is higher relative to sewered areas which reflects the significant contribution of nitrate from wastewater relative to other sources. Nitrate loading from agricultural areas is independent of sewer service because agricultural wastes and runoff are not discharged to sanitary sewer systems.

The predicted nitrate concentrations are less than 10 mg/l as N (nitrogen) everywhere within the GWMA. Three sub-basins have predicted nitrate concentrations of between 5 mg/l as N and 10 mg/l as N. These sub-basins have large inhabited areas using on-site wastewater systems and/or they have significant areas of agricultural lands. The remaining sub-basins have predicted nitrate concentrations of less than 5 mg/l as N. It is noteworthy that natural nitrate concentrations in ground water above 1 mg/l as N are uncommon. Most of the GWMA is estimated to have nitrate loadings that would elevate the ground water nitrate concentration above pre-development concentrations.

5.5 Commercial and Industrial Facilities and Households

Commercial and industrial facilities can be the source of chemical releases to the environment which could potentially impact ground water. A list of commercial and light industrial sectors that have been identified as potentially significant sources of ground water contamination are listed in the Geohydrology Memorandum (Golder, 1996). Some of the more common industries that have a high potential to impact ground water include electroplating and polishing services, wood and lumber treating operations, furniture refinishing and repair services, auto repair shops, road de-icing operations, scrap metal and auto junkyard dealers, and laundry and dry-cleaning establishments. Contamination incidents are most frequently associated with management and disposal procedures and storage facility failures. Ground water becomes exposed to chemicals through improper disposal in septic systems and illegal dumping or abandonment of wastes.

The Department of Ecology (DOE) maintains the Leaking Underground Storage Tank (LUST) list which includes those sites where incident reports have been filed. Table I-3-9 summarizes the information in the DOE list. At present, there are approximately 362 reported sites in Snohomish County on the LUST list. The status given in Table I-3-9 reflects the latest status of the sites as of March 1996. A site can have more than one media affected, such as soil and ground water, and each media has its own status. Almost all of the LUST sites affect either soil and/or ground water, and most sites are in the cleanup phase.

Within 90 days of learning of a potentially contaminated site, DOE conducts an initial investigation to determine if further action is required. If further action is needed, the site will then be put on the Confirmed and Suspected Contaminated Sites (CSCS) report. There are approximately 122 sites in Snohomish County listed in the CSCS report, which includes leaking underground storage tanks and other types of contaminated sites. Table I-3-10 summarizes the CSCS information by contaminant group. Metals and petroleum products are the most common contaminants that are involved with the CSCS sites in Snohomish County.

A qualitative assessment was performed to evaluate the vulnerability of ground water to contamination from commercial and industrial facilities. The analysis consisted of mapping commercial and industrial lands that overlay medium- and high-water table vulnerability areas. Based on a total of 110 mi^2 that are zoned for commercial and industrial use in the GWMA, 19 mi^2 (17%) are located over high vulnerability areas; 22 mi^2 (20%) are located over medium vulnerability areas; and 69 mi^2 (63%) are located over low vulnerability areas. A majority of the commercial and industrial areas are located in the southwestern part of the GWMA (Intercity Plateau) where a low vulnerability has been assigned due to the presence of till and impervious surfaces. The most vulnerable areas to commercial and industrial activities are located near communities that are situated in lowland areas where the water table is typically high and the shallow aquifer is unconfined. These areas occur from Everett to Arlington and in other urban areas within the GWMA.

Future planning within the GWMA is favorable, as nearly all commercial and industrial land use areas will be served by sanitary sewers. Development of commercial and industrial lands without a sanitary sewer could create additional risk of local ground water contamination due to the misuse of on-site wastewater disposal systems.

Improper household use or disposal of paints, wood finishers, cleaners, and other home chemical products also represents a potential source of ground water contamination.

5.6 Right-of-Way Maintenance and Transportation of Hazardous Materials

One of the potential hazards associated with right-of-way maintenance and the transportation of hazardous materials are spills. Spills can threaten ground water quality when hazardous materials directly infiltrate to ground water or when hazardous materials contaminate the soil and are transported to ground water by ground water recharge. The Transportation Safety Act of 1974 governs the transportation of hazardous materials. Materials such as explosives, flammable solids and liquids, radioactive substances, poisons, and corrosives fall into the category of regulated hazardous materials.

Public right-of-ways are maintained by entities such as electric companies, the Department of Natural Resources, railroads, natural gas companies, petroleum pipeline companies, and the Public Utilities Department. Roadside maintenance is conducted at the state, county, and city levels by agencies such as the Department of Transportation, Snohomish County Public Works, and the Department of Public Works of individual cities. Historically, roadside and right-of-way maintenance programs throughout Washington State have implemented a combination of chemical and physical methods. Chemical methods typically involve the application of herbicides to control weeds.

The Geohydrology Memorandum (Golder, 1996) presents a map showing the locations of major right-of-ways and pipelines that could be associated with spills. Areas of high- and medium-water table vulnerability to contamination are also shown.

5.7 Sand and Gravel Mining

Sand and gravel mining requires a number of activities, including excavating, screening, and washing. Ancillary activities include asphalt or concrete making, and vehicle maintenance and fueling. One or more of these activities could locally impact the ground water quantity and quality.

Gravel mining above the water table with no other associated activities is of low risk to ground water (Mead, 1995). Removal of the soil above the aquifer can create a sensitive area where contaminant infiltration can potentially impact the ground water. However, the potential for contaminant introduction is low when there are no other operations which bring contaminants to the area. In areas where mining occurs above the water table, the related environmental problems are very similar to those that potentially occur when stormwater is infiltrated over environmentally sensitive areas (Mead, 1995).

Petroleum leaks and spills are the most common incidents that occur at gravel mining sites that can have a potential impact on ground water depending on the frequency, quantity, and location of the discharge. Any chemical contaminants that are allowed to enter the excavation pit area have increased access to the aquifer, therefore, runoff and leaks from equipment used in the pit for excavation can be potential sources of contamination.

Reclamation of sand and gravel pits involves refilling the mined pit area with fill materials; while the source of such fill materials is usually from on-site, occasionally materials imported from off-site sources may be used in reclamation. Should these imported fill materials be contaminated, the potential for ground water contamination may increase.

Historically, the end use of reclaimed or abandoned sand and gravel pits has been a major problem concerning ground water contamination. Some of these pits have been subject to uncontrolled dumping of solid and hazardous wastes.

Sand and gravel mining which penetrates an aquifer results in additional risks to ground water by increasing turbidity and iron concentrations, and by causing local water level changes (Mead, 1995). The breaching of hydrogeological barriers between aquifers is another potential risk that is associated with mining within an aquifer. The removal of a low-permeability barrier between two aquifers can result in water quality and water level changes in both aquifers.

The locations of sand and gravel mining claims and operations within the GWMA and their relation to medium- and high-water table vulnerability areas are presented in the Geohydrology Memorandum (Golder, 1996). A total of 9,007 acres are presently designated as mineral resource lands in the GWMA and are mostly used for the mining of sand, gravel, and rock: 4,699 acres (52%) overlie areas mapped by the Phase One Study as high vulnerability to contamination; 3,211 acres (36%) overlie areas mapped as medium vulnerability; and 1,097 acres (12%) overlie areas mapped as low vulnerability.

6. PROBLEM DEFINITION

This section summarizes the potential impacts to ground water based on the information provided in Sections 2.4 and 2.5 of this report. The lists presented here were used by the GWAC in defining existing and potential ground water problems and in developing ground water management recommendations.

The potential impacts have been separated into two groups based on the scale of the problems that could arise. Regional impacts have the potential to affect several square miles or more of the ground water system and local impacts are considered to most likely affect only the site where the impact originated and nearby properties. Regional and local impacts are summarized alphabetically in this section. The order of each list does not in any way indicate severity. An arbitrary code, R.1, R.2, . . . R.9 for regional impacts, L.1, L.2, . . . L.10 for local impacts, has been assigned to each impact to facilitate future references to the list and prevent ambiguity.

6.1 Regional Impacts

R.1 Consumptive Use Consumptive use of ground water can have an impact on stream baseflow. Areas with a high rate of ground water consumptive use relative to the ground water recharge rate will normally reduce stream flow more than areas with a lower consumptive use rate.

R.2 Hydrologic Monitoring The absence of monitoring data for the GWMA is considered an impact to the ability to manage ground water resources. These data would normally include: streamflow measurements, water level measurements in wells, climatic data, and water quality data. They would be collected on a long-term basis and reported periodically. The benefits of these data include: the ability to identify and, therefore, respond to changes in water quality and quantity; the ability to evaluate the success of management efforts intended to preserve and utilize the ground water resources; and the ability to provide technical support for management recommendations.

R.3 Impervious Surfaces Roads, parking lots, and buildings form impervious surfaces which can physically block recharge to ground water. If the direct runoff from impervious surfaces is not discharged to stormwater infiltration facilities, the ground water recharge rate is reduced. The reduced ground water recharge rate can impact stream baseflow in the same manner as the consumptive use of ground water.

R.4 Nitrogen Loading from Agricultural Lands Fertilizer and manure spraying distribute nitrogen over agricultural lands. Precipitation and irrigation onto these lands results in direct runoff and ground water infiltration, both of which may be contaminated by nitrogen. Nitrogen is an important nutrient of concern because it contributes to eutrophication of surface water and excess nitrogen in ground water in the form of nitrate can be a health hazard to infants.

R.5 Nitrogen Loading from Domestic Fertilizers Nitrogen is an ingredient of fertilizers applied for domestic landscaping purposes. Precipitation and irrigation can result in direct runoff and ground water recharge that is contaminated by nitrogen in fertilizers.

R.6 Nitrogen Loading from Sanitary Wastewater Discharges On-site wastewater systems intentionally discharge to ground water. Treatment of sewage occurs in the septic tank and by biodegradation in the septic drainfield. Nitrogen is not significantly treated by these processes and, consequently, a nitrogen loading to ground water occurs.

R.7 Pesticide Loading Applications of pesticides occur in agriculture, residential and commercial landscaping, and the maintenance of right-of-ways. Precipitation and irrigation can transport pesticides resulting in contamination of direct runoff and ground water infiltration.

R.8 Public Education People without education or knowledge regarding ground water systems, the interaction between ground- and surface-waters, and the ability for contaminants to enter natural water systems are a potential impact to ground water resources. Without this knowledge, individuals are less likely to change behavioral patterns at home and at work in a way that preserves and best utilizes ground water resources.

R.9 Stormwater Infiltration Direct runoff resulting from precipitation can be managed by discharge to stormwater infiltration facilities. The stormwater infiltration facilities enable the direct runoff to discharge to the subsurface. In most urban areas, the direct runoff contains contaminants such as nutrients, metals, and organic compounds. The infiltration of these constituents can impact ground water quality.

6.2 Local Impacts

L.1 Improperly Constructed Water Wells Wells are normally installed by drilling methods and can penetrate several hundred feet into the subsurface. At the time of construction, it is necessary to install a well seal that prevents shallow ground water and surface water from flowing down to the aquifer in the disturbed zone outside the well casing. When this seal is absent or somehow deteriorated, the well can become a conduit for contaminants to travel to an aquifer that is otherwise protected by natural aquitard layers. Within the GWMA, it is most likely that impacts of this nature would result where an improperly constructed well is contaminated by a nearby septic drainfield. The contamination would generally be localized to the well and would impact those using the well water.

L.2 Leaching of Mine Wastes and Fill Materials The most common form of mining in the GWMA consists of sand, gravel, and rock extraction. Sand and gravel pits may be backfilled with foreign materials after the mining phase is completed. The fill materials may be brought into the site from off-site sources and could be contaminated. After emplacement, leaching of the backfill materials may occur resulting in ground water contamination. A contaminant plume could form in the vicinity of the backfill area and ground water resources could be contaminated.

L.3 Mining and Excavation through an Aquitard During sand, gravel and rock extraction or the excavation for utilities and buildings, it is possible to remove a geologic layer that provides a barrier to an aquifer (aquitard). If the aquitard is removed, the aquifer becomes exposed and the vulnerability increases substantially. The aquifer water levels may be permanently lowered and in extreme cases, the aquifer could be rendered unusable. The impacts would generally be localized but could approach regional scale depending on geologic conditions.

L.4 Spills at Commercial and Industrial Facilities A wide variety of chemicals are used for product development and occur in wastes generated at commercial and industrial facilities. Metals, organic solvents, and petroleum hydrocarbons are the most commonly occurring contaminants in soil and ground water. Spills, leaking storage facilities, and improper disposal of these materials present a local threat and, potentially, a regional threat to ground water.

L.5 Spills at Mining and Excavation Sites Mining and other excavations normally remove at least top soil and, in some cases, penetrate ground water. Chemical spills in these areas may be released in proximity to the water table, resulting in ground water contamination.

L.6 Stormwater Infiltration Facilities Stormwater infiltration facilities located along major roads and within commercial and industrial properties could enable spilled chemicals to migrate rapidly to ground water. Dry wells, which normally consist of a perforated concrete cylinder, enable spills to pass to the subsurface more rapidly than other types of infiltration facilities.

L.7 Transportation Spills from Pipelines Petroleum fuels transported via pipeline can be released to the soil in the event of a pipeline leak or rupture (natural gas is not considered a potential impact to ground water). The GWMA is presently serviced with modern spill response capabilities at the local and state levels, however, pipeline leaks could go undetected and result in substantial releases prior to spill response. Significant contamination of soil and ground water could occur in the event of a major release.

L.8 Transportation Spills on Railroads A variety of chemicals are transported by rail and, consequently, accidents involving trains can result in chemical spills. The GWMA is presently serviced with modern spill response capabilities at the local and state levels. However, given the size of chemical tanks transported by rail and the potential problems accessing a spill site, it is possible significant contamination of soil and ground water could occur.

L.9 Transportation Spills on Roads Gasoline, oil and chemicals are transported routinely by trucks. Larger trucks also carry a significant quantity of fuel in tanks that are normally attached to the sides where they can be easily punctured. Accidents involving trucks of any kind can, therefore, result in releases of chemicals to the ground surface. Many spills can be adequately contained prior to contamination of ground water. However, it is possible that spills could occur in proximity to water supply wells without notification of the purveyor.

L.10 Underground Storage Tanks Underground storage tanks are normally used for the storage of gasoline. Underground tanks may cause local ground water contamination problems where they leak to soil. In the case of petroleum fuels, contaminant plumes do not develop over large areas because of natural attenuation (adsorption, volatilization, and biodegradation). Underground storage tanks are also used to store other chemicals that are typically associated with industrial and commercial facilities. Leaks from underground tanks are becoming less common due to new regulations that include design standards which are intended to prevent leaks to the soil. Many chemicals are more mobile and less degradable than petroleum products such that a leak could result in a large contaminant plume in ground water.

6.3 Impacts Summary and Rank

One of the goals of the Ground Water Management Plan is to provide a prioritization of potential impacts which could be used as a guide in the selection of management recommendations. The GWAC realized that any prioritization of impacts is in part subjective, based on opinion and not necessarily supported by hard facts. For this reason, it was decided that the impacts be ranked initially by the consultant using professional judgment as needed. This ranking was used by the GWAC in developing management recommendations, though the rankings do not necessarily reflect the opinions of all GWAC members, and were not used to prioritize management strategies.

Because there is uncertainty in the severity of one potential impact versus another, the ranking scheme selected uses three levels, numbered 1, 2, and 3. Level 1 corresponds to the potential impact that may pose the greatest risk. Level 3 corresponds to a lesser risk.

6.3.1.1 Regional Impacts Classification	Rank
R.1 Consumptive Use	1[1]
R.2 Hydrologic Monitoring	2
R.3 Impervious Surfaces	3
R.4 Nitrogen Loading from Agricultural Lands	1[1]
R.5 Nitrogen Loading from Domestic Fertilizers	3
R.6 Nitrogen Loading from Sanitary Wastewater Discharges	1[1]
R.7 Pesticide Loading	3
R.8 Public Education	2
R.9 Stormwater Infiltration	3

[1] Rank is based on analyses in Section 4 and 5 and applies to those areas identified with the largest potential impact. These areas include those with a consumptive use/recharge ratio exceeding 5% and areas where the nitrate concentration exceeds 2.5 mg/l as N.

6.3.1.2 Local Impacts Classification	Rank
L.1 Leaching of Mine Wastes and Fill Materials	3
L.2 Improperly Constructed Water Wells	3
L.3 Mining and Excavation through an Aquitard	2
L.4 Spills at Commercial and Industrial Facilities	1[1]
L.5 Spills at Mining and Excavation Sites	3
L.6 Stormwater Infiltration Facilities	2
L.7 Transportation Spills from Pipelines	2[2]
L.8 Transportation Spills on Railroads	2[2]
L.9 Transportation Spills on Roads	1[3]
L.10 Underground Storage Tanks	3

[1] Rank is based on those facilities handling chlorinated organic solvents and which are located in medium and high aquifer vulnerability areas, and within designated wellhead protection areas of water supply wells.

[2] Intermediate rank is assigned because of an assumed low probability for the spill event to occur, however, should a spill occur, impacts could be substantial, particularly if the spill occurs in a wellhead protection area for a public water system.

[3] This rank pertains to the lack of notification to nearby water supplies when a spill occurs. The ability to respond to spills on roadways in the GWMA presently meets modern standards.

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TABLES

TABLE I-3-1

FUTURE LAND USE DESIGNATIONS AND AREAS

Land Use Code	Land Use Description	Area (mi^2)
AL	Local Agriculture	5.8
AR	Riverway Agriculture	89.0
AU	Upland Agriculture	1.1
LR	Low Density Rural 20	35.7
10	Medium Density Rural 10	4.5
R5	Medium Density Rural 5	128.5
R2	Medium Density Rural 2.3	174.2
HR	High Density Rural	21.9
UL	Urban Low Density Residential	49.4
UM	Urban Medium Density Residential	13.2
UH	Urban High Density Residential	2.7
C	Rural Commercial	0.6
UC	Urban Commercial	2.4
CI	City	40.6
G	Government	22.9
I	Rural Industrial	0.6
UI	Urban Industrial	7.7
ME	Maltby Employment Area	1.2
TR	Tribal Land	15.8
OO	Other (assumed Tribal Land)	0.7
MX	Mixed Use	57.6
FC	Commercial Forest	159.1
FR	Forest Reserve	1.8
OT	Other (assumed mixed designation)	7.8
W	Lakes, Rivers, and Streams	3.0
	TOTAL	847.9

Note: Mineral Resource lands were not included in this table because under the Snohomish County Comprehensive Plan such land uses are an "overlay" to one or more of the primary land uses listed above.

TABLE I-3-2

WATER BUDGET OF THE SNOHOMISH COUNTY GWMA

Water Budget Component	Water Budget Quantity		
	Inches/year	Acre-feet/year	Percent of Precipitation
Precipitation	46	2,090,000	100
Fate of Precipitation			
Runoff	4	180,000	9
Evapotranspiration	18	820,000	39
Groundwater Recharge	24	1,090,000	52
Total	46	2,090,000	100
Fate of Groundwater Recharge			**Percent of Groundwater Recharge**
Discharge to Streams	21	950,000	88
Other Natural Discharge	2.6	120,000	10
Withdrawals from Wells	0.4	19,630	2
Group A Systems		9,670	
Group B Systems		660	
Private Domestic		4,880	
Irrigation		1,870	
Livestock		2,480	
Mining		70	
Total	24	1,090,000	100

Source: Thomas, et al. (in press).

TABLE I-3-3

PHASE ONE STUDY WATER QUALITY SAMPLING

Type of Analysis	Number of Wells Sampled	Number of Springs Sampled
Field Measurements: (temperature, pH, dissolved oxygen, specific conductance, fecal-coliform bacteria)	297	13
Field alkalinity	91	0
Major ions, silica, laboratory alkalinity	297	13
Nutrients	297	13
Iron, manganese, arsenic	297	13
Trace elements	68	13
Septage-related compounds	95	13
Organic compounds:		
Volatile organic compounds	9	0
Chlorophenoxy-acid herbicides	12	1
Triazine herbicides	1	0
Organophosphorus insecticides	4	1
Organochlorine insecticides	1	0

TABLE I-3-4

MAJOR PUBLIC WATER SYSTEMS WITHIN THE GWMA

Water System	Water Source	Groundwater Source Percentage
Alderwood Water District	Surface Water	0%
Arlington Service Area	Groundwater	100%
Brier Service Area	Surface Water	0%
Cross Valley Water District	Groundwater and Surface Water	89%
Edmonds Service Area	Surface Water	0%
Everett Service Area	Surface Water	0%
Gold Bar Planning Area	Groundwater	100%
Granite Falls Service Area	Groundwater	100%
Highland Water Association	Surface Water	0%
Lynnwood Service Area	Surface Water	0%
Marysville Service Area	Groundwater and Surface Water	17%
Monroe Service Area	Surface Water	0%
Mountlake Terrace Service Area	Surface Water	0%
Mukilteo Water District	Surface Water	0%
Olympic View Water District	Surface Water	0%
Roosevelt Water Association	Surface Water	0%
Silver Lake Water District	Surface Water	0%
Snohomish Service Area	Surface Water	0%
Snohomish Co. PUD - Lake Roesiger	Surface Water	0%
Snohomish Co. PUD - Lake Stevens	Surface Water	0%
Snohomish Co. PUD - May Creek	Groundwater	100%
Stanwood Planning Area	Groundwater	100%
Startup Water District	Groundwater	100%
Sultan Planning Area	Surface Water	0%
Tulalip Tribes	Groundwater	100%

TABLE I-3-5

GROUND WATER CONSUMPTIVE USE BY LAND USE

Land Use Code	Land Use Description	Area (mi2)	Consumptive Use (acre-ft/yr)
CI	City	40.6	5,723.4
R2	Medium Density Rural 2.3	174.2	2,450.5
UL	Urban Low Density Residential	49.4	1,345.8
AR	Riverway Agriculture	89.0	972.7
R5	Medium Density Rural 5	128.5	838.8
TR	Tribal Land	15.8	756.1
AL	Local Agriculture	5.8	609.3
OT	Other (assumed mixed designation)	7.8	586.1
HR	High Density Rural	21.9	515.4
UI	Urban Industrial	7.7	204.6
UC	Urban Commercial	2.4	155.5
AU	Upland Agriculture	1.1	127.7
UM	Urban Medium Density Residential	13.2	126.7
I	Rural Industrial	0.6	92.4
MX	Mixed Use	57.6	80.1
ME	Maltby Employment Area	1.2	79.5
C	Rural Commercial	0.6	58.3
LR	Low Density Rural 20	35.7	51.1
OO	Other (assumed Tribal Land)	0.7	33.7
10	Medium Density Rural 10	4.5	20.6
UH	Urban High Density Residential	2.7	1.9
G	Government	22.9	0.0
FC	Commercial Forest	159.1	0.0
FR	Forest Reserve	1.8	0.0
W	Lakes, Rivers, and Streams	3.0	0.0
	TOTAL	847.9	14,830.2

Mineral Resource lands were not included in this table because under the Snohomish County Comprehensive Plan such land uses are an "overlay" to one or more of the primary land uses listed above.

TABLE I-3-6

GROUND WATER RECHARGE AND CONSUMPTIVE USE BY SUB-BASIN

Sub-Basin	Area (mi2)	Recharge (acre-ft/yr)	Consumptive Use (acre-ft/yr)	Consumptive Use Ratio*
DOUGLAS CREEK	2.5	1,934.0	498.8	25.8%
PORTAGE CREEK	18.1	17,274.7	2,098.8	12.1%
QUILCEDA CREEK	40.2	37,533.1	3,057.6	8.1%
ARLINGTON AREA	6.8	9,202.6	643.9	7.0%
CHURCH CREEK	11.4	9,329.0	621.1	6.7%
BURN HILL RIDGE DRAINAGES	3.2	3,213.3	195.6	6.1%
ALLEN CREEK	10.5	9,626.5	547.4	5.7%
MISSION CREEK	11.6	8,660.1	367.8	4.2%
WARM BEACH	4.1	2,430.1	83.9	3.5%
TULALIP CREEK	6.6	5,437.7	177.2	3.3%
STILLAGUAMISH FLOODPLAIN	19.5	19,392.7	588.3	3.0%
LAKE GOODWIN	6.6	3,690.8	106.4	2.9%
SKAGIT FLATS SOUTH	8.4	7,089.1	198.7	2.8%
SNOHOMISH ESTUARY	13.9	14,102.4	387.2	2.7%
LAKE AGNES	2.8	2,194.6	54.2	2.5%
STILLAGUAMISH CANYON DRAINAGES	11.9	17,857.5	370.1	2.1%
MARTHA CREEK	2.8	2,038.3	36.5	1.8%
BURN HILL ROAD DRAINAGES	6.6	8,380.2	147.5	1.8%
LOWER PILCHUCK RIVER	48.8	48,561.4	699.6	1.4%
KACKMAN ROAD DRAINAGES	3.5	3,739.6	50.9	1.4%
BEAR CREEK	7.9	7,570.7	101.5	1.3%
LITTLE BEAR CREEK	13.1	12,902.2	170.4	1.3%
HAT SLOUGH SOUTH	5.2	3,835.1	47.8	1.2%
MARSHLAND DRAINAGE DISTRICT	23.5	22,760.4	280.6	1.2%
JACKSON GULCH	2.1	1,865.5	22.9	1.2%
CATHCART DRAINAGES	24.3	26,160.7	280.6	1.1%
ROWLANDS CREEK	2.7	1,660.0	17.7	1.1%
GREEN WOOD CREEK	1.6	1,192.4	12.5	1.0%
TRIBUTARY 30	3.5	2,644.4	27.2	1.0%
HAT ISLAND	0.7	295.6	2.8	1.0%
PRESTIENS BLUFF DRAINAGES	1.6	1,346.6	12.5	0.9%
FOBES HILL AREA	11.1	10,859.6	99.0	0.9%
GRANVIEW AREA	11.2	13,937.6	114.6	0.8%
WALLACE RIVER	19.7	41,813.7	333.5	0.8%
ARNOT ROAD DRAINAGES	3.3	5,839.1	46.2	0.8%
SUNNYSIDE RAVINES	6.8	6,305.1	48.6	0.8%
PILCHUCK CREEK	24.5	23,752.9	163.3	0.7%
UPPER PILCHUCK RIVER	37.2	85,423.5	584.8	0.7%
JORDAN ROAD DRAINAGES	8.3	13,755.6	78.2	0.6%
SAUK RIVER	16.3	41,693.9	199.5	0.5%
SNOQUALMIE RIVER	7.2	11,969.5	55.7	0.5%
FRENCH CREEK	27.6	32,289.3	137.0	0.4%
NORTH CREEK	27.6	23,202.0	94.8	0.4%
EBEY HILL DRAINAGES	8.4	13,738.7	53.7	0.4%
JIM CREEK	11.9	19,110.0	73.5	0.4%
GRANDVIEW AREA	14.7	20,188.4	73.0	0.4%
MAINSTEM SKYKOMISH RIVER	46.8	101,082.1	307.1	0.3%
WOODS CREEK WEST	32.8	38,946.9	116.9	0.3%
FRAILEY MOUNTAIN DRAINAGES	8.6	16,312.2	46.0	0.3%
HELL-HAZEL DRAINAGES	9.2	20,227.7	42.4	0.2%
BOULDER RIDGE	10.8	22,196.8	45.9	0.2%
HIGGINS RIDGE AREA	16.5	35,615.5	61.2	0.2%

TABLE I-3-6

GROUND WATER RECHARGE AND CONSUMPTIVE USE BY SUB-BASIN

Sub-Basin	Area (mi2)	Recharge (acre-ft/yr)	Consumptive Use (acre-ft/yr)	Consumptive Use Ratio*
UPPER N FK STILLAGUAMISH RIVER	6.9	12,206.9	20.1	0.2%
WOODS CREEK EAST	26.2	34,341.4	31.4	0.1%
SQUIRE CREEK	9.2	19,798.2	15.2	0.1%
SULTAN RIVER	22.9	35,091.2	22.5	0.1%
CANYON CREEK	10.4	19,842.3	12.1	0.1%
ROBE VALLEY DRAINAGES	15.2	37,632.5	15.4	0.0%
MUKILTEO DRAINAGES	12.4	6,479.3	0.0	0.0%
BALLINGER DRAINAGE	7.8	3,587.0	0.0	0.0%
EVERETT EAST	3.5	1,786.7	0.0	0.0%
EVERETT WEST	4.3	1,825.1	0.0	0.0%
SW COASTAL DRAINAGES	20.5	11,234.8	0.0	0.0%
SWAMP CREEK	22.4	13,387.4	0.0	0.0%
TOTAL	847.9	1,109,394.3	14,799.3	

*The consumptive use ratio is computed: (consumptive use)/(annual recharge)

TABLE I-3-7

NITRATE LOADING ANALYSIS RESULTS

Sub-Basin	Potential Nitrate Concentration (mg/l as N)
SNOHOMISH ESTUARY	8.75
DOUGLAS CREEK	8.44
STILLAGUAMISH FLOODPLAIN	8.42
ALLEN CREEK	6.38
MISSION CREEK	6.16
SKAGIT FLATS SOUTH	5.61
MARSHLAND DRAINAGE DISTRICT	5.58
WARM BEACH	4.98
TULALIP CREEK	4.70
LAKE GOODWIN	4.18
SUNNYSIDE RAVINES	4.04
FOBES HILL AREA	3.94
QUILCEDA CREEK	3.75
LAKE AGNES	3.56
PORTAGE CREEK	3.45
BEAR CREEK	3.16
LOWER PILCHUCK RIVER	3.15
SNOQUALMIE RIVER	3.04
CATHCART DRAINAGES	2.82
CHURCH CREEK	2.72
LITTLE BEAR CREEK	2.71
MARTHA CREEK	2.60
PRESTIENS BLUFF DRAINAGES	2.60
SAUK RIVER	2.57
ARLINGTON AREA	2.56
UPPER PILCHUCK RIVER	2.56
FRENCH CREEK	2.52
KACKMAN ROAD DRAINAGES	2.40
NORTH CREEK	2.22
HAT SLOUGH SOUTH	1.99
JACKSON GULCH	1.96
EVERETT WEST	1.93
BURN HILL ROAD DRAINAGES	1.93
ARNOT ROAD DRAINAGES	1.88
MAINSTEM SKYKOMISH RIVER	1.87
TRIBUTARY 30	1.84
BALLINGER DRAINAGE	1.79
EBEY HILL DRAINAGES	1.78
FRAILEY MOUNTAIN DRAINAGES	1.62
EVERETT EAST	1.60
ROWLANDS CREEK	1.54
GREEN WOOD CREEK	1.53

TABLE I-3-7

NITRATE LOADING ANALYSIS RESULTS

Sub-Basin	Potential Nitrate Concentration (mg/l as N)
MUKILTEO DRAINAGES	1.53
SW COASTAL DRAINAGES	1.48
GRANVIEW AREA	1.44
SWAMP CREEK	1.41
HAT ISLAND	1.37
WALLACE RIVER	1.17
PILCHUCK CREEK	1.07
WOODS CREEK WEST	1.03
HELL-HAZEL DRAINAGES	0.95
JORDAN ROAD DRAINAGES	0.82
STILLAGUAMISH CANYON DRAINAGES	0.77
UPPER N FK STILLAGUAMISH RIVER	0.76
HIGGINS RIDGE AREA	0.62
GRANDVIEW AREA	0.58
JIM CREEK	0.55
WOODS CREEK EAST	0.48
BURN HILL RIDGE DRAINAGES	0.45
SULTAN RIVER	0.35
BOULDER RIDGE	0.31
SQUIRE CREEK	0.11
CANYON CREEK	0.09
ROBE VALLEY DRAINAGES	0.06

TABLE I-3-8

ESTIMATED LOADING FACTORS FOR NITRATE BY LAND USE

Land Use Code	Land Use Designation	Nitrate Loading by Activity			Total Loading	
		Wastewater (grams/acre/yr)	Lawn Fertilization (grams/acre/yr)	Agriculture (grams/acre/yr)	Unsewered Areas (grams/acre/yr)	Sewered Areas (grams/acre/yr)
FC	Commercial Forest	0	0	0	0	0
FR	Forest Reserve	0	0	0	0	0
G	Government	0	0	0	0	0
W	Water	0	0	0	0	0
CI	City	74,601	1,590	0	76,191	1,590
UH	Urban High Density Residential	149,202	1,590	0	150,792	1,590
UM	Urban Medium Density Residential	74,601	1,590	0	76,191	1,590
UL	Urban Low Density Residential	41,445	2,385	0	43,830	2,385
HR	High Density Rural	12,434	1,193	0	13,626	1,193
R2	Medium Density Rural 2.3	3,597	345	0	3,942	345
R5	Medium Density Rural 5	1,658	159	0	1,817	159
R10	Medium Density Rural 10	829	80	0	908	80
LR	Low Density Rural 20	414	40	0	454	40
AR	Riverway Agriculture	0	0	17,064	17,064	17,064
AU	Upland Agriculture	0	0	17,064	17,064	17,064
AL	Lowland Agriculture	0	0	17,064	17,064	17,064
I	Rural Industrial	39,749	0	0	39,749	0
UI	Urban Industrial	79,497	0	0	79,497	0
C	Rural Commercial	39,749	795	0	40,544	795
UC	Urban Commercial	79,497	795	0	80,292	795
ME	Maltby Employment Area	39,749	0	0	39,749	0
OT	Other (assume mixed designation)	41,445	1,590	0	43,035	1,590
MX	Mixed Use	41,445	1,590	0	43,035	1,590
TR	Tribal Land	12,434	1,193	0	13,626	1,193
OO	Other (assume Tribal Land)	12,434	1,193	0	13,626	1,193

Note: Does not include nitrate from residential and commercial/industrial stormwater.
All nitrate loadings are grams of nitrate as nitrogen.

TABLE I-3-9

SUMMARY OF LUST SITES WITHIN SNOHOMISH COUNTY

Status	Number of Sites	Percent of Total
Cleanup Started	189	52
Cleanup Finished	143	40
Monitoring	7	2
Awaiting Cleanup	19	5
Unknown	4	1
TOTAL	362	100

Media Affected	Number of Sites*	Percent of Total
Soil	355	98
Groundwater	102	28
Drinking Water	1	<1
Surface Water	1	<1
Undetermined	1	<1

* A site may have one or more affected media.
Source: DOE, March, 1996.

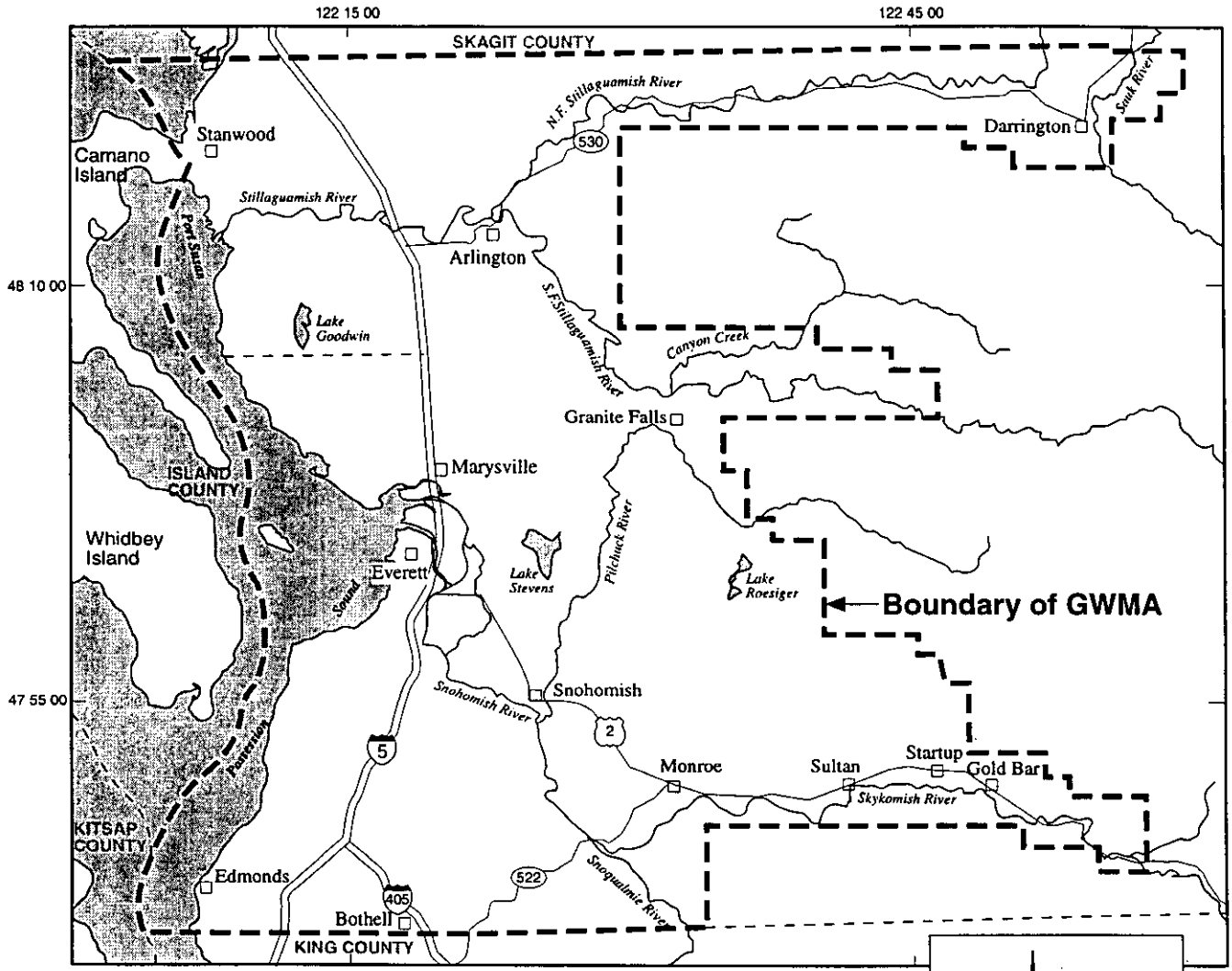
TABLE I-3-10

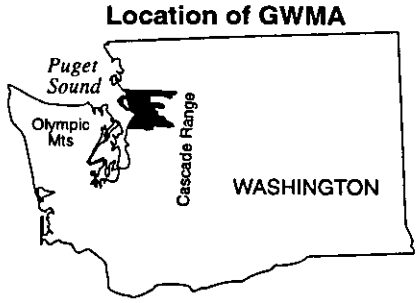
SUMMARY OF CONTAMINATED SITES IN SNOHOMISH COUNTY

Contaminant	Number of Associated Sites	Percent of Total Sites
Metals and Cyanide	102	83.6
Petroleum Products	97	79.5
Non-Halogenated Solvents	49	40.2
Halogenated Organic Compounds	39	32.0
PCBs	19	15.6
Conventional Contaminants, Organic	19	15.6
Conventional Contaminants, Inorganic (Cl, S, N)	16	13.1
Pesticides	14	11.5
PAHs	14	11.5
Phenolic Compounds	7	5.7
Corrosive Wastes	6	4.9
Base/Neutral/Acid Organics	5	4.1
Reactive Wastes	5	4.1
Dioxin	2	1.6

Notes:
122 CSCS Sites in Snohomish County; several sites are in cleanup of one or more contaminants.
Source: DOE, July, 1996.

FIGURES



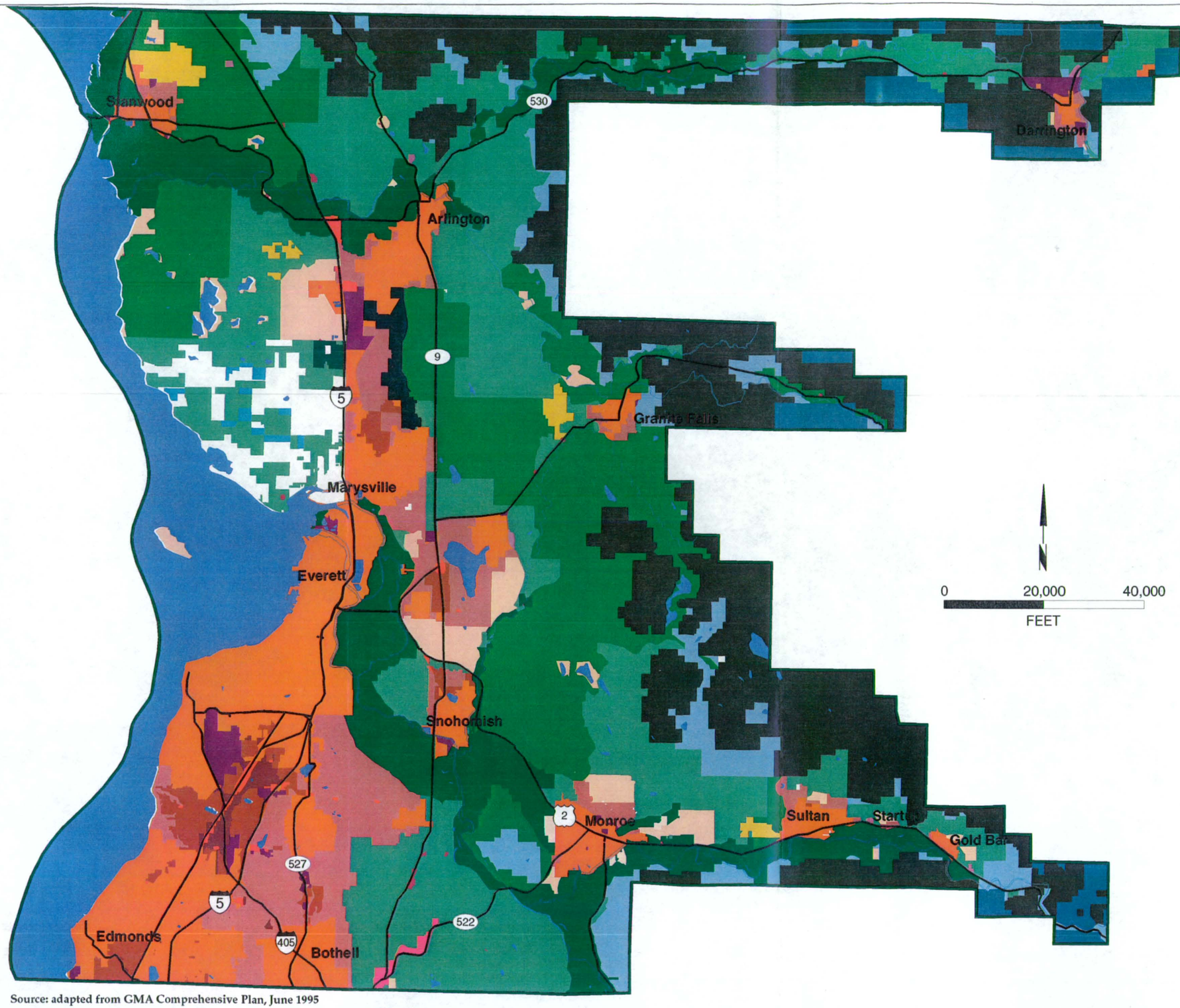


Source: Thomas, et al. (1997)

FIGURE **I-3-1**
LOCATION MAP OF THE SNOHOMISH COUNTY GWMA
SNOHOMISH/GWMP/WA

PROJECT NO. 963 1326.600 DRAWING NO. 74950 DATE 4/29/99 DRAWN BY TK

Golder Associates



Future Land Use

- Commercial Forest
- Forest Reserve
- Government
- Tribal Lands
- Urban High Density Residential - 1
- Urban High Density Residential - 2
- Urban Low Density Residential
- High Density Rural Residential
- Medium Density Rural 2.3
- Medium Density Rural 5
- Medium Density Rural 10
- Low Density Rural 20
- Riverway Agriculture
- Upland Agriculture
- Lowland Agriculture
- Rural Industrial
- Urban Industrial
- Rural Commercial
- Urban Commercial
- Maltby Employment Area
- Mixed Urban / Other land Uses
- Water

Source: adapted from GMA Comprehensive Plan, June 1995

FIGURE **I-3-2**
FUTURE LAND USE
SNOHOMISH/GWMP/WA

PROJECT NO. 963 1326.600 DRAWING NO. 74953 DATE 4/29/99 DRAWN BY TK

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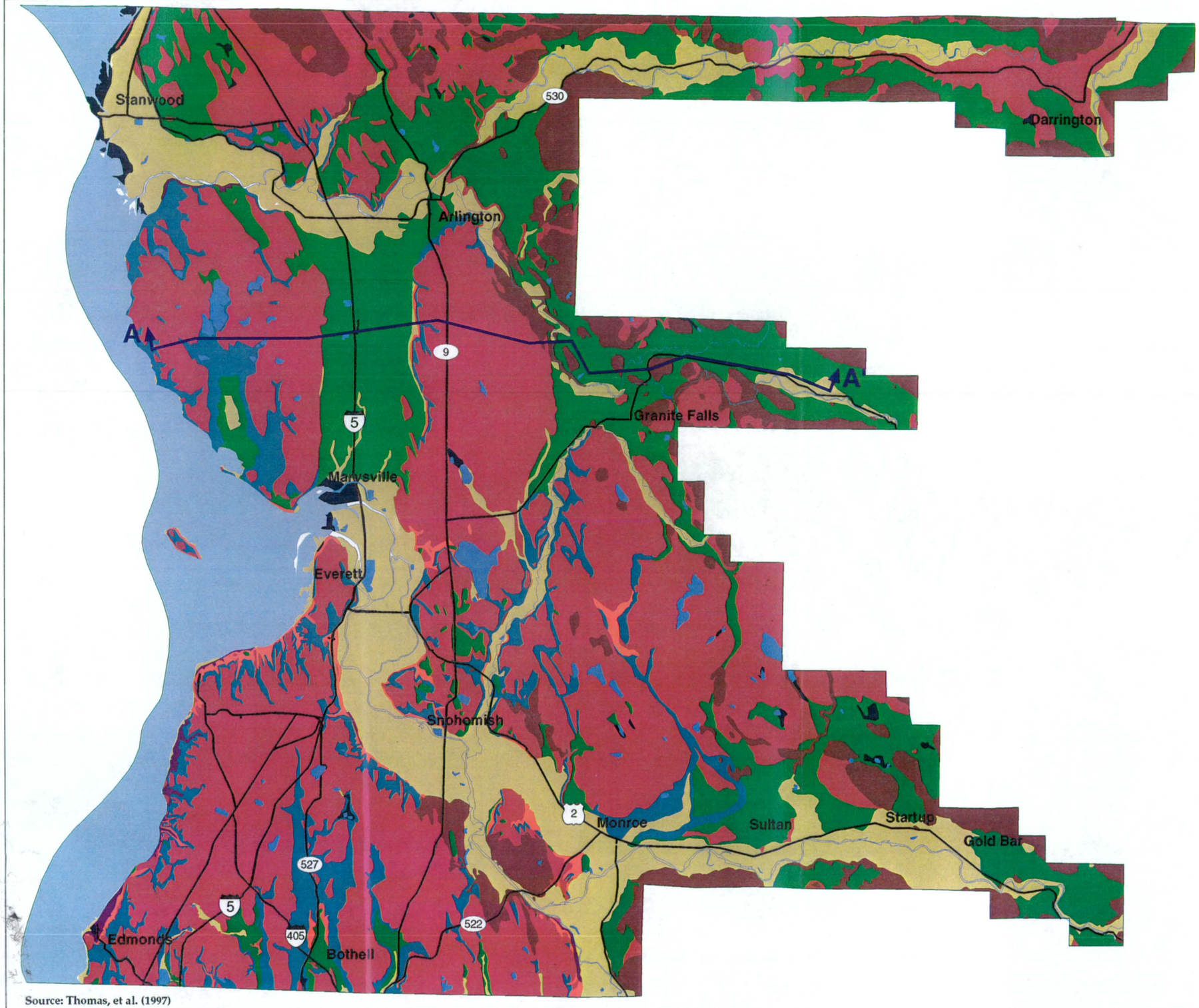

EXPLANATION

A A' Location of Geologic Cross Section

Geohydrologic Units

- Organic deposits (Qm)
- Alluvium (Qal) -- Aquifer
- Vashon recessional outwash (Qvr) -- Aquifer
- Vashon till (Qvt) -- Confining bed
- Vashon advance outwash (Qva) -- Aquifer
- Transitional beds (Qtb) -- Confining bed
- Undifferentiated sediments (Qu) -- Aquifer
- Bedrock (Tb) -- Confining bed

N

0 20,000 40,000

FEET

Source: Thomas, et al. (1997)

FIGURE **I-3-3**
SURFACE GEOLOGY
SNOHOMISH/GWMP/WA

PROJECT NO. 963 1326.600 DRAWING NO. 74954 DATE 4/29/99 DRAWN BY TK

Golder Associates

West
A

East
A'

Elevation (feet)

1,000
900
800
700
600
500
400
300
200
100
Sea Level
-100
-200
-300

Tulalip Plateau

Marysville Trough

Getchell Plateau

South Fork Stillaguamish River

Canyon Creek

Granite Falls

Qvt
Qva
Qtb
Qu
Qvr
Qal
Tb

EXPLANATION OF GEOLOGIC SYMBOLS

- Qal Alluvium
- Qvr Vashon Recessional Outwash
- Qvt Vashon Till
- Qva Vashon Advance Outwash
- Qtb Transitional Beds
- Qu Undifferentiated Sediments
- Tb Tertiary Bedrock

N

0 6,700 13,400

FEET

Approximate Vertical Exaggeration = 33.5x

Source: Thomas, et al. (1997)

FIGURE **I-3-4**
GEOLOGIC CROSS SECTION A-A'
SNOHOMISH/GWMP/WA

PROJECT NO. 963 1326.600 DRAWING NO. 76190 DATE 4/29/99 DRAWN BY EA

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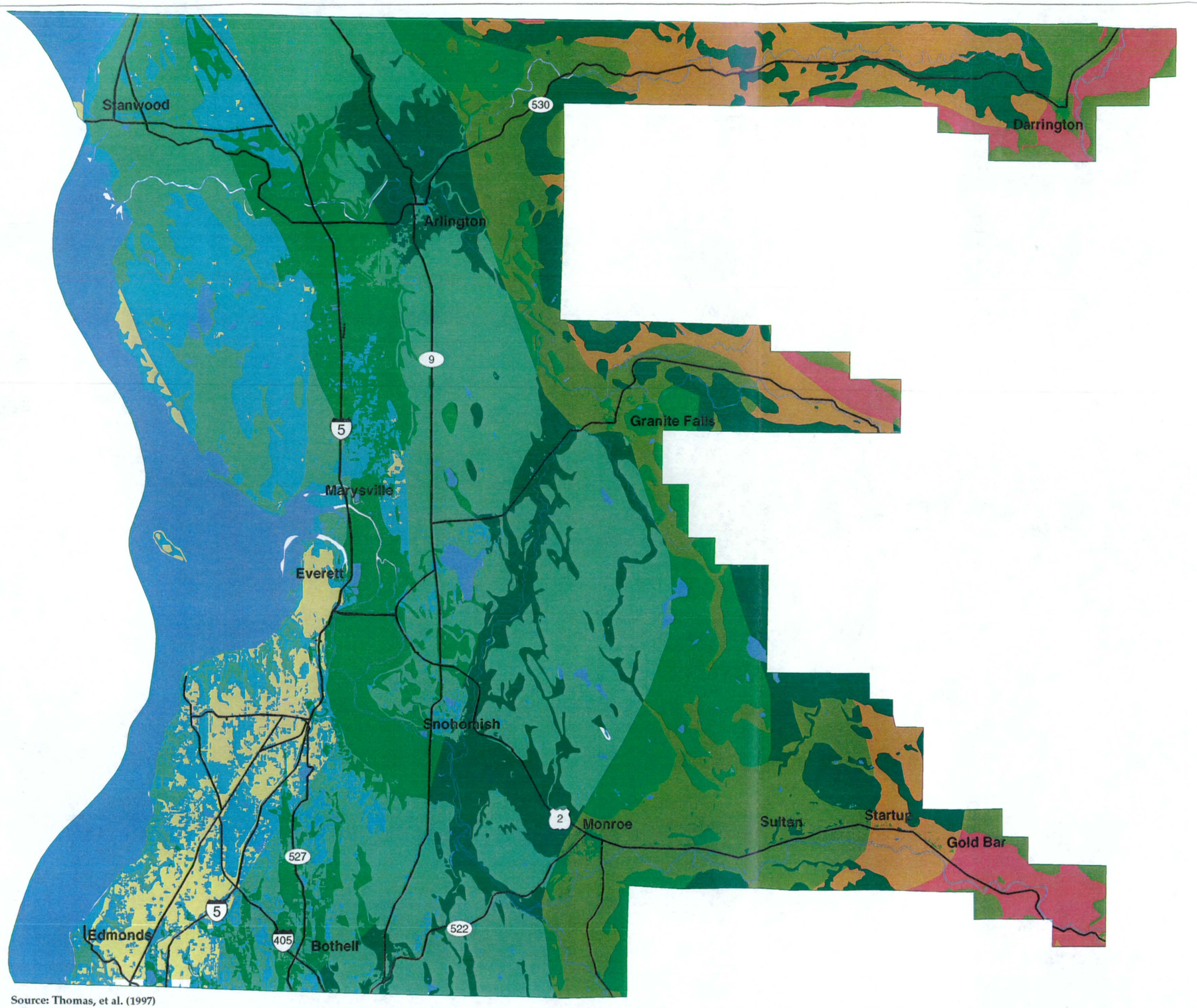

Groundwater Recharge in Inches/Year

- 0
- 1-9
- 10-14
- 15-19
- 20-24
- 25-29
- 30-39
- 40-49
- 50-75

Other Unit

- Water

N

0 20,000 40,000

FEET

Source: Thomas, et al. (1997)

FIGURE **I-3-5**
AREAL DISTRIBUTION OF GROUND WATER RECHARGE
SNOHOMISH/GWMP/WA

PROJECT NO. 963 1326.600 DRAWING NO. 74951 DATE 4/29/99 DRAWN BY TK

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SKAGIT FLATS SOUTH
CHURCH CREEK
DOUGLAS CREEK
Stanwood
PILCHUCK CREEK
PRESTIENS BLUFF DRAINAGES
JACKSON GULCH
STILLAGUAMISH FLOODPLAIN
TRIBUTARY 30
HAT SLOUGH SOUTH
MARTHA CREEK
GREEN WOOD CREEK
ROWLANDS CREEK
LAKE GOODWIN
LAKE AGNES
WARM BEACH
MISSION CREEK
TULALIP CREEK
HAT ISLAND
Marysville
Everett
EVERETT EAST
EVERETT WEST
SUNNYSIDE RAVINES
SNOHOMISH ESTUARY
MUKILTEO DRAINAGES
SW COASTAL DRAINAGES
NORTH CREEK
SWAMP CREEK
Edmonds
ALLINGER DRAINAGE
LITTLE BEAR CREEK
Bothell
BEAR CREEK
GRANDVIEW AREA
GRANVIEW AREA
ARNOLD ROAD DRAINAGES
KACKMAN ROAD DRAINAGES
ARLINGTON AREA
Arlington
PORTAGE CREEK
QUILCEDA CREEK
ALLEN CREEK
LOWER PILCHUCK RIVER
FOBES HILL AREA
Snohomish
MARSHLAND DRAINAGE DISTRICT
CATHCART DRAINAGES
FRENCH CREEK
Monroe
530
9
5
2
527
522
405
EBEY HILL DRAINAGES
BURN HILL RIDGE DRAINAGES
JIM CREEK
BURN HILL ROAD DRAINAGES
JORDAN ROAD DRAINAGES
UPPER PILCHUCK RIVER
WOODS CREEK WEST
WOODS CREEK EAST
SNOQUALMIE RIVER
FRAILEY MOUNTAIN DRAINAGES
HELL-HAZEL DRAINAGES
HIGGINS RIDGE AREA
BOULDER RIDGE
UPPER N FK STILLAGUAMISH RIVER
SQUIRE CREEK
SAUK RIVER
Darrington
CANYON CREEK
STILLAGUAMISH CANYON DRAINAGES
ROBE VALLEY DRAINAGES
Granite Falls
SULTAN RIVER
WALLACE RIVER
Sultan
Startup
Gold Bar
MAINSTEM SKYKOMISH RIVER

Source: Snohomish County GIS

EXPLANATION

Water

Sub-Basin Boundary

N

0 20,000 40,000

FEET

FIGURE **I-3-6**
SUB-BASIN BOUNDARIES
SNOHOMISH/GWMP/WA

PROJECT NO. 963 1326.600 DRAWING NO. 74955 DATE 4/9/98 DRAWN BY TK

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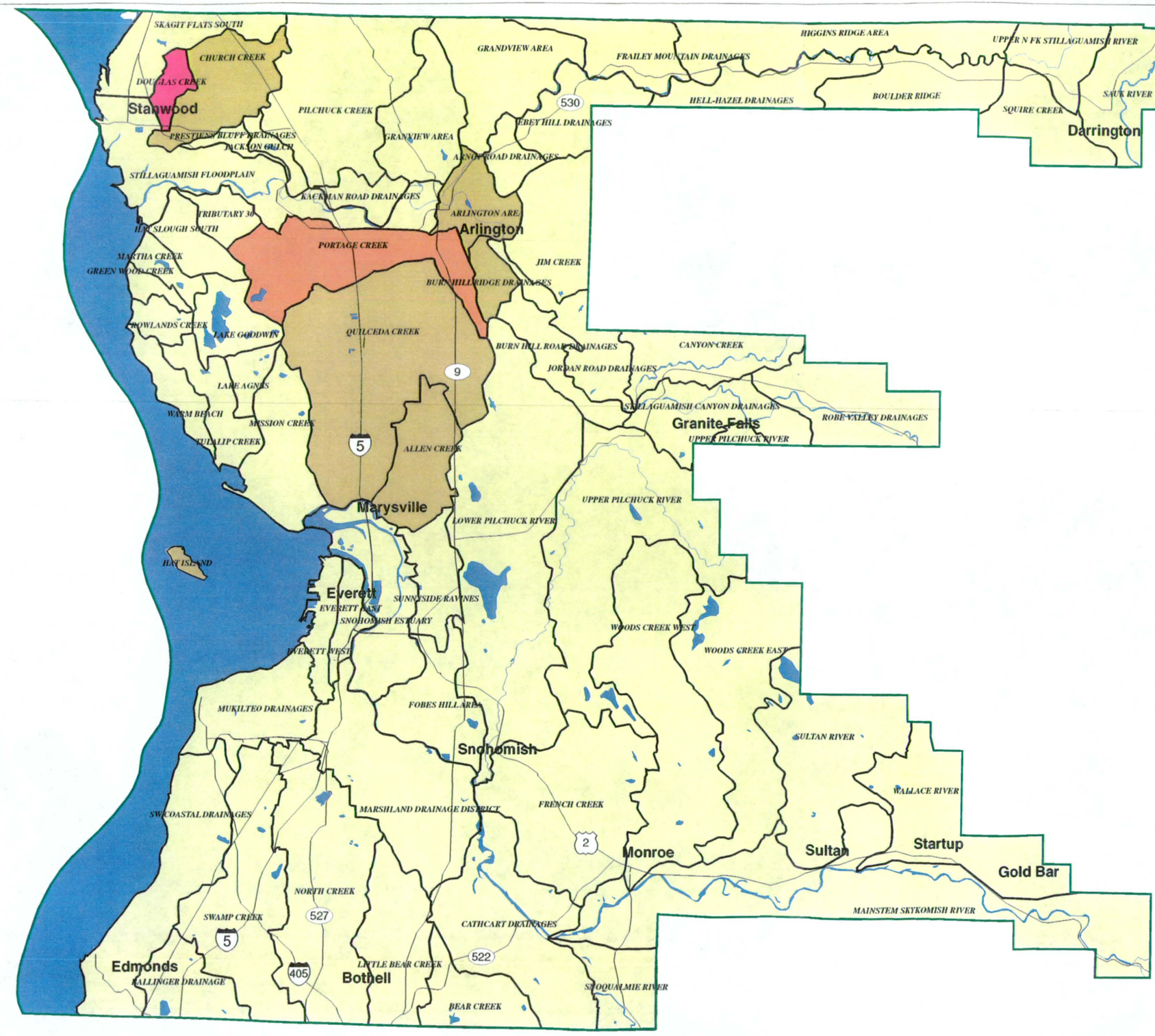

EXPLANATION

Consumptive Use as a Percentage of Groundwater Recharge

- 0-5%
- 5-10%
- 10-15%
- 15-20%
- 20-25%
- 25-30%

Other

- Water
- Sub-Basin Boundary

N

0 20,000 40,000

FEET

FIGURE **I-3-7**

CONSUMPTIVE USE AS A PERCENTAGE OF GROUNDWATER RECHARGE

SNOHOMISH/GWMP/WA

PROJECT NO. 963 1326.600 DRAWING NO. 74956 DATE 4/9/98 DRAWN BY TK

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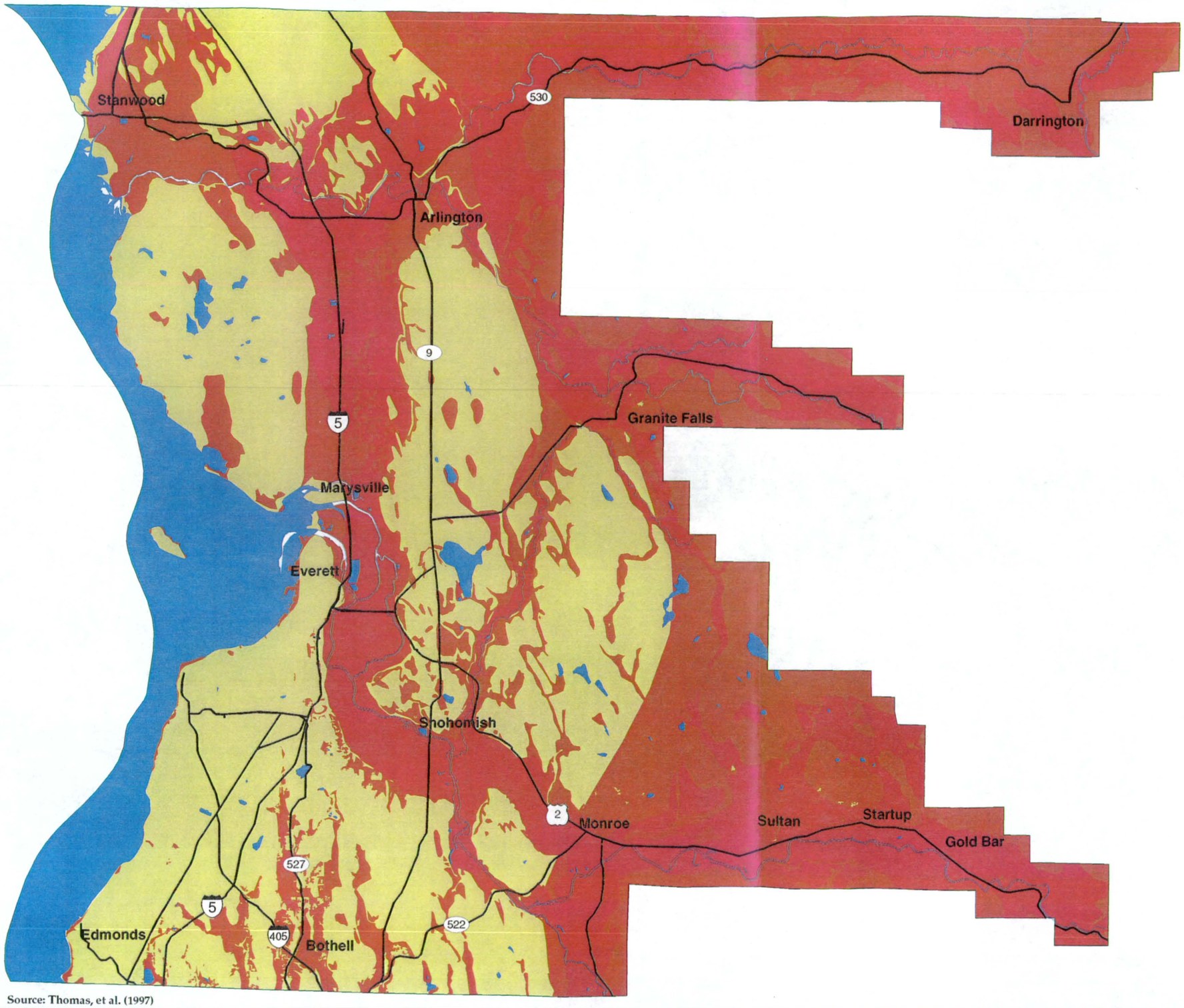

EXPLANATION

Aquifer Vulnerability

- Low
- Medium
- High

Other Unit

- Water

N

0 20,000 40,000

FEET

Source: Thomas, et al. (1997)

FIGURE **I-3-8**

WATER TABLE VULNERABILITY MAP

SNOHOMISH/GWMP/WA

PROJECT NO. 963 1326.600 DRAWING NO. 74952 DATE 4/29/99 DRAWN BY TK

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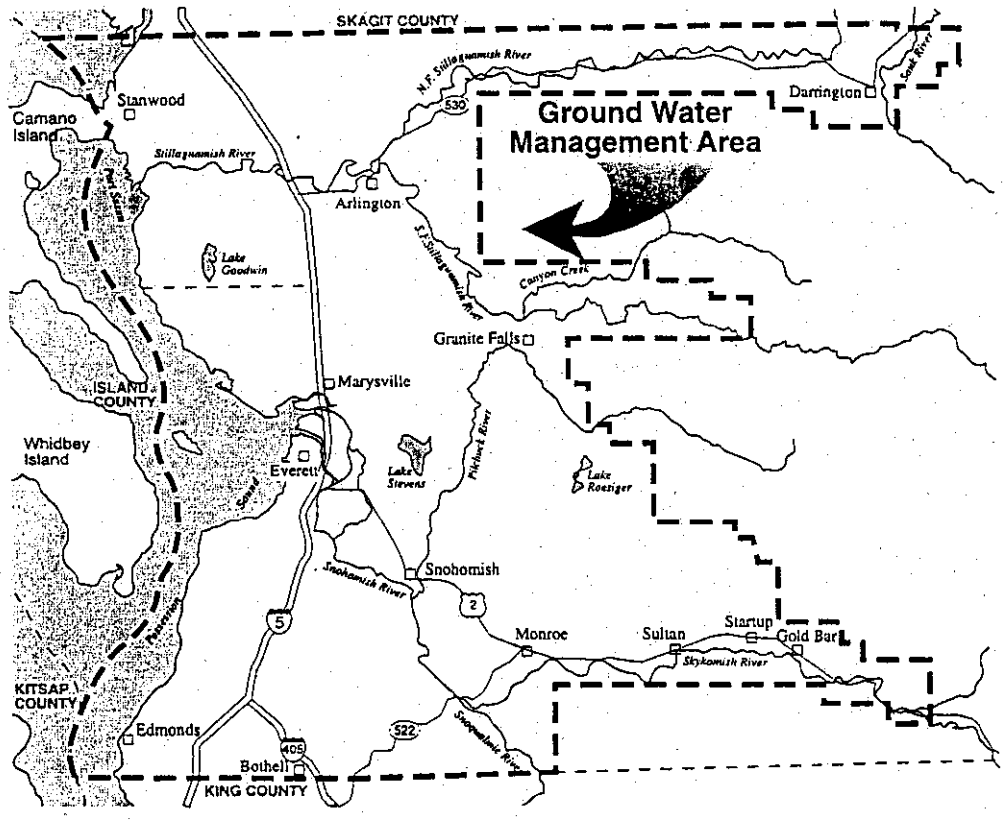
Snohomish County Ground Water Management Plan

Section II: Management Alternatives

Prepared under the Direction of the Snohomish County Ground Water Advisory Committee



GROUNDWATER
YOUR TREASURE DOWN UNDER

Snohomish County

Golder Associates

May 1999

Funding provided by the
Washington State
Department of Ecology
Centennial Clean Water Fund

WASHINGTON STATE DEPARTMENT OF ECOLOGY

SECTION II

MANAGEMENT ALTERNATIVES

1. INTRODUCTION

Section I provides an overview of the geo-hydrology of the Snohomish County GWMA, and identifies the key issues associated with ground water management. This section examines ground water management issues and alternatives from a programmatic standpoint and forms the basis for the actual implementation of ground water management strategies. The purpose of this section of the GWMP is to:

1. Identify existing programs that address potential ground water problems (regulatory, voluntary, and educational);

2. Identify issues, or gaps, in the existing programs; and

3. Develop alternatives to address the issues.

Management strategies were evaluated for a number of specific categories. Each category is discussed in separate sub-sections as follows:

General Alternatives
Ground Water Use and Influence on Surface Water
Stormwater Impacts
Nitrogen in Ground Water
Pesticides in Ground Water
Well Construction and Decommissioning
Surface Mining and Excavation
Illegal Dumping
Commercial and Industrial Chemicals
Transportation Spills
Underground Storage Tanks

Each sub-section is organized to present specific details for each category, including:

Goals

Goal statements are provided for each section of the document. In most cases, the goal statements were taken from discussion papers prepared by the GWAC. In cases where goal statements were not directly obtainable from discussion papers, they were provided by the consultant to indicate the overall intentions of the information and alternatives presented.

Problem Statement

Problem statements used in this document were developed based on the Phase One Study report prepared by the U.S. Geological Survey (1997) and the Geohydrology Memorandum (Golder, 1996) summarized in Section I.

Existing Programs

Existing programs were identified by the GWAC and the consultant during the process of developing management strategies. This process occurred between January and November 1997.

Issues and Alternatives

Specific issues associated with each management category were identified and discussed by the GWAC. A total of 47 issues were identified. This process resulted in specific management alternatives that, in the opinion of the GWAC and its consultant, addressed the specific issue. A total of 80 different management alternatives were developed for the 47 issues.

Preferred Alternatives

To develop a set of preferred alternatives, the GWAC conducted an evaluation and ranking of each issue and alternative. These evaluations considered the alternative's feasibility, effectiveness, cost, time and difficulty to implement, and consistency with land and water use plans. Based on those evaluations, the preferred management alternatives were selected. Section III (Preferred Alternatives Report) contains a more detailed summary of each preferred alternative. Each preferred alternative is, however, highlighted here in Section II, and given an alpha-numeric identifier (e.g., ADMIN-1).

In the process of evaluating the preferred alternatives, the wording and focus of the alternative was, in some cases, modified by the GWAC. Thus, the wording of alternatives shown in Section II may differ from that presented in Section III.

The preferred alternatives selected for implementation do not preclude the future reconsideration of remaining alternatives. The GWMP is intended to be reviewed and up-dated on a periodic basis, during which time all alternatives may be reconsidered.

2. GENERAL ALTERNATIVES

This section presents four general alternatives. These alternatives have application to the entire Ground Water Management Area (Figure I-3-1) and the ongoing implementation of the ground water management program.

2.1 Ground Water Program Administration

2.1.1 Goals

To identify an agency that will oversee the implementation of the Ground Water Management Program.

2.1.2 Problem Statement

The Ground Water Management Program of Snohomish County will begin implementation in 1998. At present, there is no agency identified that will monitor the implementation progress. In addition, there is no agency identified that will in the future identify and be aware of opportunities for implementation of alternatives from the plan that were not identified for immediate implementation.

2.1.3 Existing Programs

The Snohomish County Department of Public Works, Surface Water Management Division (SWM), has responsibilities to manage surface water discharge and to conduct projects to monitor stream flow and water quality. Some of the work completed by SWM relates to ground water resources. Snohomish County Planning and Development Services (PDS) considers ground water resources in several aspects of planning and permitting. Ground water resources are considered along with other natural resources. PDS is presently the lead administrative agency in the development of the Ground Water Management Plan.

The Washington State Department of Ecology administers the State's Ground Water Management Programs (Chapter 173-100 WAC). In this capacity, Ecology has specified the content of the program, participates in developing the program, and certifies the program. Ecology could be involved during implementation as an implementing agency but is not tasked with any follow-up role to oversee implementation.

2.1.4 Issues

2.1.4.1 Issue 1)

No agency has been identified to oversee and track implementation progress of the Ground Water Management Program.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County or another agency should identify an existing division to provide oversight and track implementation progress for the Ground Water Management Program. ADMIN-1

Alternative 3) Ecology should identify a division to provide oversight and track implementation progress for the Ground Water Management Program.

2.2 Critical Aquifer Recharge Area Designation

2.2.1 Goals

To develop a land designation for Critical Aquifer Recharge Areas (CARAs) that can be considered during future planning decisions in Snohomish County.

2.2.2 Problem Statement

Many decisions are made regarding land development or changes in land use. Public agencies involved with guiding this development must have access to information that provides an indication of natural resources vulnerability. Snohomish County presently has not delineated Critical Aquifer Recharge Areas (CARAs). Such delineations would enable the County to make better planning decisions during routine day-to-day operations. The County is also required to designate critical areas per the State of Washington Growth Management Act.

Once a CARA is designated, the County is required to conserve the resource by regulations. At present, the County does not have any regulations that specifically identify CARAs. In the future, as problems are identified or potential problems become well-defined, the County may develop new regulations or amend existing regulations to specifically address CARAs.

2.2.3 Existing Programs

Lands with a critical recharging effect on aquifers used for potable water are required to be designated and protected per Chapter 36.70A RCW Growth Management. This requirement extends across jurisdictional boundaries and requires cooperation between cities and the County.

Chapter 365-190 WAC *Minimum Guidelines to Classify . . . Critical Areas* (Guidelines) define "areas with a critical recharging effect upon aquifers used for potable water" as "areas where an aquifer that is a source of drinking water is vulnerable to contamination that would affect the potability of water." The term "aquifer recharge area" is used very generally but the Guidelines suggest that the following designated areas be included in

local designations: Sole Source Aquifers, Special Protection Areas, and Wellhead Protection Areas, which are summarized below. Ecology is presently drafting more specific guidelines for the designation of CARAs.

Sole Source Aquifers are federally designated by the U.S. Environmental Protection Agency (EPA), per the federal Safe Drinking Water Act. This designation is intended to protect aquifers representing the sole source of drinking water for an area. The designation specifically focuses on federally funded projects, preventing funding of projects that could adversely impact ground water. The Sole Source Aquifer designation does not offer protection for local development that does not utilize federal funds. Snohomish County has two designated Sole Source Aquifers: the Cross Valley Aquifer, located in the Clearview–Maltby area; and the Newberg Area Aquifer, located east and south of the Pilchuck River.

Special Protection Areas are designated per Chapter 173-200 WAC "Water Quality Standards for Ground Waters of the State of Washington." Special Protection Areas include lands that require increased protection in order to preserve ground water quality. The designation allows the Department of Ecology (Ecology) to impose special requirements for permits issued under their authority such as State Waste Discharge Permits and ground water rights.

Wellhead Protection Areas are delineated by individual Group A water systems (e.g., more than 15 connections or 25 individuals) that use ground water. These areas are delineated for each well or wellfield. They encompass the recharge area to the wells and are partitioned according to the time-of-travel for ground water to flow to the wells. Wellhead Protection Area delineation is a requirement of the Group A Public Water System rules, Chapter 246-290 WAC. The State of Washington first adopted the Wellhead Protection rules in 1994. At present, not all Group A systems have completed the delineations.

Critical Areas Regulations have been developed for Snohomish County and are documented in Snohomish County Code Chapter 32.10. The chapter defines Critical Areas as: (a) Fish and wildlife habitat conservation areas; (b) Geologically hazardous areas; and (c) Wetlands. By reference, the chapter incorporates the County's Interim Ground Water Protection Regulations. Eleven objectives are listed in the chapter as follows:

1. To protect unique, fragile and important elements of the natural environment;

2. To implement the Growth Management Act by designating, and adopting, regulations for critical areas;

3. To inform county residents of the hazards from, and importance of, critical areas;

4. To increase predictability regarding what can be developed on sites that contain, or are near, critical areas;

5. To reduce public costs resulting from inappropriate development activities on, or near, critical areas;

6. To protect the public from natural hazards;

7. To minimize the need for emergency rescue services;

8. To balance the private rights of individual property owners with the need to protect the public health, safety and welfare and preserve environmentally sensitive areas;

9. To prevent, or reduce, the likelihood of damage to property in a manner which is consistent with its natural constraints; and

10. To provide clear procedures for review of applications and to provide the criteria for compliance with both State Environmental Policy Act (SEPA), Chapter 43.21C, RCW, and the policies of the Snohomish County comprehensive plan concerning critical areas.

The Critical Areas Regulations apply to all development occurring after April 1, 1995. The regulations emphasize protection of surface water and wetlands and the protection of the public from geologically hazardous areas. The regulations do not directly address Critical Aquifer Recharge Areas.

Interim Ground Water Protection Regulations were developed by Snohomish County and are detailed in Snohomish County Code Chapter 32.11. They apply to projects requiring a SEPA review and, specifically, to eight land uses as follows: 1) underground storage tanks; 2) commercial, industrial, and institutional facilities that use hazardous substances; 3) large on-site sewage systems; 4) petroleum pipelines; 5) surface mining requiring a Department of Natural Resources permit; 6) solid waste facilities; 7) land application of sewage sludge; and 8) projects where salt water intrusion exists. Where impacts to "critical aquifer recharge areas" are identified, the Interim Ground Water Protection Regulations require a mitigation plan with preventive measures, monitoring, process control, and remediation, as appropriate. Approval of the mitigation plan by the County is required for the project. A definition of "critical aquifer recharge area" is not provided in the regulations.

2.2.4 Issues

2.2.4.1Issue 1)

Snohomish County has not designated Critical Aquifer Recharge Areas (CARAs) or regulations that reference CARAs.

> **Alternative 1)** No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County and Cities should identify and designate an Interim Ground Water Protection Area (IGPA). The IGPA should be based on Figure I-3-8, which is based primarily on the U.S. Geological Survey Phase One Study water table vulnerability map. Additionally, the IGPA should include: 1) any new wellhead protection areas, up to and including the zone of contribution, as delineated by Group A, Group B, or individual water systems; 2) any new Sole Source Aquifers; and 3) any new Special Protection Areas. The IGPA should be considered by the County and Cities for planning purposes. When the County and Cities develop a Critical Aquifer Recharge Area map, this map should replace the IGPA. ADMIN-2

Alternative 3) Snohomish County and Cities should review and develop criteria for defining Critical Aquifer Recharge Areas (CARAs) in the County and subsequently develop a CARA map. Snohomish County and Cities should review regulations and make changes as needed and feasible in order to conserve Critical Aquifer Recharge Areas. The review of regulations should include, but not be limited to, activities, such as: grading, landscaping, drainage, chemicals, hazardous waste, and wastewater. ADMIN-3

2.2.4.2 Issue 2)

Areas in the County may exist that are critical to aquifer recharge for reasons other than potable water supply.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County should delineate and conserve areas in the County that have a critical recharging effect for the preservation of stream baseflow, wetlands, and other sensitive areas. These areas should be shown on the County's Critical Aquifer Recharge Area (CARA) map and conserved in a similar manner as CARAs.

Alternative 3) The Marysville Trough should be designated a critical aquifer recharge area, and policies established to protect recharge. This designation should be consistent with criteria developed under Alternative 4.

Alternative 4) Snohomish County should review and develop criteria for defining Critical Aquifer Recharge Areas (CARAs) and subsequently develop a proposed CARA map for all portions of the Ground Water Management Area. Snohomish County should review regulations and make changes as needed and feasible in order to conserve Critical Aquifer Recharge Areas. The review of regulations should include, but not be limited to, activities such as: grading, landscaping, drainage, chemicals, hazardous waste, and wastewater. The CARA definition criteria, the proposed CARA map, and revised regulations will be provided to all jurisdictions within the Ground Water Management Area for their consideration. The following should be included as part of the designation:

- Jurisdictions should provide a method of assessing proposed development actions against adopted performance standards. Project level review and the performance-based standards should consider, but not be limited to, the following:

- Avoiding disruption of natural soil drainage channels to the maximum extent feasible.

- Landscaping that employs the natural contours and surfaces to promote infiltration.

- Diversion and spreading of runoff from rooftops, patios, and other clean impervious surfaces onto preserved pervious surfaces.

- Terracing and other means of detaining runoff on-site to promote infiltration over as large an area as possible.

- The use of subsurface drains and infiltration systems when appropriately designed and maintained.

2. Specific considerations of development effects on infiltration and recharge quantities should be applied to project review under the SEPA process. When development regulations are based on the recharge goals established under comprehensive plans, SEPA review at the project level then becomes the final evaluation of the plan implementation.

3. Mitigation that provides for a range of options such as the infiltration and retention and slowing of runoff, the redirection of clean stormwater to remaining pervious surfaces, and artificial recharge.

4. Options for small parcels, including actions taken at the individual single home-site level. These often provide the best opportunities for maintaining effective recharge.

2.3 Centralized Ground Water Quality Database

2.3.1 Goals

To develop an information management system that: 1) identifies trends before they become problems; 2) supports management decisions to protect ground water; and 3) provides the public with general information on the County's ground water quality and quantity.

2.3.2 Problem Statement

A variety of ground water quality data are presently collected in Snohomish County. These data include samples from public water systems, from Snohomish Health District, and from individual well owners. At present, the data are stored at either the State

Department of Health or the Snohomish Health District. Additional data are available through other agencies, such as the USGS, WDOE, or EPA. The data are not necessarily organized in a similar fashion and, consequently, cannot be easily reviewed and interpreted.

2.3.3 Existing Programs

Ground water monitoring programs in Snohomish County are conducted by public water systems, designated as Group A or Group B, depending on system size. Public drinking water systems in Washington State are regulated by the Department of Health (DOH) according to Chapters 246-290 (Group A Systems) and 246-291 (Group B Systems) WAC. Both Group A and B systems are required to periodically collect water quality data from their sources of supply. Group A systems analyze for the most comprehensive list of chemical constituents. Group B systems analyze a reduced list focusing on general water quality parameters and bacteriological parameters. Data for Group A systems are submitted to DOH. DOH has developed one or more computer databases for storing water quality data and is presently improving these facilities. Snohomish Health District gathers water quality data from Group B systems.

Snohomish Health District does not have administrative responsibility of Group B water systems, as these systems are governed by DOH. However, DOH has limited resources and cannot provide much, if any, regulatory oversight to the Group B systems. Snohomish Health District attempts to fill this void through tracking and monitoring Group B systems and making available technical assistance to these systems. Group B systems are those with less than 15 connections and servicing less than 25 people. The District's program establishes a comprehensive database to track water systems that enable the District to send periodic reminders and notifications to system purveyors. The database includes water quality data. The technical assistance offered through this project has resulted in improvements in water quality monitoring compliance. Before the project, 10 to 15% of the systems were in compliance. Currently, the compliance rate is 40 to 60%. The District attributes the increased compliance rate to increased system operator knowledge. This project receives state funds through a public health improvement plan (PHIP) local consolidated contract. The contract is administrated through DOH (Darst, 1997). After 1997, the Health District will no longer receive PHIP funding and, without a new funding source, the project will likely cease.

Private (single-residence) drinking water systems in Snohomish County are regulated under Chapter 9, Snohomish Health District Sanitary Code, "Supplemental Drinking Water Policies and Procedures for Individual Water Systems." The policies and procedures provide for assessments to determine water availability, supply source, quality, maximum contaminant levels and treatment standards (Darst, 1997). The rules and regulations provide for initial tests for coliform bacteria and maximum contaminant levels identified in Chapter 9, SHD Sanitary Code. The regulations do not provide for an on-going monitoring program.

2.3.4 Issues

2.3.4.1 Issue 1)

A centralized database of ground water quality data does not presently exist in Snohomish County.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish Health District and Snohomish County should develop a water quality database (ground- and surface-water). The database should be used to store source water quality data collected by Group A, Group B, and private water-systems in the County and other relevant data. Organic compounds, such as pesticides, and general water quality parameters, such as nitrate, should be included in the database. Existing historical data should be reviewed and included in the database, pending evaluations of data quality. The data should be geographically referenced to the point at which the source water samples are collected. The database could be made available to the public at the County offices and local libraries and/or through an internet web page. Provisions should be included in a database plan to periodically report on water quality status and to make recommendations regarding water resources management. This database should be coordinated with water quantity databases developed from alternatives presented in Section 3. ADMIN-4

Alternative 3) Snohomish County and the Snohomish Health District should consider developing ground water monitoring sites in areas where the number of existing sites is inadequate and: 1) aquifer conditions are vulnerable to contamination or have been shown to have indications of contamination; 2) sources of contamination are present; or 3) growth is planned and possibly of concern due to high development densities. Preferences should be given to wells that were sampled during earlier studies, such as the U.S. Geological Survey Phase One Study.

2.4 Public Education

Public education activities were implemented through early actions by the GWAC during 1996 and 1997. These early actions included development of educational materials, consisting primarily of written materials in a brochure or bulletin format. A logo was also developed as part of the early actions. These materials were printed and distributed during 1997.

This section addresses long-term public education on ground water resources in Snohomish County. Several possible alternatives are described that could be used to continue educational efforts into the future.

2.4.1 Goals

GOAL 1 Develop educational programs regarding the role of local ground water as it pertains to the quality of all natural systems, and especially lifestyles, of all people living in the Pacific Northwest.

GOAL 2 Increase the public's sense of ownership and stewardship of the ground water resources.

2.4.2 Problem Statement

Ground water is concealed from view by nature. Consequently, the effects of certain actions, such as dumping wastes on the ground, blocking recharge into the soil, and over pumping in wells cannot be seen. Most people have not, during their education, been exposed to ground water resources and particularly the ground water system. Without this personal knowledge, individuals cannot act as stewards of the environment, best utilizing the available resources while also preserving them.

2.4.3 Existing Programs

2.4.3.1 National Programs

The Ground Water Foundation has worked to promote understanding of ground water to all ages. This year is their second annual Children's Ground Water Festival and the Foundation has an adjunct program for others who would like to learn how to stage such an event. It begins two days before the Children's Festival so that the framework is taught before experiencing the event. It takes place in the last week of March. The Foundation also has an annual program that recognizes leaders in ground water protection. This year's awards will be given at the American Water Works Association Water Resources Symposium (Secrest, 1997).

Another Foundation program names local individuals as ground water guardians for particular areas across the United States: Carolyn Boatsman of the City of Renton is one and other southern Washington counties have guardians named in the Ground Water Foundation's newsletter. Anyone can become a ground water guardian by joining the Foundation and demonstrating their interest and activities in ground water protection. The State of Michigan has a program, co-sponsored by the Kellogg Foundation, titled GEMs that teaches ground water stewardship at all levels.

2.4.3.2 Local Programs

There are several local organizations that provide public education on ground water resources. Snohomish County Public Utility District (PUD), Marysville Parks Department, the Tulalip Tribes, and the City of Everett are a few examples of these organizations.

Snohomish County PUD has several educational programs, one of which is the "Conservation Education Program." This program provides assistance and materials to local schools. To develop and maintain this program, PUD hires a part-time, fully accredited teacher(s) and trains them on relevant conservation principles. PUD promotes the program to principals and teachers of local schools and asks the teachers to arrange for assistance in the classroom. PUD provides all of the materials and a teacher to present them (Vexler, 1997).

2.4.4 Issues

2.4.4.1 Issue 1)

Snohomish County lacks a single organization to lead ground water resources educational efforts.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) The GWAC recommends that Washington State University Cooperative Extension Service of Snohomish County seek funding and develop an on-going program to educate the public on ground water resources. ADMIN-5

2.4.4.2 Issue 2)

Existing organizations that provide public education on water resources may not address ground water and may not necessarily continue their efforts in the future.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) The GWAC should encourage and support organizations that provide education on ground water resources, such as the Tulalip Tribes, the Marysville Parks Department, the City of Everett, the Snohomish Health District and the Environmental Alliance for Senior Involvement. The GWAC should identify and contact organizations to help them develop educational materials on ground water resources, as needed.

2.4.4.3 Issue 3)

Local institutes that provide continuing education may not presently offer courses on conservation of ground water resources (both quality and quantity).

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) The GWAC should contact local institutes (e.g., UW Bothell, Edmonds Community College, Everett Community College) and encourage them to develop continuing education courses on water resources conservation.

3. GROUND WATER USE AND INFLUENCE ON SURFACE WATER

Alternatives in this section address issues related to the use of ground water and the potential impacts on surface water flow rates.

3.1 Goals

To manage ground water resources of the County to meet future needs while preserving instream values.

3.2 Problem Statement

Problem/Concern Within a watershed, ground water plays an important role in recharging surface water during the dry times of year. At these times, precipitation is not plentiful and ground water discharge to the streams is the dominant form of natural replenishment. The quantity of ground water discharge during these dry times is critical to the stream ecology and other instream values. Overuse of ground water by pumping wells may reduce the ground water discharge to streams and, consequently, reduce instream values and aquatic habitat. The effects of ground water pumping on streams will normally be realized prior to when wells no longer can obtain ground water.

Sources Any process by which ground water is extracted may impact stream baseflow. Large public water system wells and irrigation wells will normally create the greatest impact. The use of ground water in areas that are sewered also can result in impact, as wastewater is routed out of the watershed rather than returning to the ground water system. Residential use of ground water with septic drainfield discharge is a use of ground water that minimizes consumptive use. However, in general, any ground water used outdoors can deplete stream baseflow due to evaporation.

Present Conditions Existing regional data are inadequate to quantify the effect of ground water withdrawals on stream baseflows and ground water levels. Limited well water level data collected for the Phase One Study do not appear to indicate any substantial declines in ground water levels. However, locally in the County it has been reported that wells have been impacted by water level declines. The Phase One Study estimated that a total of 1,090,000 acre-feet of ground water recharge occurs annually. About 1,070,000 acre-feet of the recharge discharges through springs, into streams, rivers, and Puget Sound. A total of 19,630 acre-feet per year was estimated to be withdrawn by water wells, primarily for use in public and private water systems (15,210 acre-feet), agriculture (4,350 acre-feet), and mining (70 acre-feet).

Predicted Future Conditions Consumptive use was analyzed in each of 64 sub-basins present in the GWMA in order to assess potential future impacts to stream baseflow. The consumptive use represents that portion of the ground water in a sub-basin that is completely used up and cannot provide recharge to the stream. Thus,

consumptive use is an indirect measure of the potential impact to stream baseflow (note: in water rights terminology, it is common to use the consumptive use estimate in order to evaluate the burden of a water use on a stream).

The consumptive use analysis results presented in Figure I-3-7 and in Table I-3-6 are based on several assumptions described in Section I, Section 4.1. Land use designations used in the analysis were based on the Future Land Use Map presented in the Snohomish County GMA General Policy Plan dated June 28, 1995. Based on the analysis, most of the sub-basins in the GWMA are forecast to have future consumptive use of less than 5% of the estimated annual ground water recharge. Eight sub-basins are forecast to have a consumptive use exceeding 5% of the total ground water recharge rate to the sub-basin: Douglas Creek, Portage Creek, Quilceda Creek, Arlington area, Church Creek, Burn Hill Ridge Drainages, and Allen Creek. There is a degree of uncertainty associated with the forecast and it is not known if a consumptive use exceeding 5% of the ground water recharge rate will impair instream values. The analysis results, however, indicate the areas that should be given priority in the implementation of ground water management recommendations related to managing ground water quantity.

Revisions to the Future Land Use Map are likely to occur, and in some areas down-zoning has already been approved. Specifically, the R2.3 designation (one dwelling per 2.3 acres in rural areas) has been revised to one dwelling per 5 or 10 acres. In addition, some of these areas are subject to a rural cluster ordinance. The net result of down-zoning, in conjunction with clustering, on consumptive use is highly dependent on the specific hydrogeologic setting and the specific zoning/clustering geometry. Increased population afforded by clustering will increase water demand, but decreased impervious area can increase the net recharge per dwelling.

3.3 Existing Programs

3.3.1 Regulatory Management

Water quantity and use is regulated at the state level by the Washington Growth Management Act RCW 36.70A (GMA), the Drinking Water Regulations Chapter 246-290 WAC, and the State Water Right Act Chapters 90.03 and 90.44 RCW being the most influential.

Growth Management Act (GMA) mandates that counties and cities have proof of adequate quantity and quality water for drinking water prior to issuing building permits. Proof of water rights illustrates most clearly that adequate supply is planned for the water system's service area. The County relies on the Washington State Department of Health (DOH) and the Snohomish Health District to track and verify the ability of purveyors and private water systems to safely serve water prior to Snohomish County Planning and Development Services (PDS) issuing a building permit.

Conservation Each Group A purveyor must have a conservation plan as part of its Comprehensive Plan that is filed with and approved by DOH (per Chapter 246-290 WAC). The elements of the Comprehensive Plan vary according to the system's size but all include some planning for future supplies. Water use data is collected by the Group A purveyors to document overall water usage in the system.

Reclaimed Water The 1995 Washington State Legislature directed the Departments of Ecology and Health to develop standards for using reclaimed water for direct recharge of ground water aquifers. The Legislature declared that "to the extent reclaimed water is appropriate for beneficial uses, it should be so used to preserve potable water for drinking purposes."

Water Rights In the State of Washington, water rights are issued per the appropriation doctrine – "first in time, first in right." Certificates are required for the use of ground water above certain limits. Exempt uses (e.g., no certificate required) include domestic and commercial/industrial uses up to 5,000 gallons per day and irrigation of less than ½ acre of land. All other uses must have a ground water right certificate.

3.3.2 Voluntary and Education Programs

Water districts, municipalities and Ecology created the Water Conservation Coalition of Puget Sound. This coalition of water suppliers is working together to achieve economies of scale and consistency of conservation messages as they fulfill the element of their comprehensive plans. The Coalition's work fits into three categories: Public Education, Technical Programs and Policy Recommendations, with an added topic of Outdoor Watering. The Coalition promotes use of water-saving appliances such as special showerheads and faucet aerators. The Coalition's work plan targets public education at both youth and adult levels at general and specific industries, e.g., the landscape industry. The Coalition offers technical assistance and has projects that promote outdoor water conservation such as model codes for irrigation and landscaping, and demonstrations of native plant gardens. This group is self-funded. DOH has many different brochures available to the general public on various aspects of conservation. The brochures are available to purveyors for distribution to customers.

3.4 Issues

3.4.1 Issue 1)

Programs that focus on conserving ground water resources in the GWMA do not presently reach the Group B and individual well-water systems.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) DOH, Snohomish Health District, and the Washington State Drilling and Ground Water Association should make water conservation information available to purveyors of Group B and individual systems. USE-1

3.4.2 Issue 2)

Consumptive use of ground water may increase in the future due to population growth.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County should, where feasible, encourage: 1) re-use of wastewater; 2) expansion of surface water reservoirs; 3) storage of water in aquifers (aquifer storage and recovery) and 4) use of closed loop systems by industrial users.

3.4.3 Issue 3)

The present data are inadequate to support and determine the most appropriate water resources management actions that should be taken.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County and Ecology should consider preparing sub-basin plans to collect data and characterize ground- and surface-water hydrology and the potential impacts that could result from future ground water withdrawals. The sub-basin plans should be completed in a prioritized manner, for example, as shown in Table I-3-6. The first sub-basin plan should be completed as a pilot study to: 1) identify the costs; and 2) identify data needs and collection procedures. USE-2

Alternative 3) Snohomish County should identify volunteer well owners (public water systems and private wells) to collect data on water use, by metering, and depth-to-water in the well. The data should be provided to Snohomish County who will report on water use and depth-to-water periodically (e.g., every 5 years).

4. STORMWATER IMPACTS

Alternatives in this section address issues related to the impacts of stormwater on ground water. Alternatives are presented that address issues concerning: 1) impervious surfaces which block ground water recharge; 2) infiltration of direct runoff which may carry contaminants to ground water; and 3) entry of spilled chemicals into stormwater infiltration facilities.

4.1 Goals

To ensure an understanding of the relationship between surface water infiltration and ground water quality/quantity and the awareness of the techniques which protect the ground water resources.

4.2 Impervious Surfaces

4.2.1 Problem Statement

Problem/Concern Roads, parking lots and buildings form impervious surfaces that block precipitation from recharging ground water. Precipitation landing on the impervious surfaces becomes runoff that is discharged to either surface water, such as a stream, or to a specially constructed infiltration pond. If stormwater runoff (direct runoff) from impervious surfaces is not discharged to stormwater infiltration facilities, the ground water recharge rate is reduced. A reduction in ground water recharge can impact stream baseflow.

Sources Every development is constructed with some proportion of impervious surfaces, such as roof tops, sidewalks, parking lots, and roads. These surfaces divert precipitation from infiltrating the land surface. If the direct runoff is discharged to surface water, such as a stream, river, or Puget Sound, some ground water recharge is permanently lost.

Present Conditions Limited information exists that presently shows how urbanization has affected ground water recharge and, subsequently, the baseflow of streams. There is, however, an abundance of information that can be used to show how urbanization has increased the quantity of direct runoff. This increased runoff is an indirect measure of the lost ground water recharge. In the southwest county area, it is estimated that the present level of development has reduced ground water recharge by approximately 13,400 acre-ft/yr (Part I, Section 4.1) in comparison to pre-development. This quantity of water equates to about 12 million gallons per day, which could serve a population of approximately 75,000.

Predicted Future Conditions Analysis from Part I, Section 4.1, indicates that new development associated with population growth to the year 2012 will result in a potential incremental loss of 14,515 acre-ft/yr of ground water recharge. This analysis is based on assumptions that are described in Part I. This loss of recharge is additional to any

present losses. The lost recharge would occur if all new development discharged stormwater directly to surface water rather than infiltration facilities. The lost recharge would be concentrated in the Urban Growth Areas.

4.2.2 Existing Programs

4.2.2.1 Regulatory Management

The Stormwater Management Manual for the Puget Sound Basin is used for site development in Snohomish County, although the manual is not formally adopted by the County and is only used when required by NPDES and HPA permits. This manual was prepared by the Washington State Department of Ecology and contains numerous BMPs (best management practices) for managing stormwater. Infiltration of direct runoff to the subsurface is encouraged in the manual. Many industry-specific BMPs are also described.

The Snohomish County zoning code allows a developer to use pervious technologies for roadways, sidewalks and parking lots. Areas of pervious surfaces can then be deducted from the calculation for runoff for stormwater facility designs. This provides an economic incentive by reducing County stormwater management fees to property owners (Kerwin, 1997).

The County's Growth Management Act General Policy Plan (NE Policies 3.D.1) states that "developments should use site-design techniques that allow recharge of ground water and reduce harmful run-off. These techniques include lot clustering, limits on impervious surfaces, and protection of tracts of undisturbed vegetation."

Stormwater from state highways is managed under the Washington State Department of Transportation (DOT) Highway Runoff Manual. DOT does not allow pervious surfaces in high-traffic or high-speed areas for safety reasons. However, the manual promotes the use of pervious surfaces in park-and-ride lots and rest areas (Fisher, 1997). The DOT also used Ecology's stormwater BMPs for infiltration under its NPDES permits.

4.2.2.2 Voluntary and Education Programs

A variety of educational programs are offered to professionals working on stormwater facilities planning and design. Most of these programs focus on implementation of stormwater management BMPs (best management practices) for both quantity and quality control.

4.2.3 Issues

4.2.3.1 Issue 1)

Snohomish County Planning and Development Services (PDS) at present may not be granting approval for implementations of pervious surface technologies to the extent possible or encouraging the use of infiltration facilities.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County Planning and Development Services and Department of Public Works should develop a coordinated approach regarding stormwater management and ground water recharge. STORM-1

Alternative 3) Snohomish County should develop an educational seminar for Planning and Development Services staff regarding the value of, and technical aspects of, stormwater management BMPs in site development, emphasizing the application of pervious surface technologies and stormwater infiltration facilities.

Alternative 4) Snohomish County should develop (or obtain existing) guidelines for the usage of pervious surface technologies in site development. These guidelines should be made available to local professionals, developers, site review applicants, and staff.

4.2.3.2 Issue 2)

No incentives exist to use pervious surface technologies.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County should work with appropriate County agencies and jurisdictions within the GWMA to develop an incentive program (e.g., fee reductions, early assumption of maintenance, early bond release, funding) that encourages developments to utilize pervious surface technologies. STORM-2

4.2.3.3 Issue 3)

Site development review process does not necessarily attempt to reduce the coverage of impervious surfaces.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County (through the County Zoning Code) and Jurisdictions should require that site designs for new developments minimize the amount of impervious surface and maximize the ground water recharge rate, particularly in areas where the recharge potential is considered high. STORM-3

4.2.3.4 Issue 4)

Urban development in Critical Aquifer Recharge Areas may reduce ground water recharge.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County and Jurisdictions should review development plans in Critical Aquifer Recharge Areas to assess impacts to ground water recharge and take actions to mitigate impacts, including consideration of limiting densities.

4.3 Infiltration of Direct Runoff

4.3.1 Problem Statement

Problem/Concern Runoff resulting from precipitation can be managed by discharge to stormwater infiltration facilities. The stormwater infiltration facilities enable direct runoff to discharge to the subsurface. In most urban areas, direct runoff contains contaminants such as bacteria, nutrients, metals and organic compounds. Potential exists for these contaminants to enter ground water.

Sources Any areas where development has occurred will generate direct runoff that contains contaminants. Commercial lands with large parking lots and gasoline stations would normally generate runoff with the highest concentrations of automobile-related metals and organic compounds. Residential areas may have the highest concentrations of bacteria and nutrients due to decaying vegetation and pet wastes.

Present Conditions Ground water quality in the GWMA is generally of good quality and contamination by infiltration of direct runoff has not been identified as a problem. This is not surprising, as direct runoff has not been shown to be a significant cause of

regional ground water contamination. More commonly, however, the contaminants in direct runoff are detected where direct runoff is discharged to streams, ponds, or lakes. In these environments, the contaminants accumulate in the sediments and provide a food source to micro-organisms.

Predicted Future Conditions Contaminants in direct runoff are not likely to become a regional ground water contamination problem in the GWMA for the following reasons: 1) the majority of the GWMA is unsuitable for infiltration of stormwater due to the low permeability till soils, and 2) the contaminants in direct runoff do not appear to create significant ground water contamination problems. Potential exceptions include, for example, where infiltration facilities are constructed for gasoline filling stations or other facilities that handle large quantities of hydrocarbons. These special cases could lead to local contamination of ground water.

4.3.2 Existing Programs

4.3.2.1 Regulatory Management

Washington State Department of Ecology (Ecology) administers the Puget Sound Water Quality Management Plan. This plan requires that local stormwater management programs be consistent with the State plan and Ecology's Stormwater Management Manual. The manual addresses minimum technical requirements for new developments; erosion and sediment control; runoff control; and urban land use BMPs. The section of the manual on urban land use addresses runoff management BMPs for many different industrial land uses, public agency required BMPs, and source control BMPs. According to the stormwater management manual, commercial agriculture and forest practices are exempt from the requirements of the Puget Sound Water Quality Management Plan.

Requirements for infiltration facility BMPs may be imposed through Snohomish County's drainage code, Title 24, or through NPDES permit requirements. The code requires developments over 5,000 square feet be evaluated by Washington State Department of Fisheries and Wildlife for hydraulic project approval (HPA) before the County will issue a building permit. HPA approval is contingent upon meeting drainage and erosion control standards according to the Ecology Stormwater Management Manual (Leif, 1997).

Snohomish County Code Title 25 establishes a fee schedule to single-family residents and commercial facilities for County stormwater management. The fee schedule for commercial facilities is based on the facilities' square footage of impervious surface and whether or not they have a stormwater treatment facility. Homeowners are charged a flat fee. This code provides for an initial inspection of a stormwater management facility, however, it does not provide any provisions to determine if the facility is being maintained. The only provision for maintenance is within the property deed. Consequently, the County cannot ensure that facilities are being maintained (Kerwin, 1997).

Snohomish County has established a Stormwater Management Program to fulfill the requirements of its NPDES permit, as required under the Federal Clean Water Act. The County has adopted, in ordinance form, equivalent technical standards to those contained in Ecology's Stormwater Manual. Standards for infiltration system design are defined in the County's manual.

As required by the Stormwater Management Program, Snohomish County has adopted an ordinance prohibiting pollution discharges to County storm sewers. The Stormwater Management Program also requires the County to implement a systematic program to investigate and eliminate illicit discharges to the storm sewer. The Snohomish County Surface Water Management Division, in coordination with the Snohomish Health District, is in the process of developing the illicit discharge elimination program. The illicit discharge elimination program will include technical assistance to commercial facilities.

DOT has implemented an Ecology-approved Highway Runoff Manual that addresses BMPs for stormwater infiltration facilities. In the Puget Sound area, about 75% of DOT infiltration facilities incorporate biofilters. On a routine basis (usually in summer), biofilter material is removed and replaced. Used biofilter material is treated as vactor waste and disposed (Fisher, 1997).

According to DOT, newer infiltration systems have a maintenance program that is put into practice with the installation of the system. This program results in fewer system failures. Older systems are managed or maintained, as needed, or when a complaint is received (Fisher, 1997).

4.3.2.2 Voluntary and Education Programs

Currently, no educational workshops are available from Ecology for education of local agencies on stormwater management programs or BMPs. An informational flyer is available to homeowners with examples of how to reduce stormwater runoff on single-family residents.

4.3.3 Issues

4.3.3.1 Issue 1)

Until the County Council revises Title 24, the stormwater ordinance, and adopts a revised stormwater manual to meet the equivalent of Ecology's stormwater standards, there is no direct way for the County to require infiltration system best management practices, unless NPDES or HPA permits are required.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) The GWAC should support Title 24 revisions currently under development. STORM-4

4.3.3.2 Issue 2)

Ecology no longer provides technical assistance and educational workshops for local agency staffs who administer stormwater management programs.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Ecology should obtain funding to reinstate educational workshops for local agency professionals involved in administration and enforcement of stormwater management programs.

Alternative 3) The Environmental Protection Agency should obtain funding to conduct educational workshops for local agency professionals involved in administration and enforcement of stormwater management programs.

4.3.3.3 Issue 3)

Some Department of Transportation (DOT) stormwater infiltration systems do not provide any treatment of direct runoff.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County Department of Public Works and Washington State Department of Transportation should jointly define priorities for upgrades to older infiltration systems that do not provide water quality treatment and seek state funding to perform the upgrades. Infiltration systems addressed through these efforts should be prioritized based on aquifer vulnerability, as shown in Figure I-3-8.

Alternative 3) Snohomish County Planning and Development Services should inform the Snohomish County Department of Public Works and DOT of pertinent information presented in Part I (Geohydrology Memorandum) for use in future planning for stormwater management.

4.3.3.4 Issue 4)

Some developments in Snohomish County have infiltration facilities that fall under the responsibility of a homeowners' association and may not be properly maintained.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County should adopt maintenance standards for all stormwater facilities and should develop an inspection program.

Alternative 3) Snohomish County should revise Title 24 to require that residential stormwater facilities be deeded to the County so that the County can maintain these facilities. Additional funding through increases in stormwater management fees should be obtained to provide for this maintenance activity.

Alternative 4) Snohomish County and Jurisdictions should consider development and adoption of a local ordinance requiring homeowners' associations to submit maintenance plan to the County for maintenance of infiltration facilities. When approved by the County, the homeowner's association has the option of maintaining the facilities or fee payment to the County for maintenance in accord with the approved plan.

4.4 Infiltration of Spilled Contaminants

4.4.1 Problem Statement

Problem/Concern Stormwater infiltration facilities located along major roads and within commercial and industrial properties could enable spilled chemicals to migrate rapidly to ground water, should a spill occur. It is possible that these types of incidents could occur without notice and, consequently, they would not receive proper remedial actions. The design of the infiltration facility has some effect on the degree to which contaminants can quickly travel to ground water. Facilities that do not incorporate containment or barrier-layer features present the greatest risk. In most cases, the contamination of ground water by chemical spills would be localized.

Sources Certain locations in urban areas are prone to accidents by both cars and trucks. Accidents can result in spill chemicals including fuels. Infiltration facilities located near high-accident rate areas could receive chemical spills. If spill containment or barrier-layers are not built into the infiltration facilities, chemicals could migrate quickly to ground water. Commercial and industrial developments also may utilize infiltration facilities to manage stormwater. The potential for chemical spills to enter these facilities exists for those commercial enterprises and industries that routinely handle chemicals. Infiltration facilities located near loading docks are the most susceptible.

Existing Conditions The types, numbers, and locations of infiltration facilities in Snohomish County were not surveyed during the preparation of the GWMP. It is estimated, based on the soil conditions, that a relatively small number of these facilities exist (e.g., much fewer, for example, than in Spokane or Portland where several thousand infiltration facilities have been installed). The most abundant usage of infiltration facilities would likely be in the Marysville–Arlington area due to the urban development and the highly permeable soils that occur in this area. A shallow depth to ground water, however, would restrict the use of infiltration facilities.

Predicted Future Conditions The usage of stormwater infiltration facilities should increase in the future as a means to reduce direct runoff and enhance ground water recharge. Consequently, more facilities will be installed that could be conduits for

chemical spills to migrate to ground water. Contamination incidents, if left unreported, should result in localized contamination. Reported incidents will be remediated and should result in, at most, temporary contamination of the local ground water.

4.4.2 Existing Programs

4.4.2.1 Regulatory Management

DOT currently has a policy to not use infiltration systems in areas where accidents frequently occur. DOT engineers are required to evaluate highway use and accident frequency before a runoff management system is selected. Older DOT infiltration facilities or facilities installed in inappropriate areas are upgraded as problems are identified. Upgrades are designed according to the DOT Highway Runoff Manual. Most of Snohomish County-owned infiltration systems are located in the Marysville area with a few in the South Snohomish County area. Systems in the Marysville area were installed in the mid-1970s. These systems do not provide biofiltration and are being replaced or upgraded to provide biofiltration when a system failure is identified (Kerwin, 1997).

Snohomish County facilities that have been upgraded, or are being upgraded, are typically composed of a perforated catch basin. The catch basin is being lined with a geotextile fabric to which contaminants adsorb. The fabric is arranged like a sack that goes into the catch basin and then is filled with drain rock. The County is also experimenting with the use of sand filters at some infiltration facilities in commercial areas (Kerwin, 1997).

4.4.2.2 Voluntary and Education Programs

Under the Snohomish County Stormwater Management Program, owners of existing commercial and industrial properties have incentive to install on-site stormwater management facilities to receive a reduced rate on public utility fees. Inspections are performed to confirm the existence of a facility by the Public Works Department, Surface Water Management Division. No further inspections are required to determine that facilities are being maintained (Kerwin, 1997).

4.4.3 Issues

4.4.3.1 Issue 1)

Older infiltration facilities may exist that allow subsurface releases of hazardous substances as the result of a spill.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County and Jurisdictions should inventory direct infiltration facilities to determine their location in vulnerable aquifer areas, as shown in Figure I-3-8, and to assess the potential for ground water contamination. This inventory should be used as a basis for upgrading the facilities using modern designs. The information could be applied to a geographical map and submitted to the Snohomish County Department of Emergency Management for use in spill response. STORM-5

Alternative 3) Existing stormwater maintenance programs conducted by the County and the Jurisdictions should include upgrading of older facilities that allow direct infiltration whenever these facilities are located along major roadways. Upgrading should include retrofitting or new installations with spill containment features.

Alternative 4) Snohomish County and Jurisdictions building permit review for new and existing commercial and industrial facilities should include special review of stormwater facilities. Requirements should be made to upgrade direct infiltration facilities with spill containment facilities.

Alternative 5) Snohomish County and Jurisdictions should provide training to site review staff in the application of spill-containment technologies that can be implemented to prevent spills from entering ground- and/or surface-waters.

5. NITROGEN IN GROUND WATER

Alternatives in this section address issues related to the potential contamination of ground water by nitrogen. Alternatives are presented for issues on: 1) on-site wastewater disposal systems; 2) landscape fertilizer applications; and 3) agricultural sources of nitrogen.

5.1 Goals

To prevent contamination of ground water by nitrogen.

5.1.1 On-Site Sewage Disposal Systems

5.1.2 Problem Statement

Problem/Concern Nitrogen occurs in wastewater and is not readily treated by the biological processes of a septic-drainfield on-site sewage system. In these systems, most of the nitrogen infiltrates to ground water along with the drainfield discharge, or effluent. In ground water, the nitrogen occurs as nitrate, an oxidized form of nitrogen that can be lethal to infants. The maximum contaminant level for nitrate in public water systems is 10 mg/L as nitrogen. Where the density of on-site sewage systems is high enough, nitrate concentrations in ground water can exceed or approach the maximum contaminant level.

Sources Every on-site sewage system that discharges effluent to the subsurface is a source of nitrogen contamination of ground water. Areas where the density exceeds approximately 1.5 dwelling units per acre may develop nitrate concentrations in ground water that approach the drinking water maximum contaminant level (10 mg/L as nitrogen). Development densities less than one dwelling unit per 2.3 acres would likely have little to no measurable impact on ground water nitrogen levels.

Present Conditions The Phase One Study for the Snohomish County Ground Water Management Program evaluated nitrate concentrations in 297 samples of ground water. Seventy-five percent of these samples had nitrate concentrations less than 1.0 mg/L. Samples with higher concentrations of nitrate were often collected from wells near agricultural areas rather than areas with high-densities of on-site sewage systems. Some concentrations of nitrate exceeded the drinking water standard, but were believed to be local in extent. Overall, data collected for the Phase One Study did not reveal the presence of any regional nitrate ground water contamination caused by on-site sewage systems.

Predicted Future Conditions Nitrogen concentrations in ground water were predicted based on development to the year 2012 (Part I, Section 5.4). The predictions are based on several sources of nitrogen, including: on-site sewage systems; landscape and agricultural fertilizers; and animal wastes. The predictions indicate that ground water in a large part of the western county area would be slightly to moderately contaminated by nitrate (1 to 5 mg/L as nitrogen). The principal sources of nitrate are agriculture and on-

site sewage systems. With the exception of Hat Island, ground water nitrate concentrations were not predicted to exceed the drinking water standard of 10 mg/L as nitrogen. However, the predictions were based on regional averages computed on a sub-basin scale; locally, nitrate ground water concentrations may be higher or lower than the predictions.

5.1.3 Existing Programs

5.1.3.1 Regulatory Management

Regulatory responsibilities for on-site sewage systems are apportioned based on the daily volume of wastewater flow. Systems with flows greater than or equal to 14,500 gallons per day are regulated by the Department of Ecology. Systems with flows between 3,500 gallons per day and 14,500 gallons per day are regulated by the Washington Department of Health (DOH). Systems with flows less than 3,500 gallons per day, including individual on-site sewage systems, are regulated by the Snohomish Health District.

Ecology's regulations governing construction of wastewater facilities (Chapter 173-240 WAC) preclude the use of on-site wastewater systems with flows of 14,500 gallons per day or greater because they require that a proponent demonstrate that no other reasonable alternative exists. In the rare instances that Ecology permits such systems, the proponent is required to undertake rigorous engineering studies to demonstrate that the system will not adversely affect environmental quality. Ecology also requires public ownership, operation, and management of such systems.

Systems with flows of 3,500 gallons per day to 14,500 gallons per day are referred to by the Washington Department of Health as "large on-site sewage systems" or LOSSs. Design, construction, and operation and maintenance requirements for LOSSs are contained in the On-Site Sewage Systems Rules and Regulations of the State Board of Health (Chapter 246-272 WAC). An application for a LOSS must be accompanied by an engineering report demonstrating that the system and the surrounding soil can adequately treat and assimilate the design wastewater flow.

Standards for LOSSs installed in coarse-textured soils where there is a risk of nitrate contamination include requirements for limiting development density to two dwelling units (or equivalent for non-residential development) per acre. Additionally, systems installed in such environmental settings may be required to employ sand filtration and pressure distribution of effluent to reduce microbial populations and nitrate levels in wastewater prior to its release to the surrounding soils. Operation and maintenance of LOSSs must be provided as follows:

- For residential subdivisions where the lots are individually owned, a public entity must serve as the primary management entity, or as the third party trust for a private management entity; or

- For other types of development, including single ownership, management must be provided by a public entity or a private entity via an appropriate contract (WAC 246-272-08001).

Chapter 246-272 WAC also serves as the basis for local regulations (Chapter 8 of the Snohomish Health District Sanitary Code) used by the Snohomish Health District to manage the use of systems with flows of less than 3,500 gallons per day. The purpose of the local regulations is to protect public health from contaminants associated with domestic wastewater including: bacteria, viruses, protozoans, and nitrogen. These regulations address all aspects of on-site sewage system use including density (lot size), design, installation, and operation and maintenance.

For sites served by public water supplies, minimum lot sizes range between 12,500 square feet and 22,000 square feet, depending upon soil conditions. This results in a maximum allowable development density of 3.5 units per acre, with a limit of two units per acre for sites with Type 1A soils, defined as "very gravelly coarse sands or coarser, or extremely gravelly, soils." Type 1A soils pose the most significant risk of nitrate contamination because they allow relatively rapid recharge of underlying shallow ground waters. For sites served by individual wells, minimum lot sizes range from one acre to two acres.

The standard design of individual and small community on-site sewage systems includes a septic tank and a subsurface absorption system. Depending on soil conditions, distribution of septic tank effluent within the subsurface absorption system may be accomplished by either gravity or pressure (pump fed).

Under certain defined circumstances, the Washington Department of Health requires local health jurisdictions to modify on-site sewage system designs to achieve a performance standard that exceeds the level of wastewater treatment afforded by a typical septic tank and subsurface absorption system. That performance standard is referred to in Chapter 246-272 WAC as "Treatment Standard 2." To attain Treatment Standard 2, discharges from an on-site sewage system must meet a thirty-day average of less than 10 mg/L 5-day biochemical oxygen demand (BOD) and 10 mg/L total suspended solids (TSS), as well as a thirty-day geometric mean of less than 800 fecal coliform per 100 ml. Treatment Standard 2 typically applies to new on-site sewage systems installed in: Type 1A soils; and any soil where a minimum two foot vertical separation between the bottom of a subsurface absorption system and an underlying water table or impervious layer cannot be maintained.

Generally, this level of performance requires use of Washington Department of Health (DOH) approved alternative systems such as stratified sand filter systems, recirculating sand filter systems, or sand-lined trenches with pressure distribution of effluent. The latter represents the system most commonly used in Snohomish County to achieve Treatment Standard 2 in Type 1A soils. The Snohomish County Health District has routinely required use of sand-lined trenches with pressure distribution in Type 1A soils since the mid-1980s, well before the advent of the State's Treatment Standard 2 requirement.

It is worth noting that the DOH performance standards do not directly address treatment of nitrogen or nitrates. However, sand filters and sand-lined trenches are capable of a 40 to 60 percent nitrogen removal efficiency compared with about 20 percent for standard septic tanks and subsurface absorption systems installed in Type 1A soils (Long, 1994).

The Snohomish Health District does not currently require special site-by-site studies of potential nitrate contamination from on-site sewage systems associated with proposed developments (Raasina, 1997). Such studies would be unnecessary in most cases because of safeguards built into the aforementioned density and design requirements; however, they may be prudent in sensitive areas.

Management requirements for on-site sewage systems under the regulatory authority of Snohomish Health District are variable depending on the nature of the system. Small community systems serving properties under multiple ownership are required to be managed by a public entity or by a viable third party acting in trust for a private management entity. Operation and maintenance of systems under individual, private ownership are managed by the system owner.

5.1.3.2 Voluntary and Education Programs

The Snohomish Health District has undertaken extensive educational efforts to promote proper operation and maintenance of on-site sewage disposal systems. The Health District requires that the designers of all new systems provide the system owner with an operations manual at time of final approval. Approximately one year after final approval, the Health District mails an information packet to the system owner. The packet contains a copy of the "as-built" drawing of the system, a copy of the designer's operations manual, brochures regarding proper operation and maintenance practices, a list of registered maintenance providers, and a post card for ordering a homeowners on-site sewage system educational videotape. The Health District will re-distribute the packet every three years thereafter. Eventually, the Health District plans to supply a similar packet to owners of all of the remaining on-site sewage systems in Snohomish County that were installed prior to implementation of the aforementioned outreach program.

5.1.4 Issues

5.1.4.1 Issue 1)

An on-site sewage system density of up to 3.5 systems per acre is allowed in Snohomish County and could potentially cause nitrate contamination of ground water.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish Health District should consider re-evaluating the allowable densities for on-site sewage systems and make revisions as needed to prevent elevation of nitrate concentrations in ground water.

5.1.4.2 Issue 2)

Multi-lot development proposals presently are not required to submit information evaluating the potential for nitrate contamination of ground water from the use of on-site sewage systems.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County should consider amendments to the subdivision review process (Snohomish County Code Title 32.30, "Rural Cluster Subdivisions") to require that assessments of ground water nitrate contamination from on-site sewage systems be conducted.

5.2 Landscaping Fertilizer Applications

5.2.1 Problem Statement

Problem/Concern Nitrogen is an ingredient of fertilizers that are applied for domestic and commercial landscaping purposes. Irrigation or precipitation onto fertilized areas allows the nitrogen in the fertilizer to dissolve in water and percolate into the soils. Where fertilizers are applied excessively, plants/turf do not uptake all of the nitrogen and ground water may be contaminated. There is a great deal of variability in how fertilizer is applied. Not all applicators follow manufacturers' recommendations. Some applicators may over-water a lawn or garden. Researchers found that over-irrigated turf receiving relatively high fertilizer dosages (5 lb/1,000 square feet) will contribute more that 10 times the nitrogen loading to ground water than frugally irrigated turf receiving light applications of fertilizer (2 lb/1,000 square feet) (Morton, et al., 1988). The greatest nutrient leaching can be expected when high rates of water soluble fertilizer are applied to course textured soil.

Sources Any fertilizers applied for landscaping (including gardening) are potential sources of nitrogen contamination. The greatest potential for nitrogen contamination of ground water occurs when fertilizers are applied excessively in areas of shallow ground water and sandy soils.

Present Conditions Nitrogen contamination of ground water as a result of domestic and commercial landscaping fertilizer applications has not been documented in Snohomish County.

Predicted Future Conditions Nitrogen contamination of ground water from domestic and commercial fertilizer applications was included in the nitrogen impacts analysis conducted in the Geohydrology Memorandum (Golder, 1996). Affects solely due to fertilizer, however, were not isolated from the overall results. Based on nitrogen input to the ground water flow system, however, it is expected that little of the predicted ground water contamination is due to domestic and commercial fertilizer applications. As shown in Tables I-3-7 and I-3-8, nitrogen loading to ground water from domestic and commercial fertilizer applications is typically one-tenth or less than that from other sources.

5.2.2 Existing Programs

5.2.2.1 Regulatory Management

Fertilizers are not considered a pesticide unless a product contains a pesticide in the formula, such as a weed-and-feed type of lawn care product. Hence, they are not regulated.

5.2.2.2 Voluntary and Education Programs

Since fertilizers are not regulated, knowledge of actual fertilizer application practices are generally based on information (e.g., application rates and quantities) collected through commercial applicators. To gain some understanding of the industry conventions, information is presented here regarding application of fertilizer at a local golf club. Snohomish County does not operate a golf course, however, the County leases property near Stanwood to Kayak Point Golf Club. The club management recognizes the potential impact of fertilizer on water quality and judiciously applies fertilizer to prevent nutrient contaminated runoff. As a policy, the club does not apply readily soluble fertilizers such as ammonium sulfate or ammonium nitrate. They have been employing slow-release fertilizers such as polymer-coated or sulfur-coated products. Also, the club has been experimenting with some organic forms of fertilizer. They have established a 50 foot buffer zone around all bodies of water on the course where no fertilizer is applied. Currently, they do not monitor water quality of streams on the property (Vander Vaate, 1997).

Many resources are available to assist and educate the public on proper fertilizer application, soil amendment and composting, to prevent contamination of surface and ground water. Snohomish County Cooperative Extension Service sponsors the Master Gardener Program and has extensive information to assist the public on all aspects of gardening. Nonprofit organizations, such as Washington Toxics Coalition, Seattle Tilth and most garden clubs also offer information on measures that can be taken to limit ground water degradation.

"Water Quality Guide: Recommended Pollution Control Practices for Home Owners and Small Farm Operators," a booklet published by Ecology, National Resource Conservation Service, Cooperative Extension Service, and other local districts and

agencies, is a 31-page guide that addresses many water quality issues. Topics included in the guide are: erosion control, pasture management, animal waste management, and pesticide and herbicide management.

Washington Toxic Coalition is a nonprofit organization providing education and assistance on topics such as alternative pest management and low toxicity cleaning agents for the home. The coalition currently has a contract with Ecology and the U.S. Environmental Protection Agency (EPA) to provide an education program on integrated pest management to schools. The program is currently being implemented in the Mukilteo and Northshore School Districts. Although the focus of this program is to educate students regarding the use of pesticides, the program also incorporates concepts of sustainable agriculture and the use of compost rather than synthetic fertilizers.

Snohomish County Department of Parks and Recreation, in cooperation with Washington State University, provides information on appropriate use of fertilizers through Snohomish County Cooperative Extension Service. Examples of services offered to home growers include clinics, booklets and brochures at retail gardening centers and a booth at the Evergreen State Fair.

5.2.3 Issues

5.2.3.1 Issue 1)

Fertilizer is most likely to be misused in domestic applications.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County and/or Ecology and/or Washington State University Cooperative Extension Service of Snohomish County should develop an educational program on the use of fertilizers and alternatives to synthetic fertilizers, targeting populations in vulnerable aquifer areas.

Alternative 3) Snohomish County GWAC should continue with plans to implement the second element of the early action implementation strategies that includes dissemination of BMP information for residential lawn and garden fertilizer use. NITRATE-1

Alternative 4) Snohomish County should contract with Seattle Tilth, the Washington Toxics Coalition, or other appropriate agency to provide an information and education program regarding sustainable gardening practices.

5.3 Agricultural Fertilizer Applications and Animal Wastes

5.3.1 Problem Statement

Problem/Concern Agricultural operations routinely use nitrogen to promote crop production. Nitrogen also occurs within animal wastes, such as from cattle, dairy cows, and chickens. Excess nitrogen derived from these sources that is not utilized by plants can dissolve in water, infiltrate to ground water and cause contamination by nitrate. Agriculture within Snohomish County encompasses a wide range of crop and livestock production. Common crop production in Snohomish County includes grass and corn production for livestock, seed crops such as spinach and cabbage, and some fruit crops such as raspberries and strawberries (Jacobsen, 1997). Livestock production includes beef and dairy cattle, hogs, horses, chickens and mink. Snohomish County ranks second in the state in chicken production (broilers) and third in the state for numbers of dairy cows (Hammel, 1997).

Sources Nitrogen fertilizers applied for crop production are the primary source of nitrogen associated with agriculture. Manure spraying, which is commonly associated with dairy farms, can be a significant localized source. Nitrogen associated with animal wastes, from commercial agriculture operations and small non-commercial farms, also is a source.

Present Conditions Based on ground water sampling and analysis for the Phase One Study of the Snohomish County Ground Water Management Program, agricultural activities do not appear to have caused any widespread ground water contamination from fertilizers or animal waste material. Concentrations of nitrate and ammonia were generally low throughout the area sampled. Samples with higher concentrations of nitrate were collected from wells near agricultural areas, but regional comparisons were made between agricultural and non-agricultural areas, and no differences could be discerned in the data.

Predicted Future Conditions Analysis of nitrogen contamination of ground water was analyzed in the Geohydrology Memorandum (Golder, 1996). Agricultural sources of nitrogen, including both fertilizer and animal-waste inputs, were considered in this analysis. The predictions indicate that agricultural nitrogen sources make up the largest nitrogen loading to ground water. The Riverway Agricultural Zone, which includes 89 square miles, was predicted to have a nitrogen loading 2.5 times greater than any other land use designation. Consequently, sub-basins dominated by Riverway Agriculture were predicted to have the highest future concentrations of nitrogen in ground water. Predicted nitrogen concentrations in these areas ranged from 5 to 10 mg/L.

5.3.2 Existing Programs

5.3.2.1 Regulatory Management

Several state regulations serve to limit nitrogen in surface and ground water. Under the Water Pollution Control Act, Chapter 90.48 RCW, Ecology is granted general authority to prevent discharges of contaminants to the surface or ground waters of the state. The

code essentially establishes protocol for discharge permits. *Water Quality Standards for Surface Waters of the State of Washington*, Chapter 173-201A WAC, establishes standards for the protection of public health and protection and propagation of fish, shellfish and wildlife. *Water Quality Standards for Ground Waters of the State of Washington*, Chapter 173-200 WAC, establishes ground water quality criteria. This code also addresses agriculture activities through a memorandum of understanding (MOU) with the Department of Agriculture (WAC 173-200-080).

Additionally, the Dairy Waste Management Act (1993), Chapter 90.64 RCW, applies to degradation of surface and ground water from dairy waste. This code provides for coordination of functions between the Snohomish Conservation District (SCD), the Washington State Conservation Commission (WSCC) and Ecology. Enforcement of this code is triggered by a complaint. Ecology investigates and determines the validity of a complaint. Based on the extent of the problem, Ecology may take immediate enforcement action or refer the dairy operator to the SCD for assistance.

Since Ecology, the WSCC and the SCD are involved in regulating and assisting with dairy waste management, a description of each agency's role is presented to clarify how dairy waste management violations are resolved. Presented below is a description of each agency's roles as described in Chapter 90.64 RCW. Ecology has the following duties:

- Receive, process and verify complaints concerning discharge of pollutants from all dairy farms regardless of size;

- Determine if a dairy-related water quality problem requires immediate corrective action under water pollution control laws;

- Administer and enforce National Pollutant Discharge Elimination System permits for operators of concentrated dairy animal feeding operations, where required by federal regulation, and administer state laws;

- Appoint representatives, including dairy industry representatives, to participate in the compliance review committee that will annually review and update policy and disseminate information as needed;

- Encourage communication between local department personnel and the appropriate SCD personnel;

- Encourage the use of Natural Resources Conservation Service standards and specifications in designing best management practices (BMPs) to protect water quality; and

- Provide to the WSCC an annual report of dairy waste pollution enforcement activities.

According to Chapter 90.64 RCW, SCD is responsible for annually updating the water quality section in the Conservation District Dairy Waste Management Plan, preparing an annual water quality progress report on dairy waste management activities, and

encouraging communication between SCD and other departments. The conservation district is also responsible for carrying out compliance through assisting operators in developing best management practices.

Under the code, conservation districts are allowed to select the appropriate level of involvement in code enforcement based on several different compliance level scenarios. Components of the scenarios include dissemination of information, education, problem solving, complaint handling and assisting in compliance.

The WSCC is responsible for providing technical assistance, coordinating between involved agencies, informing conservation districts of activities and experiences of other conservation districts, and appointing conservation district representatives to serve on compliance review committees.

Dairy animal feeding operations may be allowed 22 months to develop and implement a corrective plan, unless a hardship is determined. If a hardship occurs, a time extension may be granted (Booth, 1997).

According to the 1993 Dairy Waste Management Plan Implementation Follow-up of Northeast Counties of Puget Sound Report, approximately 18% of the farms in Snohomish County had fully implemented watershed plans for dairy waste management. Of the 78 dairy farms in Snohomish County at that time, 47 farms had plans, 12 had out-dated plans and 14 had fully implemented plans. According to Ecology an optimistic estimate of current fully implemented dairy farm watershed management plans is 35% (KauzLoric, 1997).

Legislation has been proposed (Substitute House Bill 2195) to amend the Dairy Waste Management Act to require Ecology to inspect dairy farms a minimum of every two years. The amendments also require that all dairy farms be inspected during the first year the amendments are enacted. The amendments also stipulate more frequent inspections for dairy farms that have waste management problems. The proposed amendments would be administered by Ecology and local conservation districts.

5.3.2.2 Voluntary and Education Programs

Most programs that are designed to limit contamination from agricultural activities depend on voluntary cooperation from growers and livestock keepers. Snohomish Conservation District and Snohomish County Cooperative Extension Service operate a program that provides technical assistance to farmers to develop individual farm conservation plans. Generally, the individual conservation plans include best management practices (BMPs) and focus on minimizing nonpoint pollution from farm activities, particularly those associated with animal keeping.

Grant funding to assist growers, dairies and other livestock keepers in adopting best management practices is available through SCD. Monies are administered by Ecology through the Centennial Clean Water Fund.

The Natural Resources Conservation Service (NRCS) offers technical assistance for ground water quality protection to landowners located within wellhead protection areas. Also, under the 1990 Federal Farm Bill, the United States Department of Agriculture (USDA) can enroll some agricultural areas located within wellhead protection areas in its Conservation Reserve Program. The NRCS also provides technical information concerning water quality protection from agricultural operations (Jacobsen, 1997).

Snohomish Conservation District is currently applying for a Centennial Clean Water Fund grant to produce a watershed guide for chicken waste application to crops. Though SCD provides on-site consultation to assist farmers implementing BMPs, not all farmers are amenable to a site visit from SCD. For those farmers that prefer not to have a site-specific plan prepared by SCD, the proposed watershed guide may be better received.

The Washington State Farm Services Agency offers a cost-sharing program to dairy operators who need financial assistance to implement BMPs for dairy waste management. For each farm, regardless of size, $3,500 is available on an annual basis from the agency (Startin, 1997).

Most growers belong to a growers' association. Associations typically provide continuing education programs that offer updates on regulations and best management practices. Workshops or courses sponsored by these associations relative to pesticide or fertilizer application may receive accreditation by Washington State Department of Agriculture (DOA) and can be applied toward pesticide applicator recertification credits.

5.3.3 Issues

5.3.3.1 Issue 1)

Inappropriate waste management practices in concentrated dairy and chicken operations may result in the direct discharge of pollutants to surface and ground water.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) To prevent problems with stockpiled animal waste, Snohomish Conservation District (SCD) should consider establishing a soil amendment brokerage. SCD should develop a list of livestock keepers and refer residents to a livestock keeper for pick up of manure by the resident. The program could combine components of the Seattle ZooDoo program and the Seattle King-County Health Department's Industrial Materials Exchange (IMEX). NITRATE-2

Alternative 3) Snohomish Conservation District should apply to the Washington State Conservation Commission for funding to produce the watershed guide for chicken waste management.

6. PESTICIDES IN GROUND WATER

Alternatives in this section address issues related to the use of pesticides in agriculture; for the maintenance of right-of-way areas; and for domestic and commercial landscaping purposes.

6.1 Goals

GOAL 1 Prevent contamination by pesticides and nutrients of current and potential drinking water sources and/or ground- and surface-waters of ecological importance.

GOAL 2 Reduce dependence on chemicals as the single answer to the control of floral and faunal populations.

GOAL 3 Encourage practical manipulation of pest floral and faunal populations using sound ecological principals.

6.2 Agricultural Applications

6.2.1 Problem Statement

Problem/Concern Pesticides typically consist of organic compounds, many of which are toxic to humans and wildlife. To control insects and weeds, pesticides are applied in agriculture over large crop areas. These lands are subject to irrigation and precipitation which can dissolve the pesticides. The dissolved pesticides can be transported through the soil to ground water, causing ground water contamination.

Sources Any application of chemical pesticides can become a source of ground water contamination. Misused pesticides, however, create the greatest risk of ground water contamination.

Present Conditions The Phase One Study of the Snohomish County Ground Water Management Plan conducted analyses for pesticides in approximately nine ground water samples. No pesticides were detected; however, the number of samples was insufficient to address conditions in the entire County. A study completed by Ecology in the Quilceda Creek watershed identified Atrazine and Terbicil in ground water samples from private wells located near agricultural lands (Larson and Marti, 1996). The concentrations for both pesticides were low in comparison to the maximum contaminant levels for drinking water. The wells sampled were also shallow, 17 feet and 23.5 feet below ground surface, respectively. Given the limited data presently available for Snohomish County, the occurrence of pesticides in ground water is not well known.

Predicted Future Conditions Presently, there is a general movement in agriculture to reduce and/or carefully apply pesticides in agriculture. There are environmental and economic reasons for this trend. In addition, pesticides are likely to become less toxic in

the future with more non-toxic substitutes being developed and alternatives to chemicals promoted. Pesticides also have not been found to be very mobile or long-lasting in the ground water environment. They tend to adsorb to soil and to degrade reasonably quickly. These environmental fate properties are the primary reasons why regional ground water contamination by pesticides is generally limited, despite the large applications that have been going on for many years. Pesticide contamination of runoff and, subsequently, surface water bodies is a more likely mechanism for environmental contamination by pesticides.

6.2.2 Existing Programs

6.2.2.1 Regulatory Management

The Federal Insecticide Fungicide and Rodenticide Act (FIFRA) applies to the production, registration and application of all pesticides. FIFRA provides regulatory authority to EPA to review, register, label and specify requirements for pesticide use. Pesticides receive registration based on relative risk to human health and the environment.

Washington State Department of Agriculture (WSDA) is responsible for administering the Washington Pesticide Control Act (Chapter 15.58 RCW) and Washington Pesticide Application Act (Chapter 17.21 RCW). WSDA administers pesticide registration and quality control sampling; licenses of individuals who apply, sell or consult about pesticides; and investigates suspected pesticide violations and enforces regulations.

Applicator licenses are required for the application of restricted pesticides. There are three types of licenses based on the type of applicator: private applicators (farmers), public employees (right-of-way applicators), and commercial applicators. Commercial applicators are those that provide pesticide application services on a contract basis.

Private pest control applicator licensure requires that applicators receive 20 hours of re-certification credits every 5 years to maintain their license. Commercial applicators must receive 40 re-certification credits in 5 years. Failure to do so requires that an applicator re-take the licensure test. Washington State Department of Agriculture is responsible for accrediting all re-certification courses. About 30% of accredited re-certification courses available are offered through the Washington State University Cooperative Extension Service. Other courses that may receive accreditation are sponsored by growers' associations and product vendors.

The Pesticide Incident and Report Tracking panel (PIRT), administered by Washington State Department of Health, tracks and reports incidents involving pesticides. The panel compiles incident reports from several state agencies including departments of Labor and Industry, Health, Agriculture, Ecology, Natural Resources and Fish and Wildlife. The panel prepares an annual report to the legislature (Baum, 1997).

Snohomish County does not regulate the use of pesticides. All pesticide issues are referred to WSDA or DOH (SCHD, 1997).

With regard to drinking water wells, DOH has a database containing incidents of exceedances of drinking water standards. In 1994, DOH collected data regarding pesticide contaminants from 1300 systems in Washington State. Drinking water standards for pesticides were exceeded in 3% of the systems sampled. Specific data regarding detection of pesticides in drinking water wells in Snohomish County is not available from DOH at this time (Stern, 1997).

6.2.2.2 Voluntary and Education Programs

U.S. Soil Conservation Service, Snohomish Conservation District, and Washington State Cooperative Extension Service operate a program that provides technical assistance to farmers in the development of individual farm conservation plans. Generally, the individual conservation plans include best management practices (BMPs) and focus on minimizing non-point source pollution from farm activities, particularly those associated with animal keeping. Snohomish Conservation District does not provide information on integrated pest management (IPM) and refers related questions to the Cooperative Extension Service.

The use of IPM is being encouraged by many agencies to reduce sole reliance on synthetic pesticides for pest control. Integrated pest management is an ecologically based pest control strategy that integrates appropriate tactics including cultural practices, natural enemies, resistant host varieties, physical methods and pesticides to suppress a pest population to a tolerable level.

Most growers belong to an association that provides continuing education. Courses or workshops offered through associations relative to pesticide applicator licensure can be accredited by WSDA and applied toward re-certification credits. The Centennial Clean Water Fund provides grant money to commercial growers needing assistance to adopt best management practices. This program is administered through the Ecology Water Quality Grants Program by SCD.

Washington State University Cooperative Extension Service provides education and technical assistance to growers. Education programs for growers consist of approximately 5 workshops per year, approximately 12 "Growers Breakfasts" per year, one 2-day, 12-credit re-certification program per year, and a newsletter published 4 times per year. Information disseminated through these programs includes updates on new regulations, best management practices and pest control techniques (Havens, 1997).

Regarding disposal of banned pesticides, WSDA receives annual state funds to provide an agricultural chemical collection and disposal program to safely dispose of banned pesticides. With funding from the state legislature, the program provides collection events in about 6 counties per year, including Snohomish County. There is a possibility that this program may operate with fixed locations to provide convenience to farmers (Hoffman, 1997).

6.2.3 Issues

6.2.3.1 Issue 1)

Collection of unwanted pesticides is limited in Snohomish County.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Washington State Department of Agriculture should consider developing a seasonal or permanent pesticide collection site in Snohomish County for better accessibility to farmers. PEST-1

6.2.3.2 Issue 2)

Pesticide applications occurring in Snohomish County are not presently inventoried or mapped.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County, Snohomish Conservation District or Ecology should consider developing a program to map and inventory pesticides used in agriculture with the County, focusing first on vulnerable aquifer areas, as shown in Figure I-3-8. The map and inventory can be used to support various water resources programs, including but not limited to, wellhead protection programs and ground water monitoring programs. PEST-2

6.2.3.3 Issue 3)

Commercial pesticide users such as turf farms, golf courses, nurseries, and forest land managers may not be trained in the use of best management practices for pesticide applications and the use of non-toxic alternative pesticides.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County, Snohomish County Cooperative Extension Service, or Snohomish Health District should apply to EPA or Ecology for a grant to fund an educational program targeting commercial pesticide applicators, such as turf farms, nurseries, golf courses, and forest lands, providing information on best management practices for pesticide applications and the use of less toxic alternatives. PEST-3

6.3 Right-of-Way Maintenance

6.3.1 Problem Statement

Problem/Concern Right-of-way areas include primarily city streets, county roads, state highways, pipeline corridors, powerlines, and railroads. The various interests that maintain these areas may apply pesticides to control weeds and other undesirable plants. Precipitation onto these areas can dissolve pesticides in water. Percolation of the water into the soils to ground water can result in ground water contamination.

Sources Any right-of-way areas where pesticides are applied can be a source. Misuse of pesticides creates the greatest potential for contamination of ground water.

Present Conditions Pesticide contamination of ground water resulting from applications on right-of-way areas has not been identified in Snohomish County. Pesticide applications in right-of-way areas are limited at present. Most right-of-way maintenance is mechanical, consisting of brush cutting rather than the application of pesticides. Of those interests surveyed, only the Burlington Northern Santa Fe Railroad indicated pesticides were used on an as-needed basis to control weeds.

Predicted Future Conditions Pesticide applications in right-of-ways will likely decrease in the future, although it is already at a low level in Snohomish County. A decline is expected due to the general movement away from pesticide applications and the costs of materials. Future maintenance practices, however, may use new non-toxic pesticides as they become available and if they are cost-effective.

6.3.2 Existing Programs

6.3.2.1 Regulatory Management

Regulations pertaining to the application of pesticides along highways and roads are the same that apply to agricultural applicators with the exception that licensure and re-certification requirements differ. Washington State Department of Agriculture requires that applicators be licensed as public pest control applicators. This license requires 40 hours of re-certification credits every 5 years, rather than the 20 hours every 5 years required of private applicators.

6.3.2.1 Voluntary and Education Programs

In order to evaluate and minimize the use of pesticides on state highways, Washington State Department of Transportation conducted a programmatic environmental impact statement to determine the preferred management technique for weed control. The preferred technique was to adopt integrated pest management (IPM). This technique was adopted as department policy (Baroga, 1997).

Snohomish County Department of Public Works does not apply restricted herbicides for weed control, per direction from the Snohomish County Council. None of its staff hold licenses for the application of restricted pesticides. Only under unusual circumstances is there a need to apply a non-restricted use herbicide such as glyphosate (Roundup) (Smith, 1997).

Olympic Pipeline, a company with two gasoline pipelines running north/south through Snohomish County, has a standing policy not to use herbicides for clearing vegetation. All vegetation control is done by mechanical means (Hopf, 1997).

Burlington Northern Santa Fe Railroad applies herbicides on an as-needed basis in order to comply with regulations related to safety and visibility of signs. Applications within Snohomish County are done by a local pest control company on contract with the railroad (Shepard, 1997). The current contract is in effect through the year 2001.

6.3.3 Issues

6.3.3.1 Issue 1)

Burlington Northern Santa Fe Railroad is the only public right-of-way pesticide applicator identified that has not adopted IPM protocols for its vegetation control operations within Snohomish County.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) The GWAC could request that Burlington Northern Santa Fe Railroad adopt IPM to limit use of herbicides. PEST-4

6.4 Landscaping Applications

6.4.1 Problem Statement

Problem/Concern Pesticides are commonly used for landscaping and gardening applications on domestic and commercial properties. When applied for these purposes, pesticides can dissolve in water and percolate into the soils. Pesticides can be transported to ground water causing contamination. Particularly with respect to domestic applications, the chances for misuse of pesticides are greatest, as there is little economic incentive to apply pesticides sparingly.

Sources Any application of pesticides can be a source of ground water contamination. However, misused pesticides pose the greatest risk.

Present Conditions The Phase One Study of the Snohomish County Ground Water Management Plan conducted analyses for pesticides in approximately nine ground water samples. No pesticides were detected; however, the number of samples was

insufficient to address conditions in the entire County. In Snohomish County, there is little data on the occurrence of pesticides in ground water.

Predicted Future Conditions The potential for pesticide contamination of ground water from domestic and commercial applications could decline in the future if applicators become better educated in the proper use of pesticides and new non-toxic or environmentally-friendly products become more common.

6.4.2 Existing Programs

6.4.2.1 Regulatory Management

All pesticides are regulated under FIFRA and administered by EPA. Pesticides available to the public are labeled with appropriate applications set forth by EPA. Failure to follow the directions on the label is a violation of federal and Department of Agriculture regulations. Only pesticides that do not have a "restricted use" designation are available to the public. These pesticides tend to be less toxic and less persistent in the environment.

6.4.2.2 Voluntary and Education Programs

EPA has an outreach program for education on integrated pest management (IPM). The goal of the program is to reduce toxic exposures. Although the program is not focused on ground water protection, the program indirectly reduces the potential for ground water contamination. Grants to agencies and organizations are available through EPA to implement educational programs.

The public may find information about minimizing use of pesticides through numerous agencies and nonprofit organizations. Snohomish County Cooperative Extension Service offers various booklets and brochures on such topics as integrated pest management, composting, and water-wise gardens. The Cooperative Extension Service also offers the Master Gardener Program. Other organizations assisting in minimizing or emphasizing judicious use of pesticides include Washington Toxics Coalition, Seattle Tilth and many garden clubs.

Washington Toxic Coalition is a nonprofit organization providing education and assistance on topics such as alternative pest control management and low toxicity cleaning agents for the home. The coalition currently has a contract with Ecology and EPA to provide an education program on integrated pest control management to schools. This program is currently being offered at Mukilteo and Northshore school districts in Snohomish County.

Snohomish County Department of Parks and Recreation, in cooperation with Washington State University, provides information and technical assistance on pesticides through Snohomish County Cooperative Extension Service. Examples of services offered to home growers include clinics, booklets and brochures at retail gardening centers and an information and education booth at the Evergreen State Fair.

6.4.3 Issues

6.4.3.1 Issue 1)

Pesticides are most commonly misused in residential applications by home owners.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County, Snohomish County Cooperative Extension Service, or Snohomish Health District should apply to EPA or Ecology for a grant to fund an educational program targeting the general public and providing information on best management practices for pesticide applications and the use of less toxic alternatives. PEST-5

Alternative 3) Snohomish County Cooperative Extension Service, through the Master Gardener's Program, should obtain/develop educational materials on pesticide applications and alternatives and make these materials available at check-out stands of major retailers. PEST-6

7. WELL CONSTRUCTION AND DECOMMISSIONING

Alternatives in this section address ground water contamination issues related to the construction of water supply wells.

7.1 Goals

Minimize the potential for ground water contamination resulting from the vertical flow of contaminants in a poorly sealed well.

7.2 Problem Statement

Problem/Concern Many domestic water wells are located in Snohomish County. The ages of these wells varies and older wells in particular may not have an adequate well seal. The purpose of the well seal is to prevent the vertical flow of water along the well borehole. When the seal is absent or deteriorated, the potential exists for contamination at ground surface to flow down the well to a water supply aquifer.

Sources Older wells, particularly those installed prior to 1972, are likely constructed with insufficient well seals. These older wells are the primary sources.

Present Conditions During the Phase One Study of the Snohomish County Ground Water Management Program, a survey was completed of the wells located in the County. A total of 1,330 wells were field located. The total number of wells is likely several times this amount. The number of wells with compromised well seals is not known.

Predicted Future Conditions The number of new wells installed without proper well seals will decline in the future due to regulations. In theory, all wells installed at present are constructed with a surface seal to a depth of at least 18 feet below ground surface. The number of existing wells with insufficient seals will likely decrease due to development and voluntary decommissioning of unused wells.

7.3 Existing Programs

7.3.1 Regulatory Management

Department of Ecology regulates well construction and decommissioning practices under authority of the Well Construction Act of 1971, Chapter 18.104 RCW, and the Minimum Standards for Construction and Maintenance of Water Wells, Chapter 173-160 WAC.

Well drillers are required to be licensed according to Chapter 173-162 WAC. Licensing requirements include 2 years of working experience under a licensed driller, a written exam and an on-site exam. It is anticipated that Chapter 173-160 WAC will be modified to require continuing education credits to maintain a driller's license (WSDOE, 1997).

Through a Memorandum of Agreement (MOA) with Ecology, Snohomish County Health District administers and enforces well sealing and decommissioning for any new or existing well. Last year, the District conducted 543 inspections of well seals. Since the MOA, the Health District has not taken any enforcement action on a driller for illegal installations because the number of incidents is low and voluntary repairs have been made to correct deficiencies. The Health District surmises that their local presence in the County discourages illegal practices.

7.3.2 Voluntary and Education Programs

Snohomish Health District offers technical assistance to well owners regarding the proper construction, sealing, and decommissioning of wells as part of their MOA with Ecology.

7.4 Issues

7.4.1 Issue 1)

Well owners are generally not aware of the potential for ground water contamination due to a poor well seal in an operating well or an older unused well on their property.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish Health District should include educational materials on well seals and well decommissioning with other educational materials that are sent to on-site sewage system permit holders. WELL-1

8. SURFACE MINING AND EXCAVATION

Alternatives in this section address issues related to surface mining and, primarily, to the mining of sand, gravel, and rock.

8.1 Goals/Objectives

GOAL 1 Prevent contamination of ground water from sand, gravel, and hard rock mining practices, and from all activities associated with mining these resources.

GOAL 2 Protect the integrity of aquifers and recharge areas for aquifers from sand, gravel, and hard rock mining.

GOAL 3 Ensure that reclamation will protect the integrity and purity of aquifers.

GOAL 4 Ensure that regulatory programs are adequate to prevent adverse effects upon ground water quality due to sand and gravel mining operations, and the follow-up process of reclamation.

8.2 Mining And Excavation Through An Aquitard

8.2.1 Problem Statement

Problem/Concern During sand, gravel and rock extraction or the excavation for utilities and buildings, it is possible to remove a geologic layer that provides a barrier to an aquifer (e.g., an aquitard). The aquifer water levels may be permanently lowered and in extreme cases, the aquifer could be completely dewatered. Impacts of this nature require special hydrogeological conditions in order to occur. It is expected such conditions are present in low frequency in the GWMA, but moderately detailed site evaluations are needed to detect if the conditions are present. Normally, these types of impacts would be localized but could approach a regional scale (several square-miles) depending on hydrogeologic conditions.

Sources Any excavation into saturated materials could breach an aquifer barrier layer, impacting aquifer water levels. The type of impact addressed here is most likely to occur when excavation/mining occurs into the side of plateau areas.

Present Conditions To date in the GWMA, one incident has been documented in which a sand and gravel mining operation penetrated a barrier layer and exposed an otherwise confined aquifer (Part I, Section 5.8). The aquifer water levels were substantially and permanently altered. It is not known how many existing mining sites are located where, due to hydrogeological conditions, similar incidents could occur.

Predicted Future Conditions Continued growth and development of aggregate supplies in the GWMA will result in surface mining at new areas. The possibility exists that some of these areas could have hydrogeological conditions, including a barrier layer and a confined aquifer. Excavations through the barrier layer could result in impacts.

The locations and numbers of sites that could be developed in areas with the necessary conditions is not known, but is expected to be small.

8.2.2 Existing Programs

8.2.2.1 Regulatory Management

Several state regulations are applicable to surface mining through their environmental risk assessment processes. Snohomish County Code (SCC) Title 23 Environmental Review (SEPA) indirectly protects ground water resources. Title 32.11 Ground Water Ordinance directly focuses on protecting ground water. Both of these regulations are administered by Snohomish County Planning and Development Services (PDS). The State Clean Water Act 90.46 RCW is the source of Ecology's regulations over State Waste Discharge Permits and National Pollutant Discharge Elimination System (NPDES) Permits. The State Clean Water Act directed Ecology to issue administrative orders to mitigate potential violations in 90.48.120 (2) RCW.

SEPA review is required by the Ground Water Protection Regulations SCC 32.11, which states that the ground water impacts of an action be subject to environmental review. A hydrologic site evaluation or a best management practices (BMPs) program can be required to protect the ground water resource. If significant impacts to a critical aquifer recharge area (CARA) are identified in the SEPA process and are determined to be unavoidable, the applicant and PDS will develop a mitigation plan or the project could be denied or curtailed. When the Hearing Examiner reviews the project's permit application, he may then require a mitigation plan. The plan may require preventative measures, monitoring, process control and remediation.

SCC TITLE 18, County Zoning Ordinance, also is administered by PDS and indirectly protects ground water. The Snohomish County zoning code requires a conditional use permit (CUP) for all new mining sites larger than 3 acres in area. Sites smaller than 3 acres in area require a County grading permit rather than a CUP. The CUP application process subjects a site to an environmental review before a permit is issued. Mitigation conditions may be specified and include posting of bonds or other protective measures.

When an application is filed with the County to mine a resource area, such as land-zoned forestry, the area may require rezoning to Mineral Conservation (MC). The rezone application is also subject to environmental review and Hearing Examiner action. The Hearing Examiner's review covers the adequacy of the environmental review.

A mineral resource lands sub-element has been incorporated in the Snohomish County General Policy Plan to satisfy the Growth Management Act (GMA), which requires that lands be available for future mining. The sub-element has policies to direct decision-making during the zoning and CUP process but does not regulate actual operation of mines. The adjacent property owners are notified on their deeds that gravel mining could occur, or is occurring, on the designated lands and of the commonly associated

impacts. Approval of a CUP or MC rezone is not limited to only those lands with a mineral resource designation; other lands can be mined, if permitted. If a CUP is applied for on designated lands, it does not automatically get permitted (Niemann, 1997).

8.2.2.2 Voluntary and Education Programs

The Washington Aggregate and Concrete Association (WACA) has instituted a program to educate and assist members. It includes a full-time staff person who manages industry self-regulation, e.g., a plant owner can request an environmental audit and a WACA representative will visit the site and note all problems and advise the plant manager on how to achieve compliance (Chattin, 1997).

WACA also schedules an annual, three-hour compliance education seminar, which includes Ecology personnel, and is given at locations across Washington. Each year the seminar addresses new subjects of concern, usually regulations that are becoming effective in the near future.

8.2.3 Issues

8.2.3.1 Issue 1)

The County staff that issue Conditional Use Permits (CUPs) for surface mining may not have proper training or access to technical assistance for decision making regarding the approval process.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County (Planning and Development Services and/or Public Works) should develop one or more programs to train CUP project managers on surface mining operations. Training should include the basics as to how these facilities can cause impacts and the nature of other regulatory programs that will be in effect for operating facilities. This training should emphasize the gaps in existing regulations and how CUP project managers can minimize the potential for impacts.

Alternative 3) Snohomish County should consider providing and/or requiring that project managers seek and obtain technical assistance for surface mining CUP applications. Such assistance could be provided, for example, to decide upon the requirements of a geohydrologic assessment and to review geohydrologic assessments submitted by CUP applicants.

8.2.3.2 Issue 2)

Geohydrologic evaluations are not necessarily required for proposed surface mining sites.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County Planning and Development Services should amend the Conditional Use Permitting (CUP) process for surface mining to require that geohydrologic evaluations, identifying the locations of relevant aquitards and their relation to proposed mining activities, be completed by all applicants. MINE-1

8.2.3.3 Issue 3)

Surface mining on sites smaller than 3 acres does not require a Conditional Use Permit (CUP), but rather requires a County grading permit.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County Planning and Development Services (PDS) should require that geohydrologic evaluations, identifying the locations of relevant aquitards and their relation to proposed mining activities, be completed by all applicants for grading permits that will be used for surface mining.

8.2.3.4 Issue 4)

Surface mining operators may not have training to identify when aquifer breaching conditions are encountered.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) The Washington Aggregate and Concrete Association (WACA), the Washington Department of Natural Resources, the Department of Ecology, or the Washington Environmental Council should consider presenting in annual seminars materials regarding the breaching of aquifers by surface mining. Educational materials should also be prepared and distributed to aggregate producers. MINE-2

Alternative 3) Snohomish County Planning and Development Services (PDS) should consider adding a provision to the Conditional Use Permit (CUP) that requires surface mining operations within the GWMA to have periodic inspections of site conditions by qualified geologists or hydrogeologists. MINE-3

8.3 Leaching Of Mine Waste And Fill Materials

8.3.1 Problem Statement

Problem/Concern The most common form of mining in the GWMA consists of sand, gravel and rock extraction. Sand and gravel pits must be reclaimed (backfilled and graded) after the mining phase is completed. In some cases, fill materials may be brought in from off-site sources and could be contaminated. After emplacement, leaching of backfill materials may occur, resulting in ground water contamination.

Sources Any reclaimed mining operation in which an excavation has been backfilled by contaminated, or non-inert, materials is a potential source. Reclaimed pits that used inert materials would not be a source of ground water contamination.

Present Conditions Ground water contamination caused by the leaching of backfill materials at sand and gravel facilities has not been identified in the GWMA.

Predicted Future Conditions Increased mining activities in the future will increase the risk for contamination of ground water by this process (e.g., leaching of backfill). Sand and gravel mining areas typically are located where ground water is vulnerable to contamination. In cases where imported backfill materials are used for reclamation of a sand and gravel mine, proper testing should occur to ensure that such materials do not include contaminants. In the absence of proper testing, contaminated backfill materials could be unknowingly accepted at a mine, and contaminants contained in the imported materials could be leached to underlying ground water.

8.3.2 Existing Programs

8.3.2.1 Regulatory Management

Under Chapter 78.44 RCW the Washington State Department of Natural Resources (DNR) Reclamation Permit is required for surface mining sites greater than three acres in area. After the applicant obtains the County Conditional Use Permit (CUP) and/or Mineral Conservation (MC) rezone, DNR will issue the reclamation permit. DNR and Snohomish County do not coordinate their efforts in the permitting process for a surface mining site.

DNR has some ability to require an assessment of hydrogeology at a surface mining site. An excerpt from Chapter 78.44 RCW reads, "Where mining is contemplated within critical aquifer recharge areas. . . public water supply watersheds, sole source aquifers, and wellhead protection areas, and designated aquifer protection areas as set forth in Chapter 36.36 RCW, a thoroughly documented hydrogeologic analysis of a reclamation plan may be required . . . ."

Initially, there is a bond posted prior to the issuance of the reclamation permit. The amount of the bond is based on how much of the site is open and in need of future reclamation. The bond is reviewed annually and its amount is determined by how much of the site is being mined. As the bond amount increases, it creates incentive for the operator to start reclaiming portions of the site, thereby reducing the bond amount in the subsequent year.

Once a site phase is complete, reclamation must begin on that portion of the site. Under Section 78.44 RCW, the operator has two years in which to complete the reclamation of the identified portion. If the reclamation is not completed after that time period, DNR may take the bond and have the work completed by an outside contractor. The 1994 amendments to Section RCW 78.44 give DNR much more flexibility in what it requires for minimum standards of reclamation. It also allows a permit to be withdrawn for non-compliance (Anderson, 1997).

The Washington State Growth Management Act RCW 36.70A requires that local comprehensive plans address and protect water quality and quantity, and critical areas. Upon a petition for a review, the State Growth Management Hearings Board reviews county and city comprehensive plans to verify that all requirements are fulfilled. Critical areas include Critical Aquifer Recharge Areas (CARAs). Snohomish County instituted the GMA in its General Policy Plan (GPP) and Ground Water Ordinance, Title 32.11, but has not delineated any specific CARAs.

8.3.2.2 Voluntary and Education Programs

The Washington Aggregate and Concrete Association (WACA) provides annual seminars for the aggregate industry, which include discussion of environmental impacts and regulations. WACA also has developed an education program for 5th and 6th graders called "Aggregate Mining in the Classroom." The school materials are provided locally but have not been widely promoted.

8.3.3 Issues

8.3.3.1 Issue 1)

The chemical quality of imported backfill materials is not routinely evaluated for the reclamation of surface mining excavations.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Washington State Department of Natural Resources (DNR) should consider adding a provision to reclamation permits requiring evaluations to show that any imported backfill materials are clean and inert. MINE-4

Alternative 3) Washington State Department of Natural Resources (DNR), Ecology, Snohomish County, and the Washington Aggregate and Concrete Association (WACA) should prepare and distribute educational materials for

operators detailing responsibilities and monitoring methods to evaluate backfill materials. Specific testing procedures should be detailed.

Alternative 4) Washington State Department of Natural Resources, Ecology, Snohomish County, and the Washington Aggregate and Concrete Association should recommend surface mining operators require that individuals providing backfill demonstrate the materials are clean and inert. MINE-5

8.3.3.2 Issue 2)

Snohomish County Planning and Development Services (PDS) and the State of Washington Department of Natural Resources (DNR) do not coordinate the permitting process for surface mining operations.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County Planning and Development Services should consider amending all Conditional Use Permits (CUP) issued for surface mining to require that: 1) no excavation is allowed until the DNR reclamation permit has been obtained and provided to PDS; and 2) reclamation must be complete within two years after each mining phase is completed. MINE-6

Alternative 3) Snohomish County Planning and Development Services should collaborate with DNR to prepare a Memorandum of Understanding (MOU) identifying reciprocal responsibilities, including, for example, that: 1) a copy of the approved reclamation plan and permit should be submitted by DNR to PDS for CUP compliance within 150 days after issuance of the CUP; and 2) a detailed reclamation plan, which includes mitigation for impacts to Critical Aquifer Recharge Areas and other sensitive areas, be required. MINE-7

8.3.3.3 Issue 3)

Older surface mining sites exist in the County that have not been reclaimed and could be developed in the future for other purposes under a County grading permit.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County Planning and Development Services should amend the grading permit process to include a provision requiring evaluations to demonstrate backfill materials are clean and inert. MINE-8

8.3.3.4 Issue 4)

It is not necessarily required that a surface mining operation evaluate the presence of water supply wells in proximity to the existing or proposed facility.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) The GWAC or Snohomish County Planning and Development Services (PDS) should request that Ecology modify the NPDES/State Waste Discharge general permit to include a well inventory for all land within a specified radius of the proposed or existing facility.

Alternative 3) Snohomish County Planning and Development Services (PDS) should consider requiring surface mining Conditional Use Permit (CUP) applications to include a well inventory for water supply wells within a specified radius of the proposed facility. MINE-9

Alternative 4) Snohomish County Planning and Development Services (PDS) should consider a revision to the zoning code to require a contingency plan for the replacement of surrounding residents' potable water in the event that a proposed mineral excavation has detrimental effects on ground water quantity or quality (from General Policy Plan, Appendix H-d-11).

8.4 Spills at Mining and Excavation Sites

8.4.1 Problem Statement

Problem/Concern Mining and other excavations typically remove at least top soil and, in some cases, may penetrate ground water. Chemical spills in these areas may occur in proximity to a water table, resulting in ground water contamination. Spills may occur, for example, from: the operation and maintenance of heavy equipment; refueling; concrete batch operations; and hot mix asphalt operations.

Sources Any heavy equipment operated within or adjacent to an excavation is a potential contaminant source. Concrete batch operations and hot mix asphalt operations are also potential sources.

Present Conditions There are presently no sand and gravel mining operations in Snohomish County listed as contaminated sites by the Department of Ecology. As described in Part I, Section 5.8, a total of 9,007 acres of land in Snohomish County are presently designated as mineral resource lands. Eighty-eight percent of these lands overlie medium- and high-vulnerability aquifers.

Future Predicted Conditions Due to increasing regulations pertaining to the handling of hazardous and potentially-hazardous materials at surface mining facilities, it is unlikely that many ground water contamination events will be experienced, or that the risk of such events will increase.

8.4.2 Existing Programs

8.4.2.1 Regulatory Management

In compliance with state and federal laws, Ecology has prepared a combined National Pollutant Discharge Elimination System and State Waste Discharge (NPDES/SWD) General Permit that applies to surface mining operations. The permit was prepared in 1994 and addresses the handling of stormwater and process water at these facilities. Permits are issued to individual facilities and must be renewed every five years. Ecology does not issue public notice in regard to permit violations, however, this information is publicly available.

During the last two years of the current NPDES/SWD Permit period, Ecology will use the monitoring data collected by permittees for ground- and surface-discharge waters to determine permit effluent limits for potential contaminants and the scope of monitoring required in the re-issued general permit (after 5 years). Ground water is presently monitored for pH, with 6.5-8.5 being the acceptable limit in discharge waters (coincides with drinking water standards). In November of 1997 monitoring will also be required for total petroleum hydrocarbons and for nitrates where explosives are used. Concrete batch plants with discharges to ground water will be monitored for chloride, sulfate, total petroleum hydrocarbons, alkalinity, total dissolved solids, nitrate, and oil and grease.

Spill reports to Ecology are required of all spills with minimum spill volumes ranging from 5 gallons to 50 gallons. The minimum volume of a spill that requires a report to Ecology depends on the type of chemical. Stormwater and process-water monitoring data are reported to Ecology quarterly and monthly, respectively, for any permitted discharges to surface water and ground water. These monitoring reports are entered into the State's Washington Permit Life Cycle System (WPLCS) database. Forty-six Snohomish County surface mines have general permits and their reports are screened by an Ecology enforcement officer.

The general permit does not require that monitoring wells be used to monitor ground water quality. However, a Companion Order can be prepared requiring ground water monitoring. Three permit applications are presently under review that may require monitoring wells: 1) a mine near Granite Falls is being asked to monitor at depth for water quality; 2) a mine in King County will install two monitoring wells to observe ground water elevations; and 3) a mine in Snohomish County will have monitoring wells to ensure mining remains above the seasonal-high ground water level (Drabek, 1997).

The State of Washington also has specified ground water quality standards that must be met by any facility with discharges to ground water, intentionally or unintentionally. The water quality standards are presented in Chapter 173-200 WAC. Compliance with these standards is stated within the NPDES/SWD General Permit.

8.4.2.2 Voluntary and Education Programs

The Washington Aggregate and Concrete Association (WACA) provides annual industry compliance education seminars at different locations in Washington State. These seminars provide information to aggregate producers on NPDES/SWD permits.

8.4.3 Issues

8.4.3.1 Issue 1)

There are presently no procedures by which notice is issued to owners of nearby water supply wells that a surface mining operation has committed an NPDES/SWD General Permit violation that could impact water wells.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) The GWAC or Snohomish County should request that Ecology develop a procedure by which well owner's near a surface mining operation are notified of NPDES/SWD General Permit violations whenever such violations could impact water wells. MINE-11

9. ILLEGAL DUMPING

Alternatives in this section address issues related to the illegal dumping of hazardous materials on public and private vacant land and abandoned properties.

9.1 Goals/Objectives

To prevent the contamination of ground water by spills or dumped chemicals that are illegally disposed on vacant land and abandoned properties.

9.2 Problem Statement

Problem/Concern Illegal dumping occurs commonly on vacant land and abandoned properties. Dumped materials may include wastes and chemicals that can spill onto the soils and infiltrate to ground water. Ground water contamination and nearby water supplies or surface waters could be contaminated by these spills. Cleanup of illegal dumping sites is typically costly and is paid for by the public or private land owners.

Sources Any toxic wastes or chemicals disposed illegally on public or private lands are a source of ground water contamination.

Present Conditions There are no known illegal dumping sites in Snohomish County that are presently listed in Ecology's database of hazardous sites and are known to have caused contamination of ground water. Illegal dumping sites exist in the County, however, the exact number and locations are not presently inventoried. Many illegal dumping sites exist in the state where toxic chemicals and wastes have been illegally disposed on vacant land.

Future Predicted Conditions Illegal dumping of wastes will continue in the future. It is possible that if disposal of hazardous wastes and unwanted chemicals becomes expensive or more difficult, the dumping problems and the chances for ground water contamination will both increase.

9.3 Existing Programs

9.3.1 Regulatory Management

The Washington State Patrol is generally not called in connection with reports of illegal dumping. However, they can respond by sending a trooper to investigate the scene if the act is in progress, and may cite an individual if they are caught. Response to complaints of illegal dumping is typically left to the local jurisdiction, either police or fire department, depending on the type of material dumped, or to the Snohomish County Department of Emergency Management. If the report is for garbage or materials that have been dumped on a property at some time in the past, the State Patrol leaves it up to the property owner and the Snohomish Health District to determine clean-up procedures.

Local governments have approaches to illegal dumping of solid wastes that may vary from one another. The City of Monroe, for example, takes a reactive approach to such dumping. If someone is caught in the act, the officers will instruct them to pick up all of the debris/refuse and return it to their vehicle. In the event of a liquid material (e.g., oil), the officer will direct them to dig up the entire area where the material was dumped. If the responsible party does not comply with the officer's clean-up instructions, they are cited with a misdemeanor for violation of city code. In the City of Everett, if the Police Department can identify the responsible party, the party can be cited with misdemeanor charges for violation of city code. The amount of the fine would be determined by a judge.

The Snohomish Health District (SHD) responds to complaints regarding illegal dumping. Generally, a citizen will call SHD to report an incident that they have seen or some materials that they have found. If the responsible party is identified, SHD sends them up to three letters indicating that there has been a violation and describing the clean up action that must be taken. Following the second notice and a failure to respond, a Health Officers' Order can be issued and legal action can be initiated. In court, SHD will seek actions and fees to clean up the dump site and fees for all legal costs. SHD does not have the authority to levy fines to the responsible party.

The Washington State Department of Ecology responds to complaints of unknown or suspected hazardous material dumps as a spill emergency. Ecology coordinates these responses closely with local fire departments. Generally, Ecology will visit a disposal site, sample the material, and determine a course of cleanup action. Funds are available for cleanup through the Model Toxics Control Act. Solid waste (e.g., garbage) is strictly handled by local jurisdictions. The Washington Department of Fish and Wildlife also has the authority to cite individuals if they are caught dumping illegally.

Data Maintenance The Snohomish Health District maintains a "database" of historic dumping sites and/or complaints. The Department of Ecology has maintained an Environmental Complaints Tracking System for about the past five years. Data maintained in this database includes information regarding the complaint, such as type of material, quantity, location, and actions taken.

9.3.2 Voluntary and Education Programs

Educational programs have been initiated by the Snohomish County Public Works Solid Waste Management Division and the Snohomish Health District. Educational programs have included bus panels, school presentations, as well as brochures.

9.4 Issues

9.4.1 Issue 1)

Vacant lands exist in the County which are or can become sites for illegal dumping.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County Planning and Development Services should inventory abandoned sites in the County that are commonly used for illegal dumping. Land owners should be notified of the site status and the potential liability due to illegal dumping. DUMP-1

Alternative 3) Snohomish County should consider developing a database to store information on illegal dumping in terms of materials and locations. The database should be used to identify sites of frequent dumping and to locate signs warning about the penalties of illegal dumping.

Alternative 4) Snohomish County should review with the County Sheriff's Department the feasibility of patrolling abandoned sites and of reporting illegal dumps to Ecology and Snohomish Health District. DUMP-2

Alternative 5) Snohomish County Planning and Development Services should encourage property owners of abandoned surface mining sites to limit access by the use of fencing and signs.

Alternative 6) The GWAC should consider expanding the early action education program to emphasize the detrimental effects of illegal dumping on water quality.

10. COMMERCIAL AND INDUSTRIAL CHEMICALS AND HOUSEHOLD HAZARDOUS WASTE

Alternatives in this section address issues related to the handling of chemicals and wastes by commerce, industry, and households and the associated potential for ground water contamination.

10.1 Goals

To minimize the potential for ground water contamination resulting from the use of chemicals and fuels by commerce, industry, and households.

10.2 Problem Statement

Problem/Concern Commercial and industrial businesses and households may handle chemicals on a regular basis. These chemicals include, for example, solvents, fuels, and hazardous wastes. If these materials are spilled or leaked into the soil without proper remediation, ground water contamination can occur.

Sources Any commercial or industrial business or household handling chemicals is a potential source. Existing contaminant sites under investigation by the state or EPA are potential sources. Historic spills that have not been identified or remediated are also potential sources.

Present Conditions Part I, Section 5.5, evaluated the present conditions in Snohomish County regarding commercial, industrial, and household chemical handlers. A total of 3,616 facilities were identified based on Standard Industry Code (SIC) as critical material users. The critical material users identified include a variety of businesses, all of which are likely to handle one or more chemicals as part of their operations. A total of 362 sites were identified in the Ecology database of Leaking Underground Storage Tanks. Twenty-eight percent, or 102, of these sites were identified to have contaminated ground water. A total of 92% of the sites were remediated or in remediation. A total of 122 sites were identified in Snohomish County in the Ecology database for Confirmed and Suspected Contaminated Sites.

Most households contain chemical substances such as automotive materials, cleaners, solvents, glues, paints, and garden chemicals that, if improperly managed, have some potential to cause contamination of ground water. Currently, these substances can be properly disposed of through drop-off programs at paint and automotive stores, household hazardous waste collection events, and the new Moderate Risk Waste facility.

Predicted Future Conditions Due to regulations, educational programs, and the costs associated with hazardous waste disposal, chemical releases to the environment will likely decrease in the future. There is a general trend to minimize the usage of chemicals in order to decrease hazardous wastes. Regulations have been recently developed and continue to be developed that target specific problems in industria and

commercial facilities. These regulations also help to reduce the chances of chemical spills.

10.3 Existing Programs

10.3.1 Regulatory Management

The regulatory program that serves as the basis for hazardous waste control efforts is the federal Resource Conservation and Recovery Act (RCRA). The Department of Ecology enforces regulations that have been developed by the EPA under the RCRA program. Ecology also enforces their own hazardous waste regulations: the State Hazardous Waste Management Act, Chapter 70.105 RCW, and the Dangerous Waste Regulations, Chapter 173-303 WAC. Chapter 173-303 WAC is somewhat broader in scope than the federal RCRA regulations. Local regulations pertaining to hazardous waste controls include the Snohomish Health District's Sanitary Code Chapter 3.5, regulations governing moderate risk waste handling.

RCRA identifies approximately 400 specific substances as hazardous wastes. Substances may also be designated hazardous waste under RCRA if they exhibit any characteristics such as ignitability, corrosivity, reactivity, and/or EP (laboratory test) toxicity.

In addition to the substances that are designated as hazardous waste under RCRA, Chapter 173-303 WAC designates substances as hazardous wastes if they exhibit the characteristic of persistence and toxicity.

As a result of the more restrictive state definition, there are many wastes that are considered hazardous by Ecology but are considered non-hazardous by EPA and other states. Facilities that generate more than 220 pounds of hazardous waste per month are directly regulated under RCRA and the state program; although the federal program places greater inspection emphasis on generators of over 2,200 pounds of hazardous waste per month. Certain wastes, including some pesticides and wastes containing dioxin, are so acutely hazardous that they are regulated at levels of generation of only 2.2 pounds per month. Ecology refers to these materials as extremely hazardous wastes.

Even though the state and federal programs are primarily oriented towards regulation of waste management practices, because they employ a "cradle to grave" approach to waste management, facility inspections carried out under these programs often involve review of overall hazardous material use and storage at a regulated facility. Under a "cradle to grave" system of waste management, producers of regulated wastes are required to account for hazardous wastes from their time and place of generation to their point of ultimate disposal.

Generators of less than 220 pounds of hazardous waste per month are conditionally exempt from RCRA and the state hazardous waste regulations but are governed by the local Snohomish Health District Sanitary Code, Chapter 3.5 (see below). Complaints concerning conditionally exempt small quantity generators are enforced by Snohomish

Health District. Ecology and the Snohomish County Solid Waste Management Division may provide technical assistance in conjunction with Snohomish Health District. Ecology has authority over generators that fail to meet the conditions for exemption. According to Ecology regulations, generators of less that 220 pounds per month of hazardous waste are exempt if they comply with the following conditions:

- Appropriately designate their waste; and

- Either treat or dispose of dangerous waste on-site or insure delivery to an off-site permitted hazardous waste facility or legitimate recycling facility.

Snohomish Health District Sanitary Code Chapter 3.5 regulates the conditionally exempt small quantity generators per the requirements summarized below:

- **Storage** Hazardous waste shall be stored in appropriate, compatible containers, clearly labeled, with some means of cover, and not be placed in direct contact with the ground.

- **Labeling** Container labels must include: the accumulation start date; Department of Transportation labels; description of waste including the hazards associated with the waste; and the words "Hazardous Waste" clearly marked on the label.

- **Secondary containment** Secondary containment must be: covered, made of leak-proof material, sturdy, compatible, and capable of containing ten percent of the volume of all containers, or the volume of the largest container, whichever is greater.

- **Disposal** Any generator of hazardous waste is prohibited from disposing of hazardous waste into the general municipal waste stream, a storm drain, septic system, body of water, or environment in general.

Snohomish County residents are also responsible (per Sanitary Code Chapter 3.5) for the proper handling and storage of hazardous wastes; however, requirements for homeowners are generally less stringent than the conditions listed above.

In accordance with the Washington State Hazardous Waste Management Act, Chapter 70.105, Snohomish County Solid Waste Management Division and the Snohomish Health District have developed a Moderate Risk Waste Management Plan (Plan). The goal of the Plan is to develop waste management and disposal options that will decrease the potential impact of hazardous wastes on the environment and public health. The Plan calls for education and outreach efforts, waste collection events, and ongoing planning efforts to continue to decrease the potential impacts of hazardous wastes on the environment and public health as well as to keep the Plan updated.

Regarding cleanup of hazardous waste spills, both EPA and Ecology maintain programs to respond to releases of hazardous materials to ground water. These programs are the EPA Superfund Program and the Ecology Toxics Cleanup Program. Both programs attempt to require cleanup of ground water contamination problems by the party responsible for the release of the contaminants. If the responsible party is unwilling to

accept responsibility for the release of contaminants, either EPA or Ecology can undertake the cleanup and recover their costs from the responsible party at a later date.

If a responsible party cannot be identified, EPA or Ecology will undertake cleanup at agency expense. Ecology also maintains a 24-hour Spill Response Team for urgent spill events possibly affecting soil and water.

Regulations pertaining to the storage, handling, and use of hazardous materials are also provided by the Uniform Fire Code (UFC), which is administered locally by county, city, and fire-district marshals. Article 80 of the UFC provides requirements for the prevention, control, and mitigation of dangerous conditions related to hazardous materials and provides for information needed by emergency response personnel (UFC, Section 80.101).

UFC Article 80 identifies specific storage, dispensing, use, and handling requirements for hazardous materials in various settings. Successful applicants for operation permits must demonstrate compliance with UFC Article 80. Some of the provisions include: secondary containment facilities; facility closure plans; personnel training; material safety data sheets; facility maps; and chemical inventories.

The Washington Building Code Council adopted an amended version of the UFC. In the amended version, Hazardous Materials Inventory Statements and Hazardous Management Plans are not required from businesses that are also regulated under the federal Emergency Planning and Community Right to Know Act (EPCRA), also known as Title III of the Federal Superfund Amendments and Re-authorization Act (SARA) of 1986 (P.L. 99-499). SARA Title III required each state to appoint an emergency response commission and to designate emergency planning districts in the state to facilitate emergency planning activities. The state Emergency Response Commission was given the responsibility for appointing a local emergency planning committee (LEPC) for each designated district; a committee composed of all major affected parties, both public and private.

Commercial and industrial facilities within each designated emergency planning district that maintain hazardous substances in amounts equal to or greater than compound specific thresholds established by the EPA, were required to notify the state Emergency Response Commission, the jurisdictional LEPC, and the jurisdictional fire department of the presence of such substances through standard federal forms called Material Safety Data Sheets. All facility operators affected by SARA Title III provisions were required to develop hazardous materials incident response plans and to identify transportation routes used to haul hazardous materials to or from their facilities. Based on the information provided by facility operators and other relevant data, within two years after passage of SARA, each LEPC was required to complete a comprehensive emergency management plan (CEMP).

In addition, a category of hazardous materials was exempted from the state UFC storage regulations. Several of these hazardous materials have been identified as ground water contaminants including but not limited to: benzene, carbon tetrachloride, chloroform, vinyl chloride, some pesticides and other organic solvents.

Local governments may adopt the UFC as amended by the state or may adopt a more stringent version (RCW 19.27.040). Consequently, a local government, if it chooses to

do so, could adopt a version of the UFC that lacks the weaknesses of the State's amended version.

The UFC and other regulations discussed above are normally applied where chemicals or wastes are stored. Regulations that pertain to loading dock areas are not as clearly defined. Section 307.2.5 (Hazardous Occupancy) of the 1994 Uniform Building Code may require that loading docks be constructed with secondary containment and that drainage must be directed to containment facilities. Only facilities located in sensitive areas (e.g., adjacent to streams, wetlands, etc.), and that are mandated by SEPA regulations, are required to have any special provisions (e.g., secondary containment) at loading docks. Many businesses, however, voluntarily install secondary containment facilities in loading dock areas because cleanup costs from a spill event are typically much more costly. The Puget Sound Stormwater Management Manual includes several best management practices that apply to different industries and address the containment of spills in loading dock areas. These best management practices may be required under any of several permits (e.g., NPDES, building).

Snohomish Health District regulations require households to properly store and label their household hazardous wastes. They also stipulate that household hazardous wastes may not accumulate in quantities that present a threat to public health or the environment. The regulations further stipulate that household hazardous wastes may not be deposited in a municipal solid waste collection system, an on-site sewage system, or a storm drain; on the ground surface or under the ground; or in surface or ground water. Household hazardous waste may not be deposited in a public sewer system without written approval from the sewer utility, or without a state waste discharge permit.

10.3.2 Voluntary and Education Programs

Snohomish Health District and Snohomish County Solid Waste Management Division operate the Moderate Risk Waste Management Program. This program offers presentations to trade groups, small business owners, and households regarding proper management and disposal of hazardous waste. By the end of 1998, the program plans to have a permanent facility for the collection of hazardous waste from small quantity generators (businesses that generate less than 220 pounds of hazardous waste per month) and households. The program currently operates 4 to 5 collection events annually to service these generators that cannot economically use other waste disposal options (Defenbach, 1997). In 1999, the Snohomish County Solid Waste Management Division will offer year-round collection of hazardous wastes from small quantity generators and households at a fixed Moderate Risk Waste facility in Everett. Other non-regulatory assistance provided in Snohomish County includes:

- Snohomish Health District is coordinating hazardous waste regulators through the Interagency Regulatory Assessment Committee (IRAC). IRAC's goal is to produce a hazardous waste management guide that outlines the various regulatory requirements of these agencies. This guide will also help businesses contact the appropriate agency to obtain information on hazardous waste management.

- Snohomish County Department of Public Works Solid Waste Management Division distributes brochures produced by the Washington Toxics Coalition throughout the County through a variety of programs. In addition, the Solid Waste Management Division provides training for citizens and teachers through the Master Recycling Composter Program. This training includes information about natural lawn care; proper recycling and disposal of automotive products, pesticides, and other chemical substances; and how to conduct safer car washes. The Washington Toxics Coalition provides training annually to the Master Recycler Composter program regarding household hazardous waste products and alternatives.

- Snohomish County Department of Public Works Solid Waste Management Division provides pollution prevention information and assistance to conditionally exempt commercial small quantity generators of hazardous waste through distribution of brochures, newsletters, telephone assistance, and referrals. Topics include the reduction of use of hazardous materials.

- Snohomish County Department of Public Works Surface Water Management Division, as part of NPDES permitting, will review commercial and industrial sites and provide comments to owners/operators regarding the storage and handling of chemicals and wastes.

- Snohomish County Solid Waste Management Division participates in a regional pollution prevention program called ENVIROSTARS that, through site visits and recognition, provides incentives to businesses who handle wastes and chemicals in an environmentally safe manner. Businesses are awarded one to five stars to reflect the level of effort they have put forth in pollution prevention and safe handling of wastes and chemicals.

10.4 Issues

10.4.1 Issue 1)

Businesses may not be in compliance with regulations because they are not aware of the regulations or the methods by which compliance can be achieved.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County and Ecology should enhance existing programs to provide technical assistance on an ongoing basis to small quantity generators, targeting Critical Aquifer Recharge Areas.

10.4.2 Issue 2)

Inspections of businesses for compliance with existing regulations is completed at low frequency in Snohomish County.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish Health District should evaluate the Moderate Risk Waste Management Plan to identify ways in which inspection frequency could be increased. Inspections should be focused in Critical Aquifer Recharge Areas. SPILL-1

Alternative 3) Snohomish Health District should work with fire marshals to include ground water protection concerns during routine inspections conducted under the local UFCs.

10.4.3 Issue 3)

Loading dock areas may be constructed with insufficient containment to prevent chemical spills from entering the soil and ground water.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County should develop an educational seminar for Planning and Development Services staff regarding the various BMPs that can be implemented for spill containment in loading dock areas. These BMPs could be presented along with stormwater management BMPs.

Alternative 3) Snohomish County should consider developing requirements for loading dock BMPs that will contain spills for facilities handling chemicals and located within Critical Aquifer Recharge Areas. SPILL-2

Alternative 4) Snohomish County and Ecology should consider developing incentive programs that will encourage retrofitting of existing facilities with loading dock BMPs providing spill containment.

10.4.4 Issue 4)

Urban Commercial and Urban Industrial land uses that are not served by sanitary sewers presently exist in Urban Growth Areas.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County should map Urban Commercial and Urban Industrial developed lands that are located within the future sanitary sewer service area and work with jurisdictions to extend sewer service to these areas, giving priority based on aquifer vulnerability, as mapped on Figure I-3-8.

Alternative 3) Snohomish County should identify rural commercial and industrial facilities outside of the planned sewer service area and develop management programs, including BMPs and other requirements, that emphasize the protection of ground water resources. Priority should be given to vulnerable aquifer areas, as mapped in Figure I-3-8. SPILL-3

10.4.5 Issue 5)

The amended version of the Uniform Fire Code (UFC) that is in effect in Washington State eliminates some requirements (see page 10-4) that are beneficial to ground water protection.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Ecology should conduct a project to assess planning requirements for hazardous material handlers and, as needed, develop revised planning requirements that are equivalent to Hazardous Materials Inventory Statements and Hazardous Materials Management Plans, as originally required by the UFC.

Alternative 3) Ecology should evaluate exemptions of hazardous materials from the amended UFC and consider reinstating requirements for any of the exempt hazardous materials that are known ground water contaminants.

Alternative 4) Snohomish County and the GWAC should consider working with local jurisdictions to encourage adoption of versions of the UFC that are more stringent than the state version and which address weaknesses related to ground water protection.

Alternative 5) Snohomish County should consider developing and adopting a County ordinance to compensate for the weaknesses related to ground water protection in the amended UFC.

10.4.6 Issue 6)

Regulations pertaining to the creation, handling, and storage of hazardous wastes and chemicals are complex, may overlap, and can also be in conflict with one another.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish Health District should continue the IRAC program to identify and resolve conflicts and overlaps of the existing regulations. SPILL-4

11. TRANSPORTATION SPILLS

Alternatives in this section address issues related to the transportation of hazardous materials in pipelines, by rail, and in trucks. Section 4, Stormwater Impacts, also presents issues related to the design of stormwater infiltration facilities and alternatives related to dry weather spills.

11.1 Goals

To minimize the potential for ground water contamination as a result of chemical, hazardous waste, and petroleum spills during transportation.

11.2 Problem Statement

Problem/Concern Hazardous materials are transported throughout Snohomish County using a variety of methods such as pipelines, rail, and trucks. Accidents may occur during transportation, loading and unloading, potentially resulting in chemical spills. Spilled chemicals, if not sufficiently remediated, may contaminate ground water.

Sources Any transportation of hazardous materials is a potential source. However, transportation in accident-prone areas, under inclement weather conditions, and/or in areas of high aquifer vulnerability, pose the greatest risk.

Present Conditions The ability to respond to, contain and clean up, a spill in Snohomish County is presently variable depending on location. The County is serviced by several First Responders with spill response capabilities. There are major roadways, rail, and pipelines that traverse areas of high aquifer vulnerability, and thus, some risk exists that ground water could be contaminated by a spill. There are no known ground water contamination problems in the County which originated from spills associated with the transportation of hazardous materials.

Predicted Future Conditions Higher volumes of materials will be transported, resulting in greater risk for a spill incident. However, spill prevention technologies should be improved in the future and it can be expected that spill response capabilities will also improve.

11.3 Existing Programs

11.3.1 Regulatory Management

SARA Title III

The framework for transportation-related emergency response programs was established under Law Title III of the Federal Superfund Amendments and Re-authorization Act (SARA) of 1986. SARA Title III required each state to appoint an emergency response commission and to designate emergency planning districts in the state to facilitate emergency planning activities. The state Emergency Response

Commission was given the responsibility for appointing a *local emergency planning committee* (LEPC) for each designated district; a committee composed of all major affected parties, both public and private.

Commercial and industrial facilities within each designated district that maintain hazardous substances in amounts equal to or greater than compound specific thresholds established by the EPA, were required to notify the state Emergency Response Commission, the jurisdictional LEPC, and the jurisdictional fire department of the presence of such substances through standard federal forms called Material Safety Data Sheets. All facility operators affected by SARA Title III provisions were required to develop hazardous materials incident response plans and to identify transportation routes used to haul hazardous materials to or from their facilities. Based on the information provided by facility operators and other relevant data, within two years after passage of SARA, each LEPC was required to complete a *comprehensive emergency management plan* (CEMP).

Department of Emergency Management

Within Washington State, emergency management is governed under Chapter 38.52 RCW and administered by the Division of Emergency Management (DEM) of the Washington State Military Department. Pursuant to the provisions of SARA Title III, the state legislature amended Chapter 38.52 to establish a state Emergency Management Council and to direct the state DEM to develop a state CEMP (RCW 38.52.030 and RCW 38.52.040). The legislature also directed each political subdivision in the state to either establish a local DEM, or to join with one or more other political subdivisions in collectively forming and contributing to a local DEM (RCW 38.52.070). Except where pre-empted by state or federal law or regulations, the local DEM is the designated hazardous materials incident coordinating agency and provides the planning, training, and support for First Responders and other on-scene agencies to facilitate a concerted response to a hazardous materials incident.

Each local DEM is responsible for developing and maintaining a CEMP, as specified under SARA Title III, establishing protocols for responses to emergencies and disasters including transportation-related hazardous materials spills. The Northwest Area Contingency Plan (Ecology, 1995) was prepared to address responses to worst-case discharges of hazardous substances. A local DEM is assisted in the development and maintenance of a CEMP by the LEPC, typically composed of representatives of fire departments, local government agencies, state agencies, commercial and industrial facility operators, and citizens groups. Within Snohomish County, these roles are performed by the Snohomish County Department of Emergency Management (SCEM) and the Snohomish County Local Emergency Planning Committee (SCLEPC).

Initial response to hazardous materials incidents usually involves taking actions to reduce the acute public health and safety impacts from explosion, fire, and toxic fumes. In Washington State, an incident command system has been established to clarify the

roles of personnel involved in initial response actions (WAC 296-62-311). Under the incident command system, a representative of a pre-determined response agency serves as the incident commander, the on-scene manager responsible for ensuring that each agency at the scene carries out its responsibilities.

In responding to a hazardous materials release, the incident commander will undertake the following actions:

- Assess the situation and identify hazards;
- Specify appropriate safety and personal protection measures;
- Develop action plans and priorities; and
- Contact appropriate agencies or personnel with expertise to carry out the action plan.

In many areas of the state, the local fire district or fire department has been designated by the local legislative authority as the incident command agency for their jurisdictional area under provisions of RCW 70.136.030. Washington State Patrol serves as incident command agency for all areas of Snohomish County except for the Everett Fire District and the South Snohomish County Fire District (Edmonds, Lynnwood, Mill Creek and Woodway), that have dedicated hazardous materials response teams (Hammond, 1997).

In addition, Washington State Patrol serves as the incident command agency for all releases of hazardous materials occurring on interstate and state highways and routes.

Most hazardous materials response teams are equipped with a data management and modeling computer program called Computer Aided Management of Emergency Operations (CAMEO). CAMEO includes a database of stored hazardous materials based on SARA Title III reporting and can model and estimate releases of materials, for example, in air, based on prevailing winds. The database does not contain information regarding sensitive populations or environments.

Oil and Hazardous Substance Spill Prevention and Response – Water Pollution Control

Under RCW 90.56 and RCW 90.48, Ecology responds to environmental emergencies. Response staff receive reports on small and large oil spills, fish kills, abandoned drums and pressurized cylinders, hazardous substance incidents, and other imminent threats to human health or the environment. Once Ecology receives the initial report, it completes a preliminary investigation to determine the source, cause, and responsible party of a spill as well as the type of response required. If a responsible party is identified and able to conduct the cleanup, Ecology oversees the work completed. If the "spiller" cannot be located or is unable to cleanup the spill, Ecology will use state funds for cleanup and disposal.

Model Toxics Control Act (MTCA)

Under the state Model Toxics Control Act (MTCA), Ecology is ultimately responsible for ensuring that remedial actions are undertaken that prevent long-term impacts on public health and the environment. Although Ecology normally places the burden of cleanup on the party responsible for a spill, funding is available to Ecology through the State's Toxics Control Account to undertake cleanup activities if the responsible party is unwilling or unable to do so in a timely manner. The discussion as to whether Ecology will directly undertake cleanup actions is generally based upon the likelihood that the released hazardous materials will enter environmental or public health exposure pathways such as sensitive areas and public water supplies. Ecology monitors cleanup activities and confirms the final disposition of recovered hazardous materials and contaminated environmental media.

Snohomish County Emergency Management (SCEM)

SCEM is involved with planning training, and assisting with interagency coordination. During incidents, SCEM provides support for on-scene operations and requests for resources and other assistance. Under Washington State Law, the responsible party is required to immediately notify SCEM of a spill event.

Wellhead Protection Programs

The State of Washington Wellhead Protection Program requires that Group A ground water systems coordinate with local spill response agencies. Group A ground water systems are required under the State's program to notify local spill response teams as to the locations of wellhead protection areas. Wellhead protection guidelines indicate that Group A ground water systems work with local spill response teams to develop a spill response plan for spills located within wellhead protection areas.

Pipeline Spills

The U.S. Department of Transportation (USDOT) requires pipelines to develop a spill prevention safety plan according to 49 CFR Part 194. More stringent than the USDOT regulations are those required of pipelines under the Washington State Oil and Hazardous Substance Spill Prevention and Response Act, Chapter 90.55 RCW. Administered by Ecology, this code addresses requirements for petroleum facilities to develop contingency plans for potential releases. The contingency plans must show that the facility has the capability to respond to and clean up a worst-case scenario spill. The plan identifies sensitive populations, such as schools and sensitive environments. The plan does not include data regarding drinking water wells or sensitive aquifer locations.

Railroad Spills

According to the provisions of SARA Title III, railroad carriers are required to have hazardous materials incident response plans and to identify transportation routes used to haul hazardous materials. Burlington Northern Santa Fe Railroad (BNSFR) retains a terminal-specific and a region-wide hazardous material emergency response plan. The

response plan includes a 24-hour emergency telephone line for reporting spills. The region-wide plan addresses unique circumstances such as potential for spills in remote areas with minimal access. BNSFR contracts with several companies for emergency response. Included in those contracts are provisions for the use of helicopters to access remote spill locations.

11.3.2 Voluntary and Education Programs

Olympic Pipeline Corporation (Olympic) operates two pipelines in Snohomish County transporting approximately 4 million gallons of fuel per day. Olympic applies two technologies to identify potential pipeline leaks: a "smart pig" that can detect internal changes in pressure; and a "caliper pig" that can detect internal pipe defects such as buckles and dents (Olympic, 1997).

Industry provides some valuable services to assist in rapid response to hazardous materials spills on highways. CHEMTREC has a 24-hour national information line to obtain information about chemicals such as formulations, toxicity, emergency measures, health effects, and proper handling and packaging. There are educational seminars and written materials by organizations such as the American and Washington Trucking Associations.

11.4 Issues

11.4.1 Issue 1)

The locations of water supply wells in proximity to pipelines, railroads and highways are not presently mapped in Snohomish County.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County Geographic Information Systems Department should work with local Group A and Group B water systems to identify well locations and prepare maps for distribution to Snohomish County Emergency Management and major chemical transporters. The maps should be used to assist incident response commanders. TRANS-1

Alternative 3) Snohomish County Emergency Management should coordinate with local purveyors that are developing Spill Response Plans under Wellhead Protection.

11.4.2 Issue 2)

First Responders to transportation spills and major chemical transporters do not know where vulnerable aquifers are located in Snohomish County.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County should provide training to Snohomish County Emergency Management (SCEM) on the locations of Critical Aquifer Recharge Areas in the County and should provide SCEM with GIS mapping data of the same.

Alternative 3) Snohomish County Emergency Management should distribute and train First Responders and major chemical transporters on the locations of Critical Aquifer Recharge Areas in Snohomish County.

11.4.3 Issue 3)

Spill incidents are not necessarily reported to the owners of nearby water wells, including both private wells and public water systems.

Alternative 1) No immediate action. May be reconsidered during program review.

Alternative 2) Snohomish County Emergency Management should develop procedures by which owners of water supply wells that could be affected by a spill are notified, including Group A, Group B, and private wells. TRANS-2

12. UNDERGROUND STORAGE TANKS

No issues or alternatives were identified with regard to the storage of chemicals in underground tanks. Information is presented in this section detailing the problem statement and programs that pertain to underground storage tanks.

12.1 Goals

To minimize the potential for ground water contamination by the leakage of chemicals from underground storage tanks.

12.2 Problem Statement

Problem/Concern Underground storage tanks are commonly used to store gasoline, oil, and other chemicals. By far the most common applications are for the storage of gasoline and home heating oil. On a more limited basis other chemicals, including solvents, are stored in underground tanks. Leakage from underground tanks can be difficult to detect and can result in substantial releases to the soil. Leaked materials can be transported to ground water and result in contamination.

Sources Any underground tank used to store chemicals is a potential source, however, older steel tanks in corrosive soils pose the greatest risk.

Present Conditions As detailed in Part I, Section 5.5, there are 362 leaking underground storage tanks in Snohomish County listed in the Ecology database. Of these tanks, 92% have been remediated (e.g., cleaned-up) or are in a clean-up phase. Ninety-eight percent of the incidents resulted in soil contamination; 28% of the incidents resulted in ground water contamination. Only two incidents were listed in which drinking water or surface water had been contaminated.

Predicted Future Conditions New tank regulations have substantially reduced the potential for future leaking underground storage tanks. These regulations were developed due to the ubiquitous leaking tanks associated with gasoline service stations discovered in the late 1970s and 1980s. Modern tanks have much lower risk for failure and much higher probability that leaking will be detected when present. All older tanks should be removed or decommissioned in-place in the near future.

12.3 Existing Programs

12.3.1 Regulatory Management

The Underground Storage Tank (USTs) Program was established under Chapter 90.76 RCW and is administered by Ecology under Chapter 173-360 WAC. The program regulates tanks that have at least a 10% portion of the structure underground and hold more that 1,100 gallons. Home heating oil and farm fuel oil tanks are exempt. Tanks used for home heating oil are seldom over 550 gallons.

Under the Ecology program, all tanks were to have a release detection system by 1993. In addition, by 1998, all tanks must have cathodic protection, must be constructed of steel with a sacrificial anode coating or fiberglass, and must have a spill and overflow capacity.

Though home heating oil tanks are exempt from underground storage tank regulations, they are not exempt from the Washington State Model Toxics Control Act. If a home heating oil tank has a leak, home owners may be responsible for remediation of contaminated soil and water. In general, Ecology requires remediation if any released petroleum is mobile. Mobility is defined as any oil that is not absorbed into soil (liquid), any petroleum that is moving onto adjacent property, or any fumes that are effecting adjacent property. Also, Ecology may require clean up if more than a cubic yard of soil is contaminated.

Snohomish County Fire Code, Title 16, requires permits for decommissioning home heating oil tanks. Once a tank has been removed, the Snohomish County Fire Marshal's Office records on the property title that a tank of a specified size, has been removed. For tanks that are decommissioned and left on-site, the Fire Marshal's office recommends that tanks, equal to or less that 750 gallons capacity, be capped and not filled, and that tanks greater than 750 gallons capacity be filled with sand.

12.3.2 Voluntary and Education Programs

Liability insurance for home heating oil tank leaks is available to homeowners through the Washington State Pollution Liability Insurance Agency (PLIA). The agency will pay for associated clean-up of a leak. Homeowners are not eligible for the insurance if their tank is leaking at the time they apply for the insurance.

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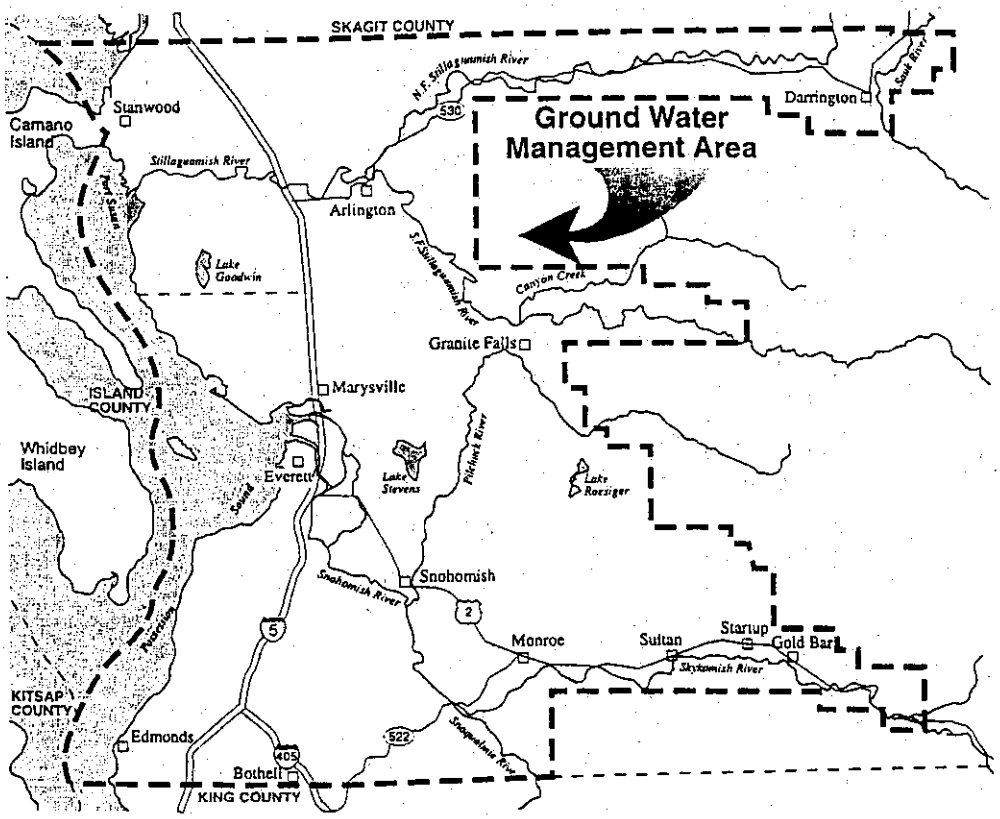
Snohomish County Ground Water Management Plan

Section III: Preferred Alternatives and Implementation

Prepared under the Direction of the Snohomish County Ground Water Advisory Committee



GROUNDWATER
YOUR TREASURE DOWN UNDER

Snohomish County

Golder Associates

May 1999

Funding provided by the
Washington State
Department of Ecology
Centennial Clean Water Fund

WASHINGTON STATE DEPARTMENT OF ECOLOGY

SECTION III

PREFERRED ALTERNATIVES

1. INTRODUCTION

1.1 Selection of Preferred Alternatives

Section II (Management Alternatives), initially submitted to the GWAC in July 1997, proposed over 80 alternative management strategies to address identified problems and potential problems relating to ground water quantity and quality. However, after consideration by the Ground Water Advisory Committee, it was concluded that the 80 alternative management strategies represented more actions than could be reasonably implemented within the foreseeable future. In order to reduce the alternatives to a more manageable number, Ground Water Advisory Committee members were asked to identify the alternatives that they felt were of the highest priority. Each member was provided with an "Alternatives Selection Sheet," similar to a ballot, on which they could designate 35 of the 80 alternatives that they felt were most appropriate to be advanced in the planning process.

The results of all participating Ground Water Advisory Committee members were tallied. By agreement between the committee and the consultant, the highest ranked 41 alternatives were selected for further review and evaluation as the "preferred alternatives" of the Ground Water Management Program. Note that some of the alternatives which were not advanced have been included as part of the unfinished agenda of the Ground Water Management Program; as such, they will be reconsidered when the program is reviewed and updated, approximately three years after certification of the program by the Department of Ecology.

Questionnaires regarding the 41 priority alternative management strategies were developed and distributed to potential lead and participating implementers, agencies and organizations with apparent responsibility for implementation of the management strategies. The questionnaires were intended to ascertain their interest in undertaking responsibilities associated with implementation, to help establish the cost and feasibility of implementation, and to identify potential sources of funding for implementation activities. Based on the responses to the questionnaires, the 41 alternatives were evaluated in accordance with criteria stipulated in Chapter 173-100 WAC, the Washington Department of Ecology's guidelines and procedures for development of Ground Water Management Programs. In addition, input from lead and/or participating implementers precipitated refinement of some of the alternatives; thus, in their final form, the preferred alternatives differ from the manner in which they were originally presented in the Alternatives Memorandum of July 1997, presented as Section II.

Table III-1 summarizes the preferred alternatives brought forward from Section II by the GWAC.

1.2 Implementation and Funding

Chapter 173-100 WAC guidelines provide for a work plan to be developed for implementing the Preferred Alternatives of a Ground Water Management Program. For each Preferred Alternative, the work plan should identify the party or parties responsible for initiating the action and provide a schedule for implementation.

This section of the Ground Water Management Program contains such an implementation work plan, and also provides a funding plan to assist in implementation. The implementation plan addresses the first three years after certification of the program by the Department of Ecology, currently estimated to occur in September 1999. It is recommended that at the end of the initial three-year implementation period, the Ground Water Management Program be reviewed by the Snohomish Ground Water Advisory Committee and updated as needed.

1.3 Potential Sources of Funding

Implementation of the Preferred Alternatives will require significant amounts of funding, and that funding will need to be obtained from a variety of sources. Proposed implementers of the Preferred Alternatives were asked to provide input concerning funding needs and potentially available funding sources. This information, together with information obtained by the consultant, was used in development of the funding plans for the individual Preferred Alternatives provided below. Note that in cases where an implementer provided an estimate of resource needs in full time equivalents (FTEs) rather than a dollar amount, the FTEs were converted to a cost estimate by multiplying the number of hours represented by an FTE by $70.00 per hour (e.g., one half FTE for one year would be 1,040 hours multiplied by $70.00 or $72,800). The $70.00 per hour employee cost was suggested by the Snohomish County Department of Public Works and Snohomish County Planning and Development Services as representing a reasonable hourly cost for a senior level employee considering wages, benefits, and all other direct and indirect costs.

The major sources of funding that appear in the funding plans are described briefly as follows.

Existing Sources: In some instances, implementing agencies indicated that they possessed sufficient resources to implement or support implementation of an alternative without the need for additional funding. Implementation with existing funding generally is possible when the action proposed in the alternative is similar to, or would integrate easily with, current activities of an implementer that are already funded through fees or some other source.

Grant Sources: A number of grants are potentially available to support initial implementation of portions of the Ground Water Management Program. Grants provide valuable support for implementation of one time actions or actions that will be supported by some permanent form of funding after initial implementation. However, because

grants are limited in duration, they cannot provide for ongoing, long term operation of a Ground Water Management Program. Some of the grants that may be suitable to fund implementation activities are described below.

Centennial Clean Water Fund. The Washington Department of Ecology administers a state water quality account for purposes of providing financial assistance to state and local governments for planning, design, acquisition, construction, and/or improvement of water pollution control facilities, as well as for undertaking water pollution control activities. The effort to develop the Snohomish County Ground Water Management Program is an example of a water pollution control activity that was funded through the Centennial Clean Water Fund. The Department of Ecology provided a grant to Snohomish County to conduct planning efforts related to the program.

Upon completion, concurrence, and certification, Snohomish County may be eligible for additional Centennial Clean Water Funds to support Ground Water Management Program implementation activities. Under current Department of Ecology criteria, Snohomish County could request up to $250,000 in Centennial funding to support implementation projects, subject to a requirement that the grant award be matched with 25 percent local contributions of cash or in-kind services. Because certification of the Ground Water Management Program will not occur until after the 1998 grant application deadline in February 1998 has passed, application for an implementation grant will not likely be possible until February 1999, and contracts could not likely be put in place with the Department of Ecology until May or June 1999.

Department of Ecology Coordinated Prevention Grants. The Department of Ecology's Solid Waste and Financial Assistance Program provides Coordinated Prevention funds to local health jurisdictions to support solid waste enforcement and management activities. Funds are also made available to solid waste agencies to support solid and moderate risk waste management activities. While available funds have been allocated, not all funds were actually used by recipients. These unused funds, termed "fallout monies," may be reallocated by the Department of Ecology for specific projects.

Department of Ecology Watershed Management Grants (SHB 2054). A watershed management grants program was established by the 1997 Washington State Legislature through passage of Substitute House Bill (SHB) 2054. Phase I of the grants program allows for up to $50,000 for each Water Resource Inventory Area (WRIA) to support watershed planning efforts. The Department of Ecology began awarding Phase I grants in December 1997. The Department of Ecology is in the process of developing rules for the second phase of the watershed management grants program in which considerably more funding is expected to be made available for each WRIA. The Watershed Management Grants Program described above was amended in 1998 through passage of House Bill 2514.

DCTED Grants. The Washington Department of Community, Trade, and Economic Development has, in the past, administered a grants program to support Growth Management Act (Chapter 36.70A RCW) implementation. These grants were provided from the Planning and Development Review Fund. While this fund has been expended, it is possible that supplemental resources could be obtained by the Department of Community, Trade, and Economic Development.

PIE/EPA Education Grants. The Puget Sound Water Quality Action Team periodically awards Public Involvement and Education (PIE) Fund grants to support projects that will contribute to the environmental quality of Puget Sound and its watersheds. The PIE grants are limited to a maximum of $40,000 per project. The deadline for applications for round two of the PIE grants was January 15, 1998. Thus, requests for funding to support educational activities associated with the Ground Water Management Program would need to be made in a subsequent round.

The U.S. EPA provides annual Environmental Education Grants for projects involving public and industry education. While grants can be as much as $250,000 for individual projects, EPA encourages requests for $5,000 or less. The deadline for Environmental Education Grant applications is usually in November of each year.

Dedicated Funds: A number of the Preferred Alternatives are proposed to be financed by what are referred to in the Implementation and Funding Plan below as "dedicated funds." Dedicated funds represent "hard money" or non-grant sources of funding for the Ground Water Management Program. Such funding would likely come from one or more of the following three sources: the Snohomish County general fund, an increase in the County's Surface Water Management Fee, or voter creation of a special revenue district known as an Aquifer Protection Area. These sources are described in more detail as follows:

General Fund. The County general fund consists of general revenues collected by Snohomish County and used to finance a wide range of governmental activities. Because general revenues are limited and the competition among county departments and agencies for monies from the general fund is intense, the general fund would not likely be available as a significant long term source of funding for the program. Instead, requests for monies from the general fund will be limited to those for "seed monies," funding used primarily to develop other grant and non-grant sources of funding.

Ground Water Management Fee. The Snohomish County Department of Public Works, the proposed lead agency for GWMP implementation, pointed out that a one dollar per parcel per year fee, similar to the existing County Surface Water Management Fee, would raise approximately $150,000 per year for ground water protection and management activities. This would be a potential funding source for a variety of ground water protection and management activities.

An increase in a fee that would include both surface and ground water, with the use of a separate ground water program, would require action by the Snohomish County Council to modify Chapter 25 of the Snohomish County Code.

Aquifer Protection Areas under Chapter 36.36 RCW. Chapter 36.36 RCW provides the Snohomish County Council authority to create one or more aquifer protection areas to finance the protection, preservation, and rehabilitation of ground water. The procedural requirements for establishing an Aquifer Protection Area or Areas are as follows:

1. The County Council must conduct a public hearing regarding the proposal to hear objections and comments from persons interested in the proposed aquifer protection area.

2. After the public hearing, the County Council may adopt a resolution causing a ballot proposition to be submitted to the registered voters residing within the proposed aquifer protection area to authorize creation of the area. The resolution must describe the boundaries of the proposed area, find that its creation is in the public interest, state the maximum level of fees that will be levied on withdrawals of water and/or on-site sewage disposal, and describe uses for the fees.

3. Should the ballot issue be approved by a simple majority of voters within the proposed aquifer recharge area, the County Council can create the area by ordinance.

A proposed aquifer protection area cannot include territory located within a city or town without approval of the city or town governing body.

Within aquifer recharge areas, fees may be imposed on withdrawals of ground water and on-site sewage disposal. The fees must be expressed as a dollar amount per household unit. Fees for facilities other than households must be expressed and imposed on the basis of household unit equivalents. Should both types of fees be imposed, the rate imposed on on-site sewage systems cannot exceed the rate imposed for the withdrawal of water. The amount of fees imposed cannot exceed that approved by the voters and the fees can only be used for activities identified in the ballot measure. Chapter 36.36 RCW permits a county to adopt an ordinance authorizing a reduction in fees that are imposed upon the residential property of a class or classes of low income persons.

Chapter 36.36 RCW allows fees collected as part of an Aquifer Protection Area to be used for the following purposes:

- Preparation and/or ongoing implementation of a comprehensive plan to protect, preserve, and rehabilitate ground water, including a Ground Water Management Program;

- Construction of water treatment facilities including sanitary sewage and/or stormwater collection, treatment, and disposal;

- A proportionate reduction in special assessments imposed by the county or cities within the aquifer protection area for sanitary sewage and/or stormwater facilities;
- Construction of public water systems;
- Monitoring individual and community on-site sewage systems; and
- Ground water quality and quantity monitoring and evaluation.

Table III-1-2 summarizes the funding needs identified in this plan.

2. GENERAL ALTERNATIVES

2.1 Ground Water Program Administration

2.1.1 ADMIN-1: Agency Oversight

Preferred Alternative: Snohomish County, or other agency, should identify an existing division to provide oversight and track implementation progress for the Ground Water Management Program.

Evaluation of Alternative:

Identified Lead Agency: Snohomish County Department of Public Works.

Participating Agencies: Numerous.

Feasibility/Effectiveness of Alternative: This alternative would be feasible and effective if adequate funding and clear regulatory authority is provided.

Conflicts with Land/Water Plans: None.

Funding Needs: Snohomish County Department of Public Works estimates that, when fully implemented, the cost of administering the Ground Water Management Plan may total as much as $500,000 - $750,000 annually. This may include the addition of the following staff: a full-time Ground Water Program Manager (discussed in more detail below), hydrologist, geologist, and ground water technician, as well as public involvement, public education, planning, clerical, and technical support staff on less than a full-time basis.

Much of the funding and staff needed by the Snohomish County Department of Public Works for plan administration are itemized under the individual alternatives that follow. However, some of the alternatives are not sufficiently developed at this time to allow generation of useful cost estimates, including ADMIN-5, USE-2, PEST-1, PEST-3, PEST-5, and DUMP-2. Funding and staffing needed by the Snohomish County Department of Public Works to support implementation of these alternatives, as well as to support other routine administrative functions associated with overall plan implementation, will be more fully identified and addressed during the initial three year period after certification of the plan by the Department of Ecology. The Implementation Plan will be amended at the time of the initial update of the Ground Water Management Plan to reflect the emergent staffing and funding needs of the Snohomish County Department of Public Works.

In the interim, funding for this specific alternative would need to be adequate to provide for at least a full time Ground Water Program Manager, approximately $146,000 per year or $438,000 for three years including wages, benefits, travel, office and communications equipment, supplies, auditing and accounting, and supervision.

Funding Availability: Funding to implement the alternative is not currently available.

Potential Funding Sources Identified by Implementers: Increase Surface Water Management Fee by $1 per year (would raise $150,000 per year), water supplier surcharge, and well fee. (These potential funding sources are discussed in more detail below under "Ease/Difficulty of Implementation.")

Time Necessary for Implementation: General program implementation would be ongoing; many of the individual program elements identified within the alternatives presented below could be implemented within three years of certification of the program by the Department of Ecology, provided adequate funding is procured.

Ease/Difficulty of Implementation: Use of the Surface Water Management Fee for ground water programs would require modification of Chapter 25 and 25A of the Snohomish County Code to include the ground water management authorities listed under Chapter 36.94 RCW. The water supplier fee and well fee would be new fees and would require adoption by the County Council. The well fee may be difficult to impose since the Washington Department of Ecology regulates construction of wells, and relinquishes portions of their collected fees to local governments only to support local well sealing and decommissioning programs.

Implementation Pathway:

Lead Implementer: Snohomish County Public Works

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish County Department of Public Works	Develop funding request for Ground Water Program Manager, including scope of duties and funding needs	Prepare for 1999 budget process
Snohomish County Council	Appropriate funding for Ground Water Program Manager for up to a three year period	2000, 2001, 2002 budget years
Snohomish County Department of Public Works (Program Manager)	Prepare Centennial Clean Water Fund Grant for implementation of GWMP	January 2000
Snohomish County Department of Public Works (Program Manager)	Prepare findings and recommendations to Snohomish County Council concerning Aquifer Protection Area ballot measure and other proposed methods/sources of funding	January 2000
Snohomish County Department of Public Works	Provide oversight and support for implementation of other alternative management strategies of the GWMP	Ongoing 2000 - 2002
Snohomish County Department of Public Works	Evaluate emergent funding needs associated with GWMP implementation and propose methods/sources of funding	Ongoing 2000 - 2002

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish County Department of Public Works	$146,000 per year or $438,000 for three years for full time Ground Water Program Manager	County general fund for late 1999 and 2000. County general fund for 2001 and 2002 if alternative source of dedicated (hard) funds is not established.
Snohomish County Department of Public Works	Emergent funding needs to be determined as GWMP implementation proceeds	County general fund for 2001 and 2002 if alternative source of dedicated (hard) funds is not established

2.2 Critical Aquifer Recharge Area Designation

2.2.1 ADMIN-2: CARA Designation

Preferred Alternative: Snohomish County should identify an Interim Ground Water Protection Area (IGPA) for the Snohomish Ground Water Management Area. The IGPA should correspond to the "moderate" and "high" vulnerability areas identified in Figure I-3-8 of Section I. Additionally, the IGPA should include: 1) any new wellhead protection areas, up to and including the zone of contribution, as delineated by Group A, Group B, or individual water systems; 2) any new Sole Source Aquifers; and 3) any new Special Protection Areas. The IGPA map will be provided to all jurisdictions within the Snohomish County Ground Water Management Area. Such jurisdictions should consider the IGPA map when making land use decisions potentially affecting ground water. When the County and jurisdictions develop a Critical Aquifer Recharge Area Map, this map should replace the IGPA.

Evaluation of Alternative:

Identified Lead Agency: Snohomish County Planning and Development Services.

Participating Agencies: Cities, Tribes.

Feasibility/Effectiveness of Alternative: Planning and Development Services indicated that the alternative would be feasible and effective provided adequate funding is available, and provided the map prepared as part of this alternative is used for planning purposes, not for regulation.

Conflicts with Land/Water Plans: None for Snohomish County. The action helps to implement policies and measures of the adopted GMA General Policy Plan (NE polices 1.A.1, 1.B.1, 1.B.2, 3.C.2, and implementation measures NE 3c and 3e).

The City of Lake Stevens indicated the alternative may be in conflict with municipal ordinances or land and water use plans because the city's industrial area sits over a portion of the PUD's emergency well aquifer. The city already has a Critical Aquifer Recharge Area map in its Comprehensive Plan.

Funding Needs: Planning and Development Services would require approximately $6,000-$8,000 in staff time/consultant services.

Funding Availability: Funding to implement the alternative is not currently available.

Potential Funding Sources Identified by Implementers: Snohomish County Planning and Development Services suggested Centennial Clean Water Fund grant, Department of Community, Trade, and Economic Development (DCTED) grant, or County general fund. The Town of Index suggested grants and other sources of outside funding.

Time Necessary for Implementation: Implementation by Planning and Development Services will take two to three months and will occur after certification, once funding becomes available.

The Town of Index indicated that a minimum of 16 months would be needed to implement the alternative as currently written.

Ease/Difficulty of Implementation: As currently written, the alternative requests action by each individual city and tribe. Since not all jurisdictions may feel compliance with this request is warranted, the alternative could be an impediment to the concurrence and certification process for the Ground Water Management Program. The County could prepare an IGPA map for all jurisdictions, and make that map available for use by the cities and tribes for consideration on an optional basis for planning purposes.

Implementation Pathway:

Lead Implementer: Snohomish County Planning and Development Services

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish County Planning and Development Services	Prepare IGPA map and distribute to all jurisdictions within the GWMA	June - August 1999

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish County Planning and Development Services	$7,000	Potentially, DCTED Planning and Development Review Fund if reallocated If not reallocated, Centennial Clean Water Fund grant

2.2.2 ADMIN-3: CARA Designation

Preferred Alternative: Snohomish County should review and develop criteria for defining Critical Aquifer Recharge Areas (CARAs) and subsequently develop a proposed CARA map for all portions of the Ground Water Management Area. Snohomish County should review regulations and make changes as needed and feasible in order to conserve Critical Aquifer Recharge Areas. The review of regulations should include, but not be limited to, activities such as: grading, landscaping, drainage, chemicals, hazardous waste, and wastewater. The CARA definition criteria, the proposed CARA map, and revised regulations will be provided to all jurisdictions within the Ground Water Management Area for their consideration. The following recommended actions should be included as part of the designation:

1. Jurisdictions should provide a method of assessing proposed development actions against adopted performance standards. Project level review and the performance-based standards should consider, but not be limited to, the following:

   - Avoiding disruption of natural soil drainage channels to the maximum extent feasible.

   - Landscaping that employs the natural contours and surfaces to promote infiltration.

   - Diversion and spreading of runoff from rooftops, patios, and other clean impervious surfaces onto preserved pervious surfaces.

- Terracing and other means of detaining runoff on-site to promote infiltration over as large an area as possible.

- The use of subsurface drains and infiltration systems when appropriately designed and maintained.

2. Specific considerations of development effects on infiltration and recharge quantities should be applied to project review under the SEPA process. When development regulations are based on the recharge goals established under comprehensive plans, SEPA review at the project level then becomes the final evaluation of the plan implementation.

3. Mitigation should be proposed that provides for a range of options such as the infiltration and retention and slowing of runoff, the redirection of clean stormwater to remaining pervious surfaces, and artificial recharge.

4. Options should also be available for small parcels, including actions taken at the individual single home-site level. These often provide the best opportunities for maintaining effective recharge.

Evaluation of Alternative:

Identified Lead Agency: Snohomish County Planning and Development Services.

Participating Agencies: Snohomish County Department of Public Works, Cities, Tribes.

Feasibility/Effectiveness of Alternative: Planning and Development Services indicates that the alternative is feasible and would be effective provided adequate funding is available to support their implementation activities and those of other county departments, particularly DPW/SWM.

Conflicts with Land/Water Plans: The action helps to implement policies and measures of Snohomish County's adopted GMA General Policy Plan (NE policies 1.A.1, 1.D.2, and implementation measures NE 3a, c, e, and g). However, if the net effect of the alternative is to promote low density development in portions of CARAs located in Urban Growth Areas, it may be in conflict with Growth Management Act policies.

To increase the potential effectiveness of this alternative, the GWAC requested that the text of the alternative be expanded to include the recommended actions listed as numbers 1 through 4 above.

The City of Lake Stevens indicated that the alternative may have a conflict with municipal ordinances or land and water use plans because the City's industrial area sits over a portion of PUD's emergency well aquifer.

Funding Needs: Planning and Development Services would require approximately $30,000 - $40,000 in staff time/consultant services to develop the program, identify regulatory revisions, and support formal amendments to county code. Public Works would require two weeks staff time, or about $5,600, to work with PDS in development of regulations to conserve CARAs.

Funding Availability: Funding to implement the alternative is not currently available.

Potential Funding Sources Identified by Implementers: Centennial Clean Water Fund grant, DCTED grant, and County general fund.

Time Necessary for Implementation: Planning and Development Services could initiate implementation of this alternative after the program is certified, once funding becomes available. The alternative would require one year to complete.

The Town of Index indicated that a minimum of 16 months would be needed to implement the alternative as currently written.

Ease/Difficulty of Implementation: Completion of ongoing effort to update the County drainage and grading regulations (Title 24), anticipated for completion in mid-1998, could delay subsequent efforts to revise codes to enhance ground water protection. Any amendments to the County's Comprehensive Plan and/or implementing regulations must comply with procedures and schedules mandated by the County's annual docketing process (Title 32.07 SCC).

The alternative suggests action by each individual city and tribe. Since not all jurisdictions may feel compliance with this request is warranted, the alternative could be an impediment to the concurrence and certification process for the Ground Water Management Program.

Implementation Pathway:

Lead Implementer: Snohomish County Planning and Development Services

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish County Planning and Development Services	Review and develop criteria for defining Critical Aquifer Recharge Areas (CARAs)	June - August 1999
Snohomish County Planning and Development Services	Develop proposed CARA map	September-November 1999
Snohomish County Planning and Development Services	Review regulations and prepare modifications as appropriate	December 1999 - May 2000 (Contingent on schedules mandated by the County's annual docketing process)
Snohomish County Department of Public Works	Assist PDS in development of regulations to conserve CARAs	December 1999 - May 2000 (Contingent on schedules mandated by the County's annual docketing process)

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish County Planning and Development Services	$35,000	Potentially, DCTED Development Review Fund, if reallocated If not reallocated, dedicated funds
Snohomish County Department of Public Works	$ 5,600	Potentially, DCTED Development Review Fund, if reallocated If not reallocated, dedicated funds

2.3 Centralized Ground Water Quality Database

2.3.1 ADMIN-4: Database Development

Preferred Alternative: Snohomish Health District and Snohomish County should develop a water quality database (ground and surface water). The database should be used to store source water quality data collected by Group A, Group B, and private water systems in the County and other relevant data. Organic compounds, such as pesticides, and general water quality parameters, such as nitrate, should be included in the database. Existing historical data should be geographically referenced to the point at which the source water samples are collected. The database should be made available to the public at the County offices and local libraries and/or through an internet web page. Provisions should be included in a database plan to periodically report on water quality status and to make recommendations regarding water resources management. This database should be coordinated with water quality databases developed from alternatives presented in Section 3.2 – Data Gaps.

Evaluation of Alternative:

Identified Lead Agency: Snohomish County Department of Public Works.

Participating Agencies: Snohomish Health District, serving as a focal point for information gathering and as a technical resource.

Feasibility/Effectiveness of Alternative: This alternative appears feasible and effective provided adequate funding can be secured. Public Works indicates it may be worthwhile to enter into an interlocal agreement with the Snohomish Health District to secure their cooperation.

Conflicts with Land/Water Plans: This alternative appears to be consistent with land and water use plans.

Funding Needs: Public Works would require 1/4 FTE (full time equivalent employee) data base technician and 1/4 FTE GIS (geographic information system) technician plus supervision, or approximately $72,800, to establish data base and enter data. The Snohomish Health District would require approximately $10,000 to perform support activities.

Funding Availability: Funding to implement the alternative is not currently available.

Potential Funding Sources Identified by Implementers: Potential funding sources were not specified by implementers.

Time Necessary for Implementation: One year to initially establish data base to commence at such time as program has been certified and when funding becomes available. Maintenance of system would be ongoing.

Ease/Difficulty of Implementation: Collecting and compiling data and establishing the data base will represent a significant level of effort, and funding to support those activities may be difficult to obtain. The overall cost for this alternative may be higher than estimated.

Implementation Pathway:

Lead Implementer: Snohomish County Department of Public Works

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish County Department of Public Works	Develop data base	January 2000 - December 2000
Snohomish County Department of Public Works	Prepare annual report on water quality status and make recommendations regarding water resources management needs	March 2001 and again in March 2002
Snohomish County Department of Public Works	Coordinate with other data management systems	January 2000 - ongoing
Snohomish Health District	Consider entering into an interlocal agreement with DPW, provide public water system data, provide technical assistance	January 2000 - ongoing

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish County Department of Public Works	$72,800	Dedicated funds
Snohomish Health District	$ 8,400	Dedicated funds

2.4 Public Education

2.4.1 ADMIN-5: Lead Public Education Organization

Preferred Alternative: The GWAC recommends that Washington State University Cooperative Extension Service of Snohomish County seek funding and develop an ongoing program to educate the public on ground water resources.

Evaluation of Alternative:

Identified Lead Agency: WSU Cooperative Extension Service.

Participating Agencies: Potentially Department of Ecology, Snohomish County Department of Public Works, and others in a supporting role.

Feasibility/Effectiveness of Alternative: This alternative would be feasible and effective provided ongoing funding can be identified.

Conflicts with Land/Water Plans: This alternative is consistent with the primary purpose of Cooperative Extension Service: education. Implementation should not be in conflict with any land use or water management plans.

Funding Needs: $60,000 per year to fund one FTE, plus a media budget (printing, mailing, etc.).

Funding Availability: Funding to implement the alternative is not currently available.

Potential Funding Sources Identified by Implementers: County general fund.

Time Necessary for Implementation: Implementation could begin as early as January 2000, if County Council provides funding in its next budget cycle, or if other funding source is secured.

Ease/Difficulty of Implementation: Cooperative Extension Service will collaborate with other agencies including the SHD and SCD regarding this alternative.

Implementation Pathway:

Lead Implementer: Snohomish County Cooperative Extension Service

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Washington State University Cooperative Extension Service	Prepare grant application and/or other request for funding	As early as January 2000 depending on grant cycles or availability of other funds
Department of Ecology, Snohomish County Department of Public Works, Snohomish Health District, others	Provide technical assistance and/or support through existing outreach programs and initiatives	Same as above

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Washington State University Cooperative Extension Service	$60,000	Up to $40,000 from PIE/EPA education grants $20,000 dedicated funds (All $60,000 in dedicated funds if grant procurement unsuccessful)
Department of Ecology, Snohomish County Department of Public Works, Snohomish Health District, others	Provide support to the level allowed with existing funding	Existing resources

3. GROUND WATER USE AND INFLUENCE ON SURFACE WATER

3.1 USE-1: Group B Conservation Information

Preferred Alternative: DOH, Snohomish Health District, and the Washington State Drilling and Ground Water Association should make water conservation information available to purveyors of Group B and individual well-water systems.

Evaluation of Alternative:

- **Identified Lead Agency:** Snohomish Health District.

  Participating Agencies: Washington State Department of Health will make pre-printed conservation pamphlets available to Snohomish Health District and well owners. Washington State Drilling and Ground Water Association will provide assistance to lead agency on request.

  Feasibility/Effectiveness of Alternative: This alternative would be feasible and effective provided appropriate materials and resources are made available to the Snohomish Health District. The health district would likely fold water conservation information into present points of contact with individual and Group B systems.

  Conflicts with Land/Water Plans: This alternative would not conflict with any land use or water management plans and would be compatible with a number of state regulatory initiatives, including Chapter 173-100 WAC which requires that management strategies of Ground Water Management Programs address water conservation.

  Funding Needs: Contacting new individual systems and Group B systems (as well as some existing systems) would likely be incorporated into existing activities with minimal resource requirements beyond production of informational materials. Costs of ongoing contacts with existing individual systems would be variable. No specific cost estimate for implementation of this alternative was provided by the health district.

  Funding Availability: Partially available, to the extent that the alternative could be incorporated into routine permitting/management activities of the health district. The ability to fund is dependent on existing resources.

  Potential Funding Sources Identified by Implementers: Potential sources of additional funding were not specified by the Snohomish Health District.

Time Necessary for Implementation: Implementation of this alternative could begin once conservation pamphlets are supplied to the Snohomish Health District. Full implementation could occur once additional funding is made available to the health district for expanded outreach.

Ease/Difficulty of Implementation: Aside from procurement of funding, no significant implementation difficulties are anticipated.

Implementation Pathway:

Lead Implementer: Snohomish Health District

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish Health District	Provide water conservation information to Group B purveyors and individual well-water system owners	September 1999 - ongoing
Washington State Department of Health	Provide pre-printed conservation pamphlets to SHD (already developed by DOH)	September 1999 - ongoing
Washington State Drilling and Ground Water Association	Provide assistance to lead implementer on request	September 1999 - ongoing

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish Health District	Level of effort not to exceed $8,400 in additional funding	Existing resources where applicable Up to $8,400 additional funding from dedicated funds
Washington State Department of Health	Provide support to the level allowed with existing funding	Existing resources
Washington State Drilling and Ground Water Association	Provide support to the level allowed with existing funding	Existing resources

3.2 USE-2: Data Gaps

Preferred Alternative: Snohomish County Department of Public Works should consider preparing sub-basin plans to collect data and characterize ground and surface water hydrology and the potential impacts that could result from future ground water withdrawals. The sub-basin plans should be completed in a prioritized manner, for example, as shown in Table I-3-6 and I-3-7. The first sub-basin plan should be completed as a pilot study to: 1) identify the costs; and 2)

identify data needs and collection procedures, including provisions for collection of adequate background water quality and quantity data.

Evaluation of Alternative:

Identified Lead Agency: Snohomish County Department of Public Works.

Participating Agencies: Snohomish County Planning and Development Services will provide perspective on land use planning/regulation. The Washington Department of Ecology could participate by providing limited comments on the scoping process as well as limited review of drafts of locally developed sub-basin plans. Ecology could provide comments on the kinds of information needed in a plan to make water right decisions (e.g., a sub-basin plan would need to evaluate any hydraulic relationships that may exist between connecting sub-basins).

Feasibility/Effectiveness of Alternative: The alternative would be feasible and effective provided adequate funding is available to conduct sub-basin plans.

Conflicts with Land/Water Plans: The alternative would not result in conflicts with land use and water management plans. The alternative may help resolve conflicts between competing beneficial uses of water resources. Implementation of this alternative should be integrated with other planning and assessment efforts in the Snohomish Basin. For example, the following efforts are ongoing with relation to watersheds and could have ground water components: the Tri-County Salmon Recovery effort (especially the Municipal Water Supply Forum), the Water Resource Inventory Area (WRIA 7) Salmon Recovery Forum, the draft Quilceda/Allen Watershed Plan, and the draft French Creek Watershed Plan.

Funding Needs: An estimate of funding needs was not provided by Public Works. Ecology Water Resources staff time of 120 hours, or approximately $8,400, would be required for review of each sub-basin plan.

Funding Availability: Funding is not presently available for implementation by Public Works.

Ecology has significant funding and resource limitations. Resources for Ecology participation would need to be shifted from other activities, such as

working through the backlog of water right permits. A water quality and quantity funding package was submitted to the 1999 legislature; however, it is not known how much of the funding package will be appropriated, or what portion of any funds that are appropriated would be available for review of locally developed sub-basin plans.

Potential Funding Sources Identified by Implementers: Potential funding sources were not specified by implementers; however, some of the sub-basin planning could be accomplished through funding potentially available to Snohomish County for watershed planning through House Bill 2514 of the 1998 legislative session.

Funds for Ecology participation could be appropriated by the state legislature.

Time Necessary for Implementation: Implementation, which would be combined with surface water sub-basin planning, would commence once funding is available.

Ease/Difficulty of Implementation: Proper implementation would require obtaining adequate baseline data at the sub-basin level, including ground water quality data.

Implementation Pathway:

Lead Implementer: Snohomish County Department of Public Works

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish County Department of Public Works	Prepare one sub-basin plan as feasibility study to determine cost and establish data collection methodologies. Evaluate feasibility of conducting other sub basin plans	Initiate in mid- 2000
Snohomish County Planning and Development Services	Provide perspective on land use planning/regulation	Same as above
Washington State Department of Ecology	Comment on the scoping process as well as on any drafts of locally developed sub-basin plans	Same as above

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish County Department of Public Works	At a basin level, some portion of approximately $200,000 that could be available to Snohomish County or its designee for watershed planning in the Snohomish and Stillaguamish River Basins should be used to fill ground water data gaps	DPW should ensure that its data needs are incorporated into any future basin planning efforts to be funded under House Bill 2514
Snohomish County Department of Public Works	Approximately $100,000 is a planning level estimate for subsequent development of a sub-basin plan as a pilot project. The cost of a sub-basin study could vary widely from sub-basin to sub-basin depending on size, complexity, and amount of baseline data available	Dedicated funds
Washington State Department of Ecology	$8,400 for one sub-basin	Dedicated funds or legislative appropriation

4. STORMWATER IMPACTS

4.1 Impervious Surfaces

4.1.1 STORM-1: Pervious Surfaces and Infiltration Facilities

Preferred Alternative: Snohomish County Planning and Development Services and Department of Public Works should develop a coordinated approach to reduce impervious surfaces and increase ground water recharge through infiltration.

Evaluation of Alternative:

Identified Lead Agency: Snohomish County Planning and Development Services.

Participating Agencies: Snohomish County Department of Public Works will provide technical support.

Feasibility/Effectiveness of Alternative: This alternative would be feasible and effective, provided adequate funding is secured. Implementation of this alternative would involve identification and evaluation of alternative stormwater management techniques and their codification through revisions to policies/regulations/administrative guidelines.

Conflicts with Land/Water Plans: The alternative will help to implement policies and measures of Snohomish County's adopted GMA General Policy Plan (NE Policies 1.D.2, 3.D.1, 3.D.4, 3.D.6, 3.D.11, 3.D.12, 5.A.2, and implementation measures NE 4d. and NE 5b.

Funding Needs: Planning and Development Services would require approximately $30,000-$40,000 in staff time/consultant services to develop program, and to prepare and support revisions to policies/regulations/ administrative guidelines. Department of Public Works would require one FTE for two to three weeks, or $5,600 to $8,400.

Funding Availability: Funding is not presently available for implementation by Planning and Development Services. According to the Department of Public Works, funding is available for their support activities.

Potential Funding Sources Identified by Implementers: Centennial Clean Water Fund and County general fund.

Time Necessary for Implementation: Implementation could be completed within one year of time at which funding becomes available. Implementation of this alternative would be facilitated if it occurs concurrent with implementation of STORM-2.

Ease/Difficulty of Implementation: The current focus on efforts to update the County draining and grading regulations (Title 24), expected to be completed in 1998, could delay action on this alternative. To a limited extent, changes consistent with this alternative could be addressed in the Title 24 revisions.

Any amendments to the GMA plan and/or implementing regulations must comply with procedures and schedule mandated by the County's annual docketing process (Title 32.07 SCC).

The Department of Public Works indicated that there may be technical and legal limitations to implementation. Current impervious surface technologies do not work well, but there are other ways to reduce impervious surfaces that could be used. Both the Department of Public Works and Planning and Development Services suggested that the alternative be restructured to reflect this limitation.

Implementation Pathway:

Lead Implementer: Snohomish County Planning and Development Services

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish County Planning and Development Services	Identify and evaluate alternative stormwater management techniques and codify their use through modifications to policies/regulations/ administrative guidelines	June 2000 - May 2001 (Implement concurrent with 4.2.3.2, Issue 2), Alternative 2)) (Dates contingent on compliance with procedures and schedules of the County's annual docketing process)
Snohomish County Department of Public Works	Provide technical support	Same as above

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish County Planning and Development Services	$35,000	Centennial Clean Water Fund grant
Snohomish County Department of Public Works	$ 7,000	Centennial Clean Water Fund grant

4.1.2 STORM-2: Implementation Incentives

Preferred Alternative: Snohomish County should work with appropriate county agencies and jurisdictions within the GWMA to develop an incentive program (e.g., fee reductions, early assumption of maintenance, early bond release, funding) that encourages the use of techniques to reduce impervious surfaces.

Evaluation of Alternative:

Identified Lead Agency: Snohomish County Planning and Development Services.

Participating Agencies: Snohomish County Department of Public Works will participate by helping to develop incentive strategies.

Feasibility/Effectiveness of Alternative: This alternative would be feasible and effective provided adequate funding is available. This alternative would involve identification and evaluation of alternative "incentives" and their codification through revisions to policies/regulations/administrative guidelines, as appropriate.

Conflicts with Land/Water Plans: This alternative would help to implement policies and measures of Snohomish County's adopted GMA General Policy Plan (NE Policies 1.C.3, 1.C.4, 1.C.7, and implementation measure NE 3m). However, it should be recognized that some techniques to promote more open spaces or pervious surfaces in Urban Growth Areas may conflict with urban levels of density.

Funding Needs: Planning and Development Services would require approximately $10,000 in staff time/consultant services to develop an incentive program and implement county policies/regulations/ administrative guidelines. Department of Public Works would require one FTE for two to three weeks, or $5,600 to $8,400.

Funding Availability: Funding is not currently available for implementation of this alternative.

Potential Funding Sources Identified by Implementers: Centennial Clean Water Fund grant and County general fund.

Time Necessary for Implementation: If this alternative is implemented concurrently with STORM-1, implementation would be completed within one year of funding availability.

Ease/Difficulty of Implementation: According to Planning and Development Services, it may be appropriate to link this alternative with implementation of STORM-1 and STORM-3.

Any amendments to the GMA plan and/or implementing regulations must comply with procedures and schedule mandated by the County's annual docketing process (Title 32.07 SCC).

Department of Public Works expressed concerns over technical problems that might arise during implementation, such as need to provide adequate areas for emergency vehicle access and parking.

Implementation Pathway:

Lead Implementer: Snohomish County Planning and Development Services

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish County Planning and Development Services	Identify and evaluate alternative "incentives" and implement their use through revisions to policies/regulations/ administrative guidelines, as appropriate	June 2000 - May 2001 (Implement concurrent with STORM-1 and STORM-3) (Contingent on compliance with procedures and schedule mandated by the County's annual docketing process)
Snohomish County Department of Public Works	Assist in development of incentive strategies	January 2001 - February 2001

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish County Planning and Development Services	$10,000	Centennial Clean Water Fund grant
Snohomish County Department of Public Works	$ 7,000	Centennial Clean Water Fund grant

4.1.3 STORM-3: Site Development Review

Preferred Alternative: Snohomish County (through the county Zoning Code and other land use regulations) should require that site designs for new developments minimize the amount of impervious surface and maximize the ground water recharge rate, particularly in areas where the recharge potential is considered high. The County should make its revised design standards available to all jurisdictions within the Ground Water Management Area for possible adaptation by those jurisdictions for use in their own communities.

Evaluation of Alternative:

Identified Lead Agency: Snohomish County Planning and Development Services.

Participating Agencies: Snohomish County Department of Public Works will provide technical support. Cities and Tribes would also be participants.

Feasibility/Effectiveness of Alternative: This alternative would be feasible and effective provided adequate funding is available. Implementation of this alternative would involve development of code revisions and support to the adoption process. This alternative focuses on code requirements, whereas 4.2.3.1, Issue 1, Alternative 2) focuses on broader county policy approaches.

Conflicts with Land/Water Plans: This alternative would help to implement policies and measures of Snohomish County's adopted GMA General Policy Plan (NE Policies 1.D.2, 3.D.1, 3.D.4, 3.D.11, and implementation measure NE 4d).

The City of Lake Stevens indicates that implementation of this alternative may conflict with utilization of their industrially zoned lands.

Funding Needs: Planning and Development Services would require approximately $30,000 - $40,000 in staff time/consultant services to develop programs and to prepare and support revisions to policies/regulations/administrative guidelines. Department of Public Works would require one FTE for one week, or about $2,800.

Funding Availability: Funding is not currently available for implementation of this alternative.

Potential Funding Sources Identified by Implementers: Centennial Clean Water Fund grant and County general fund.

Time Necessary for Implementation: Implementation of this alternative would be completed within one year of funding availability.

Ease/Difficulty of Implementation: Additional regulatory requirements may be unpopular; thus, it will be important to provide a technical basis for such requirements. Current efforts to modify Title 24 (Drainage and Grading Ordinance) may delay initiation of this alternative.

Any amendments to the GMA plan and/or implementing regulations must comply with procedures and schedule mandated by the County's annual docketing process (Title 32.07 SCC).

The alternative suggests action by each individual city and tribe. Since not all jurisdictions may feel compliance with this request is warranted, the alternative could be an impediment to the concurrence and certification process for the Ground Water Management Program. However, the alternative does not require compliance to the revised standards.

Implementation Pathway:

Lead Implementer: Snohomish County Planning and Development Services

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish County Planning and Development Services	Propose code revisions to require site designs for new developments to minimize the amount of impervious surfaces. Support adoption process	June 2000 - May 2001 (Contingent on compliance with procedures and schedule mandated by the County's annual docketing process)
Snohomish County Department of Public Works	Provide technical support	Same as above

Funding Needs:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish County Planning and Development Services	$35,000	Centennial Clean Water Fund grant
Snohomish County Department of Public Works	$ 2,800	Centennial Clean Water Fund grant

4.2 Infiltration of Direct Runoff

4.2.1 STORM-4: Stormwater Ordinance Revisions

Preferred Alternative: Support adoption of the Title 24 amendments which are currently under development. (Note: The amendments to Title 24 were adopted by the Snohomish County Council during the GWMP concurrence period.)

Evaluation of Alternative:

Identified Lead Agency: Snohomish County Planning and Development Services.

Participating Agencies: Snohomish County Public Works

Feasibility/Effectiveness of Alternative: Planning and Development Services suggests this alternative be deleted since this alternative is currently being implemented with an anticipated completion date of mid-1998. Priority should be placed on implementation of STORM-1; STORM-2; and STORM-3. Implementation of these alternatives will address the needs expressed by this alternative and will possibly provide direction for further Title 24 enhancements.

Conflicts with Land/Water Plans: This alternative does not represent a conflict with any existing land use or water management plan.

Funding Needs: Title 24 revisions are being undertaken with existing resources.

Funding Availability: Title 24 revisions are being undertaken with existing resources.

Potential Funding Sources Identified by Implementers: Title 24 revisions are being undertaken with existing resources.

Time Necessary for Implementation: The anticipated completion date for completion of the Title 24 revisions is mid-1998.

Ease/Difficulty of Implementation: No significant implementation problems are anticipated.

4.3 Infiltration of Spilled Contaminants

4.3.1 STORM-5: Older Infiltration Facilities

Preferred Alternative: Snohomish County should inventory direct infiltration facilities to determine their location in moderate or high vulnerability aquifer areas, as shown on Figure I-3-8, and to assess the potential for ground water contamination. This inventory should be used as a basis for upgrading the facilities using modern designs. The information could be applied to a geographical map and submitted to the Snohomish County Department of Emergency Management for use in spill response. Local jurisdictions should consider undertaking similar actions contingent upon demonstrated need (vulnerability) and availability of funding.

Evaluation of Alternative:

Identified Lead Agency: Snohomish County Department of Public Works for unincorporated Snohomish County.

Participating Agencies: Snohomish County Planning and Development Services could assist in research of historical drainage files, providing permit information on developments which may use infiltration facilities, and mapping of infiltrative facilities. Snohomish County Department of Emergency Management could participate by relaying vital information concerning the location of infiltrative facilities to Incident Commanders.

Also, Cities and Tribes.

Feasibility/Effectiveness of Alternative: Implementation within unincorporated areas feasible and potentially effective contingent upon securing adequate funding.

Conflicts with Land/Water Plans: No apparent conflicts for activities which may occur in unincorporated Snohomish County.

The City of Lake Stevens expressed a general concern about the alternative representing a conflict with land use in the city's industrial area.

Funding Needs: Department of Public Works provided an estimate of $500 per infiltration facility for inventory and inspection, and $20,000-$30,000 per facility for upgrade/reconstruction; however, the number of facilities was not specified.

The Town of Index indicated that: "plans, studies, and requests for cooperation would involve many hours and considerable spending."

Funding Availability: Funding is not currently available for implementation of this alternative.

Potential Funding Sources Identified by Implementers: Potential funding sources were not specified by implementers.

Time Necessary for Implementation: Implementation could commence in 2000. Facility inventories could be completed in that year; however, facility upgrades would be ongoing.

Ease/Difficulty of Implementation: It may be difficult to find effective solutions in high ground water areas.

The alternative suggests action by each individual city and tribe. Since not all jurisdictions may feel compliance with this request is warranted, the alternative could be an impediment to the concurrence and certification process for the Ground Water Management Program. However, the alternative does not require inventories to be made.

Implementation Pathway:

Lead Implementer: Snohomish County Department of Public Works

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish County Department of Public Works	Conduct inventory and inspect infiltration facilities. Upgrade/reconstruct facilities as appropriate	Inventory and inspections June 2000 – December 2000 Facility upgrades ongoing after December 2000
Snohomish County Planning and Development Services	Assist in research of historical drainage files and in providing permit information on developments which may use infiltration facilities	June 2000 – December 2000

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish County Department of Public Works	$25,000 to inventory and inspect 50 highest priority facilities ($500 per facility)	Dedicated funds
Snohomish County Department of Public Works	$250,000 to upgrade 10 highest priority facilities ($25,000 per facility)	Dedicated funds
Snohomish County Planning and Development Services	$8,400	Dedicated funds

5. NITROGEN IN GROUND WATER

5.1 Landscaping Fertilizer Applications

5.1.1 NITRATE-1: Residential Fertilizer Use

Preferred Alternative: Snohomish County Ground Water Advisory Committee (GWAC) should continue with plans to implement the second element of the early action implementation strategies that include dissemination of BMP information for residential lawn and garden fertilizer use.

Evaluation of Alternative:

Identified Lead Agency: Ground Water Advisory Committee (GWAC).

Participating Agencies: Numerous.

Feasibility/Effectiveness of Alternative: The alternative involves implementation of activities that have already been planned by the GWAC.

Conflicts with Land/Water Plans: The alternative is not inconsistent with land use and water management plans.

Funding Needs: Funding will be budgeted from Early Action Implementation funds set aside from the Centennial Clean Water Fund grant for the Snohomish County Ground Water Management Program.

Funding Availability: Early Action Implementation funds have been set aside from the Centennial Clean Water Fund grant for the Snohomish County Ground Water Management Program.

Potential Funding Sources Identified by Implementers: Not applicable.

Time Necessary for Implementation: Implementation will occur in spring 1998.

Ease/Difficulty of Implementation: No implementation difficulties are anticipated.

Implementation Pathway:

Lead Implementer: Ground Water Advisory Committee (GWAC)

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Ground Water Advisory Committee	Disseminate BMP information for residential lawn and garden fertilizer use	January 1998 - July 1998

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Ground Water Advisory Committee	Approximately $10,000	Existing Centennial Clean Water Fund grant for Early Action Implementation

5.2 Agricultural Fertilizer Applications and Animal Wastes

5.2.1 NITRATE-2: Waste Management Practices

Preferred Alternative: To prevent problems with stockpiled animal waste, Snohomish Conservation District (SCD) and WSU Cooperative Extension Service should collaborate concerning establishment of a soil amendment brokerage. SCD should concentrate on development of a pilot program with one or more large scale livestock producers to supply home gardeners with manure. WSU Cooperative Extension Service should establish an animal waste composting program for small scale livestock operations and integrate that program with its existing Livestock Advisor Outreach Program.

Evaluation of Alternative:

Identified Lead Agency: Two agencies have offered to serve as lead implementer: Snohomish Conservation District and WSU Cooperative Extension Service. Snohomish Conservation District would focus on larger scale livestock operations, while WSU Cooperative Extension Service would focus on small scale livestock operations, including non-commercial farms.

Participating Agencies: None.

Feasibility/Effectiveness of Alternative: The efficacy of such a program has been demonstrated elsewhere; however, there would be significant costs associated with full implementation.

Conflicts with Land/Water Plans: Properly implemented, this alternative would not represent a conflict with any land use or water management plans.

Funding Needs: Snohomish Conservation District estimates that to actually implement a soil amendment brokerage for large scale livestock operations, one FTE would be needed for a two-year period, or about $291,000. WSU Cooperative Extension Service estimated that to develop a program for small livestock operations would require about $30,000. The WSU program would be integrated with their existing Livestock Advisor Outreach Program.

Funding Availability: Funding is not currently available to implement the alternative.

Potential Funding Sources Identified by Implementers: No potential funding sources were identified by the implementers.

Time Necessary for Implementation: To develop a program for large scale livestock operations would require two years, commencing at the point when funding becomes available.

Ease/Difficulty of Implementation: Aside from difficulties in obtaining funding, market demand and supplier participation could be limiting factors for this program.

Implementation Pathway:

Lead Implementer: Snohomish Conservation District and WSU Cooperative Extension Service

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish County Conservation District	Develop pilot program with large scale livestock producers to supply manure to home gardeners	December 2000 – December 2002
WSU Cooperative Extension Service	Establish animal waste composting program for small scale livestock operations	Same as above.

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish County Conservation District	$291,000 ($145,000 per year for two years)	Dedicated funds
WSU Cooperative Extension Service	$ 30,000	Dedicated funds

6. PESTICIDES IN GROUND WATER

6.1 Agricultural Applications

6.1.1 PEST-1: Pesticide Collection Sites

Preferred Alternative: The Snohomish County Department of Public Works and the Washington State Department of Agriculture should investigate the feasibility of establishing a seasonal or permanent agricultural pesticide collection site at an existing county facility at which collected pesticides could be held for pick-up on a rotational basis by the Washington State Department of Agriculture. WSU Cooperative Extension Service and Snohomish Conservation District should be consulted during the investigation of feasibility concerning their willingness and availability of resources to perform activities to promote use of the site.

Evaluation of Alternative:

Identified Lead Agency: Snohomish County Department of Public Works and Washington State Department of Agriculture.

Participating Agencies: WSU Cooperative Extension Service indicated a willingness to help publicize drop-off days and the collection service in general by publicizing through existing newsletters, web sites, or displays, but would need outside funding to develop and execute.

Snohomish Conservation District expressed willingness to provide support such as advertising and promotion.

Feasibility/Effectiveness of Alternative: Establishment of a permanent or seasonal pesticide collection facility within Snohomish County would improve accessibility for farmers; however, it may not be feasible for WSDA to devote the level of resources necessary to operate such a facility.

Conflicts with Land/Water Plans: No conflicts with land use and water management plans have been identified.

Funding Needs: Establishment of collection site would require one FTE during portions of year when facility is open, or approximately $72,800 per year, assuming collection site would be operated for six months out of the year, and $3 per pound disposal costs.

Funding Availability: WSDA lacks funding for establishment of a collection site; however, WSDA possesses funding to further evaluate the feasibility of this alternative and optional strategies.
Potential Funding Sources Identified by Implementers: Appropriation of funds by the state legislature.

Time Necessary for Implementation: Since implementation of this alternative, as written, would require substantial resources, it is not known if, or when, funding could be secured and implementation could be initiated.

Ease/Difficulty of Implementation: WSDA currently conducts collections of pesticides on a county-by-county rotational basis; however, establishing a permanent or seasonal collection facility exclusively for Snohomish County would be costly. WSDA indicates that it may be more feasible for Snohomish County to designate an existing county facility as a pesticide drop-off site where pesticides could be held for collection by WSDA. Under such a scenario, WSDA would be the legal generator of the waste.

Implementation Pathway:

Lead Implementer: Snohomish County Department of Public Works and Washington State Department of Agriculture

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish County Department of Public Works	Initiate discussions with WSDA, assess feasibility of using an existing county facility as a collection site, and implement, if feasible, and funding is available	June 2000 - December 2001
Washington State Department of Agriculture	Assist DPW in the assessment of feasibility. Provide routine pick-up of pesticides from the collection site, once established	Same as above
WSU Cooperative Extension Service	Help publicize the collection site and service	Ongoing after December 2001
Snohomish Conservation District	Promote use of the collection site	Same as above

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish County Department of Public Works	$8,400 for feasibility assessment	Centennial Clean Water Fund grant
Snohomish County Department of Public Works	Unknown, dependent on feasibility assessment	Collection fees (Amount to be determined based on collection site cost) Possibly dedicated funds
Washington State Department of Agriculture	$8,400 for feasibility assessment	Centennial Clean Water Fund grant
Washington State Department of Agriculture	Unknown, dependent on feasibility assessment	Collection fees ($3 per pound) Existing funding for collections of pesticides on a county-by-county rotational basis
WSU Cooperative Extension Service	Provide support to the level allowed with existing funding	Existing funding
Snohomish Conservation District	Provide support to the level allowed with existing funding	Existing funding

6.1.2 PEST-2: Pesticide Inventory

Preferred Alternative: Washington State University (WSU) Cooperative Extension should assess the feasibility of conducting an inventory of agricultural pesticide use within the county that would focus on moderate and high vulnerability aquifer areas, as shown on Figure I-3-8. Information generated by such an inventory could be used to support various water resources programs, including, but not limited to, Wellhead Protection Programs and ground water monitoring programs. The feasibility assessment should identify potential sources of data concerning pesticide use in the county that are not bound by confidentiality restrictions, and should evaluate the reliability and comprehensiveness of available data. If available data are adequate, WSU Cooperative Extension should prepare a work plan for conducting the inventory, analyzing collected data, mapping the data collected in the inventory, and disseminating the maps. The work plan and a budget for the inventory and mapping effort would be submitted to the Snohomish County Public Works Department, the lead agency for Ground Water Management Plan implementation, for consideration as a future action.

Evaluation of Alternative:

Identified Lead Agency: Initially, the Washington State Department of Agriculture (WSDA) was identified as the lead agency for the PEST-2 Alternative. The original alternative called for WSDA to actually conduct an inventory of pesticide use in Snohomish County. However, after evaluating responses from WSDA, it became apparent that WSDA was not prepared to accept responsibility for conducting an inventory at this time due to resource limitations and because pesticide use data collected by the Agricultural Statistics Division of WSDA is largely confidential.

To facilitate assumption of responsibility for conducting a pesticide inventory by some entity other than WSDA, this alternative has been modified to provide, as a first step, more thorough scoping of the inventory and mapping effort. This would involve identifying potential data sources, characterizing the reliability and comprehensiveness of available data, and providing a well defined work plan for data collection, evaluation, and mapping. WSU Cooperative Extension has been identified as the most appropriate party to serve as the lead agency for the implementation of this alternative because of its familiarity with agricultural practices in Snohomish County, and its working relationship with WSDA and the local agricultural community.

Participating Agencies: Agencies with data that may be available for contribution to the inventory of pesticide use include: WSDA, Washington Department of Ecology, Washington State Department of Labor and Industries, and Snohomish Conservation District. Local agricultural supply dealers and chemical applicators may also have information that could contribute to the inventory.

Feasibility/Effectiveness of Alternative: This alternative should be effective in further assessing the viability of a pesticide use inventory and mapping effort, and, if appropriate, in providing a reasoned work plan for conducting such an effort. However, it is but an initial step in more protracted process of actually conducting an inventory, analyzing data, and preparing maps reflecting the inventory findings.

Conflicts with Land/Water Plans: None noted.

Funding Needs: It is estimated that the feasibility assessment would require approximately $5,500 in funding. Costs of conducting the actual inventory, analyzing data, mapping of inventory results, and dissemination of maps would be determined through the feasibility assessment.

Funding Availability: Funding is not currently available to support the feasibility assessment or to conduct subsequent inventory, data analyses, and mapping activities.

Potential Funding Sources Identified by Implementer: No specific source of funding was identified by the implementer.

Time Necessary for Implementation: The feasibility study could be completed within six months after funding becomes available.

Ease/Difficulty of Implementation: Aside from funding limitations, no significant implementation difficulties are anticipated with this alternative. However, should it be determined that the agricultural pesticide use inventory and mapping effort is feasible, and should the work plan and budget for the inventory and mapping effort be prepared in accordance with this alternative, the lead agency for Ground Water Management Plan implementation would need consider by what means the inventory and mapping effort could actually be conducted. This would involve identifying an implementer or implementers qualified to conduct the inventory, analyze collected data, and prepare accurate maps, as well as securing adequate funding to support the effort.

Implementation Pathway:

Lead Implementer: WSU Cooperative Extension

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
WSU Cooperative Extension	Conduct feasibility assessment for agricultural pesticide use inventory and mapping If feasible, develop work plan and budget for inventory	June 2000 - December 2000

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
WSU Cooperative Extension	$5,500 for feasibility assessment and to develop work plan and budget for inventory	Centennial Clean Water Fund Grant

6.1.3 PEST-3: Commercial Pesticide User Training

Preferred Alternative: The Washington State Department of Agriculture, with assistance from WSU Cooperative Extension Service, should modify recertification credit requirements for commercial pesticide applicators, such as turf farms, nurseries, golf courses, and forest lands, to include ground water and watershed protection education. Similarly, initial certification examinations should test knowledge of management of risks to ground and surface water resources associated with pesticide use. In addition, Snohomish County Department of Public Works, Snohomish Health District, and Snohomish County Planning and Development Services should continue to help manage risks associated with commercial pesticide use through their existing NPDES, and golf course permitting activities.

Evaluation of Alternative:

Identified Lead Agency: After receiving input from the participating agencies identified in the alternative, it was determined that the Washington Department of Agriculture would appear to be the most appropriate party to serve as lead agency.

Participating Agencies: WSU Cooperative Extension Service expressed willingness to serve as a participating implementer by conducting licensing classes.

Snohomish County Public Works is required to do some pesticide education under its NPDES permit.

Snohomish County Planning and Development Services is willing to participate to the extent that it can in providing pertinent information to golf course operators through its permitting process. For all recently permitted golf courses, the County has required an Integrated Pest Management plan and required monitoring.

Snohomish Health District will participate in this activity through its regulations governing moderate risk waste. The regulations allow the Health District to enforce proper storage, handling, and disposal standards.

Feasibility/Effectiveness of Alternative: A number of agencies were queried concerning their interest in undertaking responsibility for preparing a grant application necessary to implement the alternative. All agencies declined. The Washington Department of Agriculture questioned the need for a grant and suggested it may be more prudent for the Ground Water Management Program to request WSDA to modify classes required for applicator recertification credits to involve more ground water and watershed protection education. The Washington Department of Agriculture expressed willingness to accredit continuing education programs developed by WSU Cooperative Extension Service or Snohomish County, provided such programs are directed towards pesticide application (methods, safety, or equipment calibration), and/or the management of pests in the environment.

The need for modifications to initial certification examinations will need to be further evaluated through additional interaction with the Washington State Department of Agriculture. WSDA indicates that licensees are already tested on ground water issues as part of the Laws and Safety core exam and the Aquatic Pest Control category exam. Other exams administered by WSDA also include questions relating to leaching and retention of pesticides in soils. The Chemigation exam, currently under development by WSDA, should further the objective of ground water protection.

Conflicts with Land/Water Plans: No conflicts with land use or water resource plans have been identified.

Funding Needs: WSU Cooperative Extension Service indicated that a complete education program called out in the original alternative could require $60,000 in funding per year.

Funding Availability: Costs for the program could be at least partially offset by registration fees.

Potential Funding Sources Identified by Implementers: Recertification class registration fees.

Time Necessary for Implementation: Timing was not specified by Washington Department of Agriculture; however, it should be possible to implement the alternative by the end of the Ground Water Management Program's initial 3-year implementation period.

Ease/Difficulty of Implementation: Implementation may be difficult without support of industry organizations.

Implementation Pathway:

Lead Implementer: Washington State Department of Agriculture

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Washington State Department of Agriculture	Modify recertification credit requirements for commercial pesticide applicators to include ground water and watershed protection education	December 2000 - December 2001
WSU Cooperative Extension Service	Conduct licensing/ recertification classes	December 2001 - ongoing
Snohomish County Department of Public Works	Provide pesticide education as required under NPDES permit	Ongoing
Snohomish County Planning and Development Services	Provide pertinent information to golf course operators through permitting processes	Ongoing
Snohomish Health District	Participate in managing commercial pesticide use through Moderate Risk Waste Program	Ongoing

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Washington State Department of Agriculture	Funding needs to be determined after additional evaluation by WSDA	Costs for this alternative could be at least partially offset by recertification class registration fees Cost for additional evaluation by WSDA could be financed through dedicated funds
WSU Cooperative Extension Service	Funding needs to be determined after additional evaluation by WSDA	Costs for this alternative could be at least partially offset by recertification class registration fees
Snohomish County Department of Public Works	Provide support to the level allowed with existing funding	Existing resources
Snohomish County Planning and Development Services	Provide support to the level allowed with existing funding	Existing resources
Snohomish Health District	Provide support to the level allowed with existing funding	Existing resources

6.2 Right of Way Maintenance

6.2.1 PEST-4: Integrated Pest Management (IPM)

Preferred Alternative: The GWAC requests that Burlington Northern Santa Fe Railroad consider integration of IPM to limit use of herbicides for vegetation management along its trackage within Snohomish County into contracts with its vegetation control contractor.

Evaluation of Alternative:

Identified Lead Agency: Burlington Northern Santa Fe Railroad. The railroad has expressed concerns over the lead agency designations because it is not clear what responsibilities are required of a "lead agency."

Participating Agencies: None.

Feasibility/Effectiveness of Alternative: If implemented, this alternative would reduce potential water quality risks associated with herbicide use along Burlington Northern Santa Fe trackage within Snohomish County.

Conflicts with Land/Water Plans: No conflicts with land use or water resource plans have been identified.

Funding Needs: Costs for implementation of this alternative were not provided by Burlington Northern Santa Fe.

Funding Availability: Burlington Northern Santa Fe's Vegetation Management Program operates under a budget approved annually by the railroad's Chief Engineer. Within limits, allocation of budgeted funds is left to the discretion of Burlington Northern Santa Fe's Vegetation Manager.

Potential Funding Sources Identified by Implementers: None.

Time Necessary for Implementation: The current contract with a local vegetation control company is not scheduled to expire until the end of 2001. Modifications to the current contract could not occur without approval from various Burlington Northern Santa Fe departments including: Legal, Contract Services, Safety Programs, Engineering, Environmental, and Medical. Thus, it would appear that the most appropriate point of implementation would be when the post-2001 contract is negotiated and executed.

Ease/Difficulty of Implementation: Burlington Northern Santa Fe Railroad indicated that, on a national basis, it participates in selected IPM operational programs and research efforts. However, chemical and mechanical means are the primary tools used in vegetation control because of their proven safety, environmental protection, and efficacy record. Burlington Northern Santa Fe indicated that it is the railroad's intention to operate the Vegetation Management Program in a manner that considers land stewardship and water quality considerations. IPM would appear to be consistent with those considerations.

Implementation Pathway:

Lead Implementer: Burlington Northern Santa Fe Railroad

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Burlington Northern Santa Fe Railroad	Consider incorporating an integrated pest management program into future contracts with local vegetation control company	When existing contract with local vegetation control company expires

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Burlington Northern Santa Fe Railroad	Unable to determine	Resources allocated by railroad to Vegetation Management Program

6.3 Landscaping Applications

6.3.1 PEST-5: Residential Pesticide Use

Preferred Alternative: WSU Cooperative Extension Service should apply to the U.S. EPA or Washington Department of Ecology for a grant to fund an educational program targeting the general public and providing information on best management practices for pesticide applications and the use of less toxic alternatives.

Evaluation of Alternative:

Identified Lead Agency: WSU Cooperative Extension Service.

Participating Agencies: Snohomish County Public Works would provide some education as required under its NPDES permit.

Feasibility/Effectiveness of Alternative: WSU Cooperative Extension Service agreed to help prepare a grant application and would serve as lead implementer if additional funds are provided.

Conflicts with Land/Water Plans: No conflicts with land use or water resource plans have been identified.

Funding Needs: No indication of needs for developing a grant application was provided by WSU Cooperative Extension Service, although it would likely be approximately $2,400. To develop educational materials, an estimated $40,000 would be needed (one-half FTE plus support). Distribution of materials could be through the existing WSU Cooperative

Extension Service's Master Gardener Program, apparently at no additional cost.

Funding Availability: Funding is not currently available to implement the alternative.

Potential Funding Sources Identified by Implementers: No funding sources were identified.

Time Necessary for Implementation: Timing of implementation would be dependent on when grant funding might be available. Grant funding would probably not be secured until late in the Ground Water Management Program's initial 3-year implementation period.

Ease/Difficulty of Implementation: Funding would represent the most probable impediment to implementation.

Implementation Pathway:

Lead Implementer: WSU Cooperative Extension Service

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
WSU Cooperative Extension Service	Prepare a grant application for an educational program targeting pesticide use by the general public	September 1999 - March 2000
WSU Cooperative Extension Service	Implement program if grant approved	June 2000 - end of grant period
Snohomish County Public Works	Provide pesticide education as required under NPDES permit	Ongoing

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
WSU Cooperative Extension Service	$ 2,400 for grant preparation	Existing resources or dedicated funds
WSU Cooperative Extension Service	$40,000 to conduct educational program	PIE/EPA education grants
Snohomish County Public Works	Provide support to the level allowed with existing funding	Existing resources

6.3.2 PEST-6: Residential Pesticide Use

Preferred Alternative: WSU Cooperative Extension Service, through the Master Gardener's Program, should obtain existing educational materials on pesticide application and alternatives and make these materials available at check-out stands of one major retailer as part of a small scale pilot program. Should the pilot program demonstrate that this is an effective means of distributing educational materials, it should ultimately be expanded to other retailers.

Evaluation of Alternative:

Identified Lead Agency: WSU Cooperative Extension Service.

Participating Agencies: None.

Feasibility/Effectiveness of Alternative: This alternative would be feasible and would likely be effective if adequate funding can be obtained.

Conflicts with Land/Water Plans: No conflicts with land use or water resource plans have been identified.

Funding Needs: WSU Cooperative Extension Service estimated that $150,000 would be needed in the first year of the program for content development, design and printing of materials, obtaining retail space, and distribution of materials. Ongoing costs would be $75,000 per year.

Funding Availability: Funding is not currently available to implement the alternative.

Potential Funding Sources Identified by Implementers: Department of Ecology and Washington State Department of Agriculture.

Time Necessary for Implementation: Timing of implementation would be dependent on when grant funding might be available. Grant funding would not likely be secured until late in the Ground Water Management Program's initial 3-year implementation period.

Ease/Difficulty of Implementation: Funding represents the most probable impediment to implementation. The GWAC concluded that obtaining funding for implementation of the alternative as written was unlikely. Thus, this alternative will be modified to involve initiation of a small scale pilot program for testing the efficacy of distributing educational materials through retailers.

Implementation Pathway:

Lead Implementer: WSU Cooperative Extension Service

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
WSU Cooperative Extension Service	Conduct pilot program involving distribution of educational materials at the check-out stands of a major retailer	Either January 2000 or June 2000 depending on the type of grant pursued. Completion of pilot program would be six months to one year after initiation
WSU Cooperative Extension Service	Evaluate efficacy of program; prepare findings and recommendations to GWAC concerning advisability of expanding program	Within three months after completion of pilot program

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
WSU Cooperative Extension Service	Approximately $12,600	PIE/EPA educational grant or dedicated funds

7. WELL CONSTRUCTION AND DECOMMISSIONING

7.1 WELL-1: Well Seals and Abandonment Wells

Preferred Alternative: Snohomish Health District should include educational materials on well seals and well decommissioning with other educational materials that are sent to on-site sewage system permit holders.

Evaluation of Alternative:

Identified Lead Agency: Snohomish Health District.

Participating Agencies: WSU Cooperative Extension Service indicated that well education efforts could be conducted within the context of Cooperative Extension Service's small farm workshops and "home assist" program.

Feasibility/Effectiveness of Alternative: Feasibility and effectiveness of this alternative would be contingent upon securing adequate funding.

Conflicts with Land/Water Plans: No conflicts with land use or water resource plans have been identified.

Funding Needs: Assuming continued funding of the present Health District program for dissemination of educational materials to on-site sewage system owners, the resources required for this alternative could be limited to that needed for production of the educational materials. No estimate of production costs was provided.

Funding Availability: Resources are not available to cover production costs.

Potential Funding Sources Identified by Implementers: None.

Time Necessary for Implementation: Implementation could begin once funding is available to cover production costs.

Ease/Difficulty of Implementation: This alternative is feasible for only as long as the Snohomish Health District is willing to support its "piggy backing" on the educational program intended for on-site sewage system owners.

Implementation Pathway:

Lead Implementer: Snohomish Health District

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish Health District	Include information concerning well sealing and decommissioning with other materials sent to on-site sewage system permit holders	June 2000 - ongoing
WSU Cooperative Extension Service	Assist SHD in disseminating information through small farm workshops and "home assist" program	Same as above

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish Health District	$5,000 for production costs Distribution costs should be limited to the level possible with existing funding	Centennial Clean Water Fund grant
WSU Cooperative Extension Service	Provide support to the level allowed with existing funding	Existing resources

8. SURFACE MINING AND EXCAVATION

8.1 Mining and Excavation Through an Aquitard

8.1.1 MINE-1: Site Hydrogeologic Assessments

Preferred Alternative: Snohomish County Planning and Development Services should amend the Conditional Use Permitting (CUP) process for surface mining to require that geohydrologic evaluations, identifying the locations of relevant aquitards and their relation to proposed mining activities, be completed by all applicants. The requirement for geohydrologic evaluations would be waived in cases where the Department of Natural Resources invokes its authority to require such evaluation under RCW 78.44.091.

Evaluation of Alternative:

Identified Lead Agency: Snohomish County Planning and Development Services.

Participating Agencies: None.

Feasibility/Effectiveness of Alternative: This alternative would be feasible and effective provided the required elements of the geohydrologic evaluations are well defined, and such evaluations are oriented towards providing information that would be useful in determining appropriate mitigation measures.

Conflicts with Land/Water Plans: No conflicts with land use or water resource plans have been identified.

Funding Needs: Planning and Development Services anticipates that approximately $5,000 in staff time would be required to implement the alternative, including support to the adoption process.

Funding Availability: Resources necessary to implement the alternative are not currently available; however, expertise to implement the alternative exists within Planning and Development Services staff.

Potential Funding Sources Identified by Implementers: Centennial Clean Water Fund grant and County general fund.

Time Necessary for Implementation: The alternative could be completed within six to eight months after funding becomes available.

Ease/Difficulty of Implementation: Aside from funding, there do not appear to be any significant impediments to implementation.

Implementation Pathway:

Lead Implementer: Snohomish County Planning and Development Services

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish County Planning and Development Services	Prepare and support adoption of amendments to the CUP process for surface mining to require geohydrologic evaluations	June 2000 - February 2001

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish County Planning and Development Services	$5,000	Centennial Clean Water Fund grant

8.1.2 MINE-2: Operator Training/Inspections

Preferred Alternative: The Washington Aggregate and Concrete Association, the Snohomish County Aggregate Producers, the Department of Ecology, the Washington Department of Natural Resources, and Snohomish County (Department/Division to be determined) should collaborate concerning development of a program for routine dissemination of educational materials regarding the breaching of aquifers by surface mining operations. Pre-packaged education materials should be developed by Snohomish County (Department/Division to be determined) with technical assistance from the Department of Natural Resources and the Department of Ecology. Such materials could be used at training programs sponsored by the Washington Aggregate and Concrete Association and the Snohomish County Aggregate Producers, as well as at other educational events.

Evaluation of Alternative:

Identified Lead Agency: Washington Aggregate and Concrete Association, the Snohomish County Aggregate Producers; and Snohomish County (Department/Division to be determined).

Participating Agencies: Washington Department of Natural Resources and the Washington Department of Ecology could provide technical support.

Feasibility/Effectiveness of Alternative: WACA and Snohomish County Aggregate Producers could provide education to operators through their existing training programs, if materials were available in a training format.

Ecology has given numerous presentations on the "High Rock Aquifer" break since 1993 and will continue giving such presentations upon request, subject to resource limitations. The technical report that was produced in response to the High Rock incident has been widely distributed, is still available, and offers recommendations for avoiding future similar occurrences. This report could serve as the basis for development of training materials to be used in WACA and Snohomish County Aggregate Producers' sponsored training sessions.

Both participating state agencies expressed concerns regarding the need for the alternative. According to Ecology, the High Rock break of 1993 has been the only occurrence of this type in the state. Since it is a relatively rare incident, Ecology found it "curious" that this issue has been given such a high priority by the GWAC. The Department of Natural Resources offered similar concerns.

Conflicts with Land/Water Plans: No conflicts with land use or water resource plans have been identified.

Funding Needs: WACA and Snohomish County Aggregate Producers' estimate that $1,000 - $2,000 annually would be needed to provide training, provided a pre-packaged set of materials are available.

Approximately $5,000 would be needed by Snohomish County (Department/Division to be determined) to adapt Ecology's High Rock technical report into pre-packaged training materials.

Funding Availability: WACA and Snohomish County Aggregate Producers may have sufficient resources to conduct training. Funding is not currently available for Snohomish County (Department/Division to be determined) to produce training materials. Department of Natural Resources can contribute a small amount of staff time for support.

Potential Funding Sources Identified by Implementers: No additional funding sources were suggested by implementers.

Time Necessary for Implementation: To some extent, this alternative is already being implemented as Ecology has given numerous presentations on the High Rock break and will continue giving such presentations upon request, subject to resource limitations. Expanding current education efforts regarding breaching of aquifers could likely be implemented within one year after Snohomish County (Department/Division to be determined) receives funding to prepare training materials to be used in WACA and Snohomish County Aggregate Producers' training programs.

Ease/Difficulty of Implementation: Department of Natural Resources indicated that there may be difficulties in getting some mine operators to attend seminars.

Additionally, WACA and Snohomish County Aggregate Producers expressed concerns that "obtuse and conceptual prevention [is] difficult to implement."

Implementation Pathway:

Lead Implementer: Washington Aggregate and Concrete Association, Snohomish County Aggregate Producers, and Snohomish County (Department/Division to be determined).

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Washington Aggregate and Concrete Association and the Snohomish County Aggregate Producers	Provide education to operators regarding the breaching of aquifers by surface mining operations	June 2000 - ongoing
Snohomish County (Department/Division to be determined)	Prepare training materials for use by WACA and SCAP.	June 2000 - December 2000
Washington Department of Ecology	Provide presentations regarding High Rock Aquifer upon request	September 1999 - ongoing
Washington Department of Natural Resources	Provide technical support	Same as above

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Washington Aggregate and Concrete Association and the Snohomish County Aggregate Producers	$1,500	Existing resources
Snohomish County (Department/Division to be determined)	$5,000 for preparation of training materials (including printing)	Centennial Clean Water Fund grant for production and printing
Washington Department of Ecology	Presentations to be provided at the level allowed with existing funding	Existing resources for presentations, subject to limited availability
Washington Department of Natural Resources	Provide support to the level allowed with existing funding	Existing resources, subject to limited availability

8.1.3 MINE-3: Operator Training/Inspections

Preferred Alternative: Snohomish County Planning and Development Services (PDS) should consider adding a provision to the Conditional Use Permit (CUP) that requires surface mining operations within the GWMA to have periodic inspections of site conditions by qualified geologists or hydrogeologists.

Evaluation of Alternative:

Identified Lead Agency: Snohomish County Planning and Development Services.

Participating Agencies: None.

Feasibility/Effectiveness of Alternative: This alternative should be effective and feasible, provided Planning and Development Services is given the flexibility to further define the extent and scope of required site inspections and the range of potential follow-up actions.

Conflicts with Land/Water Plans: No conflicts with land use or water resource plans have been identified.

Funding Needs: Planning and Development Services estimates $1,000 would be needed to conduct evaluation of feasibility. Approximately $5,000 in staff resources, including support to formal adoption process, would be required for implementation of the CUP modifications. Funding needed for associated site inspections is not known.

Funding Availability: Funding is available for an evaluation of feasibility, but none is available for actual implementation of CUP modifications or site inspections.

Potential Funding Sources Identified by Implementers: Centennial Clean Water Fund and County general fund.

Time Necessary for Implementation: Planning and Development Services could implement the alternative within six to eight months after funding becomes available.

Ease/Difficulty of Implementation: Aside from funding limitations, no significant impediments to implementation are anticipated.

Implementation Pathway:

Lead Implementer: Snohomish County Planning and Development Services

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish County Planning and Development Services	Conduct evaluation of feasibility	June 2000 -July 2000
Snohomish County Planning and Development Services	Prepare and support adoption of amendments to CUP requirements obligating surface mining operations within the GWMA to have periodic inspections by qualified geologists or hydrogeologists	July 2000 - March 2001

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish County Planning and Development Services	$1,000 for evaluation of feasibility	Existing resources
Snohomish County Planning and Development Services	$5,000 CUP modifications	Centennial Clean Water Fund grant

8.2 Leaching of Mine Waste and Fill Materials

8.2.1 MINE-4: Backfill Material Quality

Preferred Alternative: The Snohomish County Department of Public Works, with cooperation from the Snohomish Health District and the Department of Ecology, should develop and provide to the Department of Natural Resources a set of sampling and analysis standards for demonstrating that imported mining backfill materials are clean and inert. The Department of Natural Resources should add a provision to its reclamation permits requiring that the sampling and analysis standards be used by mine operators to demonstrate that backfill materials are clean and inert.

Evaluation of Alternative:

Identified Lead Agency: Washington Department of Natural Resources was identified as the lead agency for this alternative; however, that department declined lead agency status asserting that the alternative would more appropriately be addressed by the Snohomish Health District. The health district expressed unwillingness to accept lead agency status and indicated that while it enforces Minimum Functional Standards for Solid Waste Handling (Chapter 173-304 WAC) which contain requirements that mining backfill consist of clean dirt, brick, or concrete, no triggering mechanisms exist for the health district to become involved in regulation of backfill at mining sites, except when complaints are registered.

Participating Agencies: Department of Natural Resources indicated it could act as a consultant on geology and reclamation techniques. The Snohomish Health District may assist in defining sampling and analysis standards. The Washington Department of Ecology will participate in the review of sampling and analysis standards developed under this alternative.

Feasibility/Effectiveness of Alternative: Feasibility of this alternative is greatly diminished by not having a lead agency willing to undertake implementation of the alternative. There may be a need to define sampling and analysis standards as well as to establish a record keeping system as preliminary steps in the implementation of this alternative.

Conflicts with Land/Water Plans: No conflicts with land use or water resource plans have been identified.

Funding Needs: No estimates of funding needs were offered by the potential participants in this alternative.

Funding Availability: Funding is not currently available for implementation of this alternative.

Potential Funding Sources Identified by Implementers: No potential sources of funding were suggested by the potential participants.

Time Necessary for Implementation: No estimate of time necessary for implementation of this alternative was offered by the potential participants; although DNR indicated that time necessary for implementation would depend on the complexity of the permit process.

Ease/Difficulty of Implementation: In its present form, this alternative cannot be fully implemented until DNR and Snohomish County resolve jurisdictional authority over imported fill material (See Mine 7).

Implementation Pathway:

Lead Implementer: Snohomish County Public Works

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish County Public Works	Coordinate efforts to define sampling and analysis standards for demonstrating that mining backfill materials are clean and inert. Provide results to DNR	June 2000 - June 2001
Snohomish Health District	Participate in defining sampling and analysis standards	Same as above.
Washington Department of Ecology	Participate in the review of sampling and analysis standards	Same as above

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish County Public Works	Approximately $5,600	Centennial Clean Water Fund grant
Snohomish Health District	Approximately $8,400	Centennial Clean Water Fund grant
Washington Department of Ecology	Approximately $8,400	Centennial Clean Water Fund grant

8.2.2 MINE-5: Backfill Material Quality

Preferred Alternative: Snohomish County Department of Public Works, with assistance from the Department of Ecology and Snohomish Health District, should provide the Washington Aggregate and Concrete Association and the Snohomish County Aggregate Producers with educational materials to be distributed to surface mine operators that stress the importance of ensuring that individuals providing backfill demonstrate that the backfill materials are clean and inert.

Evaluation of Alternative:

Identified Lead Agency: Although the Department of Natural Resources represents the logical lead implementer for this alternative since they permit the reclamation of mines, that department declined to accept lead agency status. The Department of Ecology expressed willingness to make the recommendation suggested in the alternative, but indicated that it was not an appropriate lead agency because Department of Natural Resources has primacy over mining reclamation issues. The Washington Aggregate and Concrete Association also declined lead agency status because that role should be filled by a regulatory agency.

Participating Agencies: Washington Department of Natural Resources indicated a willingness to provide staff support, although it indicated that no funding or equipment are available in its budget.

Feasibility/Effectiveness of Alternative: As currently structured, this alternative can not be implemented until a lead agency is identified.

Conflicts with Land/Water Plans: No conflicts with land use or water resource plans have been identified.

Funding Needs: Funding needs for implementation of this alternative were not provided by the Department of Natural Resources.

The Washington Aggregate and Concrete Association and Snohomish County Aggregate Producers indicated that mine operator training regarding this issue would require $1,000 - $2,000.

Funding Availability: The Department of Natural Resources indicated that no funding or equipment are available in its budget for implementation of this alternative.

The Washington Aggregate and Concrete Association and Snohomish County Aggregate Producers indicated that they possess funding to support educational efforts related to this issue.

Potential Funding Sources Identified by Implementers: U.S. EPA or Department of Ecology.

Time Necessary for Implementation: No estimate of time necessary for implementation of this alternative was offered by the potential participants; although DNR indicated that the need for monitoring would continue throughout the life of backfilling operations at facilities.

Ease/Difficulty of Implementation: In its present form, this alternative cannot be fully implemented until DNR and Snohomish County resolve jurisdictional authority over imported fill materials (See Mine 7).

Implementation Pathway:

Lead Implementer: Snohomish County Department of Public Works

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish County Department of Public Works	Provide educational materials to WACA and SCAP regarding the importance of use of clean and inert backfill materials for distribution to surface mine operators	June 2000 - December 2000
Washington Department of Ecology	Provide technical support in the development of educational materials	Same as above
Snohomish Health District	Provide technical support in the development of educational materials	Same as above
Washington Aggregate and Concrete Association and the Snohomish County Aggregate Producers	Distribute educational materials to surface mine operators	December 2000 - ongoing

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish County Department of Public Works	$5,000 for preparing materials (assumes technical content largely developed through MINE-1)	Centennial Clean Water Fund grant
Washington Department of Ecology	Provide support to the level allowed with existing funding	Existing resources
Snohomish Health District	Provide support to the level allowed with existing funding	Existing resources
Washington Aggregate and Concrete Association and the Snohomish County Aggregate Producers	$1,500	Existing resources

8.2.3 MINE-6: Permit Coordination

Preferred Alternative: Snohomish County Planning and Development Services should consider requiring all future Conditional Use Permits (CUPs) issued for surface mining to stipulate that: 1) no excavation is allowed until the DNR approved reclamation permit and plan(s) have been provided to PDS; and 2) the applicant will adhere to all applicable federal, state, and local regulations, including all applicable provisions of Chapter 78.44 RCW.

Evaluation of Alternative:

Identified Lead Agency: Snohomish County Planning and Development Services.

Participating Agencies: None.

Feasibility/Effectiveness of Alternative: Planning and Development Services indicated that this alternative should be feasible and effective.

Conflicts with Land/Water Plans: No conflicts with land use or water resource plans have been identified.

Funding Needs: Planning and Development Services requires $2,000 to conduct an initial assessment of feasibility and approximately $5,000 in staff time to prepare modifications and support adoption process

Funding Availability: Funding is not currently available to implement the alternative, although staff expertise necessary for implementation exists.

Potential Funding Sources Identified by Implementers: Centennial Clean Water Fund and County general fund.

Time Necessary for Implementation: Implementation could occur within six to eight months after funding is obtained.

Ease/Difficulty of Implementation: Planning and Development Services expressed concerns over the original wording of the alternative which requested the County amend Conditional Use Permits (CUP). Planning and Development Services indicated that there is no mechanism to amend CUPs that have already received approval. Thus, the GWAC modified the alternative to address conditions for issuance of any future CUPs.

Implementation Pathway:

Lead Implementer: Snohomish County Planning and Development Services

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish County Planning and Development Services	Conduct initial assessment of feasibility. If feasible, prepare modifications and support adoption process	June 2000 - January 2001 The informal agreement with DNR described in Alt. 8.3.3.2, I2, A3 should be completed prior to implementation.

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish County Planning and Development Services	$2,000 to conduct an initial assessment	Centennial Clean Water Fund grant
Snohomish County Planning and Development Services	$5,000 to prepare modifications	Centennial Clean Water Fund grant

8.2.4 MINE-7: Permit Coordination

Preferred Alternative: Snohomish County Planning and Development Services should collaborate with the Department of Natural Resources to achieve an informal agreement concerning reciprocal responsibilities and to develop more explicit guidelines for effective implementation of Chapter 78.44 RCW, including, for example, that: 1) a copy of the approved reclamation plan and permit should be submitted by Department of Natural Resources to Planning and Development Services for Conditional Use Permit compliance within 150 days after issuance of the permit; and 2) a detailed reclamation plan, which includes mitigation for impacts to Critical Aquifer Recharge Areas and other sensitive areas, be required. At such time as Department of Natural Resources administrative policies allow, the informal agreement should be modified to a Memorandum of Agreement (MOA) between the two agencies.

Evaluation of Alternative:

Identified Lead Agency: Snohomish County Planning and Development Services.

Participating Agencies: The Department of Natural Resources responded that while it is willing to provide support to Snohomish County upon request, department management has adopted a policy that the department will not enter into Memorandums of Understanding with other agencies.

Feasibility/Effectiveness of Alternative: Although a formal MOU between DNR and Snohomish County does not appear feasible, DNR has expressed a willingness to discuss cooperative regulation of surface mining operations.

Conflicts with Land/Water Plans: No conflicts with land use or water resource plans have been identified.

Funding Needs: Planning and Development Services indicates that it would need approximately $5,000 in staff resources to implement the alternative.

Funding Availability: Funding is not currently available to support implementation of this alternative.

Potential Funding Sources Identified by Implementers: Centennial Clean Water Fund grant and County general fund.

Time Necessary for Implementation: Planning and Development Services indicates that the alternative could be implemented within nine to 12 months after funding becomes available, contingent upon cooperation of the Department of Natural Resources.

Ease/Difficulty of Implementation: In its present form, this alternative cannot be fully implemented until DNR and Snohomish County develop a mutually acceptable approach to permit coordination.

In addition, Planning and Development Services indicated that developing acceptable language on reciprocal responsibilities with the Department of Natural Resources may prove time consuming and costly.

Implementation Pathway:

Lead Implementer: Snohomish County Planning and Development Services

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish County Planning and Development Services	Engage DNR in discussions regarding reciprocal responsibilities for purposes of developing an informal agreement	June 2000 - March 2001
Department of Natural Resources	Collaborate with PDS in development of an informal agreement regarding reciprocal responsibilities	Same as above

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish County Planning and Development Services	$5,000	Centennial Clean Water Fund grant
Department of Natural Resources	$2,800	Centennial Clean Water Fund grant

8.2.5 MINE-8: Grading Permits for Older Sites

Preferred Alternative: Snohomish County Planning and Development Services should amend the grading permit process to include a provision requiring evaluations to demonstrate that backfill materials are clean and inert when grading is proposed within an historic mine site.

Evaluation of Alternative:

Identified Lead Agency: Snohomish County Planning and Development Services.

Participating Agencies: None.

Feasibility/Effectiveness of Alternative: This alternative would be feasible and effective provided it is modified to limit the scope of the

proposed action to grading that is proposed in an historic mine site, not for all grading activities.

Conflicts with Land/Water Plans: No conflicts with land use or water resource plans have been identified.

Funding Needs: Approximately $5,000 in staff time would be needed for implementation activities, including support for the adoption process.

Funding Availability: Funding is not currently available to support implementation, although adequate staff expertise exists.

Potential Funding Sources Identified by Implementers: Centennial Clean Water Fund and County general fund.

Time Necessary for Implementation: This alternative could be implemented within six to eight months after funding becomes available.

Ease/Difficulty of Implementation: No significant impediments to implementation are anticipated, provided adequate funding is obtained.

Implementation Pathway:

Lead Implementer: Snohomish County Planning and Development Services

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish County Planning and Development Services	Prepare and support adoption of amendments to the grading permit process to include a provision requiring evaluations to demonstrate that backfill materials are clean and inert	June 2000 - February 2001

Funding Needs:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish County Planning and Development Services	$5,000	Centennial Clean Water Fund grant

8.2.6 MINE-9: Water Supply Wells

Preferred Alternative: Snohomish County Planning and Development Services (PDS) should consider requiring surface mining Conditional Use Permit (CUP) applications to include a well inventory for water supply wells within a specified radius of the proposed facility.

Evaluation of Alternative:

Identified Lead Agency: Snohomish County Planning and Development Services.

Participating Agencies: Snohomish Health District would participate by providing information from existing Health District records on affected wells.

Feasibility/Effectiveness of Alternative: This alternative would be feasible and effective provided Planning and Development Services is provided with flexibility to define the extent, scope, and source of data for required well inventories.

Conflicts with Land/Water Plans: No conflicts with land use or water resource plans have been identified.

Funding Needs: Planning and Development Services estimates that $2,000 in staff time will be needed to evaluate feasibility. To prepare code revisions, approximately $5,000 in staff resources would be needed, including providing support to the formal adoption process.

Snohomish Health District will not be in a position to provide a firm cost estimate until Planning and Development Services completes the evaluation of feasibility.

Funding Availability: Funding is available to Planning and Development Services for the evaluation of feasibility. Funding is not available for code revision/implementation, although expertise is available on staff for implementation.

Potential Funding Sources Identified by Implementers: Centennial Clean Water Fund and County general fund.

Time Necessary for Implementation: This alternative could be implemented within six to eight months of funding availability.

Ease/Difficulty of Implementation: Aside from funding, no significant impediments to implementation are anticipated.

Implementation Pathway:

Lead Implementer: Snohomish County Planning and Development Services

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish County Planning and Development Services	Prepare and support adoption of amendments to CUP applications to include a well inventory for water supply wells	June 2000 - February 2001
Snohomish Health District	Provide PDS information on potentially affected wells	June 2000 - ongoing

Funding Needs:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish County Planning and Development Services	$2,000 for evaluation of feasibility	Existing resources
Snohomish County Planning and Development Services	$5,000 to prepare code revisions	Centennial Clean Water Fund grant
Snohomish Health District	Approximately $1,400	Centennial Clean Water Fund grant

8.2.7 MINE-10: Water Supply Wells

Preferred Alternative: Snohomish County Planning and Development Services (PDS) should consider a revision to the zoning code to require a contingency plan for the replacement of surrounding residents' potable water in the event that a proposed mineral excavation has detrimental effects on ground water quantity or quality (from General Policy Plan, Appendix H-d-11).

Evaluation of Alternative:

Identified Lead Agency: Snohomish County Planning and Development Services.

Participating Agencies: Snohomish Health District participates in an advisory capacity during development of the plan.

Feasibility/Effectiveness of Alternative: This alternative would be feasible and effective if funding is available, and Planning and Development Services is afforded flexibility in defining the content of the contingency plan and conditions under which it would be used. The potential for use of the existing land use permit binder (bonding) for mitigation of impacts should be considered.

Conflicts with Land/Water Plans: No conflicts with land use or water resource plans have been identified.

Funding Needs: Planning and Development Services would need $3,000 to conduct feasibility assessment, including legal review regarding possible use of the land use permit binder (bonding) for mitigation. Approximately $5,000 in staff resources would be needed to prepare code revisions and provide support for formal adoption process.

Snohomish Health District will not be in a position to provide a firm cost estimate until Planning and Development Services completes the assessment of feasibility.

Funding Availability: Funding is available to Planning and Development Services to conduct feasibility assessment. Funding is not available for code revision and implementation, although expertise is available within existing staff to implement the alternative.

Potential Funding Sources Identified by Implementers: Centennial Clean Water Fund and County general fund.

Time Necessary for Implementation: This alternative could be implemented within six to eight months of funding availability.

Ease/Difficulty of Implementation: Planning and Development Services indicates that it may be difficult to develop general code language requiring a contingency plan with enough specificity to subsequently guide individual permit decisions, particularly when the range of potential contingency options is so great and individual site conditions so variable. The use of the permit binder system may be more reasonable.

Implementation Pathway:

Lead Implementer: Snohomish County Planning and Development Services

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish County Planning and Development Services	Evaluate feasibility of establishing contingency plans (or bonding) to provide for replacement of residential drinking water supplies that may be adversely affected by mining activities. If deemed feasible, prepare and support adoption of appropriate amendments to the zoning code	June 2000 - February 2001
Snohomish Health District	Participate in an advisory capacity	Same as above

Funding Needs:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish County Planning and Development Services	$3,000 for feasibility assessment, including legal review	Existing resources
Snohomish County Planning and Development Services	$5,000	Centennial Clean Water Fund grant
Snohomish Health District	Approximately $1,400	Centennial Clean Water Fund grant

8.3 Spills at Mining and Excavation Sites

8.3.1 MINE-11: Well Owner Notification

Preferred Alternative: The Department of Ecology and Snohomish Health District should collaborate in developing a memorandum of agreement or memorandum of understanding regarding protocols for notification of well owners near surface mining operations in the event of NPDES/SWD General Permit violations, or violations of the Water Pollution Control Act that could affect off-site ground water quality.

Evaluation of Alternative:

Identified Lead Agency: Washington Department of Ecology.

Participating Agencies: Snohomish Health District

Feasibility/Effectiveness of Alternative: This alternative would be feasible and effective.

Most discharge violations at mine sites are turbidity violations and minor spills which do not create a threat to ground water quality.

Conflicts with Land/Water Plans: No conflicts with land use or water resource plans have been identified.

Funding Needs: Funding needs have not been determined; however, costs for development of a notification process are anticipated to be nominal.

Funding Availability: Funding availability has not been determined; it is possible that the alternative could be implemented with existing resources.

Potential Funding Sources Identified by Implementers: Potential funding sources were not identified by the potential implementers.

Time Necessary for Implementation: This alternative could be implemented within one year of Ground Water Management Program implementation.

Ease/Difficulty of Implementation: Provided funding is not an issue, no significant impediments to implementation are anticipated. The scope of the MOU should be clear and consistent with the Health District's abilities and resources.

Implementation Pathway:

Lead Implementer:

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Washington Department of Ecology	Engage SHD in discussions concerning development of a memorandum of agreement regarding protocols for notification of well owners near surface mining operations in the event that water quality violations are observed. Complete memorandum of agreement	June 2000 - May 2001
Snohomish Health District	Collaborate with Ecology in development of a memorandum of agreement	Same as above

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Washington Department of Ecology	Ecology should consider the potential for implementation with existing funding If not, $2,800	If needed, dedicated funds
Snohomish Health District	SHD should consider the potential for implementation with existing funding If not, $2,800	If needed, dedicated funds

9. ILLEGAL DUMPING

9.1 DUMP-1: Existing/Potential Dumping Sites

Preferred Alternative: Snohomish County Department of Public Works will compile a data base containing the location and background information concerning abandoned sites that have or could be used for illegal dumping. Data will be obtained from the Snohomish County Department of Public Works Solid Waste Management Division, Snohomish Health District, Snohomish County Planning and Development Services, Department of Ecology, and, if applicable, the Environmental Protection Agency. Owners of such sites will be identified and notified of their potential liability. The locations of the sites will be mapped by Snohomish County Planning and Development Services, and the lead agency will provide the maps to appropriate surveillance and enforcement agencies and public water systems.

Evaluation of Alternative:

Identified Lead Agency: After further consideration by the GWAC, it was determined that Snohomish County Department of Public Works would be the appropriate agency to implement a modified version of this alternative.

Participating Agencies: Snohomish Health District, Snohomish County Planning and Development Services, Department of Ecology, and, if applicable, the Environmental Protection Agency would be asked to provide data concerning possible illegal dumping sites. Snohomish County Planning and Development Services would provide mapping of site locations. The Snohomish County Department of Emergency Management would provide assistance to Incident Commanders in determining "Responsible Parties."

Feasibility/Effectiveness of Alternative: In a modified form described below, this alternative would likely be feasible and effective.

Conflicts with Land/Water Plans: No conflicts with land use or water resource plans have been identified.

Funding Needs: Funding needs have not been determined, but will be estimated in the Implementation and Funding Plan.

Funding Availability: Additional funding will be needed to implement the alternative.

Potential Funding Sources Identified by Implementers: Ecology is developing a grant program for local governments to address illegal dumps. Ecology is also considering "prevention campaigns;" these will specifically target litter, but may address illegal dumping. Ecology has funding for these programs for two years, after that, legislative mandates could modify them.

Time Necessary for Implementation: This alternative should be implemented by the end of the initial three-year implementation period for the certified Ground Water Management Program, contingent on availability of adequate funding.

Ease/Difficulty of Implementation: With the exception of funding, no significant impediments are anticipated to implementation of this alternative as revised below.

Implementation Pathway:

Lead Implementer: Snohomish County Public Works

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish County Department of Public Works	Compile data regarding locations and background information of abandoned surface mining sites that have or could be used for illegal dumping Notify owners of such sites of their potential liability	December 1999 - November 2000 if funding available through Ecology's Coordinated Prevention Program Otherwise June 2001 - May 2002
Snohomish County Planning and Development Services	Provide data concerning location and status of possible illegal dumping sites. Prepare map of locations of sites	Same as above; although mapping of sites should be completed midway through implementation period
U.S. Environmental Protection Agency	Provide data concerning location and status of possible illegal dumping sites	Same as for DPW
Snohomish Health District	Provide data concerning location and status of possible illegal dumping sites	Same as for DPW
Washington Department of Ecology	Provide data concerning location and status of possible illegal dumping sites	Same as for DPW

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish County Public Works	$16,800	Potential for funding from fallout funds under Ecology's Solid Waste Coordinated Prevention Program. If support from Coordinated Prevention Program not available, dedicated funds would be needed
Snohomish County Planning and Development Services	$8,400	Same as above
U.S. Environmental Protection Agency	$1,100	Existing resources or dedicated funds
Washington Department of Ecology	$1,100	Existing resources or dedicated funds

9.2 DUMP-2: Existing/Potential Dumping Sites

Preferred Alternative: The Snohomish County Sheriff's Department will be provided with a map demonstrating the location of abandoned sites that have or could be used for illegal dumping. In its routine patrols, the Sheriff's Department should observe the identified sites and report illegal dumping activities to the Department of Ecology and Snohomish Health District, as appropriate.

Evaluation of Alternative:

Identified Lead Agency: Snohomish County Sheriff's Department.

Participating Agencies: Snohomish County Department of Public Works would provide information to the Sheriff's Department concerning the location of known and suspected illegal dumping areas. The Snohomish Health District and the Department of Ecology would serve as points of contact for the Sheriff's Department concerning identified illegal dumping activities, the Health District for solid wastes and Ecology for hazardous wastes.

Feasibility/Effectiveness of Alternative: This alternative would likely be feasible and effective if structured in a manner that will facilitate active participation of the Sheriff's Department.

Conflicts with Land/Water Plans: No conflicts with land use or water resource plans have been identified.

Funding Needs: Funding needs were not specified by the lead implementer.

The Snohomish Health District indicates that existing resources are available to address current level of illegal dumping complaints. If implementation of this alternative results in a significant increase in the number of complaints received, additional resources may be necessary.

Funding Availability: It is the desire of the GWAC that this alternative be implemented with existing resources.

Potential Funding Sources Identified by Implementers: Ecology is developing a grant program for local governments to address illegal dumps. Ecology is also considering "prevention campaigns;" these will specifically target litter, but may address illegal dumping. Ecology has funding for these programs for two years, after that, legislative mandates could modify them.

Time Necessary for Implementation: This alternative should be implemented by the end of the initial three-year implementation period for the certified Ground Water Management Program, contingent on availability of adequate funding.

Ease/Difficulty of Implementation: Implementation will hinge on the Sheriff's Department's ability to integrate surveillance of illegal dump sites into their routine patrols without increasing the need for resources. The Sheriff's Department reports that it cannot assume any additional duties and responsibilities due to the department's limited staffing.

Implementation Pathway:

Lead Implementer: Snohomish County Sheriff's Department

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish County Department of Public Works	Provide map of known and suspected illegal dumping areas to the Sheriff's Department	December 2000 - December 2000
Snohomish County Sheriff's Department	Observe the identified sites during routine patrols and report illegal dumping activities to Ecology and SHD, as appropriate	December 2000 - ongoing
Washington Department of Ecology	Respond to referrals from Sheriff's Department	Same as above
Snohomish Health District	Respond to referrals from Sheriff's Department	Same as above

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish County Sheriff's Department	Provide support to the level allowed with existing funding	Existing resources Could potentially be augmented with funding through Ecology's Coordinated Prevention Program
Snohomish County Department of Public Works	Provide support to the level allowed with existing funding	DPW's minimal role in this alternative should be funded through the alternative DUMP-1
Washington Department of Ecology	Provide support to the level allowed with existing funding	Existing resources
Snohomish Health District	Provide support to the level allowed with existing funding	Existing resources Could potentially be augmented with funding through Ecology's Coordinated Prevention Program, if alternative results in increase in the number of complaints

10. COMMERCIAL AND INDUSTRIAL CHEMICALS

10.1 SPILL-1: Inspections

Preferred Alternative: The Snohomish Health District, in its current efforts to revise the Moderate Risk Plan, should seek to add provisions for inspections or audits of facilities located in Critical Aquifer Recharge Areas.

Evaluation of Alternative:

Identified Lead Agency: Snohomish Health District.

Participating Agencies: The Snohomish County Local Emergency Planning Committee (SCLEPC) could provide assistance and information on regulatory compliance.

Feasibility/Effectiveness of Alternative: The Moderate Risk Waste Management Plan is currently undergoing revision and it is possible that compliance visits could be added as a priority of the plan, if the Snohomish Health District is convinced that the need is present.

Conflicts with Land/Water Plans: No conflicts with land use or water resource plans have been identified.

Funding Needs: Funding needed for implementation was not specified. It is likely that additional funding would be necessary unless some current moderate risk waste activities are discontinued.

Funding Availability: Resources spent on site visits to businesses would require that some other moderate risk waste functions would have to be discontinued, unless additional funding is made available.

Potential Funding Sources Identified by Implementers: Potential funding sources were not specified by the implementers.

Time Necessary for Implementation: The alternative could be implemented as part of the current revisions to the Moderate Risk Waste Management Plan, in all likelihood, within the first year of the 3-year implementation period for the Ground Water Management Program.

Ease/Difficulty of Implementation: The practice of inspecting businesses for compliance with the regulations without first receiving a complaint or an invitation was a concern of the group who drafted the original Moderate Risk Waste Management Plan. Establishing this practice as part of the updated Moderate Risk Waste Management Plan could be contested.

However, if this issue is made a priority in the Moderate Risk Waste Management Plan update, the Health District would consider implementing such a program, within the limitations of its existing resources. Additional funding will likely be needed for SHD to fully fund this alternative.

Implementation Pathway:

Lead Implementer: Snohomish Health District

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish Health District	Add provisions to MRW Plan for inspections or audits of facilities located in Critical Aquifer Recharge Areas	As part of current MRW revision process, probably in 1999

Funding Needs:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish Health District	Difficult to estimate until Critical Aquifer Recharge Areas are mapped Possibly as much as $73,000 per year (1/2 FTE)	Reallocation of resources available for Moderate Risk Waste Program implementation, and/or dedicated funds

10.2 SPILL-2: Loading Dock Spill Containment

Preferred Alternative: Snohomish County should consider developing requirements for loading dock BMPs that will contain spills for facilities handling chemicals and located within Critical Aquifer Recharge Areas.

Evaluation of Alternative:

Identified Lead Agency: Snohomish County Department of Public Works.

Participating Agencies: Snohomish County Planning and Development Services would provide assistance to Department of Public Works in identifying need for any supportive code revisions.

Feasibility/Effectiveness of Alternative: If adequate funding is available, this alternative would be feasible and could be implemented as part of the development of the County's stormwater manual.
Conflicts with Land/Water Plans: No conflicts with land use or water resource plans have been identified.

Funding Needs: Department of Public Works would require approximately $5,000 for implementation. Planning and Development Services did not specify funding needs, presumably there are none.

Funding Availability: Funding is not currently available to implement this alternative.

Potential Funding Sources Identified by Implementers: No potential funding sources were identified by the implementers.

Time Necessary for Implementation: This alternative should be implemented by the end of the initial three-year implementation period for the certified Ground Water Management Program, contingent on availability of adequate funding.

Ease/Difficulty of Implementation: Aside from funding, no significant impediments to implementation are anticipated.

Implementation Pathway:

Lead Implementer: Snohomish County Department of Public Works

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish County Department of Public Works	Developing loading dock BMW requirements for chemical handling. Provide support for adoption if applicable	June 2000 - May 2001
Snohomish County Planning and Development Services	Provide assistance to DPW in identifying need for any supportive code revisions	Same as above

Funding Needs:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish County Department of Public Works	$5,000	Centennial Clean Water Fund grant
Snohomish County Planning and Development Services	Provide support to the level allowed with existing funding	Existing resources

10.3 SPILL-3: Commercial/Industrial Sewer Service Areas

Preferred Alternative: Snohomish County Planning and Development Services and Snohomish County Department of Public Works should identify commercial and industrial facilities located outside of the planned sewer service area, but within Urban Growth Areas, and work with sewer providers to extend service, or, if service is not available, develop management programs emphasizing the protection of ground water resources. Priority should be given to moderate and high vulnerability aquifer areas, as mapped on Figure I-3-8.

Evaluation of Alternative:

Identified Lead Agency: This alternative would involve joint responsibilities: Snohomish County Planning and Development Services would identify and map sites, while Snohomish County Department of Public Works would develop management plans and conduct site visits.

Participating Agencies: Sewer utilities.

Feasibility/Effectiveness of Alternative: This alternative would be feasible and effective if modified as noted below, and if adequate funding is available for implementation.

Conflicts with Land/Water Plans: Working with sewer purveyors would be part of the County's ongoing effort to implement the General Policy Plan capital facilities element and ensure the availability of urban services to support the plan's land use designations.

Funding Needs: Planning and Development Services would require approximately $5,000 to identify and map sites. Department of Public Works would require $5,000, with site visits $200 each (the number of visits was not estimated by Department of Public Works).

Funding Availability: Funding is not currently available for Planning and Development Services and Department of Public Works; although Planning and Development Services may have some staff time available to work with sewer purveyors to encourage sewer availability.

Potential Funding Sources Identified by Implementers: Centennial Clean Water Fund Grant, DCTED GMA Funds, and County general fund.

Time Necessary for Implementation: This alternative should be implemented by the end of the initial three-year implementation period for the certified Ground Water Management Program, contingent on availability of adequate funding.

Ease/Difficulty of Implementation: Aside from funding, no significant impediments to implementation are anticipated.

Implementation Pathway:

Lead Implementer: Snohomish County Planning and Development Services and Snohomish County Department of Public Works

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish County Planning and Development Services	Identify and map commercial and industrial facilities; work with sewer service providers regarding service extensions	June 2000 - May 2001
Snohomish County Department of Public Works	Develop management plans in areas where sewer service is not available and conduct site visits	Same as above
Snohomish Health District	Provide technical assistance regarding on-site sewage system O&M requirements	Same as above

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish County Planning and Development Services	$ 5,000	DCTED Planning and Development Review Fund, if reallocated If not reallocated, dedicated funds
Snohomish County Department of Public Works	$25,000 ($ 5,000 plus $200 per site, assume 100 sites)	$ 5,000 through DCTED Development Review Fund, if reallocated $20,000 for site visits from dedicated funds
Snohomish Health District	$ 2,200	Dedicated funds

10.4 SPILL-4: Regulation Overlap

Preferred Alternative: The Snohomish Health District and the Interagency Regulatory Assessment Committee (IRAC) should annually review and update their booklet concerning small business regulatory requirements.

Evaluation of Alternative:

Identified Lead Agency: Snohomish Health District.

Participating Agencies: Interagency Regulatory Assessment Committee (IRAC). The Snohomish County Department of Emergency Management and the Snohomish County Local Emergency Planning Committee (SCLEPC) could provide assistance and information on regulatory compliance.

Feasibility/Effectiveness of Alternative: This alternative is potentially feasible and should be effective if implemented.

Conflicts with Land/Water Plans: No conflicts with land use or water resource plans have been identified.

Funding Needs: Snohomish Health District indicated that resources are already in place for working with the IRAC through the Moderate Risk Waste Program.

Funding Availability: Funding may already be available.

Potential Funding Sources Identified by Implementers: No additional sources of funding were identified by the implementers.

Time Necessary for Implementation: This alternative could be implemented within the first year of the initial three-year implementation period for the certified Ground Water Management Program.

Ease/Difficulty of Implementation: The Interagency Regulatory Assessment Committee was formed to address the issue of conflicting and overlapping regulations. The Snohomish Health District, through the IRAC, is currently in the process of producing a booklet for small businesses which lists various agency requirements related to hazardous waste management practices as well as a directory of agencies and their phone numbers. The development of this committee was in response to local business confusion about which agencies regulate them, concern with regulatory conflict between agencies, and the difficulty in knowing who to contact with specific questions. However, it was not intended that the IRAC continue once the booklet was finalized. The Snohomish Health District will poll members of the IRAC concerning whether they are interested in continuing the group.

Implementation Pathway:

Lead Implementer: Snohomish Health District

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish Health District	Request support of IRAC in continuing the operation of that organization for purposes of providing annual updates of the small business regulatory requirements booklet	September 1999 - one update per year after that time

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish Health District	Implement to the extent possible through use of Moderate Risk Waste Program funds	Existing resources

11. TRANSPORTATION SPILLS

11.1 TRANS-1: Water Supply Well Locations

Preferred Alternative: Snohomish County Planning and Development Services should work with local Group A and Group B water systems to identify well locations and prepare maps for distribution to Snohomish County Department of Emergency Management and major chemical transporters. The maps should be used to assist incident response commanders.

Evaluation of Alternative:

Identified Lead Agency: Snohomish County Planning and Development Services.

Participating Agencies: Snohomish Health District could provide information on some Group B systems. Snohomish County Department of Emergency Management would form a data base for notification of well owners and public water systems.

Feasibility/Effectiveness of Alternative: This alternative would be feasible and effective, provided adequate funding is available.

Conflicts with Land/Water Plans: No conflicts with land use or water resource plans have been identified.

Funding Needs: Planning and Development Services would require $10,000 to identify and map sites and $4,000 per year to maintain the data base and map. The latter functions could be performed by an agency other than Planning and Development Services.

The Department of Emergency Management indicates that the level of necessary funding depends on duration and complexity of the process.

The Snohomish Health District cannot estimate resource needs until the alternative is more fully scoped.

Funding Availability: Planning and Development Services currently lacks resources necessary for implementation. The Department of Emergency Management has "minimum levels of staffing." Any activities above current levels will require additional funding.

Potential Funding Sources Identified by Implementers: Centennial Clean Water Fund and County general fund.

Time Necessary for Implementation: This alternative could be implemented within six to eight months of funding becoming available.
Ease/Difficulty of Implementation: Planning and Development Services indicates that it could be quite difficult and/or time consuming to obtain

sufficiently accurate information on all Group A and Group B well locations. It may be necessary to focus on locations of Group A wells.

Implementation Pathway:

Lead Implementer: Snohomish County Planning and Development Services

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish County Planning and Development Services	Work with local Group A and Group B water systems to identify well locations and prepare maps for distribution to Snohomish County Department of Emergency Management and major chemical transporters	June 2000 - February 2001
Snohomish County Department of Emergency Management	Form a data base and disseminate information concerning well locations to incident response commanders	November 2000 - May 2001
Snohomish Health District	Provide information to PDS on locations of Group B systems	June 2000 - with periodic updates thereafter

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish County Planning and Development Services	$10,000	Centennial Clean Water Fund grant
Snohomish County Department of Emergency Management	$ 8,000 ($ 4,000 per year for the last two years of funding plan)	Centennial Clean Water Fund grant (Dedicated funds after end of three year funding plan
Snohomish Health District	$ 2,200	Centennial Clean Water Fund grant

11.2 TRANS-2: Spill Incidence Reporting

Preferred Alternative: Snohomish County Department of Emergency Management should develop procedures by which owners of water supply wells that could be affected by spills are notified, including Group A, Group B, and private wells.

Evaluation of Alternative:

Identified Lead Agency: Snohomish County Department of Emergency Management.

Participating Agencies: Snohomish Health District may be able to participate in an advisory capacity during plan development.

Feasibility/Effectiveness of Alternative: This alternative would be feasible and effective, provided adequate funding is available.

Conflicts with Land/Water Plans: No conflicts with land use or water resource plans have been identified.

Funding Needs: Department of Emergency Management could not estimate funding needs at this time. That department needs additional information concerning numbers of wells, etc. Similarly, the Snohomish Health District declined to make an estimate of funding needs until the scope of the alternative can be more fully explored.

Funding Availability: It is probable that the Department of Emergency Management would require additional funding to implement the alternative.

Potential Funding Sources Identified by Implementers: No potential funding sources were identified by the implementers.

Time Necessary for Implementation: This alternative could be implemented by the end of the initial three-year implementation period for the certified Ground Water Management Program.

Ease/Difficulty of Implementation: Funding would represent the most likely impediment to implementation of this alternative.

Implementation Pathway:

Lead Implementer: Snohomish County Department of Emergency Management

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish County Department of Emergency Management	Develop notification procedures for owners of water supply wells that could be affected by spill	June 2000 - May 2001
Snohomish Health District	Provide technical assistance.	Same as above

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish County Department of Emergency Management	DEM cannot estimate funding needs until additional information is available (numbers of wells, etc.)	Dedicated funds
Snohomish Health District	SHD cannot estimate funding needs until additional information is available (numbers of wells, etc.)	Dedicated funds

11.3 TRANS-3: Spill Response for Wellhead Protection

Preferred Alternative: Snohomish County Department of Emergency Management (SCEM) and Snohomish County Local Emergency Planning Committee (SCLEPC) should provide assistance to local purveyors in conducting spill response coordination planning as part of their Wellhead Protection Programs.

Evaluation of Alternative:

Identified Lead Agencies: Snohomish County Department of Emergency Management and Snohomish County Local Emergency Planning Committee.

Participating Agencies: Owners/operators of Group A public water system wells would seek input from the lead agencies when developing their Wellhead Protection Programs. Snohomish County Planning and Development Services could potentially provide mapping of Wellhead Protection Areas and major transportation corridors.

Feasibility/Effectiveness of Alternative: This alternative would be effective in helping owners/operators of Group A public water system wells in meeting spill response planning requirements for Wellhead Protection Programs under Chapter 246-290 WAC. It should also serve to lessen risks to ground water quality associated with transportation related spills of hazardous materials.

Conflicts with Land/Water Plans: None noted. This alternative is consistent with provisions of Chapter 246-290 WAC and the Washington Department of Health guidelines for development of Wellhead Protection Programs by public water systems.

Funding Needs: Funding needs were not articulated by the lead agencies. Coordination could potentially be accomplished without need for additional resources.

Funding Availability: No funding sources have been identified beyond existing resources.

Potential Funding Sources Identified by Implementer: No specific source of additional funding was identified by the implementers.

Time Necessary for Implementation: Implementation would occur incrementally as Group A purveyors that utilize ground water sources prepare or update their water system plans.

Ease/Difficulty of Implementation: Aside from possible funding limitations, no significant implementation difficulties are anticipated.

Implementation Pathway:

Lead Implementers: Snohomish County Department of Emergency Management and Snohomish County Local Emergency Planning Committee

RESPONSIBLE PARTY	ACTION	DATE TO INITIATE/COMPLETE
Snohomish County Department of Emergency Management	Assist water purveyors in spill response planning related to Wellhead Protection	Upon request from water purveyors, commencing in September 1999 - ongoing
Snohomish County Local Emergency Planning Committee	Assist water purveyors in spill response planning related to Wellhead Protection	Upon request from water purveyors, commencing in September 1999 - ongoing

Funding Plan:

RESPONSIBLE PARTY	FUNDING NEEDS	FUNDING SOURCE
Snohomish County Department of Emergency Management	Provide support to the level allowed with existing resources Additional funding needs would need to be communicated to the lead agency for GWMP implementation as they arise	Existing funding
Snohomish County Local Emergency Planning Committee	Provide support to the level allowed with existing resources Additional funding needs would need to be communicated to the lead agency for GWMP implementation as they arise	Existing funding

TABLES

TABLE III-1-1

Summary of Preferred Management Alternatives

Alternative Name	Statement	Geohydro Class	Preferred Alternative	Estimated Cost	Lead Implementer
ADMIN-1	Need to identify oversight entity.	N/A	Snohomish County Department of Public Works (SCPW) recommended lead agency.	$146,000 per year for full time program mgr.	SCPW
ADMIN-4	No centralized database.	R2	SHD and Snohomish County should develop database.	$ 72,800 (SCPW) $ 8,400 (SHD)	SCPW
USE-2	Present data are inadequate to support resource management actions.	R1, R2	Snohomish County and Ecology should prepare sub-basin plans.	$200,000 (SCPW) $100,000 (SCPW) $ 8,400 (WDOE)	SCPW
STORM-5	Older infiltration facilities may allow hazardous releases as the result of spills.	R3, L6, L4, L5, L9, R9	Snohomish County and Jurisdictions should inventory infiltration facilities to determine locations relative to vulnerable aquifer areas. Inventory forms basis for facility upgrades. Snohomish County Department of Emergency Management should use inventory in spill response	$ 25,000; $500 per facility inspection (SCPW) $250,000; $25,000 per facility upgrade (SCPW) $ 8,400 (SCPDS)	SCPW

Note: Alternatives sorted by lead agency.

Alternative Name	Statement	Geohydro Class	Preferred Alternative	Estimated Cost	Lead Implementer
PEST-1	Collection of unwanted pesticides is limited.	R7	SCPW and WSDA should investigate feasibility of seasonal or permanent agricultural pesticide collection site.	$ 8,400 (SCPW) $ 8,400 (WSDA)	SCPW WSDA
MINE-4	The chemical quality of proposed backfill materials is not evaluated for the reclamation of surface mining excavations.	R2, L1	SCPW, SHD, and Ecology should develop sampling and analysis standards for mining backfill materials. WDNR should then add provisions to reclamation permits that require these standards be applied in demonstrating that backfill is clean and inert.	$ 5,600 (SCPW) $ 8,400 (SHD) $ 8,400 (Ecology)	SCPW
MINE-5	The chemical quality of proposed backfill materials is not evaluated for the reclamation of surface mining excavations.	R2, L1	SCPW should provide WACA with educational materials that stress importance of demonstrating that backfill is clean and inert.	$ 5,000 (SCPW) $ 1,500 (WACA)	SCPW
DUMP-1	Vacant lands exist which are or can become sites for illegal dumping.	R2	SCPW should compile data regarding the location of abandoned surface mining sites.	$ 16,800 (SCPW) $ 8,400 (SCPDS) $ 1,100 (EPA) $ 1,100 (SHD) $ 1,100 (Ecology)	SCPW

Note: Alternatives sorted by lead agency.

Alternative Name	Statement	Geohydro Class	Preferred Alternative	Estimated Cost	Lead Implementer
SPILL-2	Loading dock areas may be constructed with insufficient containment to manage chemical spills.	L4	Snohomish County should consider developing requirements for loading dock BMP's that ensure spill containment in CARA's.	$ 5,000 (SCPW)	SCPW
ADMIN-2	No designated Critical Aquifer Recharge Area (CARA).	N/A	Snohomish County and Cities should identify Interim Ground Water Protection Area (IGPA).	$ 7,000	SCPDS
ADMIN-3	No criteria for designating CARA.	N/A	Snohomish County and Cities should develop criteria for defining CARA.	$ 35,000 (SCPDS) $ 5,600 (SCPW)	SCPDS
STORM-1	PDS may not grant approval of pervious surface technologies or encourage infiltration facilities.	R3, L6	SCPDS and SCPW should coordinate approaches to stormwater management and ground water recharge.	$ 35,000 (SCPDS) $ 7,000 (SCPW)	SCPDS
STORM-2	No incentives exist to use pervious surface technologies.	R3, L6, R9	Snohomish County should develop an incentive program.	$ 10,000 (SCPDS) $ 7,000 (SCPW)	SCPDS
STORM-3	Site development review process does not necessarily reduce the coverage by impervious surface.	R3, L6, R9	Snohomish County, through zoning code, should require site development designs to minimize impervious surface and/or maximize ground water recharge.	$ 35,000 (SCPDS) $ 2,800 (SCPW)	SCPDS

Note: Alternatives sorted by lead agency.

Alternative Name	Statement	Geohydro Class	Preferred Alternative	Estimated Cost	Lead Implementer
MINE-1	Geohydrologic evaluations are not necessarily required for proposed surface mining sites.	R2, L3	SCPDS should amend Conditional Use Permitting process for surface mining to require geohydrologic evaluations that identify position of relevant aquitards.	$ 5,000 (SCPDS)	SCPDS
MINE-3	Surface mining operators may not have training to identify when aquifer breaching conditions are encountered.	R8, L3	SCPDS should consider adding a provision to Conditional Use Permits that requires periodic inspections of surface mining operations by qualified hydrogeologists.	$ 6,000 (SCPDS)	SCPDS
MINE-6	SCPDS and WDNR do not coordinate the permitting process for surface mining operations.	L1	SCPDS should consider amending all Conditional Use Permits so that 1.) No excavation is allowed until a WDNR reclamation permit has been provided to SCPDS and that 2.) applicant will adhere to 78.44 RCW regarding reclamation schedule.	$ 7,000 (SCPDS)	SCPDS
MINE-7	SCPDS and WDNR do not coordinate the permitting process for surface mining operations.	L1	SCPDS and WDNR should prepare an MOU identifying reciprocal responsibilities.	$ 5,000 (SCPDS) $ 2,800 (DNR)	SCPDS

Note: Alternatives sorted by lead agency.

Alternative Name	Statement	Geohydro Class	Preferred Alternative	Estimated Cost	Lead Implementer
MINE-8	Older mining sites exist that have not been reclaimed and could be developed under a County grading permit.	L1	SCPDS should amend the grading permit process for historic mining sites to include a provision requiring that backfill is clean and inert.	$ 5,000 (SCPDS)	SCPDS
MINE-9	It is not necessary to evaluate the presence of water supply wells in proximity to existing or proposed surface mining sites.	R2	SCPDS should consider a requirement that surface mining CUP applications include a well inventory for water supply wells.	$ 7,000 (SCPDS) $ 1,400 (SHD)	SCPDS
MINE-10	It is not necessary to evaluate the presence of water supply wells in proximity to existing or proposed surface mining sites.	L1, L5	SCPDS should consider a revision to the zoning code to require a contingency plan for replacement of potable water supplies if ground water is detrimentally affected.	$ 8,000 (SCPDS) $ 1,400 (SHD)	SCPDS
SPILL-3	Urban and commercial land uses that are not served by sewers exist within the Urban Growth Areas (UGA).	L6, R9, R6	SCPDS and SCPW should identify commercial and industrial facilities within the UGA that are outside of planned sewer service areas and try to extend sewer services or develop management programs that protect ground water.	$ 5,000 (SCPDS) $ 25,000; $5,000 plus $200 per site (SCPW) $ 2,200 (SHD)	SCPDS

Note: Alternatives sorted by lead agency.

Alternative Name	Statement	Geohydro Class	Preferred Alternative	Estimated Cost	Lead Implementer
TRANS-1	The location of water supply wells in proximity to pipelines, roads and highways are not presently mapped.	L7, L8, L9	SCPDS should identify well locations and provide maps for distribution to SCEM and major chemical transporters. The maps should be used to assist incident response commanders.	$ 10,000 (SCPDS) $ 8,000 (SCEM) $ 2,200 (SHD)	SCPDS
MINE-11	There are no procedures by which well owners are notified of NPDES/SWD General Permit violations.	L5	Ecology and SHD should develop an MOA regarding protocols for notification of well owners in the event of NPDES/SWD General permit violations.	--	SHD
USE-1	Conservation programs do not reach Group B and individual well systems.	R1	WDOH, SHD, and WSDGA should make conservation information available.	$ 8,400	SHD
WELL-1	Well owners are generally not aware of potential for ground water contamination from poor well seals or old abandoned wells.	R8, L2	SHD should include educational materials on well seals and well decommissioning with other materials sent to on-site sewage system permit holders.	$ 5,000 (SHD)	SHD
SPILL-1	Inspections of businesses for compliance with existing regulations is completed at low frequency.	L4	SHD should seek to add provisions to the Moderate Risk Plan for inspections of facilities located in CARA s.	$ 73,000/year (SHD)	SHD

Note: Alternatives sorted by lead agency.

Alternative Name	Statement	Geohydro Class	Preferred Alternative	Estimated Cost	Lead Implementer
SPILL-4	Regulations pertaining to the handling and storage of hazardous wastes are complex, may overlap, or be in conflict with each other.	L4, L5	SHD and IRAC should annually review and update their booklet concerning small business regulatory requirements.	–	SHD
NITRATE-2	Inappropriate waste management practices in dairy and chicken operations may result in direct discharge of pollutants.	R4	Snohomish Conservation District and WSUCE should work to establish a soil amendment brokerage.	$291,000 – 2 years (SCCD) $ 30,000 (WSUCE)	SCCD WSUCE
TRANS-2	Spill incidents are not necessarily reported to owners of nearby water supply wells.	L7, L8, L9	SCEM should develop procedures by which well owners are notified of possible impacts from spills.	TBD	SCEM
TRANS-3	Spill response coordination is an essential element of programs to project public water supply wells.	L7, L8, L9	SCEM and SCLEPC should provide assistance to local purveyors in conducting spill response coordination planning.	TBD	SCEM SCLEPC
PEST-2	Pesticide applications in Snohomish County are not presently inventoried or mapped.	R7	WSUCE should evaluate the feasibility of conducting an inventory of agricultural pesticide use and develop a scope of work and budget for such an inventory.	$ 5,500 (WSUCE)	WSUCE

Note: Alternatives sorted by lead agency.

Alternative Name	Statement	Geohydro Class	Preferred Alternative	Estimated Cost	Lead Implementer
PEST-3	Commercial pesticide users may not be trained in the use of best management practices for pesticide applications.	R7	WSDA should modify recertification requirements and initial certification for commercial pesticide applicators to include ground water and watershed protection education.	TBD	WSDA
ADMIN-5	No single organization to lead education efforts.	R8	WSUCE should seek funding and develop program.	$ 60,000	WSUCE
PEST-5	Pesticides are most commonly misused in residential applications.	R7	WSU Cooperative should apply to EPA or Ecology for grant for educational program on BMP's for pesticide applications.	$ 42,400 (WSUCE)	WSUCE
PEST-6	Pesticides are most commonly misused in residential applications.	R7	WSUCE should make existing materials on pesticide applications available at a major retailer as part of a pilot program which, if successful, should be expanded.	$ 12,600 (WSUCE)	WSUCE

Note: Alternatives sorted by lead agency.

Alternative Name	Statement	Geohydro Class	Preferred Alternative	Estimated Cost	Lead Implementer
MINE-2	Surface mining operators may not have training to identify when aquifer breaching conditions are encountered.	R8, L3	WACA, SCAP, Ecology, and WDNR should develop a program for routine dissemination of educational materials regarding aquifer breaching.	$ 1,500 (WACA) $ 5,000 (Ecology)	WACA Ecology
PEST-4	Burlington Northern Santa Fe Railroad has not incorporated integrated pest management (IPM) protocols into its program for trackside vegetation management within Snohomish County.	R7	GWAC should request that Burlington Northern Santa Fe Railroad incorporate requirement for use of IPM protocols into future contracts with local vegetation control firms.	N/A	Burlington Northern Santa Fe Railroad
STORM-4	No means for County to require infiltration system best management practices, unless NPDES or HPA permits required.	R3, L6, R9	GWAC supports Title 24 (Stormwater Ordinance) revisions currently under development.	--	GWAC
NITRATE-1	Fertilizer is most likely to be misused in residential applications.	R5, R8	GWAC should implement second element of early implementation strategy that includes dissemination of BMP information on residential fertilizer use.	$ 10,000	GWAC

Note: Alternatives sorted by lead agency.

Alternative Name	Statement	Geohydro Class	Preferred Alternative	Estimated Cost	Lead Implementer
DUMP-2	Vacant lands exist which are or can become sites for illegal dumping.	R2	SCSD will be provided with a map demonstrating the location of abandoned sites that have or could be used for illegal dumping. In its routine patrols, SCSD should observe the identified sites and report illegal dumping activities to the Department of Ecology and Snohomish Health District, as appropriate.	--	SCSD

Explanation

Geohydro Class refers to the impacts classification presented in the Geohydrology Memorandum (Golder, 1997). No prioritization is implied in the summary of alternatives.

BMP – Best Management Practice
CARA – Critical Aquifer Recharge Area
DCTED – Washington Department of Community Trade and Economic Development
Ecology – Washington Department of Ecology
EPA – Environmental Protection Agency
GWAC – Ground Water Advisory Committee
IRAC – Inter-agency Regulatory Assessment Committee
SCAPP – Snohomish County Aggregate Producers
SCD – Snohomish Conservation District
SCEM – Snohomish County Department of Emergency Management
SCPW – Snohomish County Department of Public Works
SCPDS – Snohomish County Planning and Development Services
SCSD – Snohomish County Sheriff Department
SHD – Snohomish Health District
WACA – Washington Aggregate and Concrete Association
WDNR – Washington Department of Natural Resources
WDOH – Washington Department of Health
WSDA – Washington State Department of Agriculture
WSDGA – Washington State Drilling and Groundwater Association
WSUCE – Washington State University Cooperative Extension Service

Note: Alternatives sorted by lead agency.

TABLE III-1-2

Funding Plan Summary Matrix

Total New Funding Needs Identified For 3-Year Implementation Period

POTENTIAL SOURCE OF NEW FUNDING	AMOUNT
County general fund (1)	$ 438,000
Dedicated funds (2)	$ 925,600
Centennial Clean Water Fund (3)	$ 224,300
Department of Ecology Watershed Planning Grants (SHB 2054 and HB 2514) (4)	$ 200,000
Department of Ecology Coordinated Prevention Grants	$ 28,500
Department of Community Trade and Economic Development Planning and Development Review Grants (5)	$ 57,600
Puget Sound Water Quality Public Involvement and Education (PIE) and U.S. EPA Environmental Education Grants (6)	$ 92,600
TOTAL	**$1,966,600**

(1) This funding is for a full-time ground water program manager ($146,000 per year for three years including all direct and indirect costs) to be assigned to Snohomish County Department of Public Works. Should another source of hard funding be identified during the three-year implementation period, funding for this position will be shifted to that source.

(2) Dedicated funds are hard money or non-grant sources of funding. Dedicated funds could include Snohomish County general fund monies, revenues generated through an increase in the Surface Water Management Fee, or revenues created through establishment of an Aquifer Protection Area under Chapter 36.36 RCW.

(3) The total amount of a Centennial Clean Water Fund Grant for implementation of a Ground Water Management Program can be up to $250,000. Thus, an additional approximately $25,000 in funding needs could be shifted to the Centennial Grant from other potential funding sources, if needed.

(4) Some portion of the approximately $200,000 that could be allotted to Snohomish County by the Department of Ecology to conduct watershed planning for WRIAs 5 and 7 could be useful in providing basic data to support sub-basin planning efforts.

(5) Money is not currently available in the Department of Community Trade and Economic Development's Planning and Development Review Grant Fund. If additional resources are not made available through this fund during the implementation period, up to $25,000 of the amount needed could potentially be obtained through the Centennial Clean Water Fund grant discussed above. The remainder would need to be supplied from dedicated funds.

(6) The amount shown represents the total from separate grants for multiple projects.