5 | SOURCE WATER PROTECTION

INTRODUCTION

The two basic objectives of a water system are to provide a sufficient quantity of water to meet customer usage demands and to provide high-quality water. **Chapter 3** discusses the City of Richland's (City) ability to supply a sufficient quantity of water and identifies future source requirements. This chapter discusses the City's ability to protect the existing sources from contamination and to continue providing high-quality water to its customers.

All federally-defined Group A public water systems that use groundwater as their source are required to develop and implement a wellhead protection (WHP) program. In addition, all purveyors of water systems using surface water or groundwater under the direct influence of surface water (GWI) sources are required to develop and implement a watershed control program. The City's five groundwater supplies are subject to the WHP requirements. The City's Columbia River water treatment plant (WTP) and North Richland Wellfield are subject to the watershed control program requirements. The City's Water Facilities Inventory (WFI) report presents the City's active potable water sources and is presented in **Appendix Q**.

WELLHEAD PROTECTION PROGRAM

REGULATORY FRAMEWORK

The quality of drinking water in the United States is regulated by the Environmental Protection Agency (EPA). Under provisions of the Safe Drinking Water Act (SDWA), the EPA is allowed to delegate primary enforcement responsibility for water quality control to each state. In the State of Washington, the Washington State Department of Health (DOH) is the agency responsible for implementing and enforcing drinking water regulations. For the state to maintain primacy (delegated authority to implement requirements) under the SDWA, it must adopt drinking water regulations that are at least as stringent as the federal regulations. To meet these requirements, the state has published drinking water regulations that are contained in Chapter 246-290 of the Washington Administrative Code (WAC).

Section 1428 of the 1986 SDWA Amendments mandates that each state develop a WHP program. The Washington State mandate for WHP and the required elements of a WHP program are contained in WAC 246-290-135 – Source Protection, which became effective in July of 1994. In Washington State, the DOH is the lead agency for the development and administration of the state's WHP program.

The purpose of the WHP program is to provide an organized approach to effectively protect drinking water supplies from contamination. The program seeks to identify and manage potential contaminant sources near public water supply wells to prevent future contamination. An effective WHP program safeguards the health of residents, employees, visitors, and all other water users, and avoids negative financial impacts associated with contamination. To ensure a safe, quality water supply and avoid additional costs, it is necessary to protect groundwater at its source. The WHP program is a straightforward and cost-effective method to accomplish this goal.

The City's WHP was prepared in June 1998, by HDR Engineering, Inc., and is contained in **Appendix R**. The WHP contains the following required elements.

- Documentation and notification to all owners/operators of known and potential sources of contamination within the wellhead protection area (WHPA).
- Notification to regulatory agencies and local governments of the defined boundaries of the WHPAs and the findings of the contaminant source inventory (completed as part of this Water System Plan (WSP)).
- Coordination with local emergency spill responders (i.e., police, fire, and health departments) regarding WHPA boundaries, source susceptibility, and contingency plans.
- Management strategy for the sanitary control area of the well.
- Public education and outreach presenting wellhead safety and the direct impact employees and residents with the WHPA can have on the quality of groundwater.
- Emergency and spill response plan to be implemented in the event of a hazardous spill event within the WHPA.

GROUNDWATER SOURCE DESCRIPTIONS

Wellsian Way Wellfield (S02)

There are a series of wells along Wellsian Way that collect water in a commercially developed part of the City. Well No. 5 (S13) is located in the middle of a commercial parking lot area in a well house that is adjacent to a gasoline station, a big box store, and mini mall. Well No. 14 (S14) is in a grass berm next to commercial offices and Wellsian Way. Well No. 4 (S12) is located in a landscaped area just north of Wellhouse Loop near Wellsian Way. The wellhead is surrounded by paved surfaces. This well is not currently connected to the water system. Well No. 13A (S15) is located near the playfields on Wellsian Way between Railroad and Elliot Streets. This well is on standby and under study for being converted to a non-potable well supply. The Wellsian Way Wellfield is vulnerable from a sanitary control perspective and pumps out of a shallow groundwater table influenced by current and past industrial and commercial practices. Groundwater in this area is contaminated with volatile organic compounds (VOCs) requiring treatment. The Wellsian wells all pump back through a raw water line to the air stripping facility at Lee Boulevard. The facility uses polyphosphate sequesterant as a reagent. The water is treated and released to the 1182 Reservoirs, then pumped again by the 1182 Booster Pump Station to the Core 545 Zone's 5 and 10 million gallon (MG) reservoirs.

Duke Wellfield (S03)

The two Duke Wells are wells 1100-D (S16) and 1100-8 (S17). Both wells became inactive from the treated potable system in 1996. The City has no current plans to treat the wells due to the high cost of treatment and the likely preponderance of nitrate concentrations in the groundwater in this area. Both wells discharged to a common line that can be chlorinated in-line and directly pumped to the Core 545 Zone. The two Duke Wells can be blended with other potable supplies to reduce nitrate levels below the maximum contaminant level (MCL), but currently are used only in emergency situations within the potable system, so the City chooses not to do so.

Columbia Well AHA126 (S05)

The Columbia Well is a vertical turbine pump with separate in-line chlorination equipment. The well is connected to the City's telemetry system and can be turned on/off from the main human machine interface (HMI) at the WTP. The well is located in a large City-owned community park within a residential neighborhood at the corner of Wallace Street and Harris Avenue. The sanitary control area is well buffered from other uses. Groundwater at this location is likely in connection with the Columbia River, but is not directly under the influence of surface water. This well is one of the original three wells in the Columbia Wellfield, but the only one that remains in operation. Water is delivered directly to the Core 545 Zone.

Sanitary Landfill (S08)

This well is not currently connected to the treated potable system. In the late 1980s, this well was contaminated by leachates from the City's landfill. The well is used periodically for other governmental proprietary purposes but is not used for domestic purposes. There are no current provisions for using this well as an emergency or standby source for the treated water system.

ORV Park Well (S09)

The ORV Park Well historically had been used to supply water for group domestic purposes in the Horn Rapids area. The potable use at the well was discontinued in the late 1980s when the City's distribution system was extended into the area. The well is used periodically for other governmental proprietary purposes but is not used for domestic purposes. There are no current provisions for using this well as an emergency or standby source for the treated water system.

Willowbrook Well (S10)

The Willowbrook Well is one of only two City wells located in south Richland and has historically been used for supply in the Tapteal I Pressure Zone. The well has problems with high temperatures and hydrogen sulfide and can only be used when blended with other sources. The well is used periodically for other governmental proprietary purposes but is not used for domestic purposes. The City can treat the well with in-line chlorination and connect the supply to the potable system under emergency conditions.

ORV Park Well No. 2 (S11)

The ORV Park Well No. 2 historically has been used to supply water for group domestic purposes in the Horn Rapids area during peak summer use. The potable use at the well was discontinued in the late 1980s when the City's distribution system was extended into the area. The well is used periodically for other governmental proprietary purposes but is not used for domestic purposes. There are no current provisions for using this well as an emergency or standby source for the treated water system.

SUSCEPTIBILITY ASSESSMENT

The City's contaminant source inventory was completed using data from two origins: 1) state and federal databases; and 2) personal interviews. The City updates the inventory every 2 years and most recently completed an update in April 2016. All or most of the other components of the Wellhead Protection Plan remain unchanged. Withdrawal rates at the wells in 2014 were similar to the original

protection plan and time of travel calculations. The original 1-, 5-, and 10-year time of travel boundaries are still valid.

The City's geographic information system (GIS) will incorporate the business license category designation for facilities. The WPHAs will be part of the business license database. Using these mechanisms, the City Public Works Department will be notified when a business is applying for a license within a WPHA, and the City will be able to query the database for potential contaminant sources by category.

WELLHEAD PROTECTION AREAS

A WHPA is defined as the surface and subsurface area surrounding a well, wellfield, or spring that supplies a public water supply through which contaminants are likely to pass and eventually be transported into the drinking water system[1]. It is the area surrounding a drinking water source that must be protected for public health and safety.

Theoretically, horizontal distance and time are proportional with respect to a particle of water and a well. Delineating boundaries of the WHPA for each source is most commonly accomplished using time of travel rates of groundwater, by establishing 6-month, 1-year, 5-year, and 10-year time of travel (TOT) areas. For example, a 1-year TOT zone represents an area around that well in which a contaminant may reach the well within 1 year. Each zone has different management strategies based on the risks posed within each zone and the urgency of response to contaminants within the zones.

Within the 6-month and 1-year TOT zones, drinking water supply is vulnerable to viral, microbial, and direct chemical contamination. Existing literature suggests that bacteria and viruses survive less than 1 year in groundwater[1]. Laboratory confirmation of contamination and evaluation of a contaminant plume, in addition to planning and implementation of cleanup, could take months; if such a direct contamination occurred within the 6-month or 1-year TOT zones, it may be too late by the time the process is accomplished to remove or treat the contamination. Thus, within the 6-month and 1-year TOT zones, intensive resource management should be conducted to protect the water source. Chemicals capable of contaminating groundwater should not be stored or used within these zones.

The area between 1- and 5-year TOT boundaries is sufficiently far enough away from a wellhead that, should contamination occur, there will be more time to respond. All potential and known contamination sources should be identified and managed with an emphasis on pollution prevention and risk management.

The 10-year TOT delineated boundary is the outer edge of a wellhead protection zone. Here an inventory of potential and known contamination sources should be identified and managed. It covers the largest area and educational outreach will be important in the 10-year TOT area to enlighten the public and business about their impacts on water supply. The area between the 5- and 10-year TOT boundaries is representative of the longer term water sources.

There are several delineation methods that can be used to delineate TOT boundaries. Two methods that have been used for the City's WHP were the Calculated Fixed Radius Method (CFR) and an analytical method called the TWODAN Model. The CFR method was used for the Wellsian Way Wells, the Harrison Well (which is still not yet constructed and has not been in use), and the

[1] Washington State Department of Health (June 2010). *Wellhead Protection Program Guidance Document.* (Technical Publication No. 331-018 Revised).

Willowbrook Well. The TWODAN Model was used to further refine the CFR data for the Columbia Well, Duke Wells, and North Richland Wells (which are now classified as a surface water source) to give more realistic WHPA and TOT zones.

The current CFR TOT zones, which are calculated based on the highest pump rating available for each well, or its maximum capacity, using the method outlined in the *Washington State Wellhead Protection Program* (DOH, 1993), are the same as previous calculations based on current pumping rate capacities of the wells. The TWODAN Model calculations were kept for the Columbia and Duke Wells due to their more detailed predictions of groundwater flow. For a description of the TWODAN Model and calculations for the wells, refer to **Appendix R**.

The CFR WHPA boundaries in this WSP reflect no changes in well production data or water rights for the City's wells and wellfields. Inactive sources are included because CFR data are needed in the event that these wells are utilized in emergency situations or rehabilitated in the future to become regular active sources. The TOT boundaries for all of the wells are presented in **Appendix R**.

From a geology perspective, most of the wells are screened in the shallow aquifer in the Hanford Formation. The Ringold Formation and Columbia River Basalt Group underlie the Hanford Formation. Major production wells in the North Richland area are relatively shallow and completed in the unconfined aquifer. The unconfined aquifer is generally overlain by coarse, permeable sediments and vulnerable to contaminants spilled, leaked, or applied to the soil. The production wells (by source number) with their corresponding production area type are presented in **Table 5-1**.

Table 5-1
Existing Production Well Data

Source No.	Source Name	Source Type	Source Use	Protection Area Type (Years)
05	Columbia Well	Well	Permanent	1
10	Willowbrook Well	Well	Emergency	10
13	Well 5	Well in Well Field	Permanent	10
14	Well 14	Well in Well Field	Permanent	10
16	Well 1100-D	Well in Well Field	Emergency	10
17	Well 1100-8	Well in Well Field	Emergency	10

The 1-, 5-, and 10-year CFR TOT for each of the City's wells has been calculated based on the pumping rates presented in the City's current WFI, and is presented in **Table 5-2**.

Table 5-2
1-, 5-, and 10-year CFR

Source No.	Source Name	Well Pumping Rate (gpm)	Aquifer Porosity[1]	Open Interval or Length of Well Screen (feet)	Calculated Fixed Radius (feet)		
					1-year Travel Time to Well	5-year Travel Time to Well	10-year Travel Time to Well
05	Columbia Well	556	0.22	36	1,253	2,802	3,962
10	Willowbrook Well	1,000	0.22	194	724	1,619	2,289
13	Well 5	2,803	0.22	22	3,599	8,048	11,381
14	Well 14	1,350	0.22	23	2,443	5,462	7,725
16	Well 1100-D	1,260	0.22	36	1,886	4,218	5,965
17	Well 1100-8	250	0.22	76	578	1,293	1,829

(1) A generalized value of 0.22 was used, as recommended in the DOH Washington State Wellhead Protection Program (1993).

Groundwater quality of the unconfined aquifer is compromised by the presence of contaminant plumes associated with the Hanford site, as well as upgradient agricultural operations, the City landfill, and industrial facilities in the North Richland area. Uranium, gross alpha, gross beta, nitrate, and various organic chemicals are present at levels that exceed drinking water standards, or, as in the case of tritium, are present in concentrations that are of public concern. The full extent of this contamination is not known, but generally occurs upgradient from City water supply wells or in areas potentially upgradient if present water level conditions are altered. The City maintains a minimum 2:1 diversion to withdrawal rate at the North Richland filtration site to keep contamination plumes from flowing towards City supplies. The infiltration basins operated by the City appear to protect the wells in the North Richland Wellfield from local contaminant plumes. The extent of the hydraulic influence of these infiltration basins has not been established, and the effectiveness of these basins in protecting more distant production wells, or under varying operational conditions, is not known. Nitrate contamination is widespread, and increased concentrations have resulted in the loss of use of the Duke Wellfield, except for peak demand situations that require blending of water to meet drinking water standards.

Signs were put up at WHPAs in 2003. The City contacted affected and interested parties in 2004, and maintains contact with new businesses. A copy of the wellhead protection notification is contained in **Appendix R**. A partial update of source inventory was conducted in 2001, along with the water supply vulnerability study. A complete source inventory update was conducted in 2016 with updates performed every 2 years. A contingency plan was developed in 2003, and an emergency response plan was updated in 2009. The City's development regulations were updated in 2003 to incorporate appropriate controls and standards for wellhead protection and contaminant prevention.

WATERSHED CONTROL PROGRAM

Purveyors of water systems using surface water or GWI sources are required to develop and implement a watershed control program. The City is supplied surface water from the Columbia River. To protect water supplies and prevent source water contamination, the DOH requires purveyors of surface water or GWI sources to prepare a watershed control program as a component of the WSP. The watershed control program contains the following elements, as required by WAC 246-290-135. A brief summary of the information presented in the City's watershed control program is presented in the subsequent sections.

- A description of the watershed that includes its location, hydrology, and land ownership, and the identification of activities that may have a negative impact on source water quality.
- An inventory of all potential sources of surface water contamination, including the locations of owners/operators located within the watershed that have a significant potential to contaminate the source water quality.
- Watershed control measures that include documentation of ownership and relative written agreements, as well as monitoring activities and water quality.
- System operation and emergency provisions.
- Documentation of water quality trends.

WATERSHED BACKGROUND

The City is located in Benton County, Washington, near the confluence of the Columbia, Snake, and Yakima Rivers. The City's watershed is defined as the drainage area of the Columbia River upstream of the City's Columbia River Raw Water Intake facility. Although the City plays a role in protecting the watershed, the Columbia River incorporates a very large watershed upstream of the City's sources that could be contaminated by numerous sources over which the City has no control or jurisdiction. If this were ever to occur, the City's groundwater sources, in conjunction with the emergency interties with the City of Kennewick, would allow the City to continue to supply the system. Another method of protection from this vulnerability is to further enhance the secondary supply, which will be completed through several future projects for new wells and redundancy within the system.

POTENTIAL SOURCES OF SURFACE WATER CONTAMINATION

An essential element of a watershed control program is an inventory of all potential sources of contamination throughout delineated wellhead protection and watershed control areas. The purpose of the inventory is to identify past, present, and proposed activities that may pose a threat to the sources of water supply.

Washington State Department of Ecology (Ecology) maintains a facility/site database online that lists facilities and sites that could pollute the air or water. These include:

- State clean-up sites;
- Federal superfund sites;
- Hazardous waste generators;
- Solid waste facilities;
- Underground storage tanks; and
- Enforcement.

A list of each potential source of contamination within the City's water service area is contained in **Appendix S**, as is a figure presenting the location of each potential contamination source within the City's water service area.

WATERSHED CONTROL MEASURES

The City adheres to the following practices to limit the impact on water quality, maintain or improve the existing fish and wildlife habitat, and protect capital improvements within the City's water service area.

- Limit additional road building activities and ensure maintenance activities meet current federal and state standards within sensitive areas that are tributary to the Columbia River.
- Monitor building and planning permits issued in the drainage basin that are tributary to the Columbia River.
- Adhere to Ecology's 2004 Stormwater Management Manual for Eastern Washington during building and planning permit reviews.
- Perform water quality analyses of raw water.

The watershed is also protected under numerous federal and state regulations, including, but not limited to, the following programs.

- Federal Statues and Requirements
  - SDWA
  - Clean Water Act
  - Resource Conservation and Recovery Act, including the Underground Storage Act
  - Comprehensive Environmental Response, Compensation, and Liability Act (or Superfund)
- State Statues and Requirements
  - Shoreline Management Act
  - Stormwater Management

Source Vulnerability

The City is highly dependent on the Columbia River for its water supply, which makes it vulnerable to water quality contamination. The City's groundwater sources ease its reliance on the Columbia River, and reduce the possibility that a water contamination event in the Columbia River will impact the City's ability to supply its water system. A detailed vulnerability analysis was conducted as part of the City's *2002 Comprehensive Water Plan*.

Emergency Provisions

In the event of surface water contamination that renders water unsuitable for potable use, the City will implement the following emergency response.

1. Shut down the North Richland Wellfield and WTP, and obtain water quality samples.
2. Notify DOH of the surface water contamination.
3. Notify all customers of the problem and instruct them to boil all water to be used for consumption and cooking, if boiling is effective for the type of contamination.
4. Close the appropriate distribution and transmission main valves to isolate the area of contamination within the distribution system.
5. Isolate booster pump station and reservoir facilities, as needed, to prevent the spread of contamination within the distribution system.
6. Analyze water quality of water within reservoirs and dispose of properly, if contaminated.
7. Disinfect reservoirs, the WTP, and water mains, as necessary, to remove any contaminated residuals, if disinfection is effective for the contamination type.
8. Adjust control of system facilities, as necessary, to provide supply from the City's groundwater sources or the interties with the City of Kennewick, provided that these sources have not been contaminated.
9. Flush and disinfect the North Richland Wellfield and WTP infrastructure, as needed, to remove contaminant from source water.
10. Monitor water quality at the North Richland Wellfield and WTP, and investigate cause of contamination.
11. Implement water use reduction measures, as necessary, to ensure an adequate supply of water.