CHAPTER 5

SOURCE PROTECTION PLAN

WELLHEAD PROTECTION PROGRAM

INTRODUCTION TO WELLHEAD PROTECTION PROGRAM

Many communities rely on groundwater as a primary or sole source of potable water. Recognizing the importance of preserving this essential public resource, Congress mandated in the 1986 Amendments to the federal Safe Drinking Water Act that each state must develop a wellhead protection program. In Washington State this program is administered through the State Department of Health (WDOH).

In 1994, the Washington Administrative Code Section 246-290-100 was modified to include mandatory wellhead protection measures for all public water systems meeting the Federal definition. WDOH refers to these systems as "Group A" systems. As part of the wellhead protection measures, administrators of Group A systems are required to develop a specific Wellhead Protection Program for their wells and well fields.

Sallal completed a Wellhead Protection Plan in 1998. The Wellhead Protection Plan (Wellhead Protection Plan –Sallal Water System, Compass Geographics, Inc.) is provided in Appendix J.

Continued residential and commercial growth in the Sallal/North Bend area brings with it the challenge of increased demands for potable water and the increased potential risk that surface or subsurface activities may have a detrimental impact on groundwater resources. The ultimate goal of the Wellhead Protection Program is to protect potable groundwater supplies through groundwater resource delineation; potential groundwater contaminant identification and management strategies aimed at pollution prevention. Wellhead protection programs must apply best management practices (BMPs) and provide public (customer) education to users working or living within the Wellhead Protection Areas (WHPA).

Wellhead Protection Programs were intended and are required to be ongoing programs that are incorporated into the management and administration of the individual water systems and are subject to periodic review and revision to meet changing conditions. The major aspects of the Sallal Wellhead Protection Program are discussed in this section.

AQUIFER SUSCEPTIBILITY

Aquifer susceptibility refers to the potential risk for contamination of a drinking water supply by discharges or releases at or near the ground surface. In Washington, the

susceptibility of an aquifer is ranked as high, moderate, or low on the basis of several factors. These include:

- The type and condition of the well's surface seal and casing, which will prevent surface water from entering the well.

- The depth and type of the aquifer. Shallow, unconfined aquifers are more susceptible to releases at the ground surface than deep aquifers with one or more confining layers. Aquifers in granular bedrock or unconsolidated formations maybe less susceptible to contamination than bedrock aquifers where water may travel relatively quickly over long distances in joints, fissures, or cavern systems.

- Interaction with surface water. Wells in alluvial deposits adjacent to rivers may draw significant quantities of their water from the surface stream with very little resident time in the formation to aid in purification.

- Land use in the vicinity of the well. Agricultural usage with heavy ag-chemical applications, or industrial usage, are higher risk activities than undeveloped forest or grasslands. Residential usage with septic systems may be higher risk than the same land use with a public sewer system installed.

The Association production wells are rated as having a low susceptibility.

PRODUCTION WELLS

Water for the Sallal Service Area comes from three wells. One well is located near the Edgewick Road interchange, north of Interstate 90. The other two wells are located on the northwestern flank of Rattlesnake Ridge within the boundary of the Cedar River Watershed property owned by the City of Seattle. The two wells near Rattlesnake Ridge produce approximately 90 percent of the water used by Sallal.

Well #01 and Well #02

Wells #01 and #02 are located near Rattlesnake Ridge within the City of Seattle Watershed. The City of Seattle is the actual owner of the wells with the Association leasing the wells under a long-term agreement. Well #01 (originally labeled TW-1) was drilled in 1983, is 348 feet deep, and is completed with 8- and 12-inch casings. Well #02 (originally labeled PW-1) was completed in 1985 is 163 feet deep and is completed with 10-inch casing. Well #01 is completed with a 100-hp line-shaft pump that produces approximately 750 to 800 gpm at normal capacity. Well #02 is also equipped with a 100-hp pump and produces approximately 800 gpm at normal capacity.

Well #03 Edgewick Well

Well #03 is often referred to as the Edgewick well and is located near the Edgewick interchange on Interstate 90, in the east-central part of the Association's service area. The well site is located in an area of some commercial and industrial operations along the I-90 corridor. Well #03 was drilled and constructed in 1987; the well is 255 feet deep and was completed with 8-inch diameter casing. The well is equipped with a 15-hp pump and produces approximately 76 gpm under normal capacity. A second well has been drilled at this site, Well 3A. Well 3A is currently not in use.

DELINEATION OF WELLHEAD PROTECTION AREAS

Several methods of differing sophistication can be used in the determination of the Wellhead Protection Areas for each of the production wells. A brief summary of the various methods is provided below in the order of sophistication from the least sophisticated to the most sophisticated method.

- **Calculated Fixed Radius Method (CFR).** This method is the simplest approach and is based on a simplified water balance formula. This method does not require any knowledge of the aquifer characteristics, except for porosity. The well capture zone derived from this approach simply consists of a circular area surrounding the wellhead. No consideration is given to the regional hydraulic gradient, or aquifer boundaries.

- **Hydrogeologic Mapping.** This method involves mapping the aquifer boundaries, particularly recharge areas, in relation to the wells of interest. A qualitative assessment of groundwater can provide general information on the source of water to wells and its direction of flow. Hydrogeologic mapping is usually carried out to some extent for any WHPA analysis and can generally be used to determine the ultimate recharge areas of the aquifer. A significant portion of the Snoqualmie Valley including the project area has been mapped as part of a U. S Geological Survey water resources investigation.

- **Conventional Analytical Modeling.** This method takes into account the basic aquifer characteristics, such as transmissivity, aquifer thickness and hydraulic gradient. Analytical modeling most often assumes steady-state conditions and can be used to calculate capture zones to the boundary of the hydrogeologic system. An example of a commonly used analytical model is the U.S. EPA WHPA code.

- **Sophisticated Analytical Modeling.** This method utilizes techniques that have more recently been developed that can take into account boundary conditions and variable recharge conditions in addition to the basic

characteristics, such as transmissivity, aquifer thickness and hydraulic gradient. TWODAN is one such model developed by Fitts (1995). This model is a two-dimensional analytical groundwater flow model developed to evaluate groundwater flow and determine WHPAs. The program is capable of solving large numbers of analytical solutions to model diverse irregular boundary conditions, and is more sophisticated than other analytical models such as the U.S. EPA WHPA code.

- **Numerical Groundwater Flow Modeling.** This method is the most sophisticated used to delineate WHPAs. Groundwater flow models are often used for complex systems composed of irregular aquifer boundaries and multiple wells. A numerical groundwater flow model incorporates the hydraulic characteristics and boundary conditions of the aquifer and uses a "particle tracker" to numerically simulate the rate and direction of "particles" of groundwater moving through the system. The final accuracy of the WHPA derived from a numerical groundwater flow model is a function of how well the groundwater flow model can simulate observed field conditions. This is often a function of how much data is available to develop and verify the model. When the data is limited or cost prohibitive to obtain (i.e., additional monitoring wells), a less sophisticated WHPA delineation method may be more appropriate than numerical groundwater flow modeling.

The Sallal Wellhead Protection Areas were delineated using a combination of hydrogeologic mapping and TWODAN sophisticated analytical modeling. Groundwater modeling to determine the capture zones for the Association production wells was performed using the two-dimensional analytical groundwater flow model TWODAN (version 4.0; Fitts, 1995). The two-dimensional analytical element groundwater model was used to estimate the 6-month, and 1-, 5- and 10-year capture zones for the Association production wells. The groundwater flow field is simulated to be consistent with known water level data and aquifer properties. Pumping wells are then inserted into the flowfield and particle traces are used to delineate the time of travel capture zones for each well or wellfield. Wells of the Association are completed in a hydraulically similar aquifer. Two aquifers (the valley aquifer and the bedrock upland aquifer) were modeled in the simulation used to model the Sallal and nearby Riverbend production wells.

The TWODAN analytical modeling was performed on all three of the Association's supply wells. However, the WHPA for Wells #01 and #02 was subsequently modified using hydrogeologic mapping and interpretation of previous hydrogeologic investigations conducted in this region of complex hydrogeology. The WHPA for Well #03 was also modified slightly based on further hydrogeologic investigations conducted by Hart Crowser related to the potential lower operations of the Grouse Ridge gravel operation.

Analytical modeling is a useful tool for evaluating groundwater flow and understanding the aquifer system and how contaminants may be transported through the system.

However, it must be realized that a groundwater model is simply a tool for hydrogeologic analysis and it is rare that a groundwater model can accurately simulate or predict groundwater conditions in all portions of the aquifer system. However, the analytical groundwater modeling technique used to prepare the Sallal Wellhead Protection Areas is more accurate than most of the other available methods commonly used to delineate a WHPA.

The WHPAs were refined and finalized into specific detailed maps and graphics depicting the proposed Wellhead Protection Areas for each of the Sallal production wells. The time of travel zones and the proposed Wellhead Protection Area for the Association Wells #01/#02 and #03/3A are depicted in Appendix J.

POTENTIAL CONTAMINANT SOURCE INVENTORY

An inventory of potential contaminant sources that may impact groundwater within designated Wellhead Protection Areas is an essential element of all Wellhead Protection Plans. Groundwater contamination originates from both point and nonpoint sources. Point sources of contamination are those that can be traced to a specific discharge point. Good examples of point sources would include landfills, an underground storage tank, industrial waste discharge pipe or transportation spill. Nonpoint sources are those that are attributed to a more widespread release of contamination rather than to a single identifiable location. Examples of nonpoint sources of contamination include general stormwater runoff from asphalted streets or agricultural applications of pesticides/herbicides.

The potential contaminant inventory was completed through a two step process that included a search of current government database information using a Geographic Information System, followed by a field inspection task to verify the database information and discover previously unrecorded sources. Environmental database information used in the preparation of the Sallal Wellhead Protection Plan was supplied by Vista Information Solutions, Inc., of San Diego, California and included the most current information from the Environmental Protection Agency databases, other Federal sources, Washington State Department of Ecology, and other sources. These databases contain known and suspected hazardous materials spills or releases, registered hazardous waste generators, historical landfill sites, small quantity hazardous waste generators, underground storage tanks and other database information related to the use, transport, storage, or release of hazardous materials. This level of environmental scrutiny exceeds the current requirements of the Washington State Wellhead Protection Plan and provides an enhanced level of due-diligence in the evaluation of potential and existing sources of contamination that may pose a threat to public groundwater sources.

The environmental database contains records from approximately 500 various federal, state and local information sources. An abbreviated list of the records contained in the environmental geographics data packages would include:

NPL – National Priorities List. These sites fall under the EPA's Superfund program, which was established, to fund cleanup of contaminated sites that pose a risk to human health and the environment.

CERCLIS – Comprehensive Environmental Response, Compensation and Liability Act Information System. This database contains approximately 15,000 nationally identified hazardous sites that may require cleanup.

RCRIS – Resource Conservation Recovery Act Information System. This combination of databases provides information on sites which generate, transport, store, treat or dispose of hazardous waste. These databases include corrective actions (CORRATS), Treatment, Storage and Disposal facilities (TSD), and RCRA large and small generators.

ERNS – Emergency Response Notification System. This database contains information on release of oil and hazardous substances from spill reports made to EPA, U.S. Coast Guard, and Dept of Transportation.

LUST – Leaking Underground Storage Tanks. Information from the state of Washington on leaking underground storage tanks which are one of the major causes of soil and groundwater contamination.

SWS and SWLF – Solid Waste Sites and Solid Waste landfill Sites. This database contains information collected at the state and local level providing a comprehensive list of solid waste sites including active and inactive landfills, incinerators, transfer stations, recycling locations and other locations where solid waste is stored, treated or processed.

SPL and SCL – State Priority List and State Cleanup List. This is a State of Washington database of sites with known or suspected contamination under the jurisdiction of the Washington Model Toxics Control Act (MTCA).

WA and TI – Washington State Toxics and Toxics Release Inventory System. This is a State of Washington database concerning toxic sites and registered releases of toxic compounds at sites within the State of Washington.

Additional information was also obtained through the U. S. EPA Geographic Information Query System. Land use and zoning information was obtained from King County through the King County GIS Technical Resource Center. Land use in the Association Service Area ranges from single-family homes on 1/3 to 20+ acre homesites to industrial.

Commercial or potential commercial activities within and on the periphery of the Sallal service area include:

- Truck Stop- major truck repair and fueling facility
- Truck and automobile repair/service
- Gravel pits and gravel operations
- Light and heavy industry and fabrication
- Retail, warehouse and wholesale shops
- Hobby farms and horse ranches /stables

The Association is in a nearly ideal situation in many respects pertaining to the location of their primary production wells (Wells #01 and #02) within the City of Seattle Watershed. This is a real advantage in managing a Wellhead Protection Area. The watershed area is already maintained relatively contaminant-free with in-place land-use planning/zoning that will prohibit future industrial or other impacts to the watershed and the Association's wells. The only potential impacts to this well would occur from spills or contaminants discharged within the immediate Rattlesnake Lake Park area. Sallal is working closely with the City's Park department to ensure that proper safeguards are taken with regard to activities in this area. It is our understanding that most of these are in place such as controlled access to the watershed and day use only of the park with no overnight users, no motorized boats on the lake (minimizes spill risks) and toilet facilities with containment vessels for collection and off-site waste processing. However, in general Sallal Wells #01/#02 are placed in a relatively ideal location.

Sallal Well #03/3A Wellhead Protection Area is preferable given its location since the capture zone exists in the upland area of Grouse Ridge. This places most of the truck fueling, service center and industrial activities in this area down gradient of the well. Potential future activities which may result in potential sources of contamination include additional residential housing development within the WHPA, forestry practices on Grouse Ridge and the development of the gravel resources on property adjacent to the proposed Sallal Well #3/3A Wellhead Protection Area. Sallal has worked closely with Cadman Gravel and their consultants during the design of the lower gravel operations for the proposed Grouse Ridge Gravel Mine. The location of proposed operations were moved to maximize the distance to the WHPA and additional monitoring wells will be installed to provide early warning of any potential contaminants. Sallal also secured an agreement with Cadman that any damage to the Sallal Well will result in an immediate replacement of the well by Cadman.

WELLHEAD PROTECTION PROGRAM MANAGEMENT STRATEGIES

Private residences comprise the largest percentage of land use within all of the Wellhead Protection Areas within the Association service area. Residential use presents a low to moderate risk of contamination to the aquifer, provided that homeowners take reasonable care in the use and disposal of household chemicals, and maintain private septic systems in good working order.

The primary management activity of the Association with respect to residential use within the Wellhead Protection Areas is educational. Residences within each of the Wellhead Protection Areas have been notified of their inclusion within the WHPA by mail. A copy of the notification letter and information brochure are included in the Wellhead Protection Plan. The notification letter was accompanied by a map showing the limits of the Wellhead Protection Area, as well as a brochure that describes the nature of groundwater, typical sources and modes of contamination, and how to prevent groundwater contamination.

Primarily due to the lack of other potential contamination sources, septic systems have been identified as a potential source of contamination among residential areas within the Wellhead Protection Area. Under ordinary conditions, septic tanks pose a relatively small risk to groundwater. Potential risks of contamination increase if hazardous materials are discarded through a septic system, if the septic system itself fails, or if conduits like old improperly abandoned wells are adjacent to septic systems, providing a potential mechanism for untreated wastewater to reach deeper aquifer systems.

Under WAC 246-272-155501, between January 1, 1995 and January 1, 2001, all local health departments (King County) in Washington State are required to develop and implement an on-site sewage system operation and maintenance program. The Association will participate and request information from the King County Health Department to monitor the condition of septic systems within their WHPAs. As part of the educational outreach program described above, a flyer was distributed to all parcel owners within the Sallal Wellhead Protection Areas. The brochure discusses the Wellhead Protection Program and outlines the need for care in the use and maintenance of septic systems. The Association will distribute a copy of this brochure to all new customers who purchase or construct homes within the WHPA.

Commercial and/or industrial operations within the Wellhead Protection Area pose, in general, a greater hazard to aquifers than residential use. Depending on the type of business, releases of hazardous chemicals can result from misuse, improper storage, improper disposal, equipment failure, or other mechanisms. Industrial releases are also likely to involve greater volumes than releases from residential sources. All businesses operating in or near the Wellhead Protection Area were notified by mail of their status with respect to the WHPA boundaries. A brochure will also be attached that explains the nature of groundwater usage and the potential threats to drinking water aquifers.

The Association's Board of Directors, its operational and management staff are dedicated to providing the highest quality drinking water possible to the members of the Association. As discussed in this document, the Association's Wellhead Protection Area for its major production Wells (#01 and #02) is relatively free of potential contaminant sources, with no anticipated future industrial or commercial activities. The Association's Well #03 WHPA will require some monitoring and on-going management to ensure that the high-quality groundwater resources remain usable to the Association.

CONTINGENCY PLAN FOR ALTERNATIVE SUPPLY

Sallal has developed a Contingency Plan that prioritizes the measures to be undertaken if a well were to become contaminated or water production was disrupted. The Association Production Wells #01 and #02 produce approximately 90 percent of the water needs of the Association. In the event Wells #01 and #02 were contaminated, production from these wells would immediately be terminated and the remaining well (#03/3A) in the system would be brought on line at a higher capacity to meet the demand. Existing interties with the City of North Bend and the Riverbend Homesites Association would be activated under an emergency agreement. This would be sufficient to provide water supplies to approximately 65 percent or more of the Association's members (everyone below the South Fork of the Snoqualmie River) and could be activated in a relatively quick time period of hours to at most a day or two.

The Association would immediately have to notify approximately 30 percent of its members (Wilderness Rim) living at an elevation higher than the Riverbend development to take actions to secure temporary water supplies. Emergency water trucks could be utilized in some of the communities. Getting water to these higher elevations in the system will be difficult because the Association does not have any sources or tanks above this hydraulic head and delivery of water to customers above that hydrostatic level will be difficult and require some system modifications.

Alternate sources of water would have to be obtained and put on line in a relatively short order to not have a significant impact to existing Sallal members at higher elevations. There appear to be two alternatives to further developing a Contingency Plan that would have procedures and capabilities in place to work around the disruption of these production wells.

The first one would be to reestablish the working relationship and agreement with the City of Seattle that existed previously when the Association obtained their water from the City. Developing a system that would utilize water from the City of Seattle Cedar River Watershed (either from the penstocks or from their onsite well) would help to provide emergency water. This approach is currently under investigation and negotiation with the Seattle Public Utilities.

The second course of action is to obtain additional sources of water, likely another well, to supplement and potentially augment water produced by Wells #01 and #02. The preferable location to place this well would be at a relatively high position approximately at the same elevation as the existing wells. Either a location across the valley on the other side of the Association's service area or another well installed within the Watershed could be suitable. If an additional well is installed within the watershed boundary either as a new source or as a replacement for an existing well, the well should not be sited in close proximity to the existing wells. Distance between the wells further reduces the very low possibility of a single contamination event impacting multiple wells.

The Association has sufficient funds to immediately undertake the emergency construction of a replacement well within the watershed boundary if one of the wells becomes inoperative.

EMERGENCY SPILL/INCIDENT RESPONSE COORDINATION

Spill response planning is an important part of the wellhead protection program and the emergency management plan. Effective spill response requires coordination and communication among the responding agencies and organizations. The following organizations may be involved in a spill response for a Wellhead Protection Area:

- Washington Department of Ecology, (425) 649-7000
- Washington Department of Health, (877) 481-4901
- Washington Department of Transportation, (206) 726-6752
- Washington State Patrol, (425) 649-4370
- King County Fire District No. 38, (425) 392-3433
- King County Emergency Management, (800) 523-5044

A current list of emergency contacts and telephone numbers is maintained by the Association Water System operator and manager. In addition, the Association has agreements with various contractors including excavation, construction and electrical to provide rapid response to the Association in the event of a crisis. The Association maintains a 24-hour voice mail on their phone with after hours/emergency phone numbers listed.