Excerpts from

Department of Ecology State of Washington Critical Aquifer Recharge Areas Guidance

Revised March 2021 Publication 05-10-028

(Page numbers are from the document, as printed on the bottom of the page)

Page 2: The Centers for Disease Control and Prevention5 (CDC) has information about public drinking water contamination and health effects: The presence of contaminants in water can lead to adverse health effects, including gastrointestinal illness, reproductive problems, and neurological disorders. Infants, young children, pregnant women, the elderly, and people whose immune systems are compromised because of AIDS, chemotherapy, or transplant medications, may be especially susceptible to illness from some contaminants.

Remediation of contaminated groundwater is overwhelmingly expensive and often takes a long time. A contamination event can cause city wells to be shut down, result in expenses for new wells, and incur costs for cleaning up contaminated soil and ground water.

Prevention of groundwater contamination is far less expensive than cleanup. Environmental Protection Agency (EPA) studies have shown that investing funds for groundwater protection is cost-effective compared to groundwater cleanup at a ratio that runs anywhere from 1:5 to 1:200 (U.S. EPA, 1995).

The Growth Management Act requires protection of public groundwater drinking supplies so that contamination events and their associated costs can be prevented.

Page 4: Critical Aquifer Recharge Areas Critical Aquifer Recharge Areas (CARA) are defined under the GMA as “areas with a critical recharging effect on aquifers used for potable water, including areas where an aquifer that is a source of drinking water is vulnerable to contamination that would affect the potability of the water, or is susceptible to reduced recharge.”

The Washington Administrative Code (WAC) Chapter 365-190-10012 further enumerates requirements for local jurisdictions to determine classification and designation of Critical Aquifer Recharge Areas.

Identifying “areas with a critical recharging effect on aquifers used for potable water,” depends on understanding aquifer recharge and what is meant by “a critical recharging effect.”

Aquifer recharge occurs where rainfall, snowmelt, infiltration from lakes, wetlands and streams, or irrigation water infiltrates into the ground and adds to the underground water that can supply a well. On the other hand, discharge areas are where groundwater meets the ground surface and ultimately flows out from a spring, wetland, stream, lake, estuary, or ocean shore.

Wells can also serve as discharge areas, especially those that pump larger volumes, such as those used by municipalities. Most of a watershed is typically a recharge area, with discharge areas occurring to a

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Transmittal: Handbook 4000.1
Issued: October 31, 2023
Effective Date: April 29, 2024

1. This Transmits:

Handbook 4000.1, FHA Single Family Housing Policy Handbook, Title II Insured Housing Programs Home Equity Conversion Mortgages (HECM), Origination through Servicing.

2. Explanation of Materials Transmitted:

This update to the FHA Single Family Housing Policy Handbook, or Handbook 4000.1, is to incorporate guidance for FHA's Title II Insured HECM program.

The following sections have been added to Handbook 4000.1:

- II.B.1 Origination/Counseling Requirements
- II.B.2 Origination/Processing
- II.B.3 Allowable Mortgage Parameters
- II.B.4 Underwriting the Property
- II.B.5 Performing the Financial Assessment of the Borrower
- II.B.6 Closing
- II.B.7 Post-closing and Endorsement
- II.B.8 Programs and Products
- III.B.1 Servicing of FHA-Insured HECMs
- III.B.2 Default Servicing
- III.B.3 Programs and Products
- Appendix 9.0 Assumed Loan Periods for Computations of Total Annual Loan Cost Rates

Existing content in the following sections has been updated to incorporate HECM guidance:

- II.D.1 Commencement of the Appraisal
- II.D.3 Acceptable Appraisal Reporting Forms and Protocols

The Appraiser must note the deficiency of MPR or MPS if the subject Property contains a well located within the foundation walls of an existing dwelling, unless there is evidence that:

- the local jurisdiction recognizes and permits such a location;
- it is common for the market area; and
- it does not adversely affect marketability.

A well located within the foundation walls of a dwelling is not acceptable for New Construction except in arctic or subarctic regions.

The Appraiser must report when water to a Property is supplied by dug wells, cisterns or holding tanks used in conjunction with water purchased and hauled to the site. The Appraiser must report whether such systems are readily accepted by local market participants.

The Appraiser must note the deficiency of MPR or MPS if the subject Property has a water source that includes a mechanical chlorinator or is served by springs, lakes, rivers, sand-point or artesian wells.

A pressure tank with a minimum capacity of 42 gallons must be provided. However, pre-pressured tanks and other pressurizing devices are acceptable if delivery between pump cycles equal or exceed that of a 42-gallon tank. Tanks must be equipped with a clean-out plug at the lowest point and a suitable pressure relief valve.

The Appraiser must note any readily observable deficiencies regarding the well and require test or inspection if any of the following apply:

- the water supply relies upon a water purification system due to the presence of contaminates;
- corrosion of pipes (plumbing);
- areas of intensive agricultural uses within one quarter mile;
- coal mining or gas drilling operations within one quarter mile;
- a dump, junkyard, landfill, factory, gas station, or dry cleaning operation within one quarter mile; or
- an unusually objectionable taste, smell, or appearance of well water.

The Appraiser must also be familiar with the minimum distance requirements between private wells and sources of pollution and, if discernible, comment on them. The Appraiser is not required to sketch or note distances between the well, property lines, septic tanks, drain fields, or building Structures but may provide estimated distances where they are comfortable doing so. When available, the Appraiser should obtain from the homeowner or Mortgagee a copy of a survey or other documents attesting to the separation distances between the well and septic system or other sources of pollution.

(C) Required Analysis and Reporting

The Appraiser must:

- report any readily observable or known deficiencies with the water;
- notify the Mortgagee when water is determined to be unsafe, report, and provide a cost to cure; and
- address any impact on value and marketability, and make the appropriate adjustments.

iv. Community Water Systems

(A) Definition

A Community Water System refers to a central system that is owned, operated, and maintained by a private corporation or a nonprofit property owners' association.

(B) Standard

A Community Water System must comply with local jurisdiction requirements.

(C) Required Analysis and Reporting

If the Property is on a Community Water System, the Appraiser must note the name of the water company on the appraisal report.

v. Individual Water Supply Systems

(A) Definition

An Individual Water Supply System refers to a potable water source providing water to an individual Property.

(B) Standard

When an Individual Water Supply System is present, water quality must meet the requirements of the health authority with jurisdiction. If there are no local (or state) water quality standards, then water quality must meet the standards set by the EPA, as presented in the National Primary Drinking Water regulations in 40 CFR §§ 141–142.

(C) Required Analysis and Reporting

The Appraiser must report on the availability of connection to a public and/or Community Water System and any jurisdictional conditions requiring connection.

When the Appraiser obtains evidence that any of the water quality requirements are not met, the Appraiser must notify the Mortgagee and provide an estimated cost to cure.

more limited extent in topographically lower areas. Recharge areas and discharge areas can be mapped using hydrogeologic techniques to determine where groundwater is and where it is flowing. Aquifers used for potable water are identified by looking at existing and future planned uses.

Existing wells and their protection areas, sole source aquifers, and aquifers otherwise identified as important supplies, are examples of "aquifers used for potable water."

DEPARTMENT OF
ECOLOGY
State of Washington

Critical Aquifer Recharge Areas Guidance

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Critical Aquifer Recharge Areas

Guidance

Water Quality Program

Washington State Department of Ecology

Olympia, Washington

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Commenters

Thank you to everyone who commented on this guidance - Your engagement and input is very much appreciated.

Abstract

The Growth Management Act (GMA) requires all cities and counties in Washington State to protect public groundwater drinking supplies so that tragic contamination events and their associated costs can be prevented. Public drinking water supply also depends on groundwater availability. Without replenishment, the amount of water in aquifers can be diminished or even depleted.

This guidance document helps local jurisdictions and the public understand what is required for the protection of local groundwater resources under the Growth Management Act. It includes guidance for planning, ordinances, and for including the Best Available Science (BAS) as these relate to Critical Aquifer Recharge Areas.

This guidance will also explain how the laws and rules of the state of Washington for water quality, pollution prevention, and water resources relate to Critical Aquifer Recharge Area protection.

We are revising the guidance to update it in response to changes in laws and rules that have occurred since 2005, and to clarify concepts in response to comments.

In 2010, the Washington State Department of Commerce significantly updated the sections of the Washington Administrative Code (WAC) they administer under the Growth Management Act. A summary of the changes can be found in Appendix 1.A. of the Critical Areas Handbook.

Access the Critical Areas Handbook from the Department of Commerce Critical Areas web page[1].

The updated Critical Areas Handbook is a indispensable resource for local jurisdictions updating their Critical Areas plans, programs, and ordinances. Much information in the Critical Areas Handbook that is important for Critical Aquifer Recharge Areas is not repeated here, so these two guidances should be used together.

[1] https://www.commerce.wa.gov/serving-communities/growth-management/growth-management-topics/critical-areas/

Section 1 - Introduction

This guidance document helps local jurisdictions and the public understand what is required for the protection of local groundwater resources under the Growth Management Act. It includes guidance for planning, ordinances, and for including the Best Available Science (BAS) as these relate to Critical Aquifer Recharge Areas.

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Although the vast majority of drinking water wells produce clean uncontaminated water, there are places around the state where groundwater has been contaminated, either with industrial/agricultural chemicals, or with nitrates from various sources (fertilizer, human waste, animal waste). Appendix B shows a map of confirmed and suspected contaminated groundwater and soil sites across the state. The Washington Nitrate Prioritization Project[3] (Morgan, 2016) was completed to analyze what we know about the occurrence of nitrates in groundwater and the on-the-ground conditions that are sensitive to contamination. For a summary, see the Story Map[4] for this project.

[2] https://www.commerce.wa.gov/serving-communities/growth-management/growth-management-topics/critical-areas/
[3] https://fortress.wa.gov/ecy/publications/SummaryPages/1610011.html
[4] https://waecy.maps.arcgis.com/apps/MapSeries/index.html?appid=95af1d23b76a45e48abcb891b1791ba2

When a public drinking water supply is compromised, the community faces the potential of health risk and great expense. Contaminated water may lead to the ingestion of toxic chemicals or other harmful substances, which could cause illness or adverse health effects.

The Centers for Disease Control and Prevention[5] (CDC) has information about public drinking water contamination and health effects:

> The presence of contaminants in water can lead to adverse health effects, including gastrointestinal illness, reproductive problems, and neurological disorders. Infants, young children, pregnant women, the elderly, and people whose immune systems are compromised because of AIDS, chemotherapy, or transplant medications, may be especially susceptible to illness from some contaminants.

Remediation of contaminated groundwater is overwhelmingly expensive and often takes a long time. A contamination event can cause city wells to be shut down, result in expenses for new wells, and incur costs for cleaning up contaminated soil and ground water.

Prevention of groundwater contamination is far less expensive than cleanup. Environmental Protection Agency (EPA) studies have shown that investing funds for groundwater protection is cost-effective compared to groundwater cleanup at a ratio that runs anywhere from 1:5 to 1:200 (U.S. EPA, 1995).

The Growth Management Act requires protection of public groundwater drinking supplies so that contamination events and their associated costs can be prevented.

In addition, public drinking water supply depends on groundwater availability. Without replenishment, the amount of water in aquifers can be diminished or even depleted.

A good groundwater protection program involves:

- Identifying groundwater resources at risk,
- Identifying threats to groundwater
- Having an implementation plan for rules to be protective, and
- Monitoring to make sure a condition that could cause an unacceptable risk is not occurring and taking action when necessary.

[5] https://www.cdc.gov/healthywater/drinking/public/water_diseases.html

The Growth Management Act and Critical Areas

The Growth Management Act[6] (GMA) requires comprehensive land use planning by counties and cities. The act, commonly known as the GMA, specifies 13 overall planning goals.

These goals include urban growth, transportation, economic development, natural resource industries, public facilities, open space and recreation, historic preservation, environmental planning, and others.

The environmental planning goal is to "protect the environment and enhance the state's high quality of life, including air and water quality, and the availability of water" (RCW 36.70A.020[7]).

Further, the land use element of comprehensive plans must "provide for protection of the quality and quantity of groundwater used for public water supplies" (RCW 36.70.330[8]).

The GMA requires the designation and protection of "Critical Areas" to prevent harm to the community from natural hazards and to protect natural resources.

- Natural hazards are frequently flooded areas and geologically hazardous areas.
- Natural resources are wetlands, fish and wildlife habitat conservation areas, and Critical Aquifer Recharge Areas, which are areas with a critical recharging effect on aquifers used for potable water.

The goal of establishing Critical Aquifer Recharge Areas is to protect the ***functions and values*** of a community's drinking water by preventing pollution and maintaining supply.

This guidance document is developed for Critical Aquifer Recharge Area management.

Groundwater is a major component of other critical areas. County wide planning policies as well as comprehensive plans are the major planning and policy documents for local governments to ensure the protection of natural resources such as groundwater, surface water, and wetlands, as well as hazards such as flooded areas, and landslide hazards.

[6] https://apps.leg.wa.gov/RCW/default.aspx?cite=36.70A&full=true
[7] https://app.leg.wa.gov/RCW/default.aspx?cite=36.70A.020
[8] https://app.leg.wa.gov/RCW/default.aspx?cite=36.70.330

Examples of comprehensive plans that integrate various environmental components include: Thurston County (2019)[9], Pierce County (2015)[10], and Spokane County (2017)[11].

Critical Aquifer Recharge Areas

Critical Aquifer Recharge Areas (CARA) are defined under the GMA as "areas with a critical recharging effect on aquifers used for potable water, including areas where an aquifer that is a source of drinking water is vulnerable to contamination that would affect the potability of the water, or is susceptible to reduced recharge."

The Washington Administrative Code (WAC) Chapter 365-190-100[12] further enumerates requirements for local jurisdictions to determine classification and designation of Critical Aquifer Recharge Areas.

Identifying "areas with a critical recharging effect on aquifers used for potable water," depends on understanding aquifer recharge and what is meant by "a critical recharging effect."

Aquifer recharge occurs where rainfall, snowmelt, infiltration from lakes, wetlands and streams, or irrigation water infiltrates into the ground and adds to the underground water that can supply a well. On the other hand, **discharge areas** are where groundwater meets the ground surface and ultimately flows out from a spring, wetland, stream, lake, estuary, or ocean shore. Wells can also serve as discharge areas, especially those that pump larger volumes, such as those used by municipalities.

Most of a watershed is typically a recharge area, with discharge areas occurring to a more limited extent in topographically lower areas. Recharge areas and discharge areas can be mapped using hydrogeologic techniques to determine where groundwater is and where it is flowing.

Aquifers used for potable water are identified by looking at existing and future planned uses. Existing wells and their protection areas, sole source aquifers, and aquifers otherwise identified as important supplies, are examples of "aquifers used for potable water."

Setting priorities for the most critical supplies helps jurisdictions make decisions about where to focus their efforts. Areas may be categorized to reflect these priorities.

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[9] https://www.thurstoncountywa.gov/planning/planningdocuments/Chapter_09_Environment and Recreation_Nov2019_FINAL_clean.pdf
[10] https://www.co.pierce.wa.us/950/Comprehensive-Plan
[11] https://www.spokanecounty.org/DocumentCenter/View/22928/2017-Comprehensive-Plan?bidId=
[12] https://apps.leg.wa.gov/WAC/default.aspx?cite=365-190-100

An example would be to apply stricter regulations and monitoring within the one-year time of travel of a public water supply well, as opposed to more sparsely developed areas of the county. Stricter regulations should be applied in an area where the aquifer is shallow and vulnerable to contamination more than an aquifer that is deep and protected.

King County Best Available Science for Critical Aquifer Recharge Areas[13] (King County, 2004) includes a discussion of recharge and discharge areas, drinking water, and prioritization of areas that are "critical".

Maps and performance standards

The GMA discusses the use of both mapping and performance standards to identify critical areas.

Maps are highly useful for Critical Aquifer Recharge Areas because they can show the location of public water supply wells, single residential wells, and aquifer boundaries. They can also be used to show the location of areas that have been rated for susceptibility to contamination, and where potential sources of contamination are located. Maps can be used to see where pollution prevention is most needed and to help plan development. Known Critical Aquifer Recharge Areas should be mapped.

Performance standards are the criteria for designation of a critical area. The Dept. of Commerce Critical Areas Handbook defines "performance standards" as the criteria or characteristics of the land that determine that it is a critical area. A performance standard is applied when reviewing development projects to determine what category of Critical Aquifer Recharge Area the proposal is in and what the applicable site conditions are.

Local policies, planning, ordinances, and programs are applied based on the outcome of the evaluation of the proposal using performance standards.

Chapter 365-190-040(5)(b)[14] states: Inventories and maps should indicate designations of natural resource lands. In circumstances where critical areas cannot be readily identified, these areas should be designated by performance standards or definitions, so they can be specifically identified during the processing of a permit or development authorization.

The purpose of a performance standard is to have an objective standard for comparison (WWGMHB, 1997).

To use performance standards, local jurisdictions need sufficient information to:

[13] https://your.kingcounty.gov/dnrp/library/2004/kcr1562/BAS-Chap6-04.pdf
[14] https://apps.leg.wa.gov/WAC/default.aspx?cite=365-190&full=true#365-190-040

- Make an informed determination as to whether or not critical areas are present on the site.
- Determine whether or not the proposed activity will impact those critical areas.

The Critical Areas Handbook[15] (Washington Dept. of Commerce, 2018) states that:

> The Minimum Guidelines in Chapter 365-190 WAC are minimum requirements for critical areas classification and designation. The Guidelines reference the statutory requirement to include best available science, and recommend that counties and cities designate critical areas using maps and performance standards. Designation is usually done with a map such as a zoning map. However, there is usually not enough on-the-ground information to do an effective job of designating critical areas using this method. Critical areas designation is typically done through performance standards. The term "performance standards" means the criteria or characteristics of the land that determine that it is a critical area.
>
> Adopting performance standards provides a way to designate critical areas without requiring a prohibitively expensive inventory and mapping before the requirements for protecting the critical area would apply. Instead, the legislative act of designation is the adoption of criteria, or performance standards, that are used to determine whether a particular area is a critical area by applying the criteria on the ground. This typically happens during local project review.

Voluntary Stewardship Program

The Voluntary Stewardship Program (VSP) was adopted into the Growth Management Act in 2011. The intent of this program is to provide a voluntary means for protection of critical areas that intersect with agricultural activities in VSP opt-in counties.

Chapter 36.70A.705 RCW[16] establishes the program. Chapter 365-191 WAC[17] enumerates the regulations for program approval.

The Washington State Conservation Commission administers the Voluntary Stewardship Program, with technical support from other state agencies, including Ecology. Both the Washington State Conservation Commission[18] and the Critical Areas Handbook[19] have detailed information about this program.

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[15] https://www.commerce.wa.gov/serving-communities/growth-management/guidebooks-and-resources/
[16] https://app.leg.wa.gov/rcw/default.aspx?cite=36.70A.705
[17] https://apps.leg.wa.gov/wac/default.aspx?cite=365-191
[18] https://scc.wa.gov/vsp/
[19] https://www.commerce.wa.gov/serving-communities/growth-management/growth-management-topics/critical-areas/

Some things to keep in mind about groundwater protection and the way the Voluntary Stewardship Program is designed:

1. The best chance for a county VSP work plan to succeed for groundwater quality protection would be by having a high rate of participation and implementation of best management practices, like precision agriculture.

2. The VSP defines protection as no further loss compared to conditions that existed in July 2011. This fits in with no net loss of wetlands because wetlands are visible at the ground surface and can be inventoried.

   The problem for groundwater with defining protection as of a certain date is that there often is not groundwater sampling for that date.

   In addition, groundwater moves and transports contaminants with it. If there are no new contaminants, upgradient groundwater and local recharge would mix with the contaminated water. This would move contaminated water away and dilute it. Contaminant concentrations should decrease (if upgradient sources aren't continuing to pollute). To keep polluted groundwater to the same concentration level as existed in July 2011 would require continuing loading of pollutants, which is illegal (RCW 90.48.080[20]).

   The prudent thing to do is to monitor groundwater quality at wells that have detected contamination over time and control polluting activities.

3. The VSP is voluntary and cannot address operators with polluting activities who do not voluntarily participate. In counties that opt-in to VSP, the county VSP work plan takes the place of the critical area ordinance for that county as they pertain to agricultural activities. However, all other regulations, ordinances, laws and rules apply. If there is a polluter in the county, and VSP would apply to that polluter (the agricultural activity that the polluter is engaged in is in a portion of the county that has opted-in to VSP), a county would not be able to use their critical area ordinance to regulate the polluter. Rather, the county would work with other regulators to enforce existing regulations (i.e. Department of Ecology water quality regulations, Clean Water Act, etc.) to stop the pollution.

   The county VSP work group would also work to adaptively manage their VSP work plan to attempt to ameliorate any decrease in the critical area function and values as they implement the VSP.

4. The VSP relies on establishing benchmarks to track progress on whether the program is successful. Without a groundwater monitoring program, or data from

[20] https://app.leg.wa.gov/RCW/default.aspx?cite=90.48.080

a groundwater monitoring program, it would be difficult to determine whether groundwater quality is improving as a result of the program.

5. The VSP metric for success is that there is no net loss or there is an improvement on a watershed basis. Groundwater pollution occurs at a particular location from a particular activity. Averaging groundwater quality for wells across an entire watershed does not indicate improvement or success if there still is ongoing unaddressed pollution at a location, even if other locations are not polluted.

Groundwater and Other Critical Areas

Groundwater is inextricably linked with all of the critical areas including wetlands, fish and wildlife habitat, critical aquifer recharge areas, frequently flooded areas, and geologically hazardous areas.

Groundwater is a source of water to streams, lakes, estuaries, wetlands, and springs; and therefore serves a critical function for wildlife and fish habitat. Some plants that provide habitat, like willows, depend on shallow ground water.

Groundwater is often a key factor in flooding and geologic hazards.

The GMA also requires that local jurisdictions give special consideration to conservation or protection measures necessary to preserve or enhance anadromous fisheries. Since groundwater is an important component of stream flow, it is necessary to maintain the groundwater supply to streams where needed to protect salmon and other anadromous species. Watershed planning under the Streamflow Protection law supports this goal. See Section 3 for more information.

Qualified Professional Assistance

Professional hydrogeologic work for the establishment of Critical Aquifer Recharge Areas should be performed by a hydrogeologist licensed in the state of Washington (RCW 18.220[21] and WAC 308-15[22]). In particular, the delineation and characterization of aquifers and the analysis of environmental fate and transport of potential contaminants should be performed by a qualified professional hydrogeologist licensed in the state of Washington.

Many activities associated with Critical Aquifer Recharge Areas may be done by others (who are not licensed professional hydrogeologists) such as planning, pollution prevention, education and outreach, ordinance enforcement, and other activities

[21] https://app.leg.wa.gov/RCW/default.aspx?cite=18.220&full=true
[22] https://apps.leg.wa.gov/WAC/default.aspx?cite=308-15

associated with city and county programs (see RCW 18.220.190: Permitted activities—Certificate of licensing not required[23]).

The Growth Management Hearings Board and Washington State Courts

GMA Hearings Boards were created by the legislature to hear cases related to the Growth Management Act. The three GMA Hearings boards - Eastern Washington, Western Washington, and Central Puget Sound - were consolidated into a single board by the legislature in 2010. Critical Areas planning and ordinance decisions are subject to review by the board. The board hears cases when a "Petition for Review" is filed. Chapters 36.70A.280[24] and 36.70A.290[25] RCW dictate conditions for appealing a city's or county's noncompliance with the Growth Management Act, including provisions for the protection of critical areas (Chapter 36.70A.060 RCW[26]). Growth Management Hearings Boards Final Decisions and Orders may be appealed to Superior Court.

The GMA Hearings Board website[27] contains a wealth of information about the board and how it works. There is a decision digest[28] through June 30, 2010 for each of the Regional Boards prior to consolidation. This website also has a case and decision search for cases after June 30, 2010, where decisions that affect Critical Aquifer Recharge Areas (CARAs) and other growth management issues can be viewed on-line.

The website also has practice and procedure information for appeals.

As of 2019, eleven counties and their included cities in Washington are not required to plan fully under the GMA (Chapter 36.70A.130[29]). These jurisdictions must still plan for Critical Areas and Natural Resources Lands. These counties are Adams, Asotin, Cowlitz, Grays Harbor, Klickitat, Ferry, Lincoln, Okanogan, Skamania, Wahkiakum, and Whitman. Appeals of Critical Areas actions under the GMA for these eleven counties and their included cities do not go to the Growth Management Hearings Board, but instead are heard by Superior court.

[23] https://app.leg.wa.gov/RCW/default.aspx?cite=18.220.190
[24] https://app.leg.wa.gov/RCW/default.aspx?cite=36.70A.280
[25] https://app.leg.wa.gov/RCW/default.aspx?cite=36.70A.290
[26] https://app.leg.wa.gov/RCW/default.aspx?cite=36.70A.060
[27] http://www.gmhb.wa.gov/
[28] http://www.gmhb.wa.gov/Global/Reader?title=Digests&path=Digests
[29] https://app.leg.wa.gov/RCW/default.aspx?cite=36.70A.130

Section 2 - Basic Groundwater Concepts

This section lists basic concepts that help with understanding the occurrence and movement of ground water.

The Hydrologic Cycle

The hydrologic cycle is how water moves in the environment. Water evaporates from the oceans, gathers in clouds, and rains or snows onto the land. After it rains or the snow melts, the water may evaporate, be used by plants, run off to streams, lakes, or the ocean; or infiltrate into the soil. Some of the water that infiltrates into the soil will reach the underground water table and will **recharge** the aquifer.

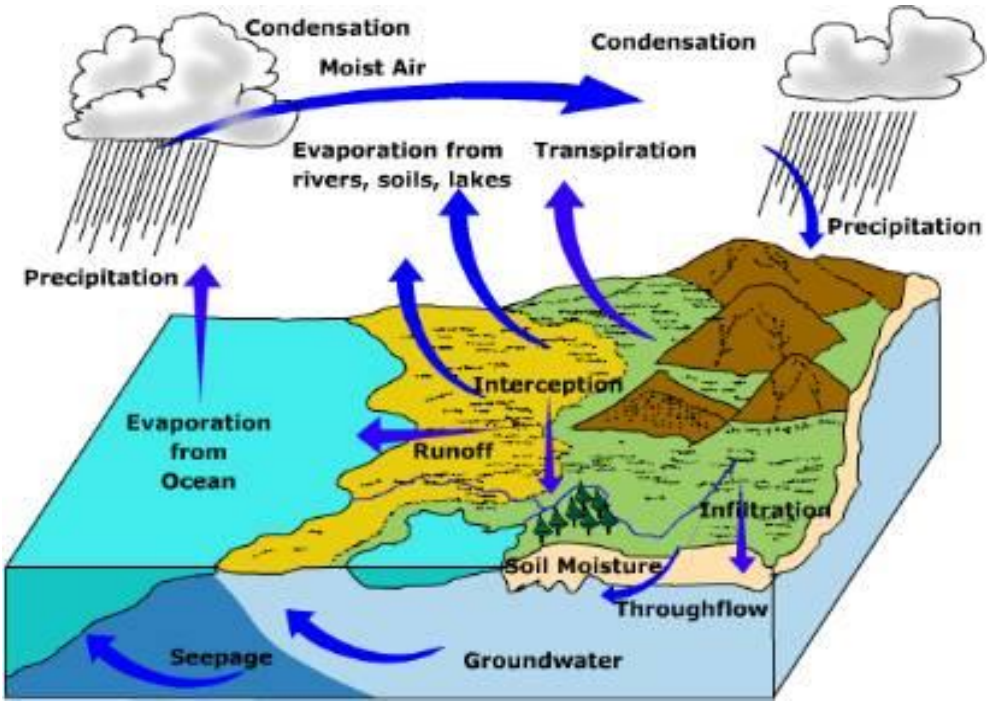

Figure 1: The Hydrologic Cycle

Aquifers

Aquifers are created when water saturates, or fills, the soil or rock matrix underground where it is permeable enough to yield useable quantities of water to a well. Underground soil/rock layers that are not permeable enough to yield useable quantities of water to a well are called aquitards. Common types of aquifers are sand and gravel, fractured bedrock, and karst (limestone).

In the Puget Sound region, the landscape that defines aquifers is made up mainly of deposits of sand and gravel related to the movement of glaciers during the last ice age. In eastern Washington, there are several types of geologic settings that contain aquifers. The largest type of aquifer in eastern Washington are the flood basalts of the Columbia Basin. In the Columbia Basin, irrigation has created aquifers by saturating the sands and gravels that overlay the Columbia Basin basalts.

A **confined aquifer** is an aquifer that lies beneath an aquitard. This condition can cause the water to be under pressure, resulting in a well that has a water level above the bottom of the aquitard (known as artesian conditions). Sometimes this pressure is great enough to cause the water in the well to flow out at the surface. Groundwater in confined aquifers flows from the direction of the highest hydraulic pressure to the lowest hydraulic pressure.

A **water-table aquifer** is water under normal atmospheric pressure, and thus is able to rise and fall. This aquifer is not capped by an aquitard and as such is impacted by surface contamination sooner than a confined aquifer. Water-table aquifers flow generally in accordance with the topography from higher elevations to lower elevations.

There may be a whole system of multiple confined aquifers and a water-table aquifer in an area. Sometimes the water table aquifer and confined aquifers beneath are connected and water from one aquifer flows into another.

Recharging Aquifers

Recharge is water that is added to groundwater, whether it is from rainfall or snowmelt that infiltrates through the ground, or some other source. Recharge can come from quite a distance through the ground over a long period, or it can come from relatively local and more recent sources.

Recharge can also carry contaminants into aquifers from the land surface. Therefore, recharge is at the center of preventing pollution and maintaining supply both for drinking water aquifers and for freshwater habitats.

Infiltration is water that soaks into the ground. All recharge is infiltrated, however, infiltration can also evaporate, flow along a shallow zone and surface downslope, or be taken up by plants instead of adding to recharge. Infiltration that reaches the water table becomes recharge.

Impervious surfaces prevent infiltration and therefore prevent recharge from occurring. Instead, rainwater or snowmelt may run off to surface water more quickly than it otherwise would. The stream's peak flow may be higher in magnitude and closer in time

to rainfall events. While increasing peak flow during rainy times, the lack of recharge can deprive streams of groundwater inflow when the streams need it the most.

Groundwater Discharge

Groundwater flows through the ground from where it is recharged to where it is discharged. **Discharge** is where water moves from underground to the land surface, either by flowing out to the top of the land surface, or by pumping from wells. Springs are a familiar example of a local groundwater discharge. Groundwater can also discharge naturally to more dispersed areas such as lakebeds and stream banks or stream beds.

In fact, in Washington, groundwater can make up a majority of stream flow, especially in late summer and early fall (Pitz and Sinclair, 1999). This is why groundwater discharge is such an important aspect of maintaining or restoring freshwater habitat.

Discharge of groundwater, whether by pumping or by seeping into streams and springs, can lower the water table if the recharge does not keep up. The effect can be to drop the water level down below the bottom of a well or to dry up a stream.

Sometimes the water table rises and discharges above the land surface. This can fill lakes and streams, create and support wetlands, or even cause flooding if the water has nowhere to drain.

Safe yield (Fetter, 1980) is the amount of naturally occurring groundwater that can be economically and legally withdrawn (discharged) from an aquifer on a sustained basis without impairing the native groundwater quality or creating an undesirable effect such as environmental damage. It cannot exceed the amount of recharge and/or leakage from adjacent strata minus the amount of discharge caused by pumping and natural sources.

The Water Table

In an unconfined aquifer, the water table is the top of where the underground is saturated with water. This is where water levels are measured if groundwater is in a water table aquifer (unconfined or at atmospheric pressure). The water table rises when recharge is greater than discharge.

People can cause the water table level to lower directly by removing groundwater from wells. A second method is by reducing the quantity of recharge. This happens where there is too much paved area (impervious surface) and storm water cannot infiltrate where it formerly did. Lack of recharge, for example during a drought, can also lower the water table level.

Figure 2 (modified from a USGS illustration[30]) shows the effects of a declining water table and why recharge is so important.

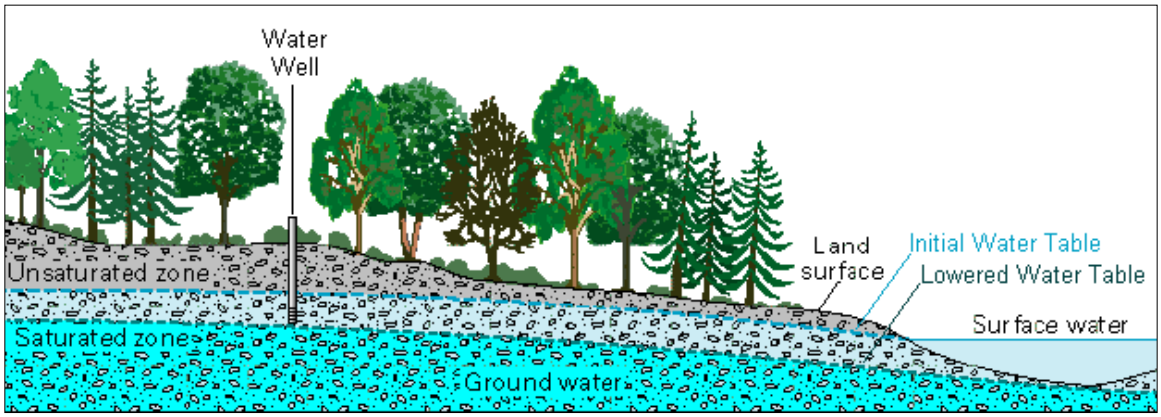

Figure 2: If the groundwater table drops to the lower dashed line, both the stream and the well go dry. The water table lowers when discharge (water out) is greater than recharge (water in).

Hydrogeologic Setting and Susceptibility to Pollution

How do contaminants get to a well? Contaminants may be spilled onto the ground or may leak from an underground tank and travel downward to the aquifer. After reaching the aquifer, contaminants may be carried along with the groundwater flow to a well.

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How groundwater flows through an aquifer – the direction and rate of flow - affects whether a contaminant will show up at a water well. Groundwater flow direction and rate can change seasonally and is impacted by pumping wells.

Although the fate and transport of contaminants are much more complex than an illustration can show, it is useful for explaining concepts.

Figure 3 is an illustration of spills travelling through the ground and reaching groundwater The large arrows indicate regional groundwater flow. The well pumping creates a local zone where groundwater flows to the well (small arrows). The area within an aquifer where groundwater flows to a well is called the capture zone.

The contaminants would be carried along with the flow of groundwater to a well, where a sample would detect contamination. Notably, contamination in groundwater that is

[30] https://www.usgs.gov/special-topic/water-science-school/science/aquifers-and-groundwater?qt-science_center_objects=0#qt-science_center_objects

downgradient of the well, but within the capture zone, can be drawn to the well because of pumping.

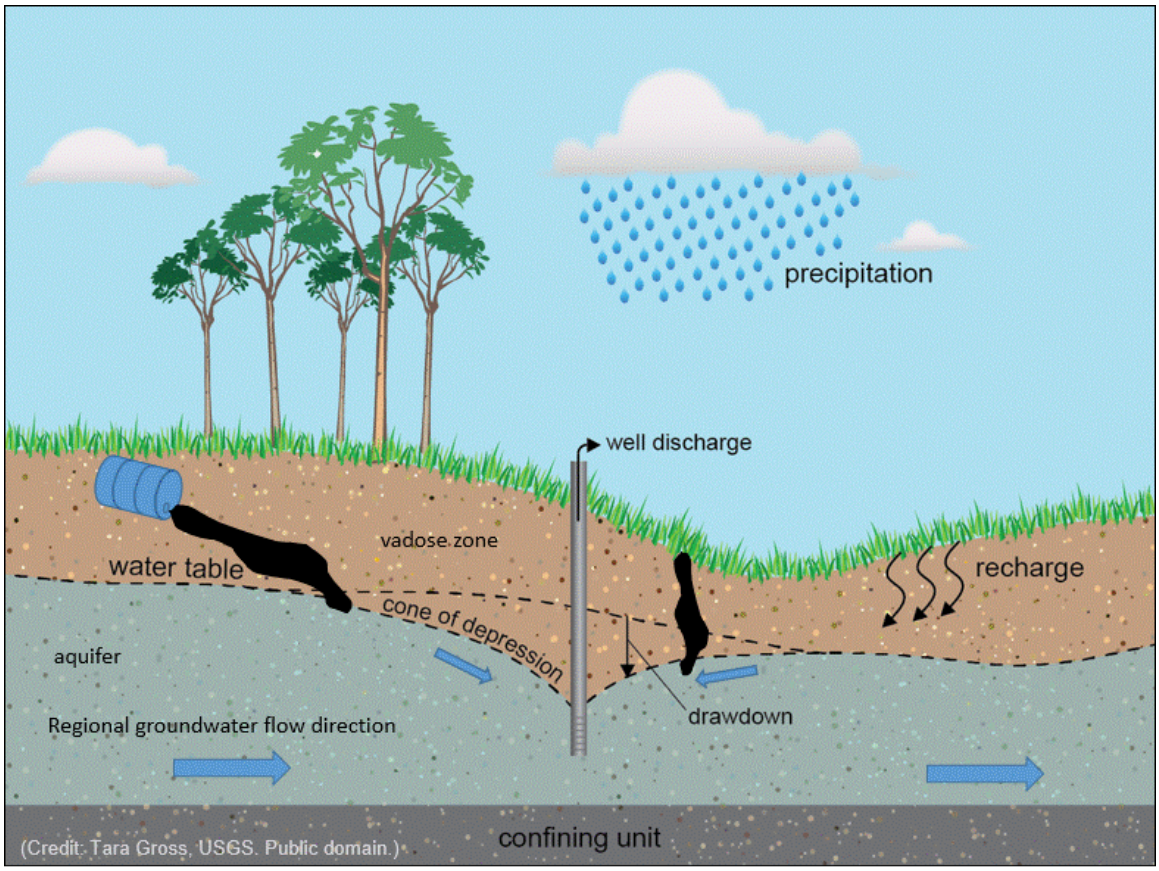

Figure 3: Cross-section illustration of groundwater flow and contaminant paths to a well.

Wellhead protection area time-of-travel zones are generally based on a broad estimate of groundwater flow to a well within an estimated period of time. Some wellhead protection areas are based on groundwater modeling and are more accurate.

The **hydrogeologic setting** is the framework that controls groundwater occurrence and movement. Where groundwater flows, the rate at which it flows, where it recharges and discharges, and how deep it occurs are all functions of what the land is like – the soil, sediments, and rocks that groundwater moves through make up the hydrogeologic setting. The hydrogeologic setting also includes the topography and the weather patterns that control recharge.

Knowledge of hydrogeologic settings is essential for establishing critical aquifer recharge areas. Prioritization of Critical Aquifer Recharge Areas can be based on the susceptibility of those settings to contamination or water quantity impacts.

Susceptibility refers to how easy (or difficult) it is to contaminate groundwater. This is related to what the geology is like. When water can move readily through the ground, it can carry contaminants to groundwater more quickly. Sandy, shallow unconfined aquifers are more susceptible than deep aquifers that are overlain by an aquitard.

Susceptibility is relative. All groundwater used for drinking water is susceptible - Some conditions are more sensitive to contamination than others.

Vulnerability refers to the risk of contamination combined with the risk from the susceptibility of the aquifer. Inventories of potential sources of contamination are helpful for establishing the vulnerability of the aquifer that supplies the critical local drinking water supply.

Because these terms are often used interchangeably, it is important to be sure of the author's meaning when encountering these terms.

Susceptibility factors

- The vadose zone consists of the unsaturated earth materials above an aquifer. Water infiltrates underground through the vadose zone to recharge water table aquifers. Factors of the vadose zone that effect susceptibility are thickness, or depth to water, and travel time.

  Depth to water is the distance through the vadose zone a contaminant must travel to reach the water table.

  In the vadose zone, travel time is the amount of time it takes a contaminant to travel from its release point to the top of the water table. Travel time is affected by the depth to water and the material through which it must pass. The deeper the water table or the more fine-grained material (silt and clay), the longer the travel time.

  Preferential flow paths, such as through fault zones, buried channels, macropores, and poorly constructed wells, can cause travel times to be much shorter than would be expected from the depth to the water table or the amount of fine materials.
- Permeability refers to how easily a liquid or gas passes through a material. Low permeability layers, such as clay or glacial till, may occur between the land surface and an aquifer, either within the vadose zone or within an aquifer system. These layers would restrict downward migration of contaminants and would provide a measure of protection to the aquifer. Low permeability layers can also be referred to as aquitards when they confine an aquifer under pressure. Care should be taken with presuming a confining layer is protective, because layers may not be laterally extensive and may have some feature that allows leakage.
- Infiltration rate is a measure of how fast water and pollutants can move downwards through the earth materials of the vadose zone. The more permeable the ground is, the faster water moves down through it, the more the underlying groundwater is

susceptible to contamination. Coarse sands and gravels allow water to pass through much more quickly than fine silts and clays.

- Chemical retardation is a measurement of how clays and organic matter react with some chemicals to slow their passage or change them chemically.
- Adsorption is a measurement of the tendency of ions dissolved in water to "stick" to particles of silt or clay. The particle size and the amount of soil organic matter affect the adsorption. A sand with no organic matter may not adsorb at all, while an organic silt or clay may adsorb well. In short, a contaminant can be captured or slowed down by adsorbing to clay.
- Hydraulic conductivity is a measure of how fast a quantity of water can move through an aquifer (for a given gradient through a unit area). The higher the hydraulic conductivity, the faster the flow.
- Gradient is the difference in water level elevation between two locations of the water table or the difference in pressure between two locations in a confined aquifer. The higher the gradient, the faster the flow.
- Just as a ball rolls downhill, water flows downhill – from higher water table elevations to lower water table elevations. Water also flows in the direction that pressure is moving it. Just as you can push a ball uphill, high-pressure conditions can push water upwards. Both pressure differences and elevation differences create gradients.
- Groundwater flow direction is determined by gradients, which in turn are influenced by pumping, discharge to surface water, topography, and geologic setting.
- Groundwater flow rate depends on the nature of the geologic materials that water flows through along with the pressure on the water. Coarser materials allow faster flow and higher pressures induce faster flow.

Seawater Intrusion

Seawater, or saltwater, intrusion is a special case that applies to jurisdictions with saltwater shorelines where seawater intrusion is a concern. Near the shore, there is an interface where the denser saltwater underlies fresh groundwater.

Groundwater extraction by a well can cause this interface to be pulled upward toward the well to the point where well water becomes salty. The aquifer in an area where seawater intrusion has occurred may become unusable for drinking water. Seawater intrusion is a difficult and expensive problem to manage, especially in the face of development pressures for shoreline properties.

The Critical Areas Handbook[31] (Washington Department of Commerce, 2018) discusses saltwater intrusion in detail, along with a detailed summary of the Growth Management Hearings Board decision that found that Jefferson County must protect the functions and values of Critical Aquifer Recharge Areas from seawater intrusion. To quote the Handbook: "The Board held the County must classify and designate seawater intrusion areas as critical areas, including best available science in a substantive way."

An excellent source of information is the Seawater Intrusion Topic Paper[32] (Kelly, 2005) that was completed for the Island County WRIA 6 Watershed Planning Process. Please consult these references on seawater intrusion for more detailed information.

Groundwater Monitoring

Groundwater monitoring is used to measure water levels and to obtain water samples for groundwater quality testing. Hydrogeologists use water levels from several wells to estimate the rate and direction of flow, and to track declines or increases in the amount of water in the aquifer.

Hydrogeologists also use water levels and the **well log** to determine whether the well is a water table well or if it is confined.

Water quality samples are used to establish background conditions, find areas that have groundwater contamination, and to track the increase or decrease of contaminants over time. If a well has contamination, it is important to look at potential sources in areas that contribute water to the well (either from recharge, from upgradient sources, or from the capture zone), and make sure that good pollution prevention practices are being followed.

[31] https://www.commerce.wa.gov/serving-communities/growth-management/growth-management-topics/critical-areas/
[32] https://fortress.wa.gov/ecy/publications/SummaryPages/1203271.html

Section 3 - Streamflow, Water Availability, and Permit-Exempt Wells

Efforts to maintain instream flow and efforts to protect Critical Aquifer Recharge Areas share some common goals with respect to water availability, anadromous fisheries, and best available science.

In January 2018, the Legislature passed the Streamflow Restoration law (Chapter 90.94 RCW[33]) that helps restore streamflows to levels necessary to support robust, healthy, and sustainable salmon populations while providing water for homes in rural Washington. The law was in response to the Hirst decision, a 2016 Washington State Supreme Court decision that limited a landowner's ability to get a building permit for a new home when the proposed source of water was a permit-exempt well. The law directs local planning groups to develop watershed plans that offset impacts from new domestic permit-exempt wells and achieve a net ecological benefit within the watershed.

Much of the information developed during streamflow restoration planning efforts can also be used to delineate Critical Aquifer Recharge Areas:

- Understanding where permit-exempt wells are being used for residential water supply helps define locations where groundwater needs to be protected for drinking water supply purposes.
- Knowledge of the relationship between groundwater and streamflows, provides the linkage between groundwater use and instream flows that are necessary to maintain healthy anadromous fisheries.
- Understanding patterns in shallow versus deep groundwater use and how those differences effect the way groundwater pumping depletes streamflow, permits a better understanding of different critical aquifer recharge area needs within the same geographic areas.
- Aquifer mapping and the identification of where groundwater discharges to streams provides basic information required during the identification and mapping of Critical Aquifer Recharge Areas.

[33] https://app.leg.wa.gov/RCW/default.aspx?cite=90.94&full=true

Section 4 - Protecting the Functions and Values of Critical Aquifer Recharge Areas

The **functions and values** of Critical Aquifer Recharge Areas are to provide the public with clean, safe, and available drinking water. In order to accomplish this goal, information is needed about the location and extent of aquifers that supply public drinking water, the susceptibility of these supplies to contamination, and potential contamination risks. In addition, planning, programs, and ordinances are needed to prevent contamination from occurring.

Preventing pollution depends on controlling land use activities to prevent contaminant spills and leaks. Critical Aquifer Recharge Areas are designated so that greater control can occur where land use activities are a high-risk for polluting sensitive aquifers.

Prioritization of Critical Aquifer Recharge Areas can be accomplished by identifying where high-value water resources are located in highly susceptible areas (King County, 2004[34]).

The following steps characterize where groundwater resources are important to the community and how to protect them.

1. **Identify** where groundwater resources are located.
2. **Analyze** the susceptibility of the natural setting where groundwater occurs.
3. **Inventory** existing potential sources of groundwater contamination.
4. **Classify** the relative vulnerability of groundwater to contamination events.
5. **Designate** areas that are most at risk to contamination events.
6. **Protect** by minimizing activities and conditions that pose contamination risks.
7. **Ensure** that contamination prevention plans and best management practices are implemented and followed.
8. **Manage** groundwater withdrawals and recharge impacts to:
    - Maintain availability for drinking water sources.
    - Maintain stream base flow from groundwater to support in-stream flows, especially for salmon-bearing streams.

The following section provides more details about each one of these steps.

[34] https://your.kingcounty.gov/dnrp/library/2004/kcr1562/BAS-Chap6-04.pdf

Step 1: Identify where groundwater resources are located

Identifying the location and extent of drinking water supply aquifers is an essential step in protecting the functions and values of Critical Aquifer Recharge Areas.

Critical Aquifer Recharge Area maps are delineations of where a community's groundwater supply meets criteria such as susceptibility, potential for contamination, and priority.

This section provides explanations of various resources that are useful for identifying the location and extent of drinking water aquifers. A list of internet links to helpful resources is at the end of this section.

Aquifer Maps

Aquifer boundaries are important to identify to give jurisdictions information about where groundwater resources are. When new wells are needed, knowledge of where aquifers may supply water is critical. This knowledge is used in water system planning and is a vital consideration for long-term planning.

Mapping drinking water supply aquifers makes use of well location and well log information as well as the location and characteristics of aquifers.

Aquifer maps are developed during hydrogeologic studies. The main source for aquifer maps are USGS studies.

Well locations are important to identify to help prioritize risk and guide local ordinances and planning near active public wells and areas where residents rely on single domestic wells for drinking water.

The Department of Ecology well log map provides approximate well locations in the center of the Township, Section, Range, Quarter-quarter square. The actual well location may be anywhere within that 40-acre square.

Public Water Supply Wells

Public drinking water supply systems are regulated by the Department of Health under the Safe Drinking Water Act (SDWA). Generally, the state regulates systems with 15 or more residential connections (Group A), and the local health jurisdiction regulates systems with 3 to 14 connections (Group B). Chapter 246-290 WAC[35] is the regulation

[35] https://apps.leg.wa.gov/WAC/default.aspx?cite=246-290&full=true

for Group A Public Water Supplies, and Chapter 246-291 WAC[36] is the regulation for Group B Public Water Supplies.

The SDWA also includes the Source Water Protection Program[37]. Under this program, wellhead protection zones are defined and the susceptibility of the well to contamination is rated. Potential contamination sources within the protection zones are also inventoried.

Wellhead protection zones are delineated as the areas where contamination in the aquifer could reach a well within a specified time period. Time-of-travel periods used by the Department of Health Drinking Water Program are six months, one year, five years, and ten years.

Zones based on these time periods are known as time-of-travel zones. Methods of delineating wellhead protection zones vary from the least accurate method of drawing a circle around the well at a fixed radius to modeling actual travel times based on aquifer characteristics.

These mapped wellhead protection zones may be designated as a category of Critical Aquifer Recharge Area (Chapter 365-190 WAC[38]). A jurisdiction may have stricter requirements for facilities closer to a water supply well. For example, some uses may be prohibited within the one-year time-of-travel zone that are allowed with mitigation in the ten-year time-of-travel zone.

Domestic Wells

Residences that are located too far from a public water supply system must rely on individual wells, springs, or surface water to supply their drinking water. Individual domestic wells are an important and widespread source of drinking water supply in Washington.

Maps of domestic well locations together with well logs help with identifying the location, extent and use of drinking water supply aquifers.

To find information about domestic wells, contact the Department of Ecology Water Resources Program.

State law requires that a well log be filed with the Department of Ecology when a well is constructed. Well log information includes location by address and/or

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[36] https://apps.leg.wa.gov/WAC/default.aspx?cite=246-291&full=true

[37] https://www.doh.wa.gov/CommunityandEnvironment/DrinkingWater/SourceWater/SourceWaterProtection

[38] https://apps.leg.wa.gov/wac/default.aspx?cite=365-190&full=true#365-190-100

township/range/section/quarter-quarter section. Figure 4 illustrates how the Township and Range system relates to locations on the ground.

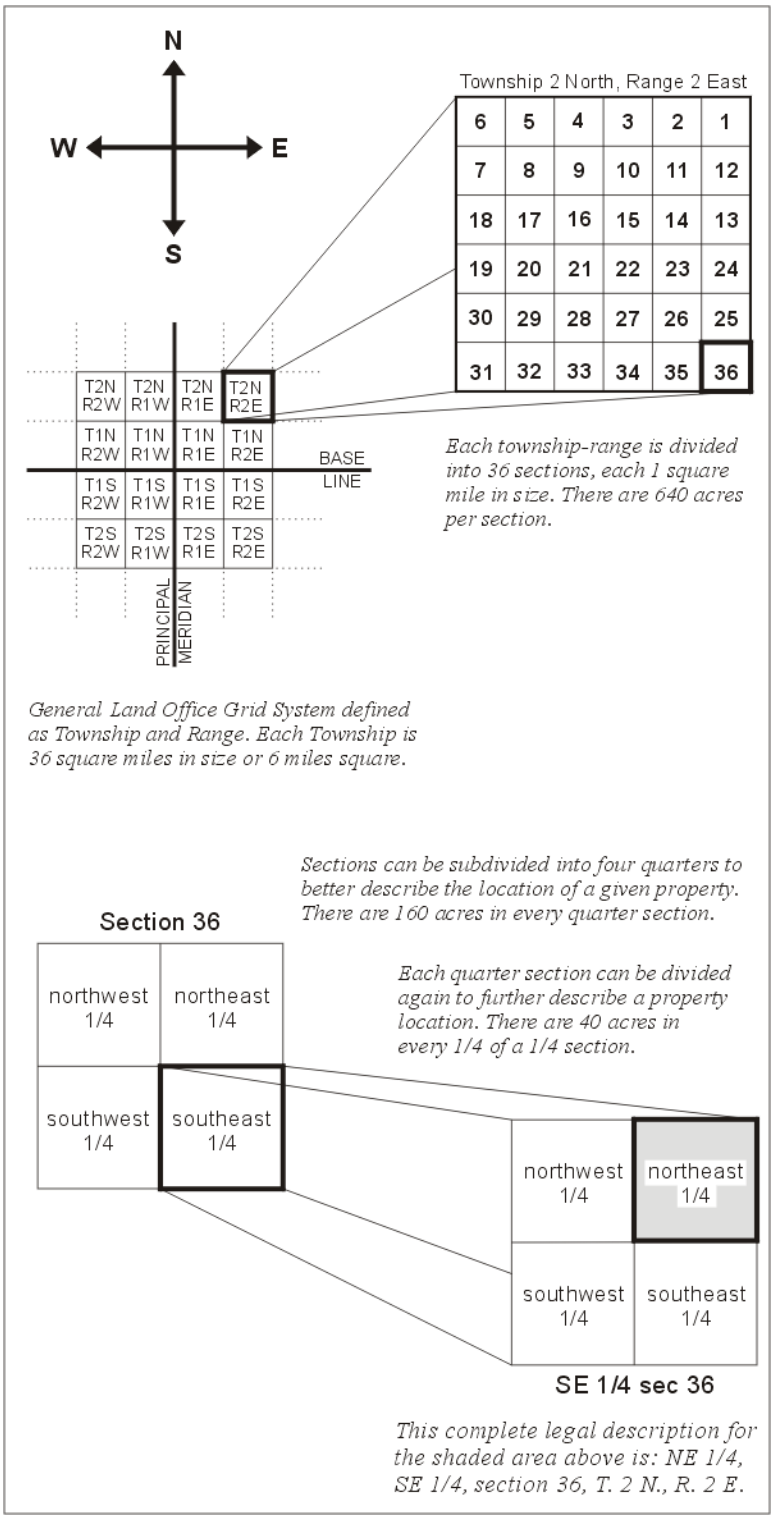

Figure 4: Township, range, section, quarter-quarter, and well location illustration from the Washington Department of Natural Resources

The following should be kept in mind when locating water supply wells when using Ecology's well log map[39]:

- The well locations were created by placing a point at the center of the township/range/section/quarter-quarter square. The actual location of the well is anywhere within that 40-acre square.

  For example, if the center of the square is in a lake, and the actual well location is on shore, the map will plot the well in the lake. The well IS NOT in the lake. There are thousands of well logs, and the locations have not been adjusted individually.

- There are many wells for which well logs have not been submitted, and therefore do not appear on this map.
- Sometimes the location information written on the well log is incorrect, and so the location shown for the well on the map is inaccurate.
- It is up to the well driller to provide accurate information on the well log. The well owner should make sure the location information is correct.

[39] https://appswr.ecology.wa.gov/waterresources/map/WCLSWebMap/default.aspx

Figure 5 is an example map that shows:

- Public water supply wells (Group A) and their protection zones
- Smaller public water supply wells (Group B)
- Wells that serve one or two households
- The location and the extent of a local aquifer

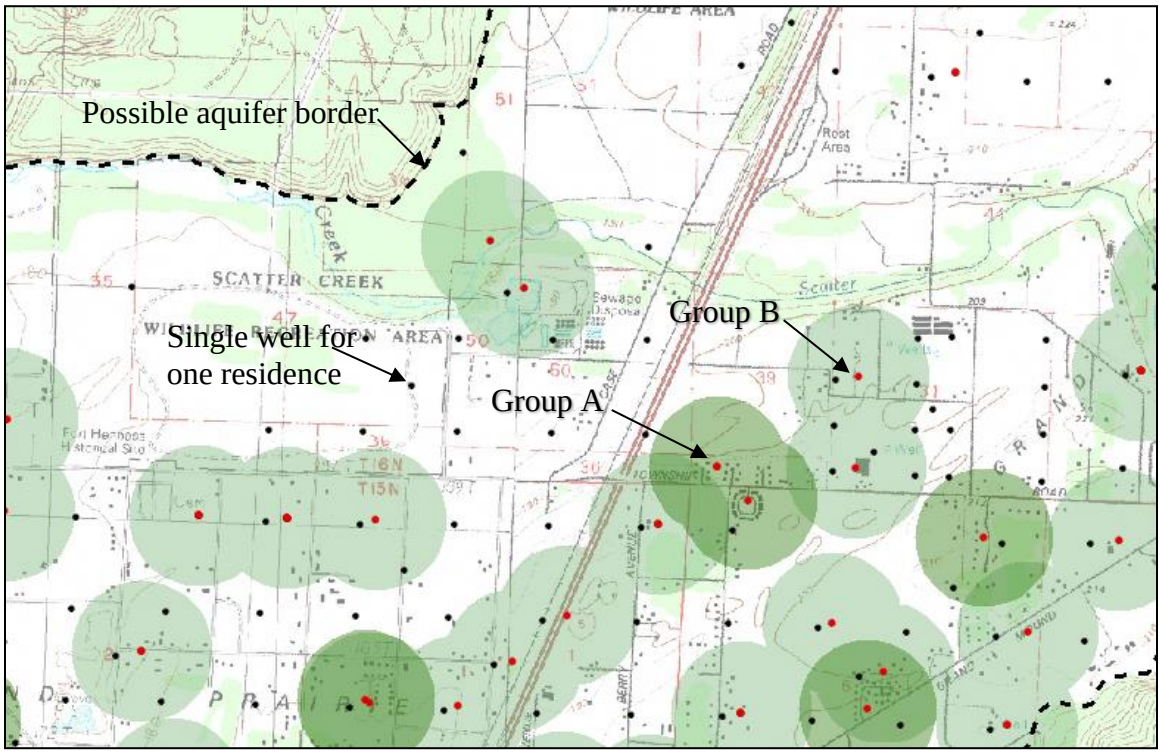

Figure 5: Location, extent, and uses of a drinking water supply aquifer

Note: The single domestic residential wells on this map appear at the nearest quarter-quarter section, NOT where they are actually located on the ground. This is because well logs report locations this way, and that is what we have to use for mapping.

Some of the Methods Hydrogeologists Use to Identify and Characterize Aquifers

Well logs, geologic, topographic, and soil maps, well testing, and field reconnaissance are some of the tools used to identify aquifers.

Figure 6 is a hydrogeologic cross-section. It shows well locations and depths, as well as the geologic formations that the wells draw water from. Hydrogeologists use a combination of methods to understand where groundwater occurs, where it is moving, and how fast. The cross-section depicts the conceptual model developed from this information.

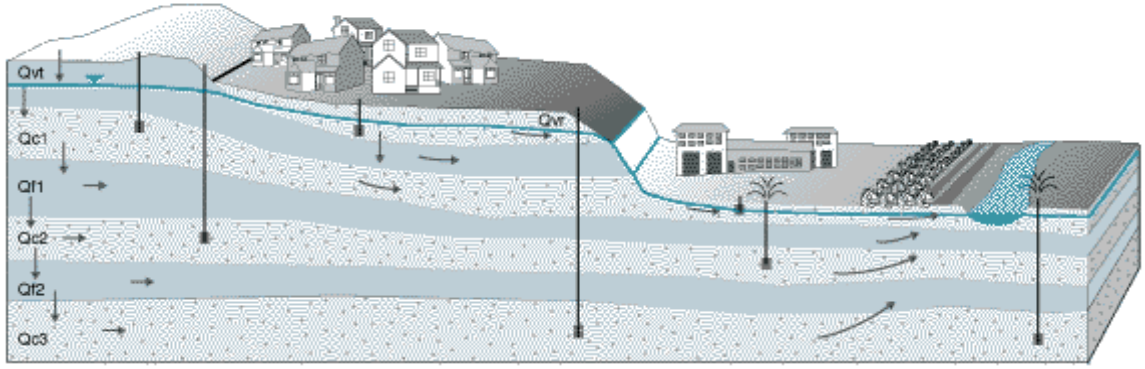

Figure 6: Representation of an aquifer system (Jones, 1999)

Figure 6 Legend

Qvt – Vashon Till semi-confining layer

Qvr – Vashon recessional outwash shallow aquifer

Qc1, Qc2, Qc3 – Confined aquifers

Qf1, Qf2 – Semi-confined units

Water well

Artesian water well

Water table

Vertical or horizontal groundwater flow direction

Well logs contain a variety of information about items that are useful for CARA designation and protection, such as:

- Location of the well
- The kinds and depths of underground materials encountered at the well location (sand, gravel, silt, clay, bedrock, etc.)
- Depth to the aquifer from which well water is being pumped
- Water level in that aquifer at the time of drilling
- An estimate of the amount of water that can be pumped from the well.
- Where the aquifers are and how far they extend. (Many well logs are needed for this analysis.)

Figure 7 is an example of a water well report, or well log for the City of Lacey. The well log shows the geologic materials and water bearing zones encountered while drilling, the well construction details, the water level in the well, and the well yield that was determined during the well test.

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W11448
UNIQUE WELL I.D. # ACR 769
Water Right Permit No. Appl. → G2-29165 - Prelim Permit

(1) OWNER: Name CITY OF LACEY Address P.O.Box 3400, 420 College St. Lacey, WA 98509-3400

(2) LOCATION OF WELL: County Thurston - NW 1/4 NW 1/4 Sec 24 T. 18 N. R. 1W W.M.

(2a) STREET ADDRESS OF WELL (or nearest address) MADRONA PARK SUBDIVISION

(3) PROPOSED USE: ☐ Domestic ☐ Industrial ☐ Municipal ☒ ☐ Irrigation ☐ Test Well ☐ Other ☐ ☐ DeWater

(4) TYPE OF WORK: Owner's number of well (If more than one) "C"
Abandoned ☐ New well XX Method: Dug ☐ Bored ☐ Deepened ☐ Cable XX Driven ☐ Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 16 inches. Drilled 334 feet. Depth of completed well 333 ft.

(6) CONSTRUCTION DETAILS:
Casing Installed: 16" Diam. from +2 ft. to 265 ft.
Welded ☒ Liner installed ☐ Threaded ☐ " Diam. from ft. to ft.
" Diam. from ft. to ft.

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Westco
Type Stainless steel Model No.
Diam. 14" Slot size 150/120 from 265 ft. to 282 ft.
Diam. 14" Slot size 150 from 294 ft. to 306 ft.
14" 150/100 313 326

Gravel packed: Yes ☐ No ☒ Size of gravel
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 130 ft.
Material used in seal ~~Cement Grout~~ Quick Grout
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level 219.53 ft. below top of well Date 6/4/97
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? Hokkaido
Yield: 1025 gal./min. with 2.01 ft. drawdown after 1 hrs.
" 1025 " 2.00 " 2 "
" 1025 " 2.21 " 4.23 "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
0	221.75	10m	219.77	120m	219.7
1 min.	219.69	30m	219.76		
5 min.	219.81	60m	219.70		

Date of test 6/4/97
Bailer test gal./min. with ft. drawdown after hrs.
Airtest gal./min. with stem set at ft. for hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☒ No ☐

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Brown gray sandy till, hard	0'	10'
Gray brown sandy till w/cobbles	10'	69'
Dirty sand and gravel, moist	69'	76'
Brown gray till	76'	79'
Brown clay with gravel	79'	87'
Brown waterbearing sand & gravel	87'	121'
Brown silty sand with gravel	121'	123'
Blue gray clay	123'	133'
Brown silty sand, H_2O	133'	153'
Brown silty sand with clay and gravel, H_2O	153'	163'
Brown sandy silt with gravel, H_2O	163'	195'
Yellowish Sand & Gravel with binder, waterbearing	195'	306'
Brown Sand and gravel with clay lenses	306'	328'
Brown, fine to medium sand with gravel	328'	331'
Brown silty sand with binder	331'	334'
Bottom hole	334'	

Work Started March 21, 1997 Completed June 11, 1997

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME HOKKAIDO DRILLING & DEVELOPING CORP. (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address P.O. BOX 100, GRAHAM, WA 98338-0100
(Signed) (WELL DRILLER) License No. 1146
Contractor's Registration No. HOKKADD178D3 Date JUNE 24, 1997

(USE ADDITIONAL SHEETS IF NECESSARY)

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Figure 7: Well logs include observations about aquifers and the earth materials that overlie the aquifers.

Maps of different types are used to help define the boundaries of aquifers.

Topographic maps show landscape changes that are often associated with aquifer boundaries. (For example, the boundary for a river valley water table aquifer is often where the bedrock slopes up from the valley floor. See Figure 8 below.)

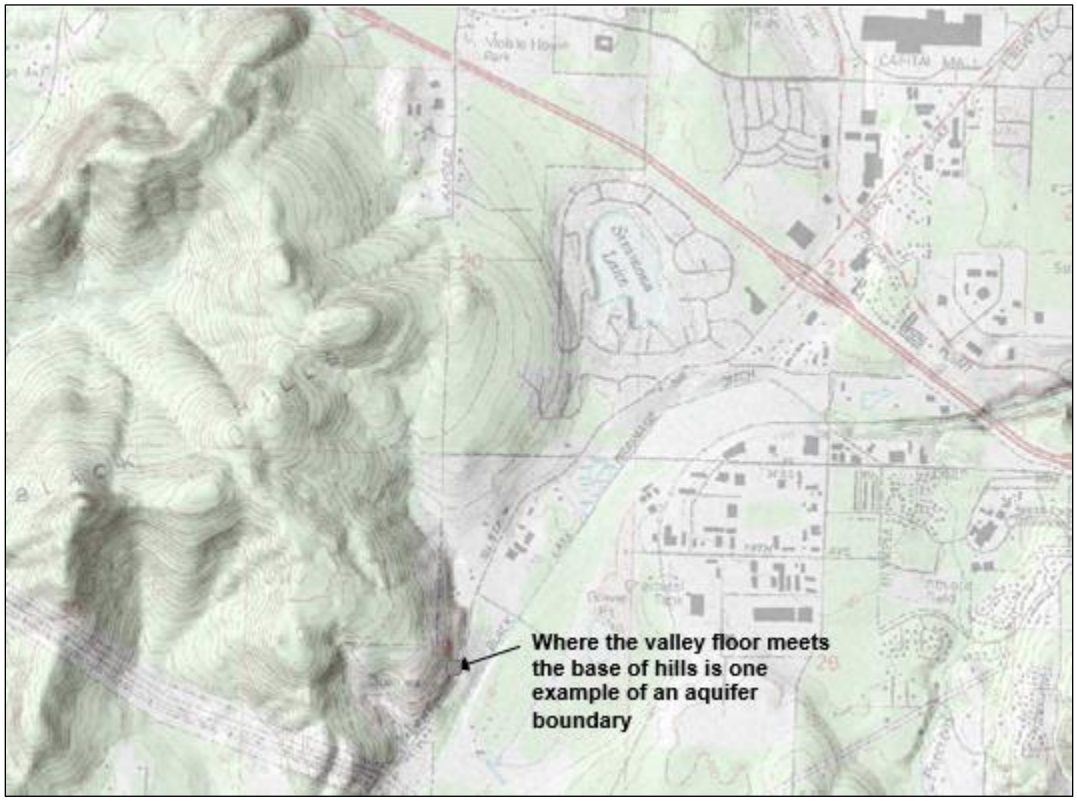

Figure 8: This topographic map shows hilly bedrock next to a flatter river valley. The boundary of the water table aquifer is likely to be where the hills slope up from the valley.

Surficial geology maps show where geologic materials are located that are likely to contain aquifers, such as alluvial deposits. An example is presented in Figure 9 below.

Many testing methods help hydrogeologists to identify and characterize aquifers. For example, aquifer tests involve pumping water out of a well at a known rate and measuring the effect in other nearby wells over time. These tests show how much water can be pumped from a well and how far away other wells may be affected. They may also show to what extent water from one aquifer may leak into another.

Geophysical methods are used to determine underground characteristics such as the nature and geometry of geologic materials, the extent of aquifers, depth to water, and water quality.

Modeling takes all of the available information and observations that a hydrogeologist has and uses the computer to simulate known conditions. It allows a hydrogeologist to model different

(what-if) scenarios and to find out what may happen when various choices are made. Example questions that modeling can address are:

- What would the effect of pumping from a well field be on stream flow?
- If a spill occurred in location A, how long would it take for the contaminants to reach the well at location B?
- How would a drought affect water table levels and stream flows?

Hydrogeology studies look at all the available resources to map and describe aquifers. Consultants, state agencies, academic studies, the U.S. Geological Survey (USGS) and other agencies are sources of this type of information. Numerous environmental firms can be contracted to do these studies for areas where there is not an existing study. These studies can be used to support the identification and characterization of Critical Aquifer Recharge Areas. Figures 9 and 10 show a hydrogeologic map and cross-section from a USGS study in Jefferson County (Simonds, 2004).

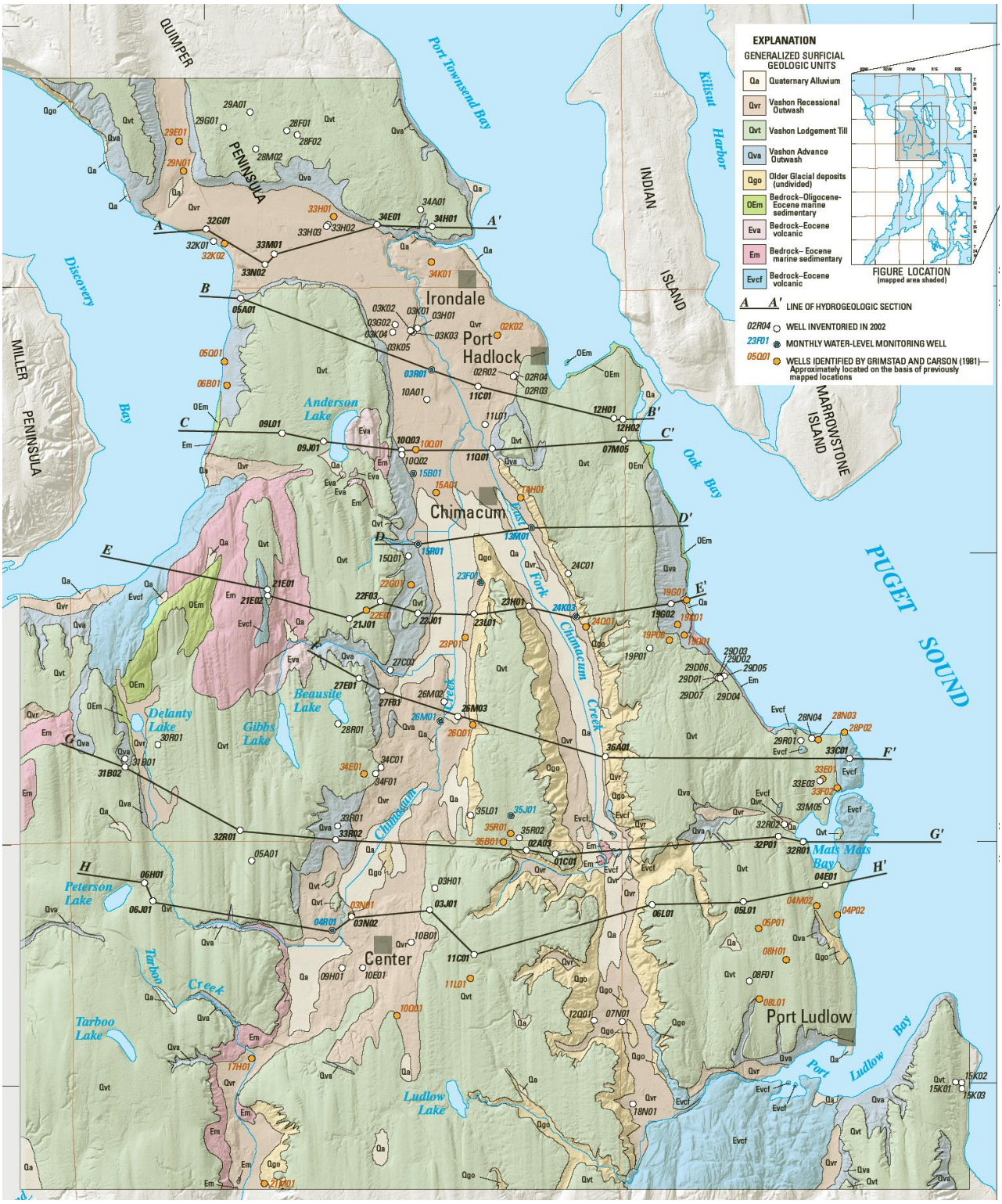

Figure 9: Hydrogeologic map of the Chimacum Basin (Simonds, 2004)

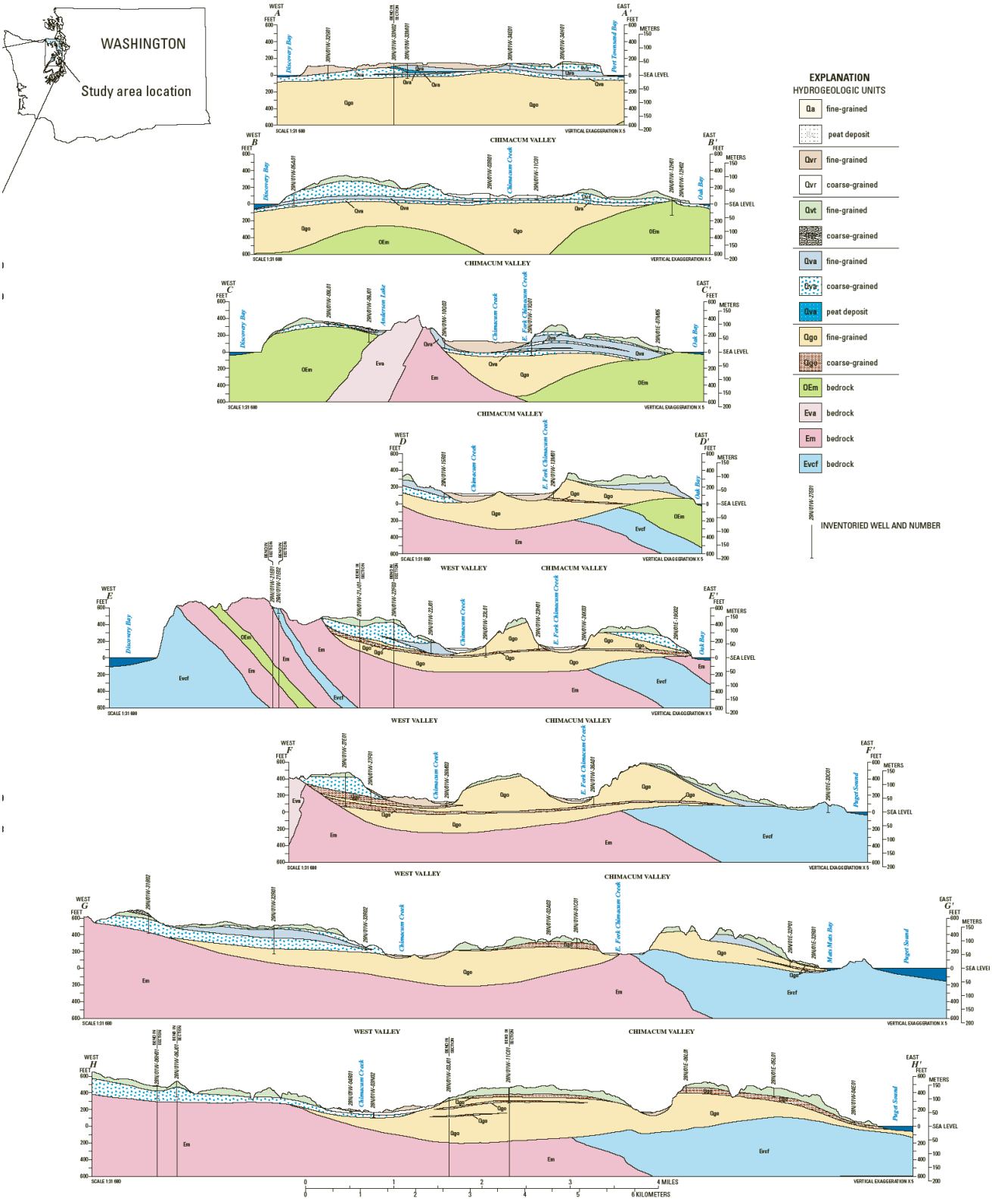

Figure 10: Hydrogeologic cross-sections of the Chimacum Basin (Simonds, 2004)

Resources

The first step is to determine what is already available for the city or county in determining where water resources are located. Here are some useful resources. More resources are listed in Section 5 under Sources for Best Available Science.

- USGS Washington State Groundwater Projects[40]
- USGS Glacial Aquifer System Groundwater Availability Study[41] (maps and data for Washington[42]) (Bayless, 2017)
- Information developed as part of streamflow restoration efforts (e.g. St. Godard (2019), discussed in the Watershed Planning section below) can be useful during identification of Critical Aquifer Recharge Areas.
- Maps of public water supply wells and their protection zones are available on the internet at both of the following websites:
    - Washington State Department of Health Source Water Assessment Program (SWAP) Map[43]
    - Washington State Department of Ecology Facility/Site Application[44]
- Another way of identifying private wells is to compare a parcel map of existing residences with public water supply service areas. Parcels outside of public water supply service areas are likely on individual wells. Parcel maps are generally available from the assessor's office or Washington State Geospatial Open Data Portal[45] (search for parcel), and the public water supply service areas are available on the Washington State Department of Health Source Water Assessment Program (SWAP) Map[46].
- Well logs and maps of well log locations are available online at the Department of Ecology Well Log Viewer[47] internet site has downloadable well logs, well records, and maps of well locations. It is important to read and understand the limitations of the well log application[48]. Hard copies of well logs are also available at the Department of Ecology Regional Offices in Lacey, Yakima, Spokane, and Bellevue. Many counties also maintain copies.
- Environmental monitoring data for both surface water and groundwater is available from the Department of Ecology Environmental Information Management (EIM) system[49].

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[40] https://webapps.usgs.gov/wawscgw/
[41] https://doi.org/10.3133/sir20155105
[42] https://mi.water.usgs.gov/projects/WaterSmart/MapPages/mapWA.html
[43] https://fortress.wa.gov/doh/swap/
[44] https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Facility-Site-database
[45] https://geo.wa.gov/
[46] https://fortress.wa.gov/doh/swap/
[47] https://fortress.wa.gov/ecy/wellconstruction/map/WCLSWebMap/WellConstructionMapSearch.aspx
[48] https://fortress.wa.gov/ecy/wellconstruction/map/WCLSWebMap/siteinformation.htm
[49] https://ecology.wa.gov/Research-Data/Data-resources/Environmental-Information-Management-database#:~:text=Go%20to%20the%20EIM%20Help%20Center%20Use%20the,sediments,%20river%20and%20stream%20water%20quality,%20and%20more.

Keep in mind that any information system may have missing or inaccurate information.

Step 2: Analyze the susceptibility of the natural setting where groundwater occurs.

Susceptibility is a term indicating the relative ease with which a release of contaminants to the land surface may contaminate groundwater. Although the underground is complex, we rely on information about the geologic setting to make some basic judgements about susceptibility. We know, for example, that aquifers in areas made up of coarse unconsolidated geologic materials (such as sand and gravel), have a higher susceptibility than aquifers in areas that have finer grained materials (such as silts and clays) above them.

Along with the characteristics of the contaminant, the characteristics of the vadose zone determines how easily a spill of a contaminant could get down to the water table. Characteristics important for the susceptibility assessment typically include soil type, surficial geology, depth to water, infiltration rate, permeability, chemical retardation factors, adsorption, and the presence or absence of an impermeable layer.

Keep in mind that **Preferential Flow** allows contaminants to travel through the ground faster than expected from the susceptibility factors alone. Because of the complexity of the underground soils and geology, preferential flow is difficult or impossible to take into account. This is another reason why pollution prevention is the best course for protecting groundwater supplies.

In general, information from the following sources can be collected and used to support determinations for Critical Aquifer Recharge Area designation and to document best available science for the record.

Further, it is helpful to look at what other jurisdictions have done. The following are good examples of susceptible drinking water aquifers:

- Spokane County: Spokane Aquifer[50]

  The Spokane County Joint Aquifer Board website has information about the aquifer and what is being done to protect it.

- Thurston County: Scatter Creek Aquifer[51]

  “The goal of the project was to make sure water in the Scatter Creek Aquifer is safe to drink now and in the future. The three-year project included groundwater monitoring, scientific modeling, and community input. A citizen advisory committee evaluated

[50] https://www.spokaneaquifer.org/
[51] https://co.thurston.wa.us/health/ehsc/index.html

scientific data and modeling for potential impacts on the aquifer and made recommendations to the Thurston County Board of Health and Board of County Commissioners. Funding for this project was provided by the Washington State Department of Ecology."

- Walla Walla County: The Gravel Aquifer[52]

  Golder and Associates produced a series of maps of the gravel aquifer in support of Walla Walla County's update of their Critical Aquifer Recharge Area best available science.

The following information is useful for getting a relative indication of the susceptibility of drinking water aquifers to contamination sources.

Groundwater quality sample results

A primary indicator of susceptibility is groundwater samples showing contamination from man-made sources. This means that contaminants have travelled from the land surface to a well already.

The Washington State Department of Health drinking water database (SENTRY[53]) records groundwater quality sampling results for public water systems.

Many jurisdictions require a water well sample when a property is sold.

The USGS National Water Information System (NWIS[54]) has groundwater sample results for wells sampled for USGS studies.

The Ecology Environmental Information Management system (EIM[55]) has a groundwater map and a data application that includes groundwater monitoring data produced by Ecology studies. Data produced from Ecology grant funded studies may also be in EIM.

Source water protection susceptibility rating and travel time

The Department of Health requires that Group A public water supply purveyors complete a susceptibility assessment that results in a susceptibility rating for each public water supply well,

[52] https://www.co.walla-walla.wa.us/document_center/commdev/planning/critical%20areas/SGA%20Figure%201A%20-%209A%20dec%2011.pdf

[53] https://www.doh.wa.gov/DataandStatisticalReports/EnvironmentalHealth/DrinkingWaterSystemData/SentryInternet

[54] https://waterdata.usgs.gov/wa/nwis/nwis

[55] https://apps.ecology.wa.gov/eim/search/default.aspx

based on a number of factors (WAC 246-290-135[56]). These factors include whether or not there is a protective confining layer above the aquifer. This rating and information is a key component of any susceptibility assessment.

The Washington State Department of Health Source Water Protection online map[57] shows time-of-travel zones for public water supply wells and susceptibility ratings.

A susceptibility rating applies to the well with the rating. Nearby wells can have different susceptibilities. For example, a public water supply well may have a susceptibility rating of low due to being a deep well beneath a confining layer, while nearby residential wells are shallow and draw water from above the confining layer.

Individual residential wells are often significantly shallower than public water systems. Many residents rely on individual residential wells for drinking water. The susceptibility analysis to support Critical Aquifer Recharge Area designation should include consideration of susceptibility in areas with these wells.

Along with susceptibility ratings, time-of-travel estimates provide information about how fast a contaminant could move toward the well.

Soil type

The National Resource Conservation Service (NRCS) develops and maintains county soil surveys. County soil surveys are the result of rigorous soil sampling, testing, and mapping. This information is housed in the NRCS' Soils Survey database. This database houses the physical characteristics and spatial distribution of soils.

The NRCS hosts an online tool called Web Soil Survey[58], which gives a user access to soil characteristics and maps. The Washington State NRCS soil survey page[59] has a table that lists areas that can be accessed with the Web Soil Survey, and areas that have an archived electronic copy (pdf) of the soil survey instead.

Important information to be collected from soil surveys includes the infiltration rate and permeability of the surface soils. Some soil surveys may also supply data on chemical retardation factors (such as organic matter content), depth to the seasonal high water table, and the presence or absence of an impermeable layer.

Soil surveys contain information for soil layers to a depth of as much as six feet.

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[56] https://app.leg.wa.gov/wac/default.aspx?cite=246-290-135
[57] https://fortress.wa.gov/doh/swap/index.html
[58] http://websoilsurvey.nrcs.usda.gov/app/
[59] https://www.nrcs.usda.gov/wps/portal/nrcs/surveylist/soils/survey/state/?stateId=WA

Surficial geology

The Washington State Geological Survey maps the geology of the State of Washington in coordination with the USGS.

The Geology Portal[60] is an online map application that displays surficial geology, geologic structure (like faults), and subsurface information[61] (well logs, boring logs).

Geologic maps, cross-sections, well logs, and boring logs have information about geologic materials at depth. Cross-sections often depict the water table and the well locations the cross-sections are based on. The same information sources used for identifying where groundwater resources are located (see Step 1) are useful for analyzing susceptibility.

Well logs

Ecology's Water Resource Program maintains a well log database[62] for wells drilled around the State. The database can be searched by use of text for a location or by a map.

Information from well logs related to susceptibility includes depth to water at the time of well construction, the presence of coarse materials, and the presence or absence of an impermeable layer. Sometimes enough data is reported so that aquifer properties can be determined.

Publications

The same publications that help identify where groundwater resources are located also have information helpful for susceptibility analysis (Step 1, Resources).

Other types of publications that may have useful information include Environmental Impact Statements (EIS), as well as groundwater reports for regulated facilities. See additional links to publications under Section 5.

Step 3: Inventory existing and potential sources of groundwater contamination.

Anywhere that a potential pollutant is used, handled, transferred, or stored is a potential source of groundwater contamination. The release of contaminants from leaks or numerous spills over time creates the potential for groundwater contamination.

Transferring chemicals from one container to another can result in groundwater contamination from many small spills over time.

[60] https://www.dnr.wa.gov/geologyportal
[61] https://geologyportal.dnr.wa.gov/#subsurface
[62] https://appswr.ecology.wa.gov/wellconstruction/map/wclswebMap/

Examples are transferring chemicals from trucks to tanks, floor washing where chemicals are used that goes down the drain to infiltrate into the ground, pumping chemicals from a drum, or leaky pipes that convey chemicals. These might not be noticeable day to day, until a drinking water well sample shows contamination or the site becomes a toxic cleanup site.

Nitrate has contaminated groundwater in many areas of the state above the Maximum Concentration Level of 10 mg/L as N (Morgan, 2016). Nitrate comes from fertilizers, manure, spreading biosolids, and onsite sewage systems.

Fertilizers and pesticides must be carefully managed to avoid contributing to nonpoint contamination of groundwater.

High densities of onsite sewage systems in areas where conditions are susceptible to the migration of contaminants to groundwater pose a risk, especially where there are drinking water wells in the vicinity.

The Ecology online map "What's In My Neighborhood[63]" shows toxic cleanup sites that have been identified and are in the Ecology information system. The Ecology Toxic Cleanup Program Web Portal[64] has links to other reports, such as the Confirmed and Suspected Contaminated Sites List. With this list, sites with confirmed and suspected groundwater contamination can be mapped in relation to aquifer boundaries and proximity to drinking water wells. See Appendix B for a map of these sites as of January, 2020.

Many of these facilities are constructed, maintained, and operated in a way that prevents spills and leaks from getting to the ground as much as is feasible. Some operations, however, are inherently more risky for pollution than others. These would include facilities that handle a large quantity of toxic materials, especially where these toxic materials are transferred or handled, increasing the possibility of an incident leading to a spill.

Stormwater Infiltration

Stormwater that infiltrates into the ground is important for recharging groundwater. Stormwater that washes over roads, parking lots, industrial areas, and even roofs picks up contaminants before the water flows into surface water or infiltrates into the ground. It is important to remove contaminants so that groundwater does not become polluted.

The state has an extensive stormwater permit program that uses stormwater manuals to guide pollution prevention efforts and flow control. These manuals provide extensive guidance on construction stormwater, industrial and municipal stormwater best management practices and stormwater infrastructure requirements to remove contaminants from stormwater before it is

[63] https://apps.ecology.wa.gov/neighborhood/
[64] https://apps.ecology.wa.gov/tcpwebreporting/

released to the environment. These requirements and best management practices also apply to discharges to underground injection control wells (UIC wells) under the state Underground Injection Control (UIC) Program[65].

All stormwater discharge using UIC wells must be registered with the state, including the locations, and meet groundwater protection requirements. Counties and cities also have to register their UIC wells. The state has an online database and query tool for UIC registrations[66].

The UIC program requires the same best management practices for discharge to a UIC well that are required for surface water in the stormwater manuals. All new UIC wells are required to have some form of treatment for stormwater discharges.

Since UIC wells can be a conduit for contamination, it is important to know where they are and be aware of the surrounding land uses and potential contamination sources. It is important to apply BMPs to stormwater discharges to UIC wells to prevent groundwater contamination.

Source water protection contaminant inventories

Public water supply systems with 15 or more connections are regulated by the Washington State Department of Health under Chapter 246-290 WAC[67]. A key requirement of this regulation is a wellhead protection program is that public water systems must inventory potential contamination sources around their water supply wells. The Department of Health works with the Department of Ecology to provide web-based maps of potential contamination sources along with locations of wellhead protection zones. This online tool is the Facility/Site atlas[68].

The GIS cover of facilities and sites regulated by the Department of Ecology can be accessed from the GIS Data website[69], along with many other GIS data sets. These facilities include toxic cleanup sites where releases have contaminated the environment.

Critical Material Inventories

Many jurisdictions require businesses that handle chemicals to submit a critical material inventory so that the jurisdictions know what chemicals are on site. The fire department requires similar reporting. These efforts may be coordinated. See the City of Redmond fire code[70] for a great example.

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[65] https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Underground-injection-control-program
[66] https://apps.ecology.wa.gov/uicsearch/
[67] https://apps.leg.wa.gov/wac/default.aspx?cite=246-290
[68] https://apps.ecology.wa.gov/facilitysite/
[69] https://ecology.wa.gov/Research-Data/Data-resources/Geographic-Information-Systems-GIS/Data
[70] https://www.codepublishing.com/WA/Redmond/municode/Redmond15/Redmond1506.html#15.06.020

Spokane County Critical Materials ordinance[71] (Chapter 3.15) is an excellent example of an ordinance for the purpose of preventing groundwater contamination from chemicals. See Appendix C for more information about Critical Materials and links.

Step 4: Classify the relative vulnerability of groundwater to contamination events.

All groundwater is vulnerable; some areas where strategic public groundwater resources are located are more vulnerable than other areas. The concept of using criteria to create classifications or categories of vulnerability helps local jurisdictions apply the appropriate measures for the risks involved.

The base classification of Critical Aquifer Recharge Areas can be based on susceptibility, and an overlay of existing contamination sources used to give the community an idea of where its strategic groundwater supplies may be most vulnerable (at risk) under current land use conditions.

For new development, classification based on natural conditions (aquifer susceptibility) allows a jurisdiction to make decisions about the type of land uses that should or should not be allowed, or which may be allowed with conditions.

There is more than one way to classify Critical Aquifer Recharge Areas. Here some examples:

- Categories based on susceptibility
    - Water table sand and gravel aquifers
    - Deeper less susceptible aquifers
    - Confined aquifers
- Categories based on set priorities and risk
    - Group A public water supply systems one-year time of travel wellhead protection zone
    - Densely populated areas that rely on ground water
    - Group B public water supply systems wellhead protection zones
    - Rural areas with a high dependence on ground water
    - Discontinuous local drinking water aquifers of limited extent
    - Sole Source Aquifers

71 https://library.municode.com/wa/spokane_county/codes/code_of_ordinances?nodeId=TIT3BUST_CH3.15CRMA&searchText=#TIT3BUST_CH3.15CRMA_3.15.070CRMALI

- Categories based on areas that have the same policies, plans, ordinances, and programs that will be applied.

These examples are not meant to be exhaustive. The categories depend on local hydrogeologic settings, use of the drinking water aquifers, and the actions that a local jurisdiction needs to set in place to protect the public potable groundwater resource.

Step 5: Designate areas that are most at risk to contamination events.

The next step in establishing Critical Aquifer Recharge Areas is to designate areas where the public drinking water supply has been determined to be at risk for contamination. This is done by combining the results of steps 1 through 4 above.

CARA designation is so that local planning and regulation can be guided appropriately, to make it clear:

- Where these areas are located (map) and what the performance standards are (criteria).
- Why these areas are at risk (susceptibility and potential contaminant sources).
- What the importance of this area is to the public drinking water supply (prioritization).

Step 6: Protect by minimizing activities and conditions that pose contamination risks.

There are all too many examples of groundwater contamination here in Washington. Municipal water supplies have been contaminated by industrial or commercial use of chemicals. The city of Tumwater, the city of Vancouver, and the city of Lakewood all have had public water supply wells contaminated. In Eastern Washington, well water turned yellow from Dinoseb, an herbicide spilled at a farm. These events have been expensive to remediate and distressing to the public.

Appendix B is a map of the Department of Ecology Suspected and Confirmed Groundwater Contaminated Sites showing the extent of locations across the state with known contamination.

Anywhere chemicals are stored, handled, transferred, or used is a potential spill or leak risk.

Well owners do not have the regulatory authority that cities and counties do to stop contamination risks or events. Public Water Supply Systems and residents on single wells rely on cities and counties to implement regulations that clearly address protection of the aquifer resource for new developments and existing land uses.

Typically, cities and counties have different departments that administer different aspects of protecting Critical Aquifer Recharge Areas. These include planning, development

services/building permits, public works, and water resources protection (stormwater, groundwater, surface water). Ideally, the relevant departments work together so that everyone involved knows about projects early.

Cities and counties can minimize risk of groundwater contamination by conditioning chemical and land uses and prohibiting very high risk uses in critical areas where such a risk is unacceptable. Some jurisdictions use a table to list land uses that are allowed, allowed with conditions, or prohibited. Two examples are given in Appendix C.

Best management practices (BMPs) are meant to prevent spills and leaks from occurring and potentially infiltrating into the ground. These typically include secondary containment, using covers over outdoor structures where chemicals are used, stored or transferred to prevent contact with rainwater, having a spill plan, and many others. The following resources provide information on pollution prevention (see also Section 6).

- The Washington State Department of Ecology provides guidance on preventing pollution from dangerous waste[72]. This information also applies to the hazardous materials before they become waste, while they are being handled, stored, treated, or transported.
- Hazardous waste collection facilities and programs – Kittitas County Moderate Risk Waste[73].
- The Washington State Department of Ecology Stormwater Manuals for Eastern and Western Washington each have a chapter on BMPs for source control. For the Eastern Washington Stormwater Manual[74], Chapter 8 is on source control (Washington State Department of Ecology, 2019a). For the Western Washington Stormwater Manual[75], Volume IV is on source control (Washington State Department of Ecology, 2019b).
- Municipal Stormwater General Permit Guidance for Cities and Counties[76]: Writing Regulations to Prohibit Illicit Discharges, Dumping, and Illicit Connections.
- The City of Spokane Critical Materials Handbook[77] includes information about best management practices to prevent pollution of the Spokane Aquifer. Much of this information can be applied to other areas.
- The Thurston County Nonpoint Program[78] has an abundance of information. Fact sheets for various pollution prevention practices are on this page, including floor drains[79], secondary containment[80], and others.

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[72] https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Dangerous-waste-guidance/Common-dangerous-waste
[73] https://www.co.kittitas.wa.us/solid-waste/moderate-risk.aspx
[74] https://fortress.wa.gov/ecy/publications/SummaryPages/1810044.html
[75] https://fortress.wa.gov/ecy/publications/SummaryPages/1910021.html
[76] https://fortress.wa.gov/ecy/publications/documents/0810061.pdf
[77] https://spokaneaquifer.org/wp-content/uploads/2012/09/2009-City-of-Spokane-Critical-Materials-Handbook.pdf
[78] https://www.co.thurston.wa.us/health/ehhw/nspo.html
[79] https://www.co.thurston.wa.us/health/ehhw/pdf/fact_sheets/floor_drains.pdf
[80] https://www.co.thurston.wa.us/health/ehhw/pdf/fact_sheets/SecContainmt.pdf

As an example of actions to help minimize contamination, Figure 11 is a poster for preventing Dangerous Waste from spilling or leaking. The same items apply to hazardous materials drums that store chemicals for use, especially when transferring chemicals from the drum to another container.

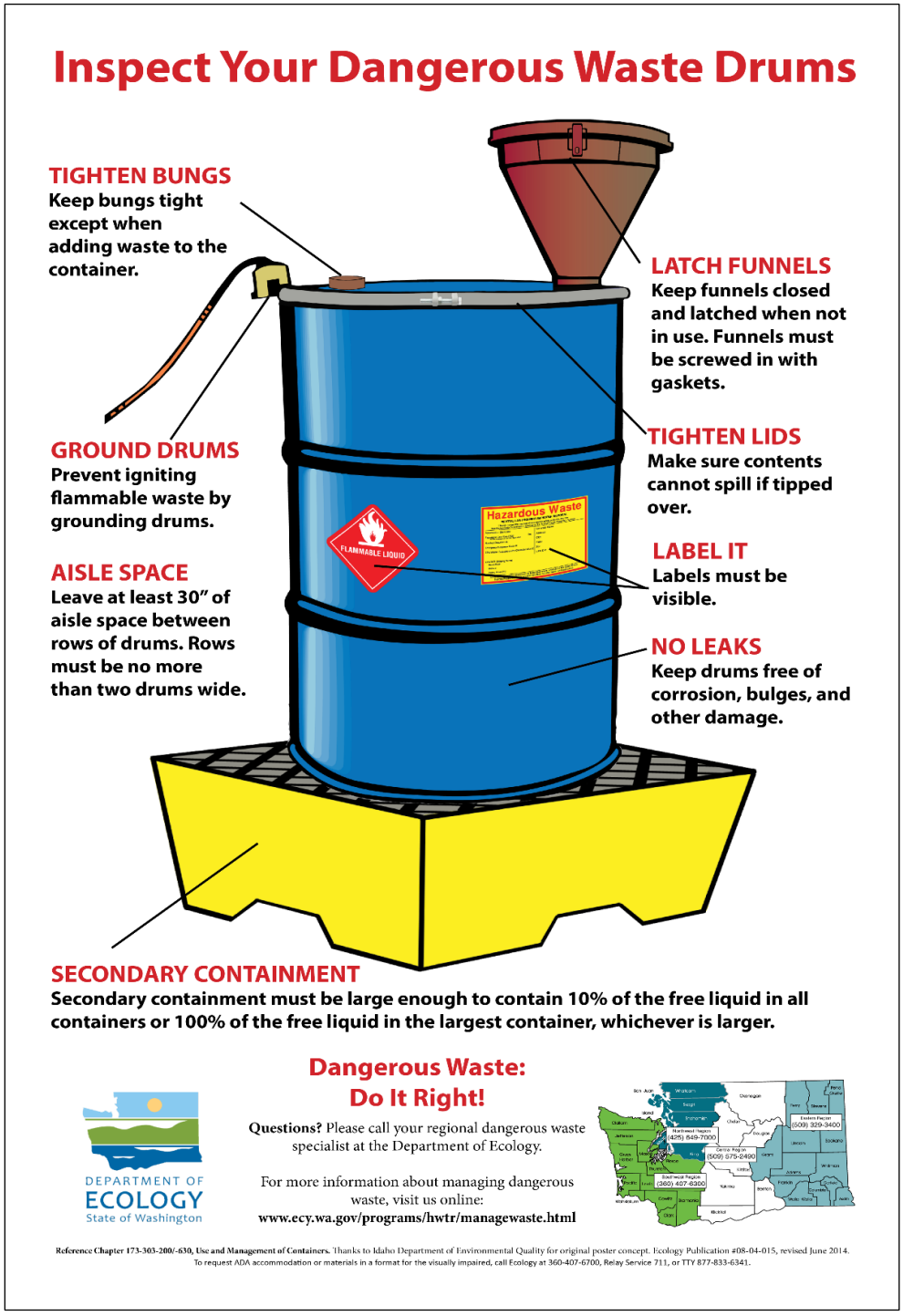

Figure 11: Requirements for Dangerous Waste Drums Poster. For more information, phone 360-407-6700 or email hwtrpubs@ecy.wa.gov.

Step 7: Ensure that contamination prevention plans and best management practices are followed.

Voluntary compliance is very important for pollution prevention. Compliance saves resources both for land owners and jurisdictions. Many jurisdictions have programs to assist land owners and operators in preventing pollution.

The best plans and practices, however, cannot prevent contamination if they are not used. The ability to inspect, obtain compliance, and enforce is needed to make sure that the county or city can stop a threat to groundwater when the land user is negligent or uncooperative.

Local codes need to be written to grant the jurisdiction regulatory authority so that they can require pollution prevention and obtain compliance before a situation contaminates the local drinking water supply.

Ordinances can be specific to the jurisdiction, or a jurisdiction may choose to adopt state or federal laws or rules by reference. Adoption by reference needs to include local authority to enforce, along with any additional ordinances needed to make adoption by reference effective.

Often, county or city hazardous materials pollution prevention programs with associated regulations are operated to prevent local land use activities from creating major toxic cleanup sites.

The City of Redmond has a robust groundwater protection program[81]. Along with development review, the city monitors groundwater quality, groundwater table levels, and monitors contaminated site cleanups. The city also coordinates with Ecology, carries out pollution prevention inspections of businesses, and does outreach to the community.

Step 8: Manage groundwater withdrawals and recharge.

The goals of managing groundwater withdrawals and recharge are to:

- Maintain availability for drinking water sources.
- Maintain adequate recharge so stream-base flow from groundwater to support instream flows is retained, especially for salmon-bearing streams.
- Initiatives under watershed planning, streamflow restoration, aquifer storage and recovery, and stormwater support the GMA goals for water availability.

Recharge

Development has a profound effect on the hydrology of an area. Increases in impervious surfaces and disturbance of natural vegetation result in increasing runoff and decreasing

[81] https://www.redmond.gov/831/GroundwaterWellhead-Protection

recharge. Local jurisdictions can improve recharge by encouraging methods that maintain or increase recharge. Methods include limiting impervious surfaces and promoting stormwater infiltration.

Methods of stormwater infiltration, such as low impact development, storm water infiltration ponds, rain gardens, and underground injection wells are described in the stormwater manuals and in guidance on Low Impact Development (LID).

Many organizations have information about Low Impact Development (LID) resources, including the Department of Ecology Low Impact Development Guidance[82] and the Puget Sound Partnership. The Washington Stormwater Center[83] is a good central place to access LID resources from many different sources.

Water supply planning

The GMA requires that critical areas give special consideration to anadromous fisheries. This overlaps in objectives with the Streamflow Restoration Act of 2018 (codified in Chapter 90.94 RCW[84]) and other watershed planning initiatives. Water supply planning studies typically have information useful for Critical Aquifer Recharge Areas, both for comprehensive plans and best available science.

Streamflow Restoration

The Washington State legislature passed the Streamflow Restoration Act to help restore streamflows to levels necessary to support robust, healthy, and sustainable salmon populations while providing water for homes in rural Washington. This law directs local planning groups[85] in 15 Water Resources Inventory Planning Areas (WRIAs) in the state to create watershed plans that achieve these goals, and Ecology's Water Resources Program has a Streamflow Restoration Section that works with these planning groups on implementation of this law.

Jurisdictions that are planning and implementing plans aimed at streamflow restoration may use the information generated to meet the requirements of the Growth Management Act for Critical Aquifer Recharge Areas, as applicable. Studies related to those plans may be particularly helpful for:

- Watershed planning for water availability for in-stream flow, which applies to the requirement that critical areas plans and ordinances give "special consideration to anadromous fisheries."

[82] https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Low-Impact-Development-guidance
[83] https://www.wastormwatercenter.org/lid-manuals-guides/
[84] https://app.leg.wa.gov/RCW/default.aspx?cite=90.94&full=true
[85] https://ecology.wa.gov/Water-Shorelines/Water-supply/Streamflow-restoration/Streamflow-restoration-planning

- Determining where permit-exempt wells are currently used to supply drinking water for homes.
- Determining where new permit-exempt wells will be located in the future.

A good example of a study that has been used in support of Streamflow Restoration Act efforts was completed by Stevens County for WRIA 59 (St. Godard, 2019). That report includes information on the location of and groundwater use by permit-exempt domestic wells; aquifer characteristics; the relationships between groundwater and surface water; and domestic dependence on aquifers for drinking water both now and in the future. This report also provides a good example of how information on Best Available Science for Critical Aquifer Recharge Areas with special consideration for anadromous fisheries may be obtained from a study designed to address streamflow restoration and permit-exempt well issues.

Watershed Planning

In addition to recent watershed planning conducted in response to the 2018 Streamflow Restoration Act, the 1998 Watershed Planning Act[86] (codified in Chapter 90.82 RCW) provided for water supply planning by local entities within the state's WRIAs. Local entities that formed a WRIA planning unit were required to include at least the counties, the largest city or town within the WRIA, and the water utility that uses the most water. Many of the WRIA planning units engaged in watershed planning between 1998 and 2012. Ecology maintains an archive of watershed planning/management documents[87].

Groundwater Management Areas

Groundwater Management Areas[88] (GWMA) may be established by either the state or local government under RCW 90.44.400. Criteria for identifying potential Groundwater Management Areas include (among others): Aquifer systems that are declining due to restricted recharge or over-utilization, aquifers identified as the primary source of supply for public water supply systems, and geographical areas where land use may result in contamination or degradation of the groundwater quality. Rules governing Groundwater Management Areas and Programs[89] are set forth in WAC 173-100.

Water System Planning

Larger, Group A, water systems regulated by the Department of Health are required to have a water system plan. This plan includes analyses of future water demand and supply, and source water assessment requirements. Public Water Supply Systems must have wellhead protection areas delineated, must do contaminant inventories within those areas, and must notify

[86] http://apps.leg.wa.gov/rcw/default.aspx?cite=90.82
[87] https://ecology.wa.gov/Water-Shorelines/Water-supply/Streamflow-restoration/Watershed-plan-archive
[88] https://apps.leg.wa.gov/RCW/default.aspx?cite=90.44&full=true#90.44.400
[89] https://apps.leg.wa.gov/WAC/default.aspx?cite=173-100&full=true

landowners of potential contaminant sources, as well as state and local agencies of the findings. Smaller water systems are required to have a small water system management program.

Guidance is provided by the Dept. of Health Water System Planning Requirements web page[90]. This includes the Water System Planning Guidebook[91] (Washington State Dept. of Health, 2020).

Drinking water suppliers do not have land use or pollution prevention authority, unless the drinking water purveyor is a government entity like a city. Landowners and regulatory agencies do have the ability to take action to protect water supplies from contamination.

Water Planning under the Growth Management Act

Local governments also include water planning in their comprehensive plans and must meet water supply planning requirements under the Growth Management Act. Mandatory elements of comprehensive plans[92] in RCW 36.70A.070 includes a land use element, which must "provide for protection of the quality and quantity of groundwater used for public water supplies."

Chapter 1 of the Dept. of Commerce Growth Management Services Critical Areas Handbook[93] has a section on Regional Planning Efforts. This section includes information about various state watershed initiatives. Since aquifers often span more than one jurisdiction, counties and cities need to work together to protect the public drinking water resource.

County wide planning policies and inter-local agreements are often necessary in unincorporated portions of the UGA. For example, cities have a vested interest in the type of development that occurs as they may ultimately annex the unincorporated lands within the UGA, but counties often oversee the development and issue the permits. As a result, some jurisdictions develop countywide planning policies or inter-local agreements to ensure the city can review development proposals before they are finalized. Local governments could apply the same model for wellheads and other Critical Aquifer Recharge Areas. For local governments who have GIS capacity, they would include inter-local jurisdictions on maps to ensure areas of concern are easily identified during the county review period and permitting.

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90 https://www.doh.wa.gov/CommunityandEnvironment/DrinkingWater/WaterSystemDesignandPlanning/PlanningRequirements

91 https://www.doh.wa.gov/Portals/1/Documents/Pubs/331-068.pdf

92 https://apps.leg.wa.gov/rcw/default.aspx?cite=36.70A.070

93 https://www.commerce.wa.gov/serving-communities/growth-management/growth-management-topics/critical-areas/

Section 5 - Best Available Science

Best available science to protect the functions and values of Critical Aquifer Recharge Areas

Protecting the functions and values of Critical Aquifer Recharge Areas involves knowing:

- Where drinking water aquifers are
- What the underground characteristics are that transmit recharge and any associated contaminants, to the extent that is practical and available
- Where groundwater is currently used for drinking water
- Where groundwater will be needed for drinking water in the future
- What contamination threats to drinking water already exist
- What measures need to be in place to protect recharge availability
- What measures need to be in place to prevent contamination of recharge
- And for special consideration for anadromous fisheries, how surface water depends on groundwater

Best available science laws and rules

Best available science for Critical Aquifer Recharge Areas is required by the Growth Management Act and is defined by the Washington Administrative Code.

- Chapter 36.70A.172 RCW[94] - Critical areas, designation and protection, best available science to be used.

  In designating and protecting critical areas under this chapter, counties and cities shall include the best available science in developing policies and development regulations to protect the functions and values of critical areas. In addition, counties and cities shall give special consideration to conservation or protection measures necessary to preserve or enhance anadromous fisheries.

- Chapter 365-195-905 through 925 WAC[95]

  Chapter 365-195-905(5)(a) WAC discusses the characteristics of a valid scientific process:

  In the context of critical areas protection, a valid scientific process is one that produces reliable information useful in understanding the consequences of a local government's

[94] https://app.leg.wa.gov/RCW/default.aspx?cite=36.70A.172
[95] https://apps.leg.wa.gov/wac/default.aspx?cite=365-195

regulatory decisions and in developing critical areas policies and development regulations that will be effective in protecting the functions and values of critical areas.

The rule goes on to list the characteristics of a valid scientific process, including peer review, methods, logical conclusions and reasonable inferences, quantitative analysis, context, and references. It then lists sources, including research, monitoring, inventory, survey, modeling, assessment, synthesis, and expert opinion. This section of the WAC is particularly applicable to Critical Aquifer Recharge Areas.

Chapter 365-195-020 WAC[96] discusses using a precautionary approach to address inadequate scientific information, along with using an interim effective adaptive management approach.

In the absence of information, using the precautionary approach to prevent contamination at the land surface is especially important. By the time a contaminant is detected at a well, groundwater is already contaminated. Preventing contamination at the land surface is of paramount importance.

See the Critical Areas Handbook[97] for more on the precautionary approach, which among other things references a court decision where it states: "In the absence of scientific information, the county should adopt a precautionary or no risk approach."

Best available science guidance

Best available science guidance has been published by the Department of Commerce Growth Management Services in the Critical Areas Handbook, which is available online at the Department of Commerce Critical Areas resources web page[98].

The Critical Areas Handbook should be consulted to obtain a good knowledge of how the concept of best available science functions within the Growth Management Act.

The following contains excerpts from the Critical Areas Handbook:

Objective of best available science

The objective of best available science is "to protect the functions and values of critical areas." Science plays a central role in delineating critical areas, identifying functions and values, and

[96] https://apps.leg.wa.gov/WAC/default.aspx?cite=365-195-920
[97] https://www.commerce.wa.gov/serving-communities/growth-management/growth-management-topics/critical-areas/
[98] https://www.commerce.wa.gov/serving-communities/growth-management/growth-management-topics/critical-areas/

recommending strategies to protect their functions and values. (Washington Department of Commerce, 2018).

Availability of best available science

With respect to the **availability** of science, the Western Washington Growth Management Hearings Board found that the best available science is science that is presently available as well as practically and economically feasible.

The Central Puget Sound Growth Management Hearings Board reasoned "that the "best available science" requirement includes the word "available" as an indicator that a jurisdiction is not required to sponsor independent research but may rely on competent science that is provided from other sources . . ."

See also Chapter 365-196-050 WAC Regional and Local Variations[99] for important distinctions related to availability of best available science with respect to smaller jurisdictions. The GMA recognizes the variability of population and available resources across the state.

When Should Best Available Science Be Applied?

1. The Critical Areas Handbook recommends applying best available science upfront, during the planning process.

   Local governments' understanding of where on the landscape critical areas occur, how they naturally function, and how best to regulate land uses that may impact them is important in ensuring that zoning and project permit decisions are being made without the need to complete expensive environmental review and new studies at the permit level. Good upfront planning and the adoption of scientifically defensible development standards should lead to quicker permit decisions.

2. Best available science should also be applied at the time of application.

   Project review may entail that the applicant provides the county or city with information that is supported by best available science. An example would be a hydrogeologic report. This information is especially important to evaluate projects against performance-based standards.

[99] https://apps.leg.wa.gov/wac/default.aspx?cite=365-196&full=true#365-196-050

What are the potential consequences if best available science is not applied?

Failure to apply best available science for critical areas under the Growth Management Act may be appealed to the Growth Management Hearings Board. When the board finds a county or city in noncompliance with the Growth Management Act, the board issues a Compliance Order. Failure to comply with a board order can result in state sanctions and loss of funding. See Appendix D for where to find more information about the Growth Management Hearings Board decisions and court cases related to the GMA and best available science.

Best available science for special consideration of anadromous fish species

Critical Areas requirements of the GMA requires best available science to be used for **special consideration of anadromous fish species**. Science is used to establish where and how groundwater affects streams and other surface water habitats.

Chapter 365-195-925 WAC[100] - Criteria for demonstrating "special consideration" has been given to conservation or protection measures necessary to preserve or enhance anadromous fisheries.

> (1) RCW 36.70A.172(1) imposes two distinct but related requirements on counties and cities. Counties and cities must include the "best available science" when developing policies and development regulations to protect the functions and values of critical areas, and counties and cities must give "special consideration" to conservation or protection measures necessary to preserve or enhance anadromous fisheries. Local governments should address both requirements in RCW 36.70A.172(1) when developing their records to support their critical areas policies and development regulations.

Groundwater quality and quantity

The Growth Management Act requires protection of **water quality and quantity**:

Planning goals include water quality and availability.

- RCW 36.70A.020 – Planning goals[101]
  - Protect the environment and enhance the state's high quality of life, including air and water quality, and the availability of water.

[100] https://apps.leg.wa.gov/wac/default.aspx?cite=365-195&full=true#365-195-925
[101] https://app.leg.wa.gov/RCW/default.aspx?cite=36.70A.020

- Comprehensive plans should address groundwater quality and quantity protection in the land use element.

- RCW 36.70A.070 Comprehensive plans – Mandatory Elements[102]
  - The land use element shall provide for protection of the quality and quantity of groundwater used for public water supplies.

Best available science for Critical Aquifer Recharge Areas, therefore, should address both quality and quantity.

Sources for Best Available Science for Critical Aquifer Recharge Areas

Groundwater scientists rely on a number of standard methods for characterizing the occurrence and movement of groundwater. These methods involve everything from topographic maps, aerial photos, on-the-ground mapping, use of existing maps for soils and geology, well log analysis, aquifer tests, geophysics, water quality testing, water level measurements, monitoring well installations, testing for seepage of groundwater into streams (or from streams into groundwater), and modeling.

There are also dozens of approaches to assessing groundwater vulnerability or susceptibility to contamination in the professional literature. Pollution prevention and best management practices for preventing contamination are widely published.

These methods have **standards of practice**. Some examples, just to name a few, are:

- Quality assurance standards for water quality sampling
- Standard methods for measuring water levels
- Aquifer test methods and standards
- Field methods

The USGS has issued an internal memo describing their role and use of best available science[103] when they are involved in studies involving wellhead protection, groundwater vulnerability, and identification of aquifer recharge areas.

Existing Sources of Information

Local government can use information that local, state or federal natural resource agencies have determined represents the best available science. They can also use information provided by a qualified scientific expert or team of qualified scientific experts.

[102] https://app.leg.wa.gov/RCW/default.aspx?cite=36.70A.070
[103] https://water.usgs.gov/admin/memo/GW/gw00.01.html

Sources that provide scientifically valid information useful for Critical Aquifer Recharge Areas include:

Public water supply data and source water protection information

- The Department of Health Office of Drinking Water Source Water Protection Program[104] is an important and valuable resource. Notable topics that are accessible from this website include:
    - The Source Water Protection Map[105] shows public water supply system time-of-travel zones. Pop-ups show the system name and ID, and lists information about the system, including the well tag ID, well depth, and susceptibility rating.

      The pop-up also has a link to the SENTRY[106] data base, where there is more information, including water quality data. With the well tag ID, you can look for the well log in Ecology's well log database[107].

      Use this map to find public water supply systems in your jurisdiction and associated information.
    - Free source water protection technical assistance;
    - Elements of wellhead protection programs;
    - SENTRY[108], the online database that has water system data, including source well information and water quality data.
- Public Water Supply Systems

  The Department of Health requires public water systems to develop water system plans, complete contaminant inventories, to determine susceptibility, and to coordinate with local government. These are great information sources.

  The easiest way to obtain water system plans is from the public water supply system. Use the Department of Health Source Water Protection (SWAP) map site[109] to identify public water supply systems and sources (wells, springs, etc.) within their area of interest. Then

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104 https://www.doh.wa.gov/CommunityandEnvironment/DrinkingWater/SourceWater/SourceWaterProtection
105 https://fortress.wa.gov/doh/swap/index.html
106 https://www.doh.wa.gov/DataandStatisticalReports/EnvironmentalHealth/DrinkingWaterSystemData/SentryInternet
107 https://appswr.ecology.wa.gov/wellconstruction/map/WCLSWebMap/default.aspx
108 https://www.doh.wa.gov/DataandStatisticalReports/EnvironmentalHealth/DrinkingWaterSystemData/SentryInternet
109 https://fortress.wa.gov/doh/swap/index.html

use SENTRY[110] to obtain contact information for the water supply systems, and obtain information directly from the water supply system.

Alternatively, contact the Department of Health Office of Drinking Water. However, they may not have all the information needed and one may need to reach out to the water supply system anyway.

State, federal, local, academic, and consultant studies

- USGS studies:
  - Washington State Groundwater Projects interactive map[111]
  - USGS Publications[112]
- National Resource Conservation Service (NRCS)
  - Washington NRCS[113] home page
  - NRCS Web Soil Survey[114]
- Ecology information resources:
  - Ecology has information about groundwater resources[115], including many local groundwater programs[116].
  - Ecology groundwater publication search[117], or use the Environmental Information System EIM Groundwater Map Search[118] report finder.
  - Environmental Impact Statements (EIS) are completed for large projects may have groundwater information. The Ecology SEPA Register[119] is the place to look for these types of projects.

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110 https://www.doh.wa.gov/DataandStatisticalReports/EnvironmentalHealth/DrinkingWaterSystemData/SentryInternet
111 https://webapps.usgs.gov/wawscgw/
112 https://www.usgs.gov/centers/wa-water/publications
113 https://www.nrcs.usda.gov/wps/portal/nrcs/site/wa/home/
114 https://websoilsurvey.nrcs.usda.gov/app/HomePage.htm
115 https://ecology.wa.gov/Water-Shorelines/Water-quality/Groundwater/Groundwater-resources
116 https://ecology.wa.gov/Water-Shorelines/Water-quality/Groundwater/Groundwater-resources/Groundwater-information
117 https://ecology.wa.gov/Research-Data/Monitoring-assessment/Groundwater-quality-assessment/Find-groundwater-publications
118 https://fortress.wa.gov/ecy/eimreporting/Map/Map.aspx?MapType=Groundwater&MapLocationExtent=-13873343.3370313%2c5711716.7542974%2c-13028904.807647%2c6275200.77356957&WellsOnlyFlag=True
119 https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-Register

  - Consultant studies for a state-regulated facility, such as toxic cleanup sites, landfills, and Aquifer Storage and Recovery (ASR) projects. To find facilities regulated by Ecology, see the online Ecology Facility/Site application[120].
- Washington State Geological Survey[121]
  - The Washington State Geological Survey at the Department of Natural Resources is an essential source for geologic information, the identification of drinking water aquifers, and their susceptibility.
  - The Geologic Information Portal[122] has a series of online geologic maps that show surficial geology, geologic structure (like faults and folds), and subsurface information[123].
- Consultant studies for local government
- Academic studies

Information developed for other requirements

Information developed for other requirements, such as stormwater studies, the Streamflow Restoration Program (see Section 3), watershed planning, or Ground Water Management Areas, is useful also for best available science for Critical Aquifer Recharge Areas. Use of these sources should be documented for the record.

Smaller jurisdictions can rely on the information generated by public water supply systems, state, and federally required studies for facilities located within their jurisdiction, and other studies as listed above. A literature review helps to document best available science for the record. Asking for volunteers in the community, technical assistance from the state, and applying for grants are ways to augment local resources. (See WAC 365-195-910 (2)[124]).

120 https://apps.ecology.wa.gov/facilitysite/SearchData/ShowSearch.aspx?ModuleType=FacilitySite&RecordSearchMode=New
121 https://www.dnr.wa.gov/geology
122 https://www.dnr.wa.gov/geologyportal
123 https://geologyportal.dnr.wa.gov/#subsurface
124 https://apps.leg.wa.gov/WAC/default.aspx?cite=365-195-910

Section 6 - Working with State and Federal Laws and Rules

The Washington State Growth Management Act and rules refer to how local authorities should coordinate with other government authorities in several places. Three of the concepts contained in the GMA rules that apply to laws and rules follow.

- Local government should consider existing state, federal, and other authority's laws, rules, and permits (WAC 365-196-735 - State and Regional Authorities[125]).
- Local plans and policies may in some respects be adequately implemented by adopting the provisions of such other programs as part of the local regulations (WAC 365-196-830 – Protection of Critical Areas[126]).
- Projects may be approved based on compliance with other local, state or federal rules or laws, providing environmental concerns are mitigated (RCW 43.21C.240 – Project Review Under The Growth Management Act[127]).

The GMA allows jurisdictions to avoid duplication of effort by making use of what is already being done by others. The functions and values of Critical Aquifer Recharge Areas should still be protected.

Success, then, depends on identifying potential contamination sources, identifying other laws, rules, and planning efforts that are relevant to Critical Aquifer Recharge Areas and identifying where local action is needed to ensure protection.

Local jurisdictions need to grant themselves regulatory authority to require pollution prevention and to obtain compliance before a situation contaminates the local drinking water supply. Ordinances can be specific to the jurisdiction, or a jurisdiction may choose to adopt state or federal laws or rules by reference. A county or city may coordinate several programs and codes that prevent pollution, such as stormwater source control, hazardous waste and hazardous materials pollution prevention programs, and fire department regulations. Appendix A is an example of coordinated programs from the City of Issaquah.

State Pollution Prevention Laws and Rules

Washington State Department of Ecology

State laws and rules to prevent pollution are housed under various programs at the Department of Ecology. These include Water Quality, Hazardous Waste and Toxics Reduction,

[125] https://apps.leg.wa.gov/wac/default.aspx?cite=365-196-735
[126] https://apps.leg.wa.gov/wac/default.aspx?cite=365-196&full=true#365-196-830
[127] https://app.leg.wa.gov/rcw/default.aspx?cite=43.21C.240

Toxics Cleanup, Solid Waste, and Water Resources. Ecology lists the rules it administers online[128]. Some jurisdictions adopt some state rules by reference, and some jurisdictions explicitly require that state laws and rules be complied with.

Water Quality Program

The Water Quality Program[129] administers laws and rules for preventing pollution of waters of the state, including underground water.

Water Pollution Control Act

Chapter 90.48 RCW, the Water Pollution Control Act[130], authorizes the Department of Ecology "to control and prevent the pollution of streams, lakes, rivers, ponds, inland waters, salt waters, water courses, and other surface and underground waters of the state of Washington."

Chapter 90.48.080 prohibits discharge of polluting matter in waters of the state[131]:

> It shall be unlawful for any person to throw, drain, run, or otherwise discharge into any of the waters of this state, or to cause, permit or suffer to be thrown, run, drained, allowed to seep or otherwise discharged into such waters any organic or inorganic matter that shall cause or tend to cause pollution of such waters according to the determination of the department, as provided for in this chapter.

Groundwater Quality Standards

Water Quality Standards for Groundwaters of the State of Washington, Chapter 173-200 WAC[132], are rules "to maintain the highest quality of the state's groundwaters and protect existing and future beneficial uses of the groundwater through the reduction or elimination of the discharge of contaminants to the state's groundwaters."

Along with the listed criteria, other important aspects of these standards include antidegradation, technology-based treatment requirements, special protection areas, and implementation and enforcement. The Implementation Guidance for the Groundwater Quality Standards[133] has more information.

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[128] https://ecology.wa.gov/About-us/How-we-operate/Laws-rules-rulemaking
[129] https://ecology.wa.gov/About-us/Get-to-know-us/Our-Programs/Water-Quality
[130] https://app.leg.wa.gov/RCW/default.aspx?cite=90.48
[131] https://app.leg.wa.gov/RCW/default.aspx?cite=90.48.080
[132] https://apps.leg.wa.gov/WAC/default.aspx?cite=173-200
[133] https://fortress.wa.gov/ecy/publications/summarypages/9602.html

Stormwater Pollution Prevention

Stormwater ordinances can be written to prevent pollution of both surface water and groundwater. They can be written to coordinate with state stormwater permits[134] and the underground injection control (UIC) regulations (Chapter 173-218 WAC[135]).

- Illicit Discharge Detection and Elimination (IDDE/ICID) Field Screening Manual[136]
- Underground Injection Control Program[137]

  The guidance for stormwater facilities regulated under the Underground Injection Control program describes the best management practices (BMPs) to reduce solids, metals, and oil from injection wells used along roads and parking areas, or used to collect roof runoff at non-industrial settings.

  The UIC best management practices (BMPs)[138] are now housed in Ecology's stormwater management manuals.

- Stormwater Management Manual for Eastern Washington (2019) - Chapter 5.6[139]
- Stormwater Management Manual for Western Washington, Volume 1.4[140]

  These manuals include requirements for deep UIC wells that are constructed for the purpose of stormwater management:

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[134] https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources
[135] https://apps.leg.wa.gov/WAC/default.aspx?cite=173-218
[136] https://www.wastormwatercenter.org/illicit-connection-illicit-discharge/
[137] https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Underground-injection-control-program
[138] https://fortress.wa.gov/ecy/ezshare/wq/Permits/Flare/2019SWMMEW/2019SWMMEW.htm#Topics/Chapter5_RunoffTreatmentBMPDesign/SubsurfaceInfiltrationUICWells/SubsurfaceInfiltrationUICWells_MiniTOC.htm%3FTocPath%3D2019%2520SWMMEW%7CChapter%25205%2520-%2520Runoff%2520Treatment%2520BMP%2520Design%7C5.6%2520Subsurface%2520Infiltration%2520(Und
[139] https://fortress.wa.gov/ecy/ezshare/wq/Permits/Flare/2019SWMMEW/2019SWMMEW.htm#Topics/Chapter5_RunoffTreatmentBMPDesign/SubsurfaceInfiltrationUICWells/SubsurfaceInfiltrationUICWells_MiniTOC.htm%3FTocPath%3D2019%2520SWMMEW%7CChapter%25205%2520-%2520Runoff%2520Treatment%2520BMP%2520Design%7C5.6%2520Subsurface%2520Infiltration%2520(Underground%2520Injection%2520Control%2520Wells)%7C_____0
[140] https://fortress.wa.gov/ecy/ezshare/wq/Permits/Flare/2019SWMMWW/2019SWMMWW.htm#Topics/VolumeI/UICProgram/UICProgram_MiniTOC.htm%3FTocPath%3D2019%2520SWMMWW%7CVolume%2520I%2520-%2520What%2520Requirements%2520Apply%2520to%2520My%2520Site%253F%7CI-4%2520UIC%2520Program%7C_____0

UIC wells that extend below an upper confining layer and discharge into the underlying vadose zone are designated by Ecology as deep UIC wells. This includes drywells where drilling extends through a surficial till layer into the vadose zone below. Local jurisdictions may impose additional limits on the total depth of these UIC wells based on specific hydrologic conditions and other considerations.

Other considerations that would inform a decision to impose additional limits include whether a site is at an increased risk of accidents or spills; the difficulties inherent in cleaning up vadose zone or groundwater contamination should it occur; and the difficulty ensuring the land use that was originally cited in the UIC well authorization does not change to a higher risk use.

Nonpoint Program

Ecology's Water Quality Program developed Washington's Water Quality Management Plan to Control Nonpoint Sources of Pollution[141] (Nonpoint Plan, Washington State Department of Ecology, 2015). The Nonpoint Plan explains the impact of nonpoint pollutions sources, the regulatory framework, Ecology's efforts toward preventing nonpoint pollution of the waters of the state, and Ecology's role in coordinating with various agencies and entities to control nonpoint pollution.

Ecology's Nonpoint staff work with local landowners, local jurisdictions, and Conservation Districts to prevent nonpoint pollution and correct nonpoint pollution discharges. Ecology provides technical assistance, grant funding, and regulatory backstops while working with landowners on voluntary compliance to implement best management practices. The Nonpoint Plan has chapters on many topics, including sources of nonpoint pollution, and groundwater.

Pollution Identification and Control (PIC) programs identify sources of pollution and works with landowners to control the source. PIC programs, and other nonpoint source control programs, have been adopted by multiple counties. One example of a successful program is the one administered by Kitsap County. The Kitsap County PIC program resulted in re-opened shellfish beds by identifying sources of fecal coliform bacteria and addressing them (Success Story[142], Washington State Department of Ecology, 2017). The same concept of identifying potential sources and addressing them is applicable to nonpoint sources of groundwater pollution. Kitsap County has written the Pollution Identification and Correction (PIC) Program Guidance[143] (Kitsap County, 2014) that describes funding sources and how to implement a program.

[141] https://fortress.wa.gov/ecy/publications/documents/1510015.pdf
[142] https://fortress.wa.gov/ecy/publications/documents/1710011.pdf
[143] https://kitsappublichealth.org/environment/files/PIC_Guidance_Document.pdf

Ecology is working on the Voluntary Clean Water Guidance for Agriculture[144]. Several chapters relate to practices that can help protect groundwater from nonpoint pollution.

The Voluntary Stewardship Program (see Section 1) has overlapping goals with the Nonpoint Plan, which states:

> An effective Voluntary Stewardship Program could complement the protection and pollution reduction goals of federal and state clean water laws by helping to implement the best management practices needed to meet the water quality standards and clean water laws.

Hazardous Waste and Toxics Reduction Program

The Hazardous Waste and Toxics Reduction program enforces Washington's toxics laws, including the Dangerous Waste regulations that many businesses need to comply with. They also offer technical assistance to businesses to reduce or eliminate their use of hazardous chemicals, work to identify safer chemical alternatives, support the development of green chemistry, and test consumer products for toxic chemicals.

The web page lists Hazardous Waste and Toxic Reduction programs and services[145]. These include technical assistance to businesses in partnership with local governments, inspecting large quantity hazardous waste generators, and pollution prevention planning.

The program administers Chapter 173-303 WAC - Dangerous Waste Regulations[146].

Reducing and Eliminating Use of Toxic Chemicals Prevents Groundwater Contamination

The Hazardous Waste and Toxics Reduction Program plays a crucial role in reducing the amount of toxic chemicals used in Washington State by:

- Providing technical assistance to businesses[147] so that they can reduce or eliminate their use of toxic chemicals;
- Working on reducing the amount and toxicity of chemicals used in the state through research and providing information needed to support legislation.

Reducing the amount and toxicity of chemicals used reduces the risk of groundwater contamination.

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144 https://ecology.wa.gov/About-us/Our-role-in-the-community/Partnerships-committees/Voluntary-Clean-Water-Guidance-for-Agriculture-Adv
145 https://ecology.wa.gov/About-us/Get-to-know-us/Our-Programs/Hazardous-Waste-Toxics-Reduction
146 https://apps.leg.wa.gov/WAC/default.aspx?cite=173-303
147 https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Preventing-hazardous-waste-pollution

For example, Ecology is working on reducing PFAS compounds in the environment. Ecology's web page explains what PFAS are[148]:

> PFAS are a large group of perfluorinated and polyfluorinated alkyl substances. These very stable, manufactured chemicals remain in the environment for a long time without breaking down, and some of them build up in people and the environment.
>
> PFAS are water soluble and highly mobile, meaning they can easily contaminate groundwater and can be hard to filter out. Many PFAS transform into highly persistent perfluorinated chemicals in the environment. There are no natural processes that can break down these substances. Exposures could continue for hundreds or thousands of years.

Ecology and the Washington State Department of Health have been developing a Chemical Action Plan[149]. The Chemical Action Plan includes sources of PFAS, exposure routes, health effects, and recommended actions. Actions include rules for drinking water, recommendations for legislation for notifications and restrictions, and managing PFAS contamination in soil and groundwater.

Toxics Cleanup

The Toxics Cleanup Program[150] works to clean up contaminated land and water. Under the Model Toxics Control Act (MTCA)[151], the program also works to prevent pollution from underground storage tanks.

The Toxic Cleanup Program web page is your portal to find out about the cleanup process, regulations, and the online map of cleanup sites: "What's in Your Neighborhood[152]."

Solid Waste Management

The Solid Waste Management program[153] coordinates solid waste and recycling programs in Washington. The program also provides permitting and regulatory oversight for major industrial facilities in Washington. The Solid Waste Management program administers several laws, including Chapter 36.58 RCW - Solid waste disposal[154], and Chapter 70.95J RCW – Municipal

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148 https://ecology.wa.gov/Waste-Toxics/Reducing-toxic-chemicals/Addressing-priority-toxic-chemicals/PFAS
149 https://fortress.wa.gov/ecy/publications/documents/1804005.pdf
150 https://ecology.wa.gov/About-us/Get-to-know-us/Our-Programs/Toxics-Cleanup
151 https://ecology.wa.gov/Spills-Cleanup/Contamination-cleanup/Rules-directing-our-cleanup-work/Model-Toxics-Control-Act
152 https://apps.ecology.wa.gov/neighborhood/
153 https://ecology.wa.gov/About-us/Get-to-know-us/Our-Programs/Solid-Waste-Management
154 http://app.leg.wa.gov/RCW/default.aspx?cite=36.58

sewage sludge – Biosolids[155]. Regulations for solid waste management includes Chapter 173-350 WAC[156].

Water Resources

In addition to administering water rights and the streamflow restoration program, the Water Resources program[157] also administers laws and rules for well construction and for Ground Water Management Areas.

Well Construction:

- Chapter 18.104 RCW – Water Well Construction[158]
- Chapter 173-162 WAC – Minimum Standards for Construction and Maintenance of Wells[159]

Ground Water Management Areas:

- Chapter 90.44.400 through 90.44.430 RCW - Ground Water Management Areas[160]
- Chapter 173-100 WAC - Ground Water Management Areas[161]

Washington State Department of Health

Office of Drinking Water

The mission of the Office of Drinking Water[162] is to protect the health of the people of Washington by ensuring safe and reliable drinking water.

The department administers regulations for various public water supplies. Large systems (15 or more connections) are regulated under Chapter 246-290 WAC[163].

The purpose of this chapter is to ensure

> (a) Adequate design, construction, sampling, management, maintenance, and operation practices; and
>
> (b) Provision of safe and high quality drinking water in a reliable manner and in a quantity suitable for intended use.

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155 http://app.leg.wa.gov/RCW/default.aspx?cite=70.95J
156 https://apps.leg.wa.gov/WAC/default.aspx?cite=173-350
157 https://ecology.wa.gov/About-us/Get-to-know-us/Our-Programs/Water-Resources
158 https://app.leg.wa.gov/RCW/default.aspx?cite=18.104
159 https://apps.leg.wa.gov/WAC/default.aspx?cite=173-160
160 https://app.leg.wa.gov/RCW/default.aspx?cite=90.44
161 https://apps.leg.wa.gov/WAC/default.aspx?cite=173-100
162 https://www.doh.wa.gov/CommunityandEnvironment/DrinkingWater/TheOfficeofDrinkingWater
163 https://app.leg.wa.gov/wac/default.aspx?cite=246-290&full=true

Smaller systems, with less than 15 connections, are regulated under Chapter 246-291 WAC[164]. A few other public water system types are nonresidential where the public uses water, like campgrounds, stores, and schools (see WAC 246-290-020(4)).

In addition to regulating public water supplies, the department administers the Source Water Protection Program[165] (see this website for extensive information). This program includes wellhead protection requirements and contaminant inventory requirements for public water supply purveyors.

Wastewater Management

The department administers regulations for Large Onsite Sewage Systems (LOSS) and Onsite Sewage Systems (OSS). OSS are onsite systems with a design capacity of up to 3,499 gallons per day or less, and LOSS are systems with a design capacity of 3500 gallons per day up to 100,000 gallons per day.

The Local Health Officer has authority and approval over systems with design flows through any common point up to 3,499 gallons per day.

Washington State Department of Health LOSS Program per Chapter 70.118B RCW[166], has authority and approval over:

- Wastewater treatment systems receiving domestic strength sewage at design flows from 3,500 to 100,000 gallons per day that use subsurface treatment or disposal. May include mechanical treatment.
- Any LOSS for which jurisdiction has been transferred to DOH from Ecology in accordance with the statute.

Systems that receive industrial wastewater discharges or that have a design capacity of greater than 100,000 gallons per day are regulated by the Department of Ecology.

Local Health Jurisdictions regulate OSS under local rules that must be at least as stringent as state rules. The state administers the OSS program under Chapter 246-272A WAC[167].

Washington State Department of Agriculture

The Washington State Department of Agriculture (WSDA) administers regulatory programs for pesticide and nutrient management[168] that are important for the prevention of groundwater contamination.

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[164] https://app.leg.wa.gov/wac/default.aspx?cite=246-291&full=true
[165] https://www.doh.wa.gov/CommunityandEnvironment/DrinkingWater/SourceWater/SourceWaterProtection
[166] https://app.leg.wa.gov/rcw/default.aspx?cite=70.118B
[167] https://app.leg.wa.gov/wac/default.aspx?cite=246-272A&full=true
[168] https://agr.wa.gov/departments/pesticides-and-fertilizers

WSDA is the State Lead Agency (SLA) for administering the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). WSDA is responsible for developing pesticide use regulations and managing pesticide use and distribution in Washington State. WSDA has the authority to regulate pesticides and to prevent contamination of surface and groundwater from pesticides statutorily through Washington's Pesticide Control and Pesticide Application Acts (Chapters 15.58 RCW and 17.21 RCW). WSDA's Pesticide Management Division and Natural Resources Assessment Section work together to implement FIFRA at the state level.

Pesticide Management Division

Registration Services Program – Fertilizers and Pesticides

Following federal and state regulations the Registration Services Program reviews and registers pesticide and fertilizer products for distribution and use in Washington State. Fertilizer Compliance is a branch within Registration Services and enforces state regulations relating to the registration, distribution, storage, and guarantee of analysis of fertilizers.

State pesticide regulations related to pesticide registration are found in the Washington Pesticide Control Act Chapter 15.58 RCW[169] and General Pesticide Rules Chapter 16-228 WAC[170]. State fertilizer regulations related to fertilizer registration and compliance are found in Fertilizers, Minerals and Limes Chapter 15.54 RCW[171] and Chapter WAC 16-200[172]. Fertigation rules (the application of plant nutrients through irrigation systems) is found at WAC 16-202[173] Part 6.

Pesticide Compliance Program

The Pesticide Compliance Program enforces state and federal pesticide laws and rules, and structural pest inspection rules. Compliance staff work out of six locations across the state: Moses Lake, Olympia, Spokane, Tri-Cities, Wenatchee and Yakima. The primary Compliance activities are inspection, investigation and providing regulatory update presentations to licensed applicators, growers and other stakeholders at winter conferences and meetings. The program conducts inspections of pesticide applicators (Ag and Non-Ag), dealers, pesticide manufacturers and marijuana growing operations. Investigations are conducted when pesticides are alleged to have been misused causing human exposure or property damage, improper distribution, improper licensing or other violations of pesticide laws and rules. Inspection and investigation authority is based on FIFRA, the Washington Pesticide Control and Pesticide Application Acts (Chapters RCW 15.58 and RCW 17.21), General Pesticide Rules Chapter 16-228 WAC, Rules Relating to Chemigation Chapter 16-202-1001 WAC, Secondary and Operational

[169] https://apps.leg.wa.gov/RCW/default.aspx?cite=15.58
[170] https://apps.leg.wa.gov/WAC/default.aspx?cite=16-228
[171] https://apps.leg.wa.gov/RCW/default.aspx?cite=15.54
[172] https://apps.leg.wa.gov/WAC/default.aspx?cite=16-200
[173] https://apps.leg.wa.gov/wac/default.aspx?cite=16-202

Containment for Bulk Pesticides Chapter WAC 16-229, Rules Relating to Restricted Use Herbicides Statewide Chapter 16-230-600 WAC, Rules relating to Applications in sixteen Eastern Washington Counties (Chapters 16-230-800, 16-231, 16-232 WAC), Worker Protection Standards Chapter 16-233 WAC, and Rules relating to Wood Destroying Organisms Chapter 16-228-2005 WAC.

Licensing and Recertification Program

The Licensing and Recertification Program is responsible for implementation of the Federal Certification and Training (C&T) Rule, 40 CFR 171, through the Pesticide Control and Application Acts (Chapter 15.58 RCW and 17.21 RCW) and the General Pesticide Rules (Chapter 16-228 WAC). This program oversees the initial and continued certification of pesticide applicators throughout the state of Washington in accordance with state and federal regulations. Pesticide applicators must meet specific competency and recertification standards in their areas of work to obtain and maintain their certification.

In 2017, EPA updated the C&T Rule to include expanded competency standards specifying ground and surface water contamination prevention. Competency standards are in place to establish a baseline knowledge in the safe application of pesticides for the protection of human and environmental health and prevention of misapplication, reducing the risk of contamination of drinking water resources particularly in critical areas.

Secondary Containment Requirements

Chapter 16-201 WAC - Bulk Fertilizer[174]

This state rule established uniform standards for secondary containment of permanent bulk fertilizer storage sites. These rules were put in place to ensure that surface water and groundwater are protected.

Chapter 16-229 WAC - Bulk Pesticides[175]

This state rule established uniform standards for secondary containment of permanent bulk pesticide storage, operational areas and permanent mixing load sites. These rules were put in place to ensure that surface water and groundwater are protected.

Dairy Nutrient Management Program

Through Chapter 90.64 RCW Dairy Nutrient Management Act[176], the Dairy Nutrient Management Program (DNMP) regulates water quality associated with licensed cow dairies. DNMP requires dairies to obtain nutrient management plans[177], prevent discharges to surface

[174] https://apps.leg.wa.gov/WAC/default.aspx?cite=16-201&full=true
[175] https://apps.leg.wa.gov/WAC/default.aspx?cite=16-229&full=true
[176] https://agr.wa.gov/washington-agriculture/laws-and-rules/livestock-nutrients
[177] https://agr.wa.gov/departments/land-and-water/livestock-nutrients/nutrient-management-plans

and groundwater, and to maintain records to demonstrate an agronomic application of nutrients.

Chapter 16-611 WAC Nutrient Management[178] defines recordkeeping requirements and specifics regarding penalties for violations of the Dairy Nutrient Management Act.

A Memorandum of Understanding[179] with the Washington State Department of Ecology outlines the responsibilities of the two agencies to protect water quality from livestock impacts.

Natural Resources Assessment Section

The WSDA Natural Resources Assessment Section (NRAS) focuses on the impacts of agricultural chemicals on Washington State's natural resources. NRAS works with the agricultural community and regulators to protect the environment and support agricultural viability.

To support the protection of water quality, NRAS collects data on commodity specific pesticide usage from agricultural producers and pesticide applicators. Additionally, NRAS's Agricultural Land Use Program[180] maps agricultural production at the field scale (greater than 0.5 acres). Georeferenced data collected in this program includes (but is not limited to) acreage, crop type, crop group, and irrigation method. This information can be used to estimate the geographic locations that pesticide applications may occur. These two databases influence the implementation of the Washington State Pesticide Management Strategy[181] (Cook and Cowles, 2009) Water Quality Protection plan.

Pesticide Management Strategy

As the SLA for administering FIFRA, WSDA is required to assess the impact of pesticides that have the potential to occur in surface and groundwater at concentrations approaching or exceeding a human health or ecological reference point.

WSDA NRAS has limited monitoring and data resources available to adequately evaluate pesticide occurrences in groundwater or explore (via monitoring) areas identified as vulnerable to pesticides of concern. Public water supply system (PWSS) sampling as required by the Washington State Department of Health (DOH) is the only consistent, on-going, statewide groundwater monitoring effort at this time. NRAS relies on groundwater data collected by PWSS and supplements that data with that collected by other agencies and organizations, which employ strict quality control and quality assurance measures, as a baseline for assessing the presence of pesticides in groundwater.

[178] https://app.leg.wa.gov/WAC/default.aspx?cite=16-611
[179] https://agr.wa.gov/fp/pubs/docs/mouagricultureecology2011final.pdf
[180] https://agr.wa.gov/departments/land-and-water/natural-resources/agricultural-land-use
[181] https://agr.wa.gov/getmedia/0c325688-56e5-44c9-8789-ebd35c315fcb/comprehensivepesticidemanagementstrategy.pdf

NRAS reviews the PWSS data annually to compare pesticide detections to EPA established drinking water standards. As funding allows, NRAS will conduct groundwater investigations based on the confirmed pesticide detections from PWSS. For example, NRAS has been investigating occurrences of DCPA (herbicide, trade name Dacthal) in Eastern Washington where DCPA concentrations have been detected at levels approaching an EPA established drinking water standard.

The state Pesticide Management Strategy outlines the process to protect groundwater from pesticides. The concentration of pesticide detections are compared to the EPA established drinking water standards (reference points). Initial actions include evaluating the extent of the pesticide occurrence, working with registrants and producers to determine the source, and identifying voluntary Best Management Practices in partnership with local conservations districts. For pesticides with confirmed detections between 75-100% of a drinking water standard, final actions WSDA may consider include use prohibition areas or other enforcement actions.

Groundwater Pesticide Detection levels are characterized as follows:

Table 1: Washington State Department of Agriculture groundwater detection levels

Level	Percent Detection of an EPA reference point
Level 1	Confirmed detection between 10-20% of an EPA reference point
Level 2	Confirmed detection between 20-50% of an EPA reference point
Level 3	Confirmed detection between 50-75% of an EPA reference point
Level 4	Confirmed detection between 75-100% of an EPA reference point

Washington State Conservation Commission and Conservation Districts

The Washington State Conservation Commission[182] (SCC) is the coordinating state agency for all 45 conservation districts[183] in Washington State. Together, the SCC and conservation districts provide voluntary, incentive-based programs that empower private landowners to implement conservation on their property (website excerpt[184]).

Conservation Districts provide a wide range of services that are non-regulatory and voluntary. These include helping land owners manage nutrients and pesticides, as well as implementing

[182] https://scc.wa.gov/about-the-commission/
[183] https://scc.wa.gov/about_conservationdistricts/
[184] https://scc.wa.gov/about-the-commission/

irrigation efficiencies. Conservation Districts manage grants that help landowners implement best management practices.

Conservation Districts also conduct research and studies that are important for understanding the state of natural resources, obtaining grants from various funding sources to do this work.

The Conservation Districts are typically the lead entity for the Voluntary Stewardship Program (see Section 1).

Identifying Gaps in Protection

Federal and state laws and rules do not replace local planning, ordinances, and programs.

Local government can focus on local conditions in a way that the state cannot. Local jurisdictions should maintain the ability to protect groundwater under their own authority by including that authority in local ordinances.

Land use planning at the local level is the most effective way to influence where facilities choose to locate. Local government planning can influence the types of future developments that occur in various areas and may be able to encourage potentially contaminating facilities to locate in areas where the aquifer has a lower susceptibility if contaminants are released.

- Counties and cities:
    - Regulate land use through comprehensive planning, zoning, and ordinances.
    - Have authority to ensure a landowner does not pollute the public drinking water supply.
    - Are able to track conditions and adapt to local concerns much more readily than the state.
- Federal and state laws, rules, and programs are often targeted toward larger facilities. For example, pollution prevention plans are required by the state if a facility generates 2,640 pounds of hazardous waste a year. A much smaller quantity of hazardous chemicals can cause contamination, especially if improper disposal into a septic system or a dry well occurs. The local jurisdiction should consider requiring pollution prevention plans where needed and not already required.
- Compliance depends on state resources to enforce. The state covers a large area and a large number of facilities, and therefore illegal activities may occur that are not detected by the state until contamination has occurred. Local attention can focus on facilities in their immediate jurisdiction and respond much faster to potential contamination issues.

This underlines why it is so important for a local jurisdiction to have included authority to act when there is a contamination threat to the local drinking water supply.

Prohibited and Conditioned Uses

Some land use activities, such as landfills, have been found to be a high-risk for groundwater contamination. Although a high-risk use may be regulated by other authorities, local jurisdictions should consider prohibiting these uses from being located within high-risk high-priority Critical Aquifer Recharge Areas. Where these uses are already sited, they should be closely monitored and strict pollution prevention requirements followed.

Examples of uses that should be considered for prohibition in Critical Aquifer Recharge Areas are landfills, wood treatment facilities, metal platers, tank farms, and facilities that treat, store, or dispose of hazardous waste. Chemical facilities that transfer or use large amounts of chemicals should also be considered to be a risk for groundwater contamination.

Some uses that have a moderate to low risk for contamination can be allowed within Critical Aquifer Recharge Areas conditionally on meeting certain requirements for approval. These are typically pollution prevention measures such as secondary containment for chemical storage areas, spill prevention measures, and contingency plans for emergencies.

Here are some questions the local jurisdiction should consider when coordinating their planning and ordinances with federal and state laws, rules, and programs.

- Does the local jurisdiction know where potentially polluting activities are located?
- Are effective protective requirements for potentially polluting activities in place?
- Is there provision for compliance monitoring?
- Is there a means to obtain compliance if there is a violation?
- Does the jurisdiction have a plan for ensuring that existing land uses are protective of groundwater?

Section 7 - Adapting to Local Conditions and Settings

The Growth Management Act allows for differences in regional or local conditions.

See WAC 365-196-050 Regional and Local Variations[185] and the Department of Commerce Critical Areas Handbook[186].

Washington has varied landscapes and populations, from sparsely populated rural areas to large cities, from dry desert to rain forest.

Ferry County has a population of 7,830 (2019 estimate). Republic, the county seat, has a population of 1,100 people. Ferry County is located in the mountainous Okanogan region where ponderosa pines flourish in the dry climate.

King County has both populous and rural areas and has varied landscapes, from the Puget Sound to the high plateau in the shadow of Mount Rainier. The total population of King County was 2,226,300 (2019 estimate).

The settings in which groundwater recharge occurs, the resources for programs, and the resources at risk vary in different parts of the state. This means that a program that protects the functions and values of Critical Aquifer Recharge Areas in one part of the state will not necessarily look like a program in another.

The Western Washington GMA Hearings Board (WWGMHB) states:

> The GMA does not require a "one size fits all" approach. A GMHB is to be guided by a common sense appreciation of the size and resources of a local jurisdiction and the magnitude of the problems to be addressed. *MCCDC v. Shelton* 96-2-0014 (FDO 11-14-96).
>
> The fundamental requirement of the Growth Management Act is that the functions and values of the critical area should be protected. For Critical Aquifer Recharge Areas, that means that public drinking water quality and quantity should be addressed in planning and ordinances.

A good critical aquifer recharge area program:

- Identifies groundwater resources at risk.
- Identifies threats to groundwater.
- Requires pollution prevention.
- Supports recharge.
- Monitors to make sure a condition that could cause an unacceptable risk is not occurring.
- Educates and informs people so that they can do their best to protect groundwater
- Takes action when necessary!

[185] https://apps.leg.wa.gov/wac/default.aspx?cite=365-196&full=true#365-196-050
[186] https://www.commerce.wa.gov/serving-communities/growth-management/guidebooks-and-resources/

Section 8 - Adaptive Management – Change Happens

The GMA requires periodic review and update of plans and ordinances for critical areas. In addition, when the scientific information for addressing critical areas is inadequate, it requires that adaptive management be used in order to determine the impacts on the critical areas from development regulations, and to reduce those impacts to protect the functions and values of the critical areas - Chapter 365-195-020 WAC[187].

Adaptive management involves strategic testing of hypotheses and related monitoring to see how well plans, ordinances, and programs are protecting Critical Aquifer Recharge Areas. Changes to permits, permitting, programs, and policies are then made as conditions change, or to improve or correct a method of protection as needed. Monitoring data results can also lead to changes in how monitoring is done and what is monitored. The comprehensive plan and development regulations should include an iterative process for amendments as new information becomes available.

Examples of new information are hydrogeologic studies that provide more information about the boundaries and characteristics of aquifers, significant land use changes and the associated groundwater contamination risks, and the results of the evaluation of voluntary and regulatory programs. A fundamental component of adaptive management is the commitment to change based upon the outcome of testing hypotheses through strategic monitoring.

Examples of adaptive management that protects the functions and values of Critical Aquifer Recharge Areas also can include:

1. Being able to correct or prevent a polluting activity by inspections, requests for compliance, and enforcement if needed.

2. Changing ordinances in response to additional knowledge about a polluting activity. For example, the City of Vancouver prohibits several activities that are a high risk for contaminating water resources (see Chapter 14.6 Water Resources Protection[188], Section 14.26.115). One of these is hard chrome plating operations. Such a facility became a toxic cleanup site and threatened the groundwater quality for city wells (See the Final Closure Plan for the Boomsnub toxic cleanup site, Section 1.1 Site Background, available from the Document Repository for Boomsnub Airco Superfund Site[189]).

[187] https://apps.leg.wa.gov/WAC/default.aspx?cite=365-195-920

[188] http://www.cityofvancouver.us/sites/default/files/fileattachments/public_works/page/1033/finalwrpordinancerevised2016.pdf

[189] https://apps.ecology.wa.gov/gsp/CleanupSiteDocuments.aspx?csid=586

3. Developing new information about an area sensitive to contamination and adapting programs, plans, and ordinances appropriately to address risks. A great example is the Scatter Creek Aquifer Septic System Management Project[190]. This project convened a Citizen's Advisory Committee to evaluate groundwater contamination risk from septic systems. The committee recommended not increasing regulatory action at the time, but recommended keeping watch over groundwater quality so that action can be taken if necessary.

   The Scatter Creek Aquifer is the sole source of drinking water for that area and is vulnerable to contamination.

See the Critical Areas Handbook[191] for more information on adaptive management.

[190] https://www.co.thurston.wa.us/health/ehsc/index.html
[191] https://www.commerce.wa.gov/serving-communities/growth-management/guidebooks-and-resources/

Section 9 - Critical Aquifer Recharge Area Reports

Many jurisdictions require that those applying for new development permits submit reports that demonstrate that the functions and values of Critical Aquifer Recharge Areas will be protected.

Reports apply to both identifying Critical Aquifer Recharge Areas and to pollution prevention. The report should support the documentation of best available science. If the jurisdiction has identified drinking water aquifers and characteristics, this information would not need to be duplicated by a permit applicant. The applicant should report critical materials (chemicals that are potential pollutants), and demonstrate that their project prevents pollution and allows recharge as applicable. The permit application can include a checklist to make sure the correct best management practices are identified and included in the permit conditions. The proponent should also identify existing drinking water wells near their site.

Protecting the functions and values of Critical Aquifer Recharge Areas depends on knowing.

- On an area-wide basis:
  - The location and extent of drinking water aquifers
  - The location of wells used for drinking water, including Group A wells, Group B wells and residential wells
  - Hydrogeologic conditions:
    - General depth to water of the water table aquifer or aquifer nearest the land surface
    - General flow direction
    - General overburden properties (glacial outwash? Clay layers? Drainage?)
  - Where streams are that have anadromous fisheries
  - Where there are (or have been) cleanup sites
  - Where there has been known groundwater contamination

  This information is applicable to sites to the extent that the area-wide information is adequate for specific sites.

- On a site-specific basis:
  - Information listed above if it is not available from the local jurisdiction
  - What critical materials are on site or are planned to be on site
  - How critical materials are kept from spilling or leaking
  - What preparations are to contain critical materials in case of a fire
  - Plans (such as a spill plan, emergency plan with contacts)

Emergency plans should include contacting public water supply purveyors, and neighbors, as well as the fire dept.

- Recharge
    - How recharge will be maintained or enhanced
    - If recharge is not conducive given site conditions, how stormwater will otherwise be discharged in accordance with legal requirements and best practices
    - How recharge of stormwater will be kept clean or treated. If treated, what the mechanisms are to inspect and maintain treatment effectiveness

Section 10 – Interjurisdictional Coordination

Since aquifers often span more than one jurisdiction, counties and cities need to work together to protect the public drinking water resource. Ordinances and implementation that protect the water supply in each other's jurisdiction is needed when the Critical Aquifer Recharge Area that protects a jurisdiction's drinking water supply is outside of its jurisdictional boundaries and therefore outside of its regulatory authority.

Interjurisdictional coordination starts with the comprehensive plan.

> RCW 36.70A.100 Comprehensive plans—Must be coordinated.
>
> The comprehensive plan of each county or city that is adopted pursuant to RCW 36.70A.040 shall be coordinated with, and consistent with, the comprehensive plans adopted pursuant to RCW 36.70A.040 of other counties or cities with which the county or city has, in part, common borders or related regional issues.

The Critical Areas Handbook states:

> County wide planning policies and inter-local agreements are often necessary in unincorporated portions of the Urban Growth Area (UGA). For example, cities have a vested interest in the type of development that occurs as they will ultimately annex the property, but counties often oversee the development and issue the permits.
>
> As a result, some jurisdictions develop countywide planning policies or inter-local agreements to ensure the city can review development proposals before they are finalized. Local governments could apply the same model for wellheads and other Critical Aquifer Recharge Areas. For local governments who have GIS capacity, they would include inter-local agreements on maps to ensure areas of concern are easily identified during the county review period and permitting.

The mere existence of an inter-local agreement does not guarantee coordination. Agreements and plans must be implemented to be useful. Comprehensive plans may be written to include implementation in ordinances and programs.

One example of an inter-local agreement to protect the drinking water supply that is sourced from groundwater is an agreement between the City of McCleary and Grays Harbor County[192]. McCleary is a small city in Grays Harbor County (Figure 12). The aquifer on which McCleary depends extends into Grays Harbor County.

[192] https://cityofmccleary.com/vertical/sites/%7B6900A7D9-59CE-4612-823A-FA3E5F25F431%7D/uploads/%7B1B4F9EEA-86BC-47D6-B2F2-9FC2FD00353E%7D.PDF

The inter-local agreement was formulated based on the report Wildcat Creek Aquifer Hydrology, Regulatory Alternative, and Recommendations Final Report[193], prepared for Grays Harbor County and the City of McCleary (Arthur, 2008). This report details the hydrogeology, development, and wells; regulatory alternatives (including under the GMA); and recommendations for Grays Harbor County, the City of McCleary, and both together.

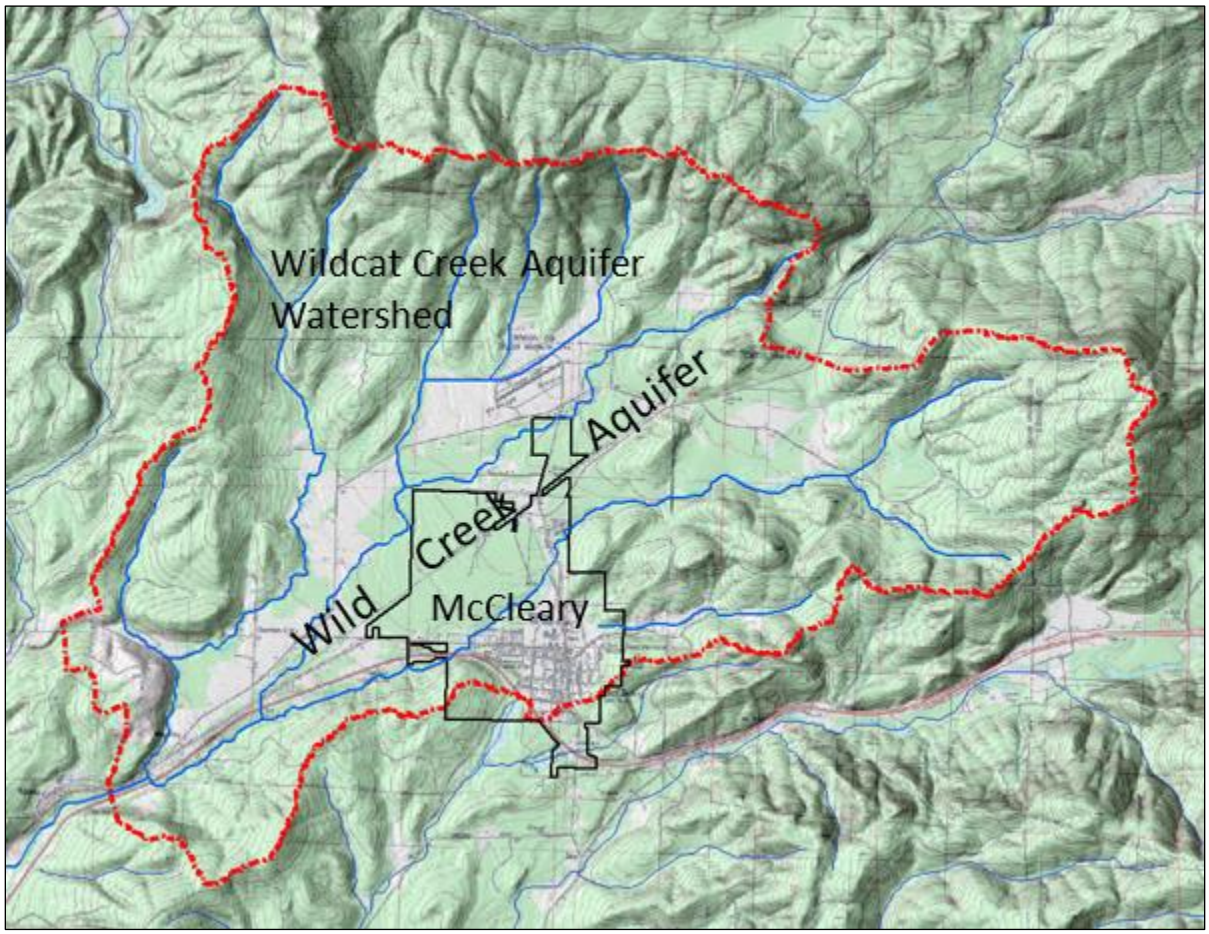

Figure 12: The drinking water aquifer for McCleary lies both in city boundaries and outside city boundaries in Grays Harbor County.

Chapter 1 of the Dept. of Commerce Growth Management Services Critical Areas Handbook[194] has a section on Regional Planning Efforts. This section also includes information about various state watershed initiatives.

[193] https://cityofmccleary.com/vertical/sites/%7B6900A7D9-59CE-4612-823A-FA3E5F25F431%7D/uploads/%7B214968EF-BDC3-44B0-9F8F-2CE99BAFC056%7D.PDF
[194] https://www.commerce.wa.gov/serving-communities/growth-management/growth-management-topics/critical-areas/

Section 11 – Implementation – Authority, Monitoring, and Program Integration

Funding and Resource Challenges

It is important to recognize resources that cities and counties have varies widely. Some counties and cities have expertise on staff, some have groundwater monitoring programs, and many have inspection programs. Other city and counties are extremely limited in resources. See also Section 7 - Adapting to Local Conditions and Settings Section 7. Funding sources jurisdictions use have included permit fees, grants, general fund, stormwater utility fees, building/development fees, and water rates.

Here are a few of important considerations for protecting the functions and values of Critical Aquifer Recharge Areas.

Authority

Cities and Counties should give themselves authority to act in their ordinances in case of a threat to groundwater resources. Jurisdictions need to have authority to inspect businesses for compliance with ordinances, and to detect and correct situations that are a threat to groundwater quality. See Appendix C – Code Examples.

Monitoring

Monitoring is important for ensuring compliance to protect groundwater resources, and for detecting contamination that has occurred in groundwater. Monitoring helps jurisdictions adaptively manage the protection of Critical Aquifer Recharge Areas and to understand what is important to address during updates.

Compliance Monitoring and Program Integration

Ordinances and plans by themselves do not protect the functions and values of Critical Aquifer Recharge Areas – Protection requires monitoring for compliance, together with technical assistance and, if necessary, enforcement. Monitoring for compliance also requires having the authority to inspect and require correction.

Inspections serve to follow-up on whether permit requirements were implemented, for code enforcement, and to detect and require correction of pollution threats. Inspections can be done in conjunction with other inspection programs for pollution prevention such as for surface water, stormwater, and for hazardous waste/materials. Fire department inspections are also good candidates for helping with resource efficiency, especially with respect to contaminant (or

"critical materials") inventories and fire prevention where a fire would cause release of contaminants.

Regulations can also be integrated for efficiency. Stormwater regulations, hazardous waste/material regulations, building and fire codes, are examples of regulations that can be incorporated into protection for Critical Aquifer Recharge Areas. Voluntary programs such as hazardous waste and pharmaceutical drop-offs also help to prevent groundwater contamination.

The City of Issaquah has developed and implemented a highly integrated program – See Appendix A: Focus on Implementation - Issaquah Gains Efficiency by Integrating Programs.

The City of Vancouver developed ordinances for the protection of water resources that includes groundwater, surface water, and storm water.

Appendix D – The Growth Management Hearings Board and Selected Decisions – includes two cases that are relevant to the need to monitor for compliance.

The county wide planning policies and comprehensive plan are important for program integration. Together with an implementation plan, cities and counties may coordinate the various departments that administer different aspects of protecting the functions and values of Critical Aquifer Recharge Areas. These include planning, building permits, development services, public works, and programs for inspecting and enforcing. It is important that different departments work together so that development proposals are shared early in the process.

Groundwater Monitoring

Groundwater monitoring is useful for understanding where contaminants have reached groundwater from land use activities, and for identifying contamination sources and requiring correction. Groundwater monitoring is also useful for identifying whether concentrations are increasing or decreasing. Counties and cities should have plans and procedures to follow-up with source identification and correction when groundwater monitoring detects contamination. This would typically include working with state regulatory programs.

Two ways of obtaining groundwater monitoring data include using existing groundwater monitoring data collected by others, and implementing a local groundwater monitoring program. Jurisdictions without resources for a locally run groundwater monitoring program can still use data produced by others.

Using existing groundwater monitoring data

- The Washington State Department of Health drinking water database (SENTRY)[195] records groundwater quality sampling results for public water systems.
- The USGS National Water Information System (NWIS)[196] has groundwater sample results for wells sampled for USGS studies.
- Some jurisdictions contract with consultants to perform studies that include groundwater monitoring data.
- The Ecology Environmental Information Management system (EIM)[197] has a groundwater map and data application includes groundwater monitoring data produced by Ecology studies. Data produced from grant funded studies may also be in EIM.

Local groundwater monitoring programs

- Dedicated groundwater monitoring (where there are resources for this).
- Well sample results from property transfers – Many jurisdictions require a water well sample when a property is sold.

A very few jurisdictions have hydrogeologists on staff who can design and maintain groundwater monitoring programs. Some jurisdictions contract with the USGS to do a groundwater study that results in water level measurements and groundwater quality assessments. The USGS does nationally supported regional studies through the National Water Quality Assessment program (NAWQA). This provides a number of jurisdictions with groundwater information. Some jurisdictions contract with a consultant to do a study that includes groundwater monitoring.

Jurisdictions that do not have capacity to support groundwater monitoring can still make use of existing groundwater monitoring data that is available online.

195 https://www.doh.wa.gov/DataandStatisticalReports/EnvironmentalHealth/DrinkingWaterSystemData/SentryInternet

196 https://waterdata.usgs.gov/wa/nwis/nwis

197 https://apps.ecology.wa.gov/eim/search/default.aspx

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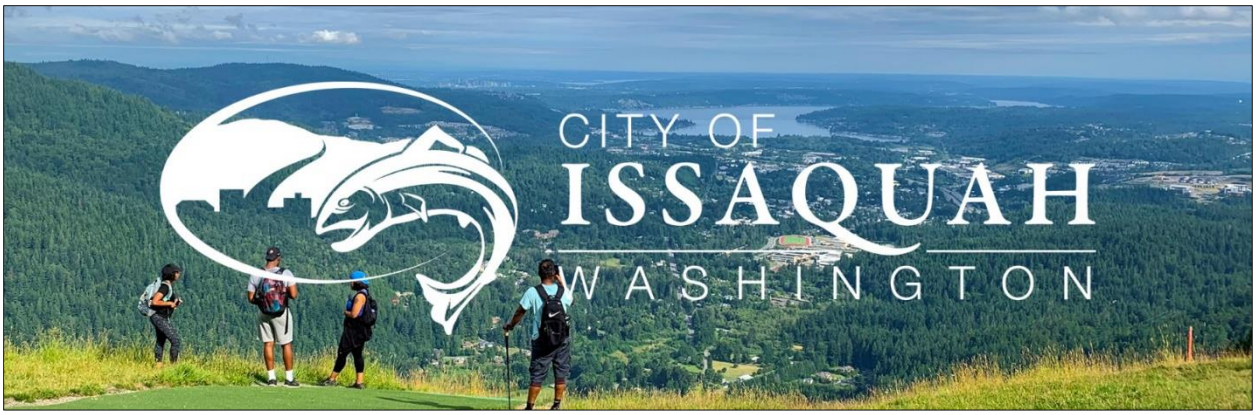
Appendices

Appendix A: Focus on Implementation - Issaquah Gains Efficiency by Integrating Programs



The City of Issaquah is located within King County and spans approximately 61-square miles and is bordered by steep upland areas including Tiger, Squawk, and Cougar Mountains. Drinking water wells located within the valley floor provide Issaquah with approximately 50% of the City's drinking water supply from groundwater. Drinking water to the nearby Sammamish Plateau is also supplemented from wells located on the Issaquah valley floor. As a result, a significant portion of the City is a critical aquifer recharge area (CARA), under the requirements of the Growth Management Act (GMA).

Issaquah Gains Efficiency by Integrating Programs

The City of Issaquah has a well-developed groundwater and pollution prevention protection program that integrates and aligns state requirements, city ordinance, inspections, and site visits with education and outreach opportunities for both businesses and residents. Effectiveness and efficiency is obtained through overlap in programs and staff. Issaquah does this by requiring businesses and development within the City and CARA to adhere to a higher standard of pollution prevention through the collection of Hazardous Materials Management Plans for both hazardous waste and hazardous materials, complying with the National Pollution Discharge and Elimination System (NPDES) stormwater permit, illicit discharge identification and prevention, and protection of our CARA.

Programs

Integration of pollution prevention goals enables programs to make use of shared resources for administration, funding, information, inspections, and public outreach and education.

- Spill Response
- Illicit Discharge Investigation
- Hazardous Materials Management Plans
- Hazardous Materials Management Inventories
- Pollution Prevention Technical Assistance

- Fats Oils and Grease management review
- Septic Inspection Verification
- Private Storm System Inspections
- NPDES Storm System Inspections
- Ambient Water Quality Sampling

Program Administration

Issaquah's environmental programs are managed by a small group of staff that are cross trained in all environmental protection aspects. Efficiencies include:

- Overlap in function and specialties
- Staff ownership over programs and improvement opportunities
- Standardizing data and information management tools, whenever possible
- Handouts and educational material by topic

Funding

- Issaquah receives some funding for elements of our pollution prevention programs and business outreach through a Local Source Control partnership with the Department of Ecology.
- Additional funding for Issaquah's pollution prevention programs comes from utility taxes, paid for by Issaquah residents and businesses.
- Our businesses may qualify for funding from King County and/or The Department of Ecology, if they choose to transition to safer choice business practices or to use safer chemicals; for example, changing from PERC dry-cleaning to professional wet cleaning.

Information

Purpose: To identify candidates for inspection and to make sure pollution prevention is being accomplished at sites with potential for contaminating, to follow up on complaints and enforcement, and to meet requirements of the NPDES Phase II stormwater permit to identify illicit discharges.

- Hazardous materials
- Reported Toxic Releases and Spills
- Toxic Cleanup Sites
- Well Head Protection Contaminant Inventories
- Ecology Facility/Site web app
- ERTS

Inspections

- Inspections and technical assistance visits serve as many purposes as possible in a single visit.
- A single inspector is trained in multiple areas of environmental compliance.
- Joint inspections between the City and other entities, such as the fire department, the Department of Ecology, the Health Department, or King County, are encouraged to insure a comprehensive application of regulations is conveyed. Often City regulations are more prescriptive.
- A single data system can be used to track inspections for multiple purposes. Issaquah uses TRAKiT as a central depository for record keeping and environmental tracking.

Communicates with the Public and Regulated Businesses

- Lets businesses know what is required and how to comply.
- Lets the regulated community know how to access technical assistance.
- Makes sure those who are regulated understand Issaquah's inspection and enforcement authority and how these are carried out.
- Lets citizens have a way to report environmental issues locally.

Appendix B: Map of Ecology Cleanup Sites for Groundwater and Soils Contamination

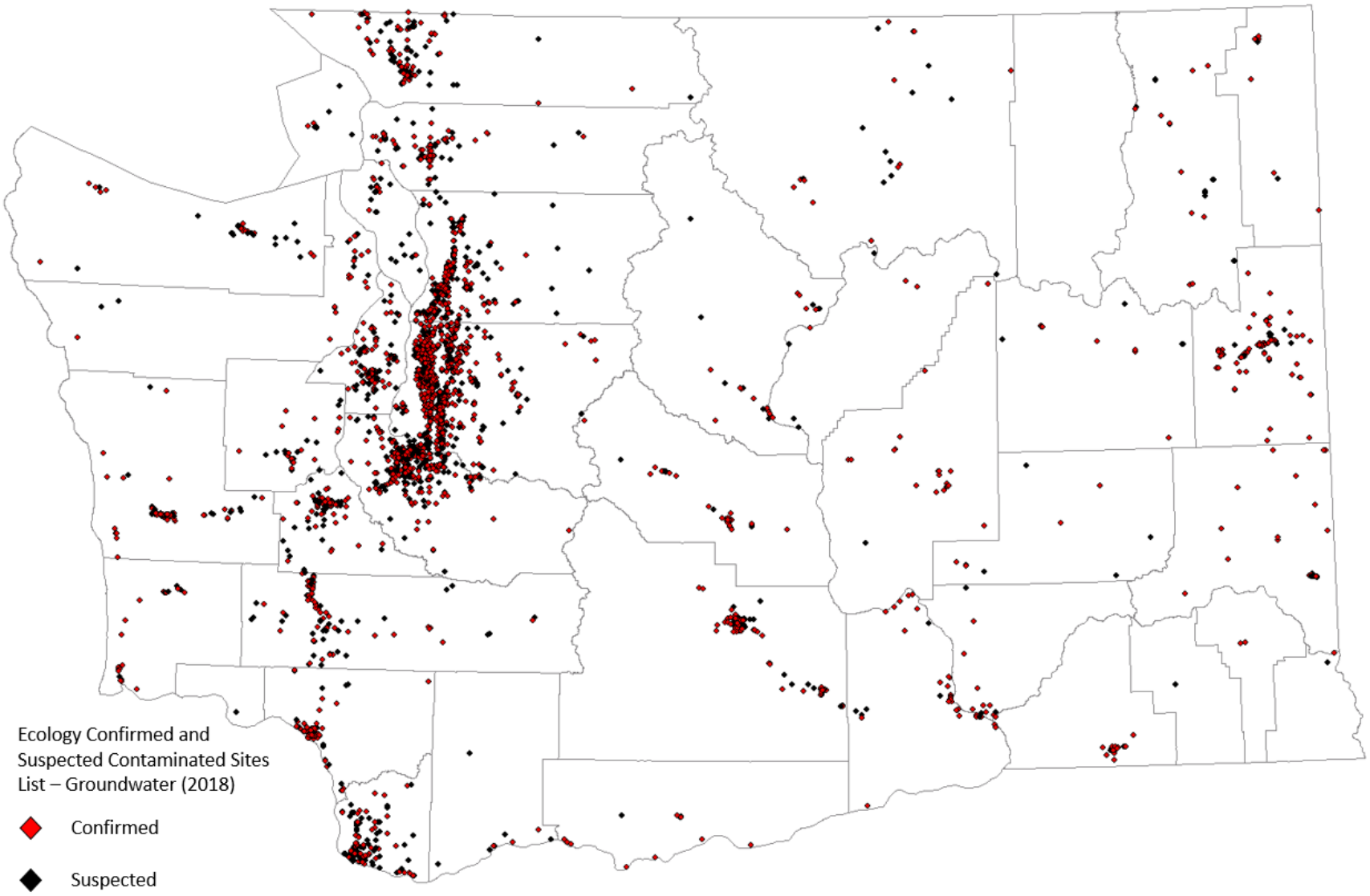


Figure 13: Washington State Department of Ecology Confirmed and Suspected Contaminated Sites Map (2018)

Appendix C: Code Examples

Integrated programs

The City of Vancouver deserves special mention because the City's Water Resource Protection Program[198] is an outstanding example of program integration to protect rivers, lakes, streams, and groundwater.

The City of Issaquah is an outstanding example of gaining efficiencies and good outcomes by integrating programs - See Appendix A.

Authority to Act and to Inspect

- Benton County has given themselves authority to prevent contamination of critical aquifer recharge areas. Benton County's critical aquifer recharge area ordinance Chapter 15.06[199] requires that:

  (a) The applicant shows that the proposed activity will not cause contaminants to enter the aquifer and that the proposed activity will not adversely affect the recharging of the aquifer;

  (b) The applicant provides evidence that the proposed water source is physically and legally available and meets drinking water standards.

  (c) Groundwater uses, withdrawals, and recharge must be consistent with RCW 90.44.050[200] (permit to withdraw groundwater) and with applicable rules adopted pursuant to RCW 90.22[201] (minimum instream flows) and RCW 90.54[202] (Water Resources Act of 1971) when making decisions under RCW 19.27.097[203] (evidence of adequate water supply) and RCW 58.17.110[204] (Approval or disapproval of subdivision).

- The City of Vancouver explicitly prohibits polluting discharges into the water resources of the city (Chapter 14.6 Water Resources Protection[205], Section 14.26.117). Section 14.26.145 on Enforcement gives the City authority to enforce, and explicitly lays out what the City may do in case of violations.

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198 https://www.cityofvancouver.us/publicworks/page/water-resources-protection-program
199 https://www.co.benton.wa.us/files/documents/CH1506BCC148013709092718PM.pdf
200 https://apps.leg.wa.gov/RCW/default.aspx?cite=90.44.050
201 https://apps.leg.wa.gov/RCW/default.aspx?cite=90.22
202 https://apps.leg.wa.gov/RCW/default.aspx?cite=90.54
203 https://apps.leg.wa.gov/RCW/default.aspx?cite=19.27.097
204 https://app.leg.wa.gov/rcw/default.aspx?cite=58.17.110
205 http://www.cityofvancouver.us/sites/default/files/fileattachments/public_works/page/1033/finalwrpordinancerevised2016.pdf

Having the authority to enforce in case of a polluting discharge to water resources allows the City to stop a pollution event, or prevent an imminent discharge. This goes beyond requiring pollution prevention at the permitting stage, and allows the City to respond after a permit has been issued.

The City of Vancouver Water Resources Protection ordinance also has code for owner/operators to inspect their facilities to prevent contaminated discharges, and for the city to inspect.

Allowed, permitted with conditions, and prohibited uses

Table 24.10-1 in Chapter 24.10.020[206] of the Thurston County code lists land use activities that are allowed without a permit, permitted with conditions, or are prohibited, depending on the category of Critical Aquifer Recharge Areas. The table links to applicable standards for land use activities. Here is a partial excerpt (see the ordinance[207] for the full table):

RESTRICTED USES AND ACTIVITIES	AQUIFER RECHARGE AREA CATEGORY				
	I			II	III
	Wellhead Protection Areas		Other CARA I		
	1-year time of travel zone	5- and 10-year time of travel zones			
Abandoned wells (decommissioning of wells) (TCC 24.10.040)	A	A	A	A	A
Asphalt plants/cement and concrete plants (TCC 24.10.070)	X	X	X	P	P
Boat refinishing	P	P	P	P	P
Cemeteries (TCC 24.10.090)	X	P	P	P	P
Chemical manufacturing/processing, mixing and remanufacturing (TCC 24.10.100)	X	X	X	P	P
Chemical storage facilities (not including fuel) (TCC 24.10.100)	X	P	P	P	P

Figure 14: Image of Table 24.10-1. Prohibited and Restricted Uses and Activities Within Critical Aquifer Recharge Areas

LEGEND:

A = Allowed without a critical area permit, subject to requirements of this title

206 https://library.municode.com/wa/thurston_county/codes/code_of_ordinances?nodeId=TIT24CRAR_CH24.10CRAQREAR_24.10.020STREPRUS

207 https://library.municode.com/wa/thurston_county/codes/code_of_ordinances?nodeId=TIT24CRAR_CH24.10CRAQREAR_24.10.020STREPRUS

P = Permitted, subject to critical area permit and requirements of this title

X = Prohibited

X/P = As determined by the approval authority, small scale uses or those using nonhazardous materials may be permitted when the quantity, nature of materials processed and mitigation methods are determined to contain no significant risk to groundwater.

Section 11.20.075 of Spokane County's critical aquifer recharge area ordinance[208] includes a similar type of table.

[208] https://library.municode.com/wa/spokane_county/codes/code_of_ordinances?nodeId=TIT11EN_CH11.20CRAR_11.20.075CRAQREAR

Critical Materials

City of Spokane Critical and Hazardous Materials List Information[209] guide sheet.

City of Spokane Business & Development Resources[210] – The Critical and Hazardous Materials topic includes the following resources:

- Critical and Hazardous Materials List Application[211] (PDF 25 KB)
- Critical and Hazardous Materials List Information[212] (PDF 22 KB)
- Critical Materials Handbook[213] (PDF 908 KB)
- Critical Materials List[214] (PDF 29 KB)
- Hazardous Materials Inventory[215] (PDF 32 KB)

Nonpoint Ordinance

- Article VI – Rules and regulations of the Thurston County Board of Health governing nonpoint source pollution[216].

Reports

- Spokane County Section 11.20.075 – Critical aquifer recharge areas[217], has a section on procedures for when a hydrogeologic report or study is required. This section is quite good, and provides for an important alternative:

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[209] https://static.spokanecity.org/documents/business/resources/guidesheets/hazardousmaterials/critical-hazardous-materials-list-information.pdf
[210] https://my.spokanecity.org/business/resources/
[211] https://static.spokanecity.org/documents/business/resources/guidesheets/hazardousmaterials/critical-hazardous-materials-list-application.pdf
[212] https://static.spokanecity.org/documents/business/resources/guidesheets/hazardousmaterials/critical-hazardous-materials-list-information.pdf
[213] https://static.spokanecity.org/documents/business/resources/guidesheets/hazardousmaterials/critical-materials-handbook.pdf
[214] https://static.spokanecity.org/documents/business/resources/guidesheets/hazardousmaterials/critical-materials-list.pdf
[215] https://static.spokanecity.org/documents/business/resources/guidesheets/hazardousmaterials/hazardous-materials-inventory.pdf
[216] https://www.co.thurston.wa.us/health/ehadm/pdf/Article_VI.pdf
[217] https://library.municode.com/wa/spokane_county/codes/code_of_ordinances?nodeId=TIT11EN_CH11.20CRAR_11.20.075CRAQREAR

> An applicant may elect to meet the appropriate performance standards in lieu of preparing a hydrogeologic report if the environmental services director or hearing examiner finds the performance standards provide adequate aquifer protection.

- City of Redmond (King County), Zoning Code (RMC title 21), Appendix 1. – Critical Areas Reporting Requirements[218] details critical aquifer recharge areas reporting. The following paragraph provides a good example of an objectives statement:

  > A critical aquifer recharge area report must be submitted to the City. The purpose of the report is to evaluate the actual presence of geologic conditions giving rise to the critical aquifer recharge area; determine the appropriate wellhead protection zone; evaluate the safety and appropriateness of proposed activities; and recommend appropriate construction practices, monitoring programs, and other mitigation measures required to ensure achievement of the purpose and intent of these regulations. The information required by this report should be coordinated with the study and reporting requirements for any other critical areas located on the site.

Incentives

The Clark County Critical Aquifer Recharge Areas Ordinance, Title 40.410[219], includes incentives for using best management practices to avoid having to provide additional geologic and hydrologic characteristics of the property:

> Incentives
>
> Best Management Practices (BMPs). Individuals who implement BMPs to safeguard groundwater may not be required to provide additional geologic and hydrologic characteristics of the subject property, pursuant to Sections 40.410.030(B) and (C). Individuals shall implement the Washington Department of Ecology's Stormwater, Water Quality, Hazardous Waste, Wetland, and Solid Waste Programs BMPs; Chapter 13.26A; and BMPs from the Washington Departments of Health, Agriculture, Transportation, and State Conservation District Office.

[218] http://online.encodeplus.com/regs/redmond-wa/doc-viewer.aspx?secid=2017#secid-4221
[219] https://www.codepublishing.com/WA/ClarkCounty/?comp-ClarkCounty40/ClarkCounty40410/ClarkCounty40410.html

Appendix D – The Growth Management Hearings Board and Selected Decisions

Each GMA Hearings Board published a digest[220] of decisions that makes it easier to find decisions related to various topics. The digests contain case summaries through June 30, 2010. After that, the Boards were consolidated, and a tool to look for cases and decisions[221] was developed. In addition, the GMA Hearings Board has published a digest of decisions from July 1, 2010 onward[222], after board consolidation.

The Critical Areas Handbook[223] Appendix 1.B contains summaries of appellate court and Growth Management Hearings Board decisions related to critical areas requirements under the Growth Management Act.

In addition to the case law summaries for Critical Areas in general, the Handbook summarizes several cases related to critical aquifer recharge areas. Please refer to the Handbook to see these case summaries in full. These cases include:

- Using best available science for determining risk from pre-existing uses
- Updating maps using updated best available science
- Not relying exclusively on public water supply mapped well head protection zones because it does not protect individual drinking water wells nor the larger aquifer
- The GMA does not necessarily require designation of an entire aquifer – However, "the extent of these designated critical recharge areas, as distinct from the underlying aquifer itself, is determined through a substantive consideration of Best Available Science"
- Seawater intrusion critical aquifer recharge area designation and adaptive management

The Handbook cautions:

> Users of the Digest are reminded that decisions of the Board may be appealed to court and thus some of the excerpted cases may have been impacted by subsequent court and/or Board rulings. It is the responsibility of the user to research the case thoroughly prior to relying on holdings of a decision.

[220] http://www.gmhb.wa.gov/Global/Reader?title=Digests&path=Digests
[221] http://www.gmhb.wa.gov/search/case
[222] http://www.gmhb.wa.gov/pages/Documents/2010-Present_Joint_Digest_July2019_Update.pdf
[223] https://www.commerce.wa.gov/serving-communities/growth-management/growth-management-topics/critical-areas/

The cases mentioned in this appendix are only a partial selection. Please refer to the GMA Hearings Board website for guidance on finding relevant cases. The Washington State Judicial Opinions Public Access Web site has an online search tool[224] to find opinions and decisions.

On the following pages are some examples of decisions from the digests from the Central Puget Sound, Western Washington, and Eastern Washington Growth Management Hearings Boards that are relevant for Critical Aquifer Recharge Areas.

Mapping and performance standards

Central Puget Sound

> "The use of performance standards is recommended in the Minimum Guidelines for … circumstances where critical areas (e.g., aquifer recharge areas, wetlands, significant wildlife habitat, etc.) cannot be specifically identified." WAC 365-190-040(1). However, where critical areas are known, cities and counties cannot rely solely upon performance standards to designate these areas. [Pilchuck II, 5347c, FDO, at 41-42.]

Local government discretion and the GMA framework

Western Washington

> The GMA provides that ultimate planning decisions rest with the local government. Such decisions are not unfettered but must be within the range of discretion allowed by the GMA. A GMHB does not substitute its judgment as to the best alternative available, but reviews the local government action to determine if it complies with the goals and requirements of the GMA. CCNRC v. Clark County 92-2-0001 (FDO 11-10-92).

Eastern Washington

> The Act requires protection of critical areas, and the county is given the opportunity to select the manner of that protection. Their choice is given great deference. Easy, et al. v. Spokane County, EWGMHB 96-1-0016, Order on Compliance (Sep. 23, 1997).

What protecting Critical Areas (CA) means

Central Puget Sound

> The Act's directive that local governments are to "protect" critical areas means that they are to preserve the structure, value and functions of wetlands, aquifer recharge areas

224 https://advance.lexis.com/container?config=00JABiZDFhYmU0My03MTRiLTQ1OTYtOGFjYi02Yjg0MWYzZTYzNGMKAFBvZENhdGFsb2f9AmKsL25rOJ32peBAlAS6&crid=c60d5fbe-e7a0-4462-b45b-9216a88b15aa&prid=74bee516-c191-45d6-b571-e34bc0824230

used for potable water, fish, and wildlife habitat conservation areas, frequently flooded areas and geologically hazardous areas. [derived from WAC 365-195-825(2)(b)] [Pilchuck II, 5347c, FDO, at 20.]

Western Washington

The GMA requirement to protect CAs directs a local government to adopt appropriate and specific criteria and/or standards. Willapa v. Pacific County 99-2-0019 (FDO 10-28-99).

Compliance monitoring and enforcement

Western Washington

If BMPs are relied upon for protection of CAs some form of monitoring and enforcement must be included to ensure that the plans are actually implemented and followed. ARD v. Shelton 98-2-0005 (FDO 8-10-98).

Eastern Washington

Further, laws can be so vague that they simply are unenforceable. That is the case here. Such an ordinance cannot satisfy GMA's duty to adopt enforceable "development regulations" to "protect" critical areas. A person should be able to determine what the law is by reading the published code. Ordinance no. 109-2003 (ICAO) relies on language too vague to create an enforceable standard and therefore cannot not operate to "control" land use activities and does not satisfy the county's GMA obligation to adopt "development regulations" to protect critical areas. The enforcement measures adopted by the county provide only for ad hoc enforcement. This does not constitute a reasoned adaptive management program, particularly where, as here, there is no provision for the monitoring of compliance. Larson Beach Neighbors and Jeanie Wagenman v. Stevens County, EWGMHB 00-1-0016, EWGMHB, Order on Compliance, November 13, 2003.

Critical Aquifer Recharge Areas

Eastern Washington

The GMA directs counties to designate, classify and protect areas with a "critical recharging effect on aquifers used for potable water." It is necessary to determine the location of recharge areas as a first step in designating and protecting them. The county must provide criteria necessary to indicate when an area needs specific scientific analysis to determine whether it is a critical aquifer recharge area. Save Our Butte Save Our Basin Society, et al. v. Chelan County, EWGMHB 94-1-0015, Compliance Hearing Order (Apr. 8, 1999).

Appendix E – Contamination is Costly

Groundwater contamination can cost millions of dollars for a single site. It often takes a long time for contamination to be detected at a drinking water well. Often, this is the first indication that groundwater has been contaminated. By the time contamination shows up at a well, the contamination has travelled from the source, through the underground, to groundwater, and has migrated in the direction of groundwater flow.

The ongoing occurrence of contamination is not obvious – It takes attention to prevent contamination. Best management practices for prevention of releases along with inspections and response plans are critical for keeping groundwater clean and safe for drinking water.

After contamination shows up at a well, cleanup can take a long time, and sometimes the water has to be treated for decades.

Currently, we do not have a readily available catalog of costs associated with groundwater contamination. Potentially liable persons do not report their costs.

Here are some of the main categories of costs associated with contamination:

1. Identifying the contamination source(s)
2. Determining what has been contaminated (soil, groundwater) and where the contaminants are going
3. Determining the feasibility of cleaning up
4. Remediating soils
5. Remediating groundwater
6. Identifying and testing wells in the area to determine what needs to happen to protect public health
7. Providing alternative sources of drinking water
    - Bottled water
    - New well or deepened well
    - Interties with another drinking water system
8. Treating drinking water to remove contaminants prior to delivery to consumers, or blending the water with a cleaner source to lower the concentration to acceptable levels
9. Suffering a decline in property values and difficulty selling or getting a bank loan
10. Lawsuits

Example costs can be obtained when the state or federal government does the cleanup.

In addition, grants and loans to local government for remedial investigation and cleanup offer a window into the kinds of costs faced by both the parties responsible for cleanup and the community when groundwater is contaminated and must be cleaned up.

Grants and loans for public drinking water systems are another source for understanding the kind of costs incurred.

Here are three examples of costs related to contaminated groundwater.

Contamination in the Freeman School District Well

Freeman is a small, rural town about 12 miles south of Spokane Valley, Washington. Freeman has both a middle school and a high school, located next to each other. Across the highway from the high school are grain silos. Wells supply drinking and irrigation water to the schools.

The grain handling facility at Freeman[225] has leached carbon tetrachloride[226] into soil and groundwater.

[225] https://apps.ecology.wa.gov/gsp/Sitepage.aspx?csid=12540
[226] https://www.atsdr.cdc.gov/toxfaqs/TF.asp?id=195&tid=35

Figure 15: Area around Freeman Cleanup Site.

Carbon tetrachloride was found in the high school well, and a treatment system was installed to remove contaminants so that the water is safe to drink and to use for irrigation. After further investigation, residential wells were sampled and the well water found to have unsafe levels of carbon tetrachloride.

Carbon tetrachloride is a man-made chemical that does not break down quickly in the environment. It was widely used as an agricultural pesticide and fumigant to kill insects and rodents in grain storage facilities. It was also used to make refrigerants and propellants for aerosol cans, metal degreasing, as a dry-cleaning agent, and other uses.

In 1985, the U.S. Environmental Protection Agency (EPA) banned the use of carbon tetrachloride for agricultural and other uses, except some industrial applications.

Costs include soil sampling, groundwater monitoring, an air stripper treatment system for drinking water treatment, monthly drinking water well sampling, and a pump and treat system to clean up groundwater.

Costs for groundwater treatment alone for 17 years range from $7 million to $10 million dollars.

Christ Community Fellowship Water System Consolidation due to High Nitrates

The Washington Department of Health Office of Drinking Water publishes a list of recipients of low interest loans from the Washington State Drinking Water State Revolving Fund[227], published in July 2020. The following is excerpted from this publication[228] to illustrate types of costs:

This project continues a project funded in 2016 and 2017. Christ Community Fellowship (CCF) has been under DOH enforcement action for years to address high nitrates (17 mg/L) in its well. The project will consolidate the CCF Water System with City of College Place.

Improvements are proposed to be constructed in two phases, and include development of a replacement city-owned well on CCF property drilled into the same Columbia River Basalt Group Aquifer that the city's existing wells are completed within.

Project components include installation of 4,500 feet of 12" water main (any additional costs of increasing line size above 8" to be borne by city funding) to connect the proposed well and CCF to the existing water system and consolidation of the city's water rights as they relate to the new well location.

Subsidy Award: $1,756,391 for a new well and water mains.

227 https://www.doh.wa.gov/CommunityandEnvironment/DrinkingWater/WaterSystemAssistance/DrinkingWaterStateRevolvingFundDWSRF

228 https://www.doh.wa.gov/Portals/1/Documents/Pubs/331-534.pdf

Hamilton – LaBree Roads EPA Superfund Site

The Hamilton – LaBree Superfund site is located about two miles southwest of Chehalis in Lewis County. The EPA fact sheet[229] provides an overview.

Figure 16: Hamilton-LaBree Superfund Site area (after U.S. EPA, 2017).

The following is an excerpt from the EPA web page for this site[230]:

The Hamilton/LaBree Roads Groundwater Contamination site) is located about two miles southwest of Chehalis, Washington. The site is contaminated with PCE. PCE is also called PERC, perchloroethylene, or tetrachloroethene. It's a chemical used for dry cleaning, metal degreasing, and other industrial processes. PCE and its byproducts can present a risk to people's health and the environment.

[229] https://semspub.epa.gov/work/10/100243654.pdf

[230] https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.Cleanup&id=1002174#bkground

In the past, PCE was spilled and dumped in Berwick Creek. Also, drums and other containers of assorted hazardous chemicals were buried in the area of what is now known as the Livestock Market. Release of the chemical from the buried and dumped containers contaminated soil, sediment, groundwater, and surface water.

EPA and the State conducted early cleanup actions to address immediate threats. Risks to people's health and the environment remain. In 2013, EPA selected an interim remedy for the site. Remedial design is underway.

The site includes two areas where releases of hazardous wastes are known to have occurred: the 10-acre Hamilton Road Impacted Area (HRIA) and the 11-acre area now known as the Livestock Market. The site also contains an area called the Thurman Berwick Creek Area where a release is likely to have occurred. Contaminated groundwater plumes originating from these areas extend to the North/Northwest of Hamilton Road (which is downgradient) as well as west of LaBree Road.

For administrative purposes, the site has been divided into two units, called Operable Units, or OUs. The HRIA is OU-1. The Livestock Market area, Thurman Berwick Creek Area, and downgradient areas outside of the HRIA are OU-2.

Contamination was first identified at the site in late 1993-early 1994 by the Washington State Department of Health (WDOH). Out of 18 water-supply wells sampled, PCE was detected in six.

EPA conducted removal actions, or short-term cleanups, to address immediate threats to human health and the environment. Actions included removing drums, pails and cans from beneath Building B on the property known as the Livestock Market area; supplying bottled water to affected well owners for drinking and cooking; and expanding the Chehalis municipal water supply system to affected residents.

The site's interim remedy for operable unit (OU) 1 includes:

- Temporarily rerouting Berwick Creek around contaminated areas;
- Removing PCE from the areas with highest concentrations, by heating the PCE-contaminated soil and sediment then collecting the contaminants before discharging either the air or water, and by treating contaminated groundwater using bioremediation;
- Placing limits on future activities at the site; and
- Site monitoring.

All of these activities are extremely costly, especially compared to what prevention would have cost.

Here are EPA Region 10 cost estimates:

- **Alternative sources of drinking water, $7 million**: EPA Region 10 responded to community needs for clean drinking water in 2001 by providing bottled water ($1 million) and connecting the community to the public water system ($6 million).
- **Drum removal and investigation, $7 million**: The additional work during that time for drum removal and investigation was around $7 million more.

- **Interim Action Feasibility Cost, $14 million**: The work EPA is doing right now is summarized in the Record of Decision for the Operable Unit 1 interim action has the Feasibility Cost in more detail and that is around $14 million.
- **Costs for the remainder of the site, $14 million**: The site is split into two operable units. Operable Unit 1 is about half of the contaminated area. EPA has not started investigation of Operable Unit 2. EPA estimates that cost to be about the same as the cost for Operable Unit 1 of $14 million.
- **Total estimated costs, $42 million:** The total cost for cleaning up this site will be about $42 million.

Appendix F – Acronyms and Glossary

This is a limited glossary of terms. For more complete explanations of terminology common to groundwater science, please refer to the USGS Water Basics Glossary[231].

Aquifer - A geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable[232] material to yield significant quantities of water to springs and wells.

Aquitard – See confining layer.

Artesian conditions – When water rises up above the level of the well intake, sometimes above ground level, it is because a confining layer causes water pressure to rise.

Confined aquifer (artesian aquifer) - An aquifer that is completely filled with water under pressure and that is overlain by material that restricts the movement of water.

Confining layer – A body of impermeable or distinctly less permeable (see permeability) material stratigraphically adjacent to one or more aquifers that restricts the movement of water into and out of the aquifers.

Precautionary approach – A precautionary approach is one that prevents harm or damage in the face of uncertainty or lack of scientific information. See the Critical Areas Handbook[233] for multiple references to the precautionary approach as it relates to the Growth Management Act.

Preferential Flow – Water flows through the least resistant path. Preferential flow occurs when there is a path for water to flow through that allows greater flow volume and shorter travel time than the surrounding material. For example, clay is very resistant to water flow, however clay can develop cracks that allows water to flow through faster than expected for clay.

Qualified licensed professional – Washington State Law, Chapter 18.220 Revised Code of Washington[234] (RCW) contains the legal requirements for licensure of geologists. Further, this RCW defines the practice of hydrogeology. A hydrogeology specialty license is required in addition to the geologist license.

"Practice of hydrogeology" means the performance of or offer to perform any hydrogeologic service or work in which the public welfare or the safeguarding of life, health, environment, or property is concerned or involved. This includes the collection of geological data, and

[231] https://water.usgs.gov/water-basics_glossary.html#top
[232] https://water.usgs.gov/water-basics_glossary.html#Permeability
[233] https://www.commerce.wa.gov/serving-communities/growth-management/growth-management-topics/critical-areas/
[234] https://app.leg.wa.gov/RCW/default.aspx?cite=18.220&full=true

consultation, investigation, evaluation, interpretation, planning, or inspection relating to a service or work that applies hydrogeology.

SDWA – The federal Safe Drinking Water Act.

Sole Source Aquifer – According to EPA's website[235], EPA defines a sole source aquifer (SSA) as one where:

- The aquifer supplies at least 50 percent of the drinking water for its service area
- There are no reasonably available alternative drinking water sources should the aquifer become contaminated

The SSA program enables EPA to designate an aquifer as a sole source of drinking water and establish a review area. EPA then reviews proposed projects that will both:

- Be located within the review area
- Receive federal funding

The review area includes the area overlying the SSA. It may also include the source areas of streams that flow into the SSA's recharge zone. EPA's review is intended to ensure that the projects do not contaminate the SSA.

The federal sole source statute only applies to federal review. However, some state laws and rules, as well as some local ordinances, list sole source aquifers as being subject to those laws, rules, or ordinances. Not all aquifers that are functionally sole source aquifers in the state are federally designated as such.

Unconfined aquifer - An aquifer which has a water table.

U.S. EPA - United States Environmental Protection Agency

USGS - United States Geological Survey

Water Table – The water level measured when water in the aquifer is at atmospheric pressure. To put it another way, when you measure water in a water table (unconfined) well, that is where the water actually is in the aquifer. On the other hand, when you measure water in a well that takes water from a confined aquifer, the water level is a measure of the pressure pushing the water up into the well, and not an indication of where the water in the aquifer is.

Well log – A written record of the geologic material through which a well was drilled. A well log normally includes the type of materials used for construction of the well itself and the depth at which the well screen is set.

[235] https://www.epa.gov/dwssa/overview-drinking-water-sole-source-aquifer-program#What_Is_SSA

Appendix G – Response to Comments on the 2005 Critical Aquifer Recharge Area Guidance

Here are the answers we received from the survey, organized by topic and question, (without blank responses).

Challenges

Have you encountered issues complying with the Growth Management Act for Critical Aquifer Recharge Areas? If yes, what would you consider the top three to be?

- **Pacific Groundwater Group submitting for King County Water District #90**

  Comment: KCWD 90 has one site of concern as there is an asphalt batch plant located within the wellhead protection area for its main wellfield. While low risk due to only indirect pathways for contamination, the District believes that the CARA requirements are not firm enough regarding allowing potential contaminant sources within sensitive areas.

  Response: During the review of the draft updated guidance, it would be good to hear from the District what they believe would be firm enough CARA requirements with respect to potential contaminant sources within sensitive areas. The guidance is not a rule – The GMA laws and rules plus local ordinances govern.

  It would be up to the Water District to work with the county or city where the wellfield is to upgrade CARA ordinance requirements. If the District believes the ordinance is not in compliance with the GMA, then the remedy is appealing to the Growth Management Hearings Board or the court.

- Jurisdictions who indicated no issues encountered in response to this question include: City of Tumwater, City of Walla Walla, City of Spokane, Clark County, Thurston County, and King County.
- **Four Horsemen Brewery**

  1. Local county codes do not have acceptable surface materials listed as pervious and exempt from permitting for new or new plus replaced surfaces. Counties should not be allowed to word codes in a manner that require critical area reviews for any change of use or for using your property for economic vitality.

     Counties are using the GMA as a trigger for permits without being required to have rules set for how they are allowed to make requirements, or what must be exempt because of how long it has existed and not data shows any change to aquifer recharge or contamination, which if true would necessitate monitoring.

Currently if an existing driveway is even raked or smoothed out, the county claims that is a change of surface material, and thus requires a permit for surface water management (SWM FEE).

2. There are no exemptions for land uses and parking areas to be exempt from contaminants of customer vehicles for home businesses when local county roads do not have sewer drainage systems or processing facilities for vehicle contaminants currently allowed on roads.
3. There is no square footage minimum table for pervious surfaces compared to impervious surface calculations. Ex. Does a 1500 sq ft impervious surface need 1500 sq ft of natural vegetation to constitute full infiltration? Does it need 1500 sq ft of natural vegetation located on the lower elevation from impervious surfaces.

   Response: The state Critical Aquifer Recharge Area guidance is not specific to localities enough to answer your question. This guidance does not address surface water management fees. This guidance defers to other guidance that reflects expertise for impervious surfaces, such as stormwater guidance. The Ecology stormwater manuals have material on parking areas. This guidance cannot specifically exempt land use practices because that is a function of local planning and ordinances. Local ordinances are deemed valid unless successfully appealed before the Growth Management Hearings Board or the court. It is possible that the Department of Commerce Growth Management Services could provide more information about land use regulation and critical areas, especially when it comes to what counties may or may not do.

- **Constance Ibsen**

  Comment: Deliberate lack acknowledgement of CARAs by decision makers, i.e. No implementation or enforcement of WWGMHB decisions.

  Response: Ecology does not directly regulate the implementation or enforcement of Growth Management Hearings Board decisions. Ecology provides guidance and review and comment when resources allow.

  The GMHB decisions apply to the jurisdiction under appeal. The Department of Commerce Critical Areas Handbook[236] Chapter 1 discusses the applicability of Court and Growth Management Hearings Board decisions to other jurisdictions:

  The GMA affords local government significant discretion in how they achieve compliance. While this provides a significant degree of flexibility, it also creates a lack of certainty. In reviewing critical area protection programs for compliance, local governments are encouraged to review decisions made by the Growth Management Hearings Board and Washington state courts. While Hearings Board decisions are not binding on jurisdictions not subject to a particular appeal, they provide guidance on

[236] https://www.commerce.wa.gov/serving-communities/growth-management/growth-management-topics/critical-areas/

how the Board may decide future appeals. Court of Appeals decisions are binding on jurisdictions within their district, and provide persuasive precedent for other jurisdictions. Supreme Court decisions are binding on all jurisdictions in the state. Local government consideration of court and hearings board decisions can help build defensible and effective critical area protection programs.

- **City of Redmond**

  Comment: The City of Redmond is complying with the GMA for CARAs. Two challenges faced by the City include:

  1. **Reclaimed water and source control**: The Department of Health is tasked with encouraging the use of reclaimed water and protecting source water. There is no guidance on how to balance the two issues in CARAs that are shallow and unconfined, such as Redmond's, that may be impaired if reclaimed water infiltrates into the aquifer.

     Response: This sounds similar to a situation in Thurston County, where there is a reclaimed water infiltration project by LOTT, the wastewater utility. Due to concerns within the community with reclaimed water and potential impacts to groundwater quality, LOTT initiated a multi-year infiltration study[237]. Thurston County is awaiting the results of that study prior to proposing critical area regulations (Chapter 24.10.190 – Reclaimed Water[238]).

  2. **Temporary Construction Dewatering**: The withdrawal of groundwater for temporary construction dewatering (TCD) is not considered a beneficial use and therefore does not need a water right. TCD can have an impact on a local jurisdiction's ability to manage groundwater withdrawals to maintain availability for drinking water sources. With no water right necessary, it is up to the local jurisdiction alone to regulate TCD. To provide a context of scale, three of the City of Redmond supply wells have pumped 4.5 billion gallons of groundwater over the past nine years. During that same time period, TCD projects have pumped more than 13 billion gallons of groundwater out of the aquifer.

     Response: Given that the state does not regulate temporary construction dewatering via water rights, it would be up to the local jurisdiction to develop plans and ordinances. The guidance does not currently address dewatering. You are welcome to suggest language on this topic during review of the draft.

[237] https://lottcleanwater.org/projects/reclaimed-water-infiltration-study/

[238] https://library.municode.com/wa/thurston_county/codes/code_of_ordinances?nodeId=TIT24CRAR_CH24.10CRAQREAR_24.10.190REWA

Best Available Science

What are the challenges your jurisdiction faces for including Best Available Science for designating and protecting Critical Aquifer Recharge Areas? What would help?

- **Pacific Groundwater Group submitting for King County Water District #90**

  Comment: The watershed could benefit by new groundwater-surface water modeling. There are no recent basin-level studies of the water resources in WRIA 9.

  Response: We agree with this comment. It relates to best available science, water availability, and anadromous fisheries. Other jurisdictions have used grant funding from Ecology to study stream flow and permit-exempt well issues. Stevens County did such a study that is useful for stream flow restoration, water availability, and best available science for critical aquifer recharge areas. We are referencing their study as an appendix to the guidance as an excellent example of best available science.

- **City of Tumwater, Public Works Department**

  Comment: Our entire jurisdiction is designated as a CARA. I assume this is because all of our soils have extreme, high, or moderate sensitivity and designating the whole city as such is easier than having a patchwork. Might also have something to do with the history Tumwater has with groundwater contamination and sensitivity around that issue.

  Response: City-wide protection of the underlying aquifer often makes sense, especially when there are municipal wells at risk of contamination plus commercial and industrial activities that need to prevent contamination.

- City of Walla Walla

  Comment: I would say the technical expertise. Our CARA's were identified as part of the original CAO in 2008 but if an update were needed then resources to assist with the technical side.

  Response: Resources to assist with the technical side are very important. The question is where the funding comes from and who would do the work. Ecology provides grants that may be used for technical Critical Aquifer Recharge Area best available science development, although applications for grants must compete against other proposals. Consultants and the USGS have been used for technical assistance. Ecology has limited resources to assist when resources are available.

- **City of Spokane**

  Comment: The City of Spokane utilizes critical aquifer recharge areas designated by Spokane County.

  Response: This is a good approach.

- **Sammamish Plateau Water & Sewer District**

  Comment: Best Available Science (BAS) is appropriate for designation of CARA areas, but not necessarily for protection.

  Response: Protecting critical aquifer recharge areas depends on keeping contaminants from going onto or into the ground. This typically involves standard best management practices like secondary containment, spill and leak prevention, and many others. It also involves best available science for understanding treatment technology effectiveness and strategies such as using Low Impact Development.

  Comment: The current emphasis on the Quantity of water to be recharged in the CARA, and less emphasis on Quality of the water being recharged. Quality is included in the guidance, but Quantity without associated quality consideration and/or monitoring seems to dominate local regulations and reviews.

  The review of quality of water proposed for recharge into a drinking water CARA needs to include performance requirements and monitoring, or not being allowed.

  Low Impact Development (LID) requirements frequently require or favor infiltration of stormwater (quantity).

  Equal weight needs to be provided to the quality, particularly those stormwater systems that collect for roads or areas where herbicides and pesticides are likely to be in use.

  Response: The Critical Aquifer Recharge Area guidance is statewide and does include both quality and quantity. In the case of stormwater, much effort has gone into monitoring stormwater to determine what the contaminants generally are, and what treatment technologies remove contaminants. The monitoring and technology components of stormwater management are extensively dealt with by the Ecology Stormwater manuals and the UIC program. The UIC program is statewide, while the stormwater permits cover populous counties and cities across the state.

  Local regulations can be commented on and appealed during updates. Project reviews are up to local jurisdiction requirements and are subject to the State Environmental Protection Act[239] (SEPA) and the Land Use Procedures Act[240] (LUPA).

- **Four Horsemen Brewery**

  Comment: Counties do not provide what aquifer levels are, and there is no bench mark for what they should be maintained at.

239 https://apps.leg.wa.gov/RCW/default.aspx?cite=43.21C
240 https://app.leg.wa.gov/RCW/default.aspx?cite=36.70C

Response: Some Counties do monitor aquifer levels – However that is a resource intensive activity.

Comment: King county uses the GMA to trigger permits for the counties revenues and has no limits on what they can require. The amount of rainfall in western Washington far exceeds the eastern side of the state, where wells and water use is very limited and completely dependent on the aquifer levels and its recharge. Adjustments should be based on average rainfall, soil type, and if impervious surfaces allowance should be adjusted to the soil types surrounding the surface. No chart exists for minimum infiltration rates needed and what soil types exceed that, and should not require permitting for X (sq ft) amount of impervious surface per X (sq ft) of surrounding soil types.

Response: Impervious surfaces are regulated at the state level by the stormwater program, which issues permits, develops guidance, and develops tools. The Critical Aquifer Recharge Area Guidance draft refers to the Ecology Stormwater program and points out the importance of recharge for groundwater quality and quantity. For more information about how impervious surfaces are regulated at the state level, see the Ecology Stormwater web page[241] that also has a link to the Ecology contact for stormwater.

- **City of Vancouver**

  Comment: A standardized list of best available science actions/submittals would provide consistency across WA. The wetlands and stormwater guidance manuals provide a list. This recommend listing provides support to the community as staff incorporate those actions into policy.

  Response: Volume IV of the 2019 Stormwater Manual for Western Washington, and Chapter 8 of the 2019 Stormwater Manual for Eastern Washington[242] are on pollution prevention using source control BMPs. Most of these BMPs are applicable to groundwater protection, since preventing contamination at the ground surface prevents groundwater contamination. See Section 4, Step 6 of the newly revised guidance for more information.

- **Constance Ibsen**

  Comment: BAS is not used. Decision makers state there is no agreement on BAS. Withhold planning funds till jurisdiction demonstrates implementation of existing CARA ordinance.

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[241] https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources

[242] https://fortress.wa.gov/ecy/ezshare/wq/Permits/Flare/2019SWMMEW/2019SWMMEW.htm#Topics/Chapter8_SourceControl/Chapter8_TitlePage.htm%3FTocPath%3D2019%2520SWMMEW%7CChapter%25208%2520-%2520Source%2520Control%7C_____0

Response: Ecology does not distribute or control planning funds, that is a function of the Department of Commerce. In addition, the Growth Management Hearings Board or the court may impact planning funds for jurisdictions who do not comply with orders.

- **City of Redmond**

  Comment: The City of Redmond used Best Available Science (BAS) to designate our CARA and currently uses BAS to protect our CARA. Challenges occur during implementation of the conclusions from the BAS when there are conflicting interests, such as reclaimed water and source control as noted in the answer to question 1. More references or links within Section 4 of the CARA guidance would be helpful for municipalities with less resources that have trouble using BAS. For example, provide links to example wellhead protection zone plans, USGS studies, state studies, etc. instead of a list (page 28 of the guidance).

  Response: We agree with this comment and have added more specific information and links to resources.

Permit Process

How could the guidance help with the review and approval process?

- **Thurston County**

  Comment: Our county struggles with the different authorities between the health officer and building official, and we are probably not alone. Guidance could provide some case studies of jurisdictions (counties and cities) that have successfully bridged this gap in their review process.

  Response: This is a really important point and we would like to include more information on this. We need more input from jurisdictions who have tackled this issue successfully.

  Comment: At the state level there are all kinds of requirements that concern water and should be related, but state regulators are compartmentalized and don't coordinate (even within Ecology). County staff are always trying to balance requirements, and different pieces of the state may be providing different direction: storm water, health, water use, GMA, etc., etc. Guidance could help by acknowledging/understanding the role of other existing water-related requirements, and provide tips on how to effectively and efficiently integrate them where they overlap or complement.

  Response: We strongly agree with this comment. We have tried to include helpful information in the guidance. The review of the draft may produce some additional recommendations. If there were resources and authorization, it would be a good idea for Ecology to work on this more between programs together.

- **Four Horsemen Brewery**

Comment: Guidance is not helpful when permitting staff does not offer guidance, but only offers enforcement and overcharging for permits. A county can claim that once a property has above 5,000 (sq ft) of impervious surface, it will always require a permit for any addition, even when no evidence shows aquifer recharge rates being affected. It would be helpful if properties and structures with approved BMP's, could be considered pervious because they have the flow control needed to make them pervious. Staff is trained to always use the GMA and surface water management as a trigger for permitting for staff and county revenues.

Response: The requirement for a permit and fees is a county decision that has to go through proper procedure to be enacted. The critical aquifer recharge area guidance cannot really address this.

- **Constance Ibsen**

  Comment: Add Ecology to the permitting process until County demonstrates understands and is implementing its CARA ordinance.

  Response: There are many aspects of development that are regulated on the local level. Ecology does not have a way to be added to the local permitting process, except through already established authorities, such as through SEPA.

- **City of Redmond**

  Comment: The CARA Guidance could help with the review and approval process by including an additional topic in Section 5 to specifically focus on what some jurisdictions require for land-use applications within a CARA.

  For example, the critical areas regulations found in the City of Redmond's zoning code (RZC 21.64.050) includes a list of prohibited activities within wellhead protection zones and wellhead protection zone performance standards that are applied to properties and new land-use activities within the CARA.

  Response: This is a very good idea. I have included example code for allowed, permitted with conditions, and prohibited uses from Thurston County in Appendix C – Code Examples.

  Comment: The City of Redmond also requires a Critical Aquifer Recharge Area report for all new land-use proposals located within the CARA. The Critical Aquifer Recharge Area report includes either a Level I or Level II hydrogeological assessment with the level of study commensurate to the risk to wellhead protection areas associated with the proposed land-use activities (RZC 21.64.050 Appendix 1,F.).

  The CARA report evaluates the existing condition of the proposed development parcel, proposed changes to the parcel that may impact groundwater quality and quantity, and

proposed measures to mitigate or prevent impacts to groundwater as a result of the project.

Response: I have added the City of Redmond code for reports to Appendix C – Code Examples. I have also added a section on reports to the guidance.

Comment: The City of Redmond also prohibits infiltration of storm water from pollution generating hard surfaces within portions of the CARA. This information is included in the City's Stormwater Technical Notebook which is the approved storm water manual for projects in Redmond.

All of the previous types of development review requirements could be useful examples to any jurisdiction looking for guidance on implementing effective CARA regulations.

Response: We appreciate this comment and recommend that other jurisdictions look at the City of Redmond's groundwater protection programs, plans, and ordinances.

Mapping

Does your jurisdiction map Critical Aquifer Recharge Areas? If not, what does your jurisdiction need to map them?

(Please see overall response at the end of this section.)

- **Pacific Groundwater Group submitting for King County Water District #90**: No, [we] rely on King County.
- City of Tumwater, Public Works Department: The county has a pretty high resolution of critical recharge areas. Does not really matter for us since the entire city boundary is a CARA, but we do map our wellhead areas. We did this in 2016 using a numerical modelling approach.
- **City of Walla Walla**: Yes
- Thurston County: Yes, we map them. Current maps were made based on soils data. It would be desirable to be able to map based on surficial geologic map and newer LiDAR, rather than soils, and have a way to update with new information from reports that come in for specific sites.
- **City of Spokane**: The City of Spokane utilizes maps created by Spokane County.
- **Sammamish Plateau Water & Sewer District**: Yes
- **Four Horsemen Brewery**: Yes, it does have pretty colors to show the CARA, but this is not actually based on surrounding properties with wells needing aquifer water and does not adjust to parcels having city water lines, and no buffers are made around existing wells that depend on surface water BMP's. It is just an overdrawn boundary to require permits for an over-permitting scheme.

- **Constance Ibsen**: Political will.
- City of Redmond: Yes, Redmond's CARAs are mapped. Redmond has a GIS section and mapping is not an obstacle.

Overall Response: The guidance includes information about mapping and resources that are helpful for mapping. This question helped us get an idea of mapping of Critical Aquifer Recharge Areas by local jurisdictions.

Data Resources

What data resources would be helpful to you?

- **City of Tumwater, Public Works Department:** A centralized list of potential contaminant sites would be nice.

  Response: Ecology's Facility/Site Atlas is an online map of facilities and sites that Ecology regulates. The Department of Health uses Facility/Site to show potential sources of contamination within wellhead protection zones. The guidance references both the source water protection online map of wellhead protection zones, as well as the Facility/Site Atlas. The Ecology online map "What's In My Neighborhood[243]" shows toxic cleanup sites that have been identified, which will give a good idea of what has caused groundwater contamination in the past.

- **Thurston County**: It would be helpful to provide technical support for updating maps (including updated data layers)

  Response: We strongly agree with this statement and we think it would be a good idea to develop a GIS/online map of drinking water aquifers, which depends on resources. The Washington State Department of Natural Resources and the USGS have been working together toward subsurface mapping. There are many mapping resources at Geologic Information Portal | WA - DNR[244].

- **City of Spokane**: More in-depth information on business activity risk potential would be helpful.

  Response: Business activity risk potential depends on the chemicals in use, the quantities, how they are stored, how they are transferred from one container to another, how releases are prevented during use, the structural components of pollution prevention (such as secondary containment), the training employees have to address spills and leaks, and on-going maintenance of pollution prevention structures and practices.

[243] https://apps.ecology.wa.gov/neighborhood/
[244] https://www.dnr.wa.gov/geologyportal

Ecology's 2019 Stormwater Management Manual for Eastern Washington Chapter 8 – Source Control[245] has information about potential polluting sources. In addition to outdoor controls to prevent stormwater contamination, pollution prevention controls should be applied to indoor activities as well.

We also recommend looking at the contaminated sites list referenced in the guidance to see what land use activities have resulted in cleanup sites.

- **Four Horsemen Brewery:** It would be helpful to have data on impervious surface (types and depth) on the quality of aquifer recharge rates and contamination levels based on soil types.

  Response: Impervious surfaces retard aquifer recharge rates and separate water infiltration from the underlying soil. The impact of soil characteristics on aquifer recharge rates and contamination levels would be another question. There is a wide variety of conditions across the state that factor into aquifer recharge rates, as well as contamination levels. Contamination levels depend on the contaminant as well as surface and subsurface conditions. A good source for the rate at which soils transmit water is the Washington NRCS Soil Survey. The Soil Survey also has soil properties relevant for contaminant transport, such as organic matter content and cation exchange capacity. The draft guidance refers and links to the Washington NRCS online Soil Survey application.

- **City of Vancouver**: A comprehensive contaminated sites layer that's accessible and can be incorporated into local GIS (City/County). The City of Vancouver keeps a separate database which duplicates efforts and requires significant effort to stay up-to-date.

  Response: Several online data resources are included in the draft guidance, including the Washington State Department of Ecology Facility/Site Application[246] and the Ecology online map "What's In My Neighborhood[247]" that shows toxic cleanup sites.

- **Constance Ibsen**: CARA parcel maps, inventory of existing hazardous sites on GIS layer, monitoring & compliance activities notes.

  Response: Parcel maps are available in GIS, so it would depend on whether the CARAs are mapped in GIS. If so, they would be overlain on the parcel map. One city actually mapped CARAs using parcel boundaries. For hazardous sites, see the above response to the City of Vancouver. Monitoring has two elements: 1) Monitoring for compliance and 2)

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245 https://fortress.wa.gov/ecy/ezshare/wq/Permits/Flare/2019SWMMEW/2019SWMMEW.htm#Topics/Chapter8_SourceControl/App_UrbLandUsesAndPollutionGenSources/ManufacturingBusinesses.htm%3FTocPath%3D2019%2520SWMMEW%7CChapter%25208%2520-%2520Source%2520Control%7CAppendix%25208-A%253A%2520Urban%2520Land%2520Uses%2520and%2520Pollution-Generating%2520Sources%7C_____2

246 https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Facility-Site-database

247 https://apps.ecology.wa.gov/neighborhood/

environmental monitoring. The guidance has information on where to find groundwater monitoring data. Monitoring for compliance is a local function. You may find Appendix A of the draft guidance illumining – It includes Issaquah's program for inspections and tracking.

- **City of Redmond**

  Comment: Updated list of emerging contaminants, their source activities and monitoring techniques.

  Response: This is a very large and complex question that deserves to be developed. The draft does not currently address emerging contaminants. Reclaimed water facilities with extensive groundwater studies are good sources of information – such as the LOTT facility in Thurston County. Ecology's web page for more information: Reclaimed water - Washington State Department of Ecology[248], and Contaminants of Emerging Concern - Washington State Department of Ecology[249]. Ecology also has numerous publications on reclaimed water, and at least one on emerging contaminants (search Ecology publications[250]). The USGS has done numerous studies on emerging contaminants.

  Comment: Table 1 (page 31) could be updated to include regulation and guidance for LID, specifically related to recharge.

  Response: The draft guidance refers to the Ecology Stormwater program for information on LID.

  Comment: High density growth within the CARA can provide challenges to monitoring the groundwater. Standards for conducting groundwater monitoring near basements, etc. in the water table would be helpful to ensure monitoring efforts are providing accurate results.

  Response: Groundwater monitoring is a vast topic. The specific case of groundwater monitoring near basements and understanding potential interference for obtaining accurate results would require specific research or finding such research, and the draft guidance doesn't have anything that specific.

Implementation – Question 1

How does your jurisdiction address groundwater protection beyond building permits?

(Please see overall response at the end of this section.)

[248] https://ecology.wa.gov/Water-Shorelines/Water-quality/Reclaimed-water
[249] https://ecology.wa.gov/Water-Shorelines/Water-quality/Wastewater/Contaminants-of-Emerging-Concern
[250] https://apps.ecology.wa.gov/publications/UIPages/SearchPublications.aspx

- **City of Tumwater, Public Works Department**: Stormwater regs. Also… our CARA rules restrict certain land uses and on top of that our WHPA regs restrict others. With the help of Thurston County, we inspect businesses to make sure they have BMPs in place to reduce the potential for discharges. We also have a groundwater monitoring program, where we take quarterly samples throughout our WHPAs as an early detection tool.
- **City of Walla Walla**: Primarily building permits but we do have CARA's mapped so if a project is proposed within the boundary our CAO provides guidance on what can and can't be done.
- **Thurston County**: We have a hazardous waste program with limited funding and we have some monitoring.
- **City of Spokane**: The City has several activities that are aimed at protecting ground water. These include hazardous waste drop off, storm water handling and disposal, and sewering requirements. Business are also required to comply with the critical materials ordinance and above ground and underground storage tank requirements.
- **Sammamish Plateau Water & Sewer District**: Not a land use agency, so we do not issue building permits, but as a water purveyor we work to monitor applications for development (building permits, tenant improvements, subdivisions, etc.), to verify any activities associated with the development that might impact groundwater quality, particularly in our Wellhead Protection areas. We look for proposals to inject and/or infiltrate stormwater and also to the type of development and whether they may have hazardous materials on site when completed that need to be included in the contaminant inventory.
- **Four Horsemen Brewery**: It requires permits for ANY SURFACE change, considers Grassed Modular Grid Pavement impervious, and even requires a permit for me to maintain my driveway when grading it sustainably for 30 years. It words its code in a way that mowing my lawn can be considered a surface material change retarding water infiltration rates if over 2,000 sq ft and requires a permit.
- **Constance Ibsen**: In reality, Mason county does not even consider CARAs in building permits.
- **City of Redmond**: Development review, groundwater quality monitoring, water table monitoring, contaminated site cleanup monitoring, coordination with Ecology, pollution prevention inspections to businesses and outreach to community.

Overall response: Thank you for this information, it is valuable and much appreciated. We have added a section on implementation that discusses authority, compliance monitoring, program integration, and groundwater monitoring. If you have suggestions for improvement, please let us know.

Implementation – Question 2

What are the challenges you see with respect to implementation?

- **City of Tumwater, Public Works Department**: I am not sure if it presents a challenge, but one thing I wish we had was better communication across different departments within our jurisdiction. Would be nice know we're catching wind of all development projects that could create problems. This is partly a data/software thing. I'm sure our permit program could facilitate knowledge sharing, but it does not do that too well in this regard.

  Response: We agree with this comment. It would be helpful if there was grant funding for a project to address this and the results shared, since this is common to many jurisdictions. We have added a section to the draft that includes sharing information across departments (Section 11).

- **City of Walla Walla**: If additional requirements are included as a result of the guidance update what resources may be available to assist or does it become an unfunded mandate.

  Response: We have added to the draft recognition of funding and resource limitations and that funding and resources vary widely across the state. Grants can help.

- **Thurston County**:

  Comment: Focus should shift away from new regulations to provide more support for the existing regulations. There is no requirement for ongoing monitoring or inspections, and very limited funding to support it, so counties can't follow up unless they get a complaint.

  Response: We have added a section on Implementation – Authority, Monitoring, and Program Integration that addresses monitoring and inspections, with recognition of funding/resource limitations.

  Comment: Limited technical expertise when doing reviews to identify issues.

  Response: This is a significant problem across the entire state, especially for small jurisdictions.

  Comment: We need a better process to keep CARA-based assessments up-to-date. Modern data are not included in CARA-base assessments. No mechanism appears to exist to factor in modern data, or on-goingly include additional data:

  1) Wellhead protection area assessments: groundwater flow and transport information from modern and updated WHPAs
  2) Recent groundwater sampling and monitoring results,
  3) Hazardous materials locations,
  4) Known contaminated sites,
  5) Updated knowledge of chemistry/chemicals of concern,
  6) Modern soils mapping,
  7) 3D geologic mapping,

8) Confining layers' extents,

9) Water/wastewater systems' information,

10) Groundwater modeling,

11) LiDAR,

12) Pumping location/rate knowledge

All of these are highly beneficial to CARA-based site assessments, but are often excluded from reviews. Data we have are not routinely part of the CARA assessment process.

Response: I strongly agree that these are very useful to have and ought to be developed so that people can access and use them more easily. I think it would greatly help groundwater protection, and would also help surface water/stormwater pollution prevention and understanding the groundwater/surface water regime. It would take dedicated resources to accomplish a better information integration. Some of these items are available online and we have detailed them in the draft guidance. The Washington Geological Survey is involved with a 3D geologic mapping project with the USGS. The USGS has developed groundwater models for large areas of the state, and information from these models and the accompanying reports are very useful.

- **City of Spokane**

  Comment: Aquifers cross jurisdictional boundaries. Need to have uniform regulations.

  Response: We have added a section on Interjurisdictional coordination (Section 10). In addition, Chapter 1 of the Dept. of Commerce Growth Management Services Critical Areas Handbook[251] has a section on Regional Planning Efforts.

  Comment: Unclear overlap of regulations intra-media and inter-media (i.e. Municipal NPDES, Industrial NPDES, UIC, SDWA, etc.). A diagram or flowchart visually identifying the overlap and the agency responsible for regulation would be helpful to the user of the guidance document.

  Response: We agree with this comment and have revised the section on working with state and federal laws and rules to be more complete. A diagram is a good idea.

- **Sammamish Plateau Water & Sewer District:** Since we are not a land use agency, and do not have certain police powers, implementation depends on the land use agency having regulations that clearly address protection of the aquifer resource for new developments and existing land owners.

  Response: This situation makes it difficult for purveyors to protect groundwater they depend on. We have added a paragraph in Section 4, Step 6 highlighting this concern.

[251] https://www.commerce.wa.gov/serving-communities/growth-management/growth-management-topics/critical-areas/

- **Four Horsemen Brewery**: The county codes are designed as a means to overcharge citizens for permits. It needs to be changed to allow citizens to construct with due diligence and awareness of infiltration rates for projects or changes of use or property use to allow maintaining your property and lessen the overcharging for permits. It should instead offer the BMP's as a guide for citizens to use for projects less than the max impervious surface allowed on a parcel, and permitting staff could be paid permitting fees for people who want guidance and lack experience with such control measures.

  Response: The requirement for a permit and fees is a county decision that has to go through proper procedure to be enacted. The critical aquifer recharge area guidance cannot really address this.

- **City of Vancouver**: There are multiple actions that have no clear oversight triggers for the CARA responsible staff. See the next #8 response for particular challenges: NPDES, secondary permittees, federal projects in Sole Source Aquifer areas, etc.

  Response: The city would need to develop oversight triggers through the comprehensive plan and development ordinances. See our response to the comment you mention. We have added a section on implementation to the draft.

- **Constance Ibsen**: NO political will.
- **City of Redmond**: Monitoring - keeping up with pace of development and changing source areas for municipal water supply wells during temporary construction dewatering activities. Urban environments become complex to monitor. There are challenges in balancing development and preservation of natural resources.

  Response: These are very challenging areas to deal with especially in light of how limited resources are.

Implementation – Question 3

What would you like to see addressed in the guidance revision with respect to implementation?

- **City of Tumwater, Public Works Department**: It would be cool to see some guidance about groundwater monitoring. What would a robust, mid-range, and a basic monitoring program look like? Also, I wish it was easier to get a good inventory of potential contaminant sites. As is its kind of difficult to compile this information.

  Response: This subject deserves an entire manual – the draft guidance will not be able to be completely detailed, but we can offer an overview. We have added information about groundwater monitoring options to the draft guidance.

  The draft guidance contains information about online resources to inventory potential contamination sources.

- **City of Walla Walla**: Better understanding if there is technical assistance available at DOE and navigating to know who to speak with.

  Response: Ecology provides technical assistance mainly through Water Quality Program Regional Office Senior Hydrogeologists, when resources allow. Contacts are listed on Ecology's web page for Critical Aquifer Recharge Areas.

- **Thurston County**: Solutions to address those challenges.

  Response: We have done what we can in the draft and welcome further suggestions.

- **City of Spokane**: Some kind of state minimum standards so that could be some consistency across jurisdictional boundaries.

  Response: The draft guidance refers to the Growth Management Act Minimum Guidelines in Chapter 365-190 WAC, and we have added a section on Interjurisdictional coordination. The GMA allows for differences in local conditions – See Section 7 – Adapting to Local Conditions and Settings.

- **Sammamish Plateau Water & Sewer District**: Our water service area includes 3 jurisdictions, each with different practices for existing sites with potential contaminant sources. While each jurisdiction includes CARAs in the Critical Area Ordinances, only one jurisdiction has a program for source control inspections for businesses with quantities of hazardous materials over a certain threshold. Requiring source control inspections would be an added benefit.

  Response: We agree with this comment and have added a section on inter-jurisdictional coordination to the draft.

- **Four Horsemen Brewery**: Guidance should be given for projects that change a soil topography with more than 3' and affect infiltration rates while giving materials exempt from needing Clearing and grading permits for Surface Water Management.

  Here is a recent result from the hearing examiner of king county. 23. Source - (https://www.kingcounty.gov/~/media/independent/hearing-examiner/documents/case-digest/appeals/code-enforcement/2018/2018%20august/ENFR170114Supp_Butler.ashx?la=en)

  Thus, anyone who works any ground or vegetation in King County, in almost any manner, would presumptively have "cleared" or "graded." Each person who mows the lawn in the summer, prunes back the hedges in the fall, or adds some gravel to fill in a walkway's wet low spots in the winter, would have the burden to affirmatively demonstrate a narrowly-interpreted exemption to the requirement to obtain a permit.

  Response: This is up to the local jurisdiction and more detailed than the draft guidance can address at this time.

- **City of Vancouver**: We'd also like to see the guidance talk more about oversight of other NPDES permits like sand and gravel and industrial general permits plus the secondary permittees like the Port and other permitted agencies like WSDOT. They don't typically require our oversight through the land use/planning process but in the name of protecting groundwater, we would want them to come in for a review.

  Response: This is going to require more research - I believe local jurisdictions can require that permittees submit a copy of the application to the city, and that the city can inspect and require compliance with the permit if the city gives itself authority in its ordinances. Some jurisdictions require compliance with state laws and regulations. Some jurisdictions adopt state laws and rules by reference. It would be a function of the local ordinance to require that permittees with a state permit submit information to the city. In addition to the GMA, Title 35, Chapter 35.88 RCW[252] gives towns and cities broad authority to protect water supplies from pollution.

- **Constance Ibsen**: Using example of SMP, Ecology review and approve and enforce CARAs, not Commerce.

  Response: From Ecology's website:

  The Shoreline Management Act[253] (SMA) requires all counties and most towns and cities with shorelines to develop and implement Shoreline Master Programs[254]. The law also defines our role in reviewing and approving local programs. The SMA was passed by the Washington Legislature in 1971 and adopted by voters in 1972. Its overarching goal is "to prevent the inherent harm in an uncoordinated and piecemeal development of the state's shorelines."

  It would require legislation, rule development, program development, and resources to have a similar program for Critical Aquifer Recharge Areas.

- **City of Spokane**: An implementation plan of rules to be protective of the aquifer should be a bullet in Section 1 as an element of a good groundwater protection program.

  Response: Good comment, we have added a bullet for this in Section 1 as an element of a good groundwater protection program. We have also added a section on implementation to the draft guidance. We welcome any additional suggestions you may have.

- **City of Redmond**: More emphasis on health of aquifer, not just the time-of-travel zones, to set up the context for the guidance in the introduction. Consideration of how source area for supply wells may change due to external forces, such as temporary construction

[252] https://app.leg.wa.gov/RCW/default.aspx?cite=35.88
[253] http://apps.leg.wa.gov/RCW/default.aspx?cite=90.58
[254] https://ecology.wa.gov/Water-Shorelines/Shoreline-coastal-management/Shoreline-coastal-planning/Shoreline-Master-Programs

dewatering. An example quality assurance planning checklist in Section 4 would be helpful. Solution planning for contaminant challenges.

Response: We hope we have made the need to prevent groundwater contamination across aquifers clear in the draft. We are not sure about the quality assurance planning checklist – Are you referring to a checklist for groundwater monitoring? It would help to understand more about what contaminant challenges you would like to see solution planning for.

Cross-Jurisdiction

If your jurisdiction has a well or a well protection area in another jurisdiction, what has been your experience with dealing with challenges and solutions for the associated Critical Aquifer Recharge Area protection?

(Please see overall response at the end of this section.)

- **City of Sumas, Kyle Christensen, Mayor**: When looking at our aquifer, the fear that always crosses my mind is in regards to contamination from runoff of farm manure and pesticides. The major feedback I would give is in regards to wellhead protection areas and the protection policies in place. Currently, we easily enough protect our wells located within City limits; however, we would have to rely on the County to safeguard our wells at May Rd and beyond. I would love if our City had a say in any developments that happen within proximity of those wells.

  Response: This is a very common concern that would be helpful to address. We have added Section 10 on Interjurisdictional coordination to the draft.

- **City of Tumwater, Public Works Department**: Parts of our WHPA's do bleed into the county (inside and outside the UGA). From my limited experience coordination has been good. I guess the worst case scenario would be where the county permitted some sort of problematic activity within our WHPA. I've never seen that, nor have I heard of that happening in the past.
- **City of Walla Walla**: Challenge would be within the urban growth area where the City does not have permitting authority. One change the City made in 2014 was to require annexation for connection to city utilities. On-going coordination with the County is key and something that requires constant work.
- **Thurston County**: Cities - who can require a business license, may not understand which new businesses may use hazardous materials or pose a threat to groundwater – [They] don't route the application to health officials to review. Even if they did, the county has no funding to do the review, and no resources. Here is a recent example: https://www.theolympian.com/news/local/article222965980.html.

  Response: This concern is common to many or most jurisdictions in the state. It takes resources to protect the functions and values of Critical Aquifer Recharge Areas. Prevention is expensive – Contamination is more expensive. We have added an appendix on the cost of

contamination to the draft. We have also added information on Critical Materials inventories that some jurisdictions require to be submitted.

- **City of Spokane**: There is a lack of communication between jurisdictions. Water districts do not always receive SEPA notifications of projects that within their wellhead protection areas. Jurisdictions are not always aware of the potential impacts to wellhead protection areas.
- **Sammamish Plateau Water & Sewer District**: See answer to questions 6-8.

  There was also an issue where the land use agency allowed and then took ownership of a UIC in an area that posed a threat to a drinking water well, and did not consult with our jurisdiction prior to development and implementation of the structure. It took legal action to manage the situation.

- **Four Horsemen Brewery**: Code enforcement officers use the code to burden responsible home owners and require them to get permits for anything you do on your property. Codes are written in a way that the change of use for a property would not have a path to compliance because a county can word its codes in a way that restricts any activity on a property without a minimum amount of exemptions they must offer in design of their policies. If the county does not have surface water management on its county roads, citizens should be exempt from surface water management on their properties.
- **Constance Ibsen**: Mason County does not recognize CARAs. Adjoining jurisdictions would need to address [them].
- **City of Spokane**: The guidance document would benefit from a cross-sectional view of 2 intersecting cones of depression to visually identify for the user of the manual how a single well can influence another, as well as promote contaminant migration.

  Response: This is a good idea. We have updated the contaminant transport schematic to illustrate the cone of depression and the concept that pumping wells can draw contamination toward the well within the capture zone.

- **City of Redmond**: The City of Redmond's CARA extends beyond the City boundaries. One challenge is the application of reclaimed water on the CARA. The City worked with King County to develop an MOU to establish a cooperative relationship regarding the use of reclaimed water within Redmond's CARA, including areas extending outside the City's boundaries.

Overall Response: Inter-jurisdiction coordination is a very common concern that is a significant challenge to address. The comments provide valuable insights into the difficulties local jurisdictions face and will be very useful for continuing discussions. We have added Section 10 on Interjurisdictional coordination to the draft. We welcome additional suggestions.

Funding

Please describe how your groundwater protection efforts are funded. If you do not have sufficient funding, please feel free to state what your funding needs are in order to meet the requirements of the Growth Management Act for Critical Aquifer Recharge Areas.

(Please see overall response at the end of this section.)

- **Pacific Groundwater Group submitting for King County Water District #90**: All efforts are included as part of the District's Group A water system planning requirements under the Department of Health. Additional efforts beyond this are difficult to undertake due to costs.
- **City of Tumwater, Public Works Department**: Water rates and occasionally grants. I don't think any funding issues are preventing us from meeting requirements.
- **City of Walla Walla**: Not a dedicated funding source. Probably through water plan update and then implementing the CAO through building permit review.
- **Thurston County**: All permitting staff are funded by permit fees. There are very limited options for general or proactive groundwater protection efforts, and very limited staff available to respond to compliance complaints. Groundwater protection programs cut off since the Site Hazard Assessment funding ended. Jurisdictions would need funding to update CARA maps and data.
- **City of Spokane**: The Water department conducts groundwater testing of the Spokane Valley Rathdrum Prairie Aquifer using utility fees. The Fire department has inspectors and storage tank permits funded from permit fees and the general fund. Storm water is funded by utility charges.
- **Sammamish Plateau Water & Sewer District**: Funds are provided through our water rates, and in some cases for new developments, through monies collected during development for review and approval of proposals within the CARA.
- **Four Horsemen Brewery**: I am a small business trying to gain economic vitality in the rural area. I am a school teacher and am actively working with hundreds of businesses that are affected by the county successfully "Complying" with the state GMA, but ignoring state laws regarding small business, rural economies, and increasing the economic vitality of rural area. We are not paid, but only affect with the closure of our businesses from permitting staff.
- **City of Redmond**: The City of Redmond is the water purveyor and uses money generated from the water rates to fund groundwater protection efforts.

Overall Response: We have added information on funding sources provided in these comments to the draft under Section 11 – Implementation – Authority, Monitoring, and Program Integration.

Long Range Plans – Question 1

When developing, or amending, long range plans does your jurisdiction consider the long term availability or protection of groundwater?

(Please see overall response at the end of this section.)

- **Pacific Groundwater Group submitting for King County Water District #90**: Only as related to 10, above.
- **City of Tumwater, Public Works Department**: Long term availability... yes. The specific example I am thinking of is our water system plan update we're currently working on. It has a section on climate impacts to our aquifer over the next many, many years. (One thing it does not do is consider the impacts of full UGA build-out, which would be interesting.) Looks like our comp plan deals with this some too. Also of note is the North Thurston County Groundwater Management Plan. Protection... also yes. The conservation element of our comp plan deals a lot with this.
- **Clark County**: Multiple long range plans address availability and protection of ground water in some fashion: The coordinated water system plan, stormwater management plan, comprehensive plan, and water resource management plans for WRIAs. The two WRIA plans are by far the most comprehensive and direct in addressing water supply. The county's stormwater plan and associated code addresses water quality the most comprehensively.
- **City of Walla Walla**: Long term availability is primarily addressed through our water system plan which is currently being updated.
- **Thurston County**: Yes, however this is a new area of focus since the Hirst decision and RCW 90.94 – Streamflow Restoration rule. Still working out how those would interact with Comprehensive Plan, ongoing streamflow restoration watershed planning, and CARA rules.
- **City of Spokane**: Yes, the comprehensive plan considers groundwater protection and availability.
- **Sammamish Plateau Water & Sewer District**: Yes, through our Water Comprehensive Plan.
- **Four Horsemen Brewery**: It thinks about groundwater, but does not have the education level to make proper decisions and the state does not require codes and implementation be designed in a manner to limit how much a county can burden its citizens with permitting fees. It is designed instead as a tool to force citizens comply with codes or have their property be taken forcefully or liens put on property for work done for disadvantaged people and fines assed without limits.
- **Constance Ibsen**: NO
- **City of Redmond**: The City of Redmond's Comprehensive Plan includes eight policies specific to the protection of the City's Critical Aquifer Recharge Areas. The policies focus on: encouraging cleanup of contaminated sites, protection of groundwater quality and quantity, prohibiting discharge of wastewater and potentially contaminated stormwater to

groundwater, retaining and enhancing aquifer recharge, promoting infiltration of clean runoff, and encouraging retention of open spaces.

Overall Response: Ecology appreciates the depth of information and experience on planning evident in these comments. We appreciate the use comprehensive planning to integrate between various planning elements and water planning, and the complexity of these efforts. We have included comprehensive plans in the draft guidance – Please feel free to offer further suggestions.

Long Range Plans – Question 2

Anything you would like to say about long range plans for the long term availability or protection of groundwater?

- **Pacific Groundwater Group submitting for King County Water District #90**: See 2 above.
- **City of Tumwater, Public Works Department**: Nothing specific, except to say that we're lucky because in general water resource protection is very important to the City. I think this is partly due to the first-hand experience we've had with groundwater contamination at our Palermo Wellfield (TCE and PCE contamination that knocked out our primary wellfield in the mid-90s). Also... our mayor is very knowledgeable about groundwater issues being that he was a professional environmental engineer at ECY for a long time.
- **City of Spokane**: Not at this time.
- **Sammamish Plateau Water & Sewer District**: Continue to emphasize protection and avoidance strategies, as clean-up is almost always more expensive, and may not be feasible.

  Response: We strongly agree with this comment and have addressed this in the draft.

- **Four Horsemen Brewery**: Ground water protection is important and people exist who will not think about the environment with regards to their business practices. People should have an exemption from needing permits when they agree to maintain and use a property using the best management practices as guides for property maintenance and home ownership.

  Response: Permits are a local requirement and jurisdictions have the flexibility to determine alternate ways of protecting the functions and values of Critical Aquifer Recharge Areas.

- **City of Vancouver**: Clarify permitting and working across disciplines as a project starts to be entertained in the planning process. We're particularly concerned that Planning isn't looking at water supply issues. Submitted projects are often far along a planning approval process before those with water protection duties get involved.

  Response: We have added language with respect to working across departments to the draft in the added Section 11 on implementation.

- **Constance Ibsen**: To ensure the quantity and quality of groundwater in Washington, Ecology will need to step in and do the work and enforce.

  Response: Enforcement is done at the local level under the GMA. Ecology's role is to provide technical guidance. Where resources allow, Ecology may review and comment on plans and ordinances.

- **City of Redmond**: As density increases, there are more challenges in protecting the CARA. The City of Redmond's Comprehensive Plan strives to focus development in two urban centers encouraging re-development of already developed land within the two urban centers while preserving open space in the more rural area of the City. This vision to focus development in the urban centers helps protect the CARA by:
  1. Promoting infiltration of clean runoff in the urban centers will ensure that groundwater recharge is enhanced.
  2. Preserving open space by concentrating development in the urban centers will help maintain groundwater quality and recharge.

  Response: Ecology appreciates the expertise of the City of Redmond and the City's efforts to protect Critical Aquifer Recharge Areas. It is important as various jurisdictions learn how to handle challenges to share knowledge, experience, and strategies.

General

Please share any other concerns or opinions about the Guidance revision – What would you like to see changed or added?

- **City of Tumwater, Public Works Department**: Not really. Will keep an eye out for draft documents to review.

  Response: We greatly value reviews, thank you!

- **Clark County**

  Comment: It seems like the current document is largely geared for jurisdictions to get some background on CARAs and the need to establish them. The guidance is not that helpful for jurisdictions that have had CARA policies and code for a while and it doesn't outline ways to improve them. Examples of great policies, code language, implementation processes, etc. would be useful guidance for the county, in addition to updated guidance regarding any new relevant statutes, court cases, and best available science.

  Response: We agree with your comment, and we have included more examples from counties and cities. The Department of Commerce updated their Critical Areas Handbook, which includes a thorough section on statutes and court cases. We have also updated the discussion on best available science. We hope this is greatly improved and value your additional review comments.

Comment: We would really like to see more guidance on helping us review uses in the use table in future reviews.

Response: We think that the City of Spokane and Spokane County have excellent procedures based on Critical Materials, so we think the Critical Materials Handbook is a good existing reference for this. See the updated Guidance Appendix C under Critical Materials. We would really like to hear from you more feedback on the updated guidance.

- **Thurston County**

  Comment: Important to use the term "hazardous materials" not "hazardous waste"

  Response: We agree with this and am making changes where it makes sense.

  Comment: Amend the restriction of businesses that are Medium Quantity Generator (MQG) of hazardous waste and Large Quantity Generator (LQG) businesses within certain CARA's or WHPA's. The problem is that your generator status is not known until you do business and start generating waste and also your generation status can change from year to year. We would have to kick businesses out of CARA's when their hazardous waste generation status reaches MQG or LQG status, instead of being able to restrict them from doing business there in the first place.

  Response: We agree with you in principal. It is up to the local jurisdiction to write their own ordinance to meet this type of need.

- **King County**

  Comment: Update Table 1. to reflect current Solid Waste Handling WAC (173-350).

  Response: We agree with this comment. We will change the WAC reference to the correct one. Just to mention, Table 1 is being replaced by Section 6 – Working with State and Federal Laws and rules. Ecology has listed laws and rules online[255], a better up-to-date resource.

  Comment: Add links to other Ecology NPDES permits such as Municipal and Industrial in Appendix B.

  Response: Appendix B has been replaced by information contained in Section 6 – Working with State and Federal Laws and Rules. Links to the Ecology web page where there are links to the Industrial Stormwater General NPDES Permit and the Municipal Stormwater General NPDES Permit have been added.

  Comment: Fix website links throughout document.

[255] https://ecology.wa.gov/About-us/How-we-operate/Laws-rules-rulemaking

Response: Done, although we will need to be checking and updating periodically because things change.

Comment: In reference to RCW 36.70A.200 (Siting of essential public facilities), King County would be interested in focusing on the permitting and water use as it pertains to the geographic limitations for siting essential public facilities including regional road maintenance facilities.

Essential public facilities that provide emergency response actions to the public such as snow and ice response, hazardous material spill response and cleanup, storm and emergency road repair are functions that are critical for public safety.

It would be beneficial to include resources and information within the CARA Guidance Document that may further allow jurisdictions to pursue siting of these facilities that King County views as essential public facilities as it relates to water use restrictions and groundwater protection within CARA designated locations.

Response: We think this is a function for local government to address in their comprehensive plan and ordinances. We don't think the draft guidance restricts these considerations.

- **City of Spokane**

  Comment: There needs to be more alignment between storm water and ground water protection.

  Response: We agree. We have tried to include more on storm water and pollution prevention. We would be interested in review comments on the draft.

  Comment: There needs to be more discussion on non-point source contribution of contaminants.

  Response: We agree. I have added a section on Ecology's nonpoint source program and information about the Voluntary Stewardship Program. We would be interested in discussing this more.

- **Sammamish Plateau Water & Sewer District**

  Comment: Include an emphasis on quality of water recharged as a primary tenet, that is mentioned in the general statements, over and over. It is covered under certain associated regulations, such as the UIC, but bringing the issues associated with the infiltration of stormwater to the forefront would be helpful. Consideration of water quality is often inferred, but not addressed directly.

  Response: We have added stormwater infiltration to Section 4, Step 3 on inventorying existing potential sources of groundwater contamination.

- **Anonymous**

  Comment: Guidance should be offered for citizens without farming experience, or college degrees.

  Response: This one guidance is written to be as understandable as we can since it is meant both for local planners, local elected persons, and residents. We agree that there are complexities to the Growth Management Act and its implementation. For more information and answers to questions I would contact the Department of Commerce Growth Management Services[256].

  Comment: It should also be offered to citizens with disabilities.

  Response: Ecology agrees and so the revised guidance is using an accessible template to help people with disabilities.

  Comment: It should not be required without government having requirements for its roads and practices first.

  Response: State agencies are required to comply with comprehensive plans and development regulations (RCW 36.70A.103[257]).

  Constance Ibsen

  Comment: Too much deference given to local jurisdictions. Lack of funding is used as an excuse not to implement.

  Response: The Growth Management Act is structured so that either the Growth Management Hearings Board or the court can order a jurisdiction to take specific actions to comply with the Act, and this only occurs after an appeal or suit has been brought.

  Discontinue giving planning dollars to jurisdictions which have a prevent record of non-implementation and enforcement of CARA regulations. Make "failure to Act" a real enforcement tool.

  Response: The distribution of funding for planning is a function of the Department of Commerce.

  Comment: Please develop sites guidelines for biosolids applications sites. Consider a time limit on that application. Do not allow any sewage sludge to be applied in CARAs.

[256] https://www.commerce.wa.gov/serving-communities/growth-management/
[257] https://app.leg.wa.gov/RCW/default.aspx?cite=36.70A.103

Response: Washington state has laws and rules regarding biosolids application to land. The biosolids general permit is currently under development because the current permit expires on September 4, 2020. There will be a public comment process. See Ecology's biosolids website[258] for information about the permit, laws and rules, and guidelines.

Comment: Also, mandatory that each jurisdiction have the county-wide water system planning document. Mason County and PUD1 need to have this done for them.

Response:

- Chapter 36.70A.070 Comprehensive Plans – Mandatory elements requires that "The land use element shall provide for protection of the quality and quantity of groundwater used for public water supplies." This requirement should include coordination with water system planning.
- Water systems are required to plan, and the Department of Health (DOH) Office of Drinking Water has drafted their Water System Planning Guidebook[259]:

  > All public water systems must develop and implement a technical, managerial, and financial plan appropriate to the system's size, complexity, and performance; expected demographic changes; community-specific resource constraints; and planning history (see WAC 246-290-100 and 105).

- Chapter 246-293 WAC – Water System Coordination Act. These are rules for implementing coordinated water system plans within a jurisdiction. The trigger for a jurisdiction to implement these rules is based on a preliminary assessment finding problems with inadequate water quality, unreliable service, or lack of coordinated planning.
- The Local Government Consistency Determination Form[260] lists requirements for water systems to be consistent with local jurisdiction plans and ordinances.

Comment: Change CTED to Dept. of Commerce in narrative of the document.

Response: Done.

- **City of Spokane**

  Comment: Language that harmonizes stormwater regulatory language and groundwater protection language should be revised and incorporated throughout the document. For example, discharge of groundwater is similar, but not synonymous with stormwater discharges and could be easily confused.

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[258] https://ecology.wa.gov/Waste-Toxics/Reducing-recycling-waste/Organic-materials/Biosolids

[259] https://www.doh.wa.gov/Portals/1/Documents/4200/DRAFT%20Water%20System%20Planning%20Guidebook.pdf

[260] https://www.doh.wa.gov/portals/1/documents/pubs/331-568.docx

Response: We agree with this comment. We will add definitions to the glossary and look for places where terminology could be confused. If you have further examples, or see where clarification would be helpful, please let us know.

Comment: Additionally, source control should be an element that incorporated into the document to add another protective layer of the aquifer in that if stormwater doesn't become impacted, the potential impacts to the aquifer are pre-mitigated.

Response: We agree with this comment, since source control is the first line of defense against groundwater contamination. Stormwater regulations and the manuals contain source control best management practices. Some jurisdictions are not required to follow stormwater regulations; however, the stormwater best management practices that are applicable to groundwater protection are very relevant. Source control is a main element of a precautionary approach.

The Industrial Stormwater General Permit[261], re-issued in January 2020, contains a section called the Conditional "No Exposure" Exemption. This section has a list of eleven questions related to whether stormwater would be in contact with pollutants. This would be a great list for local jurisdictions to use to prevent groundwater contamination. The Industrial Stormwater General Permit does not automatically apply to groundwater infiltration – See the permit for applicability. Local jurisdictions may be more stringent and use the "No Exposure" provisions to guide their pollution prevention provisions.

Comment: Treatment of stormwater should be an element identified in the manual to add a layer of protection to stormwater that is meant to be infiltrated.

Response:

Ecology implements two basic approaches to stormwater treatment at the state level.

- One is to manage water quality from roads and parking lots by removing solids, oils, and metals prior to discharge. The UIC guidance within the Eastern and Western Washington stormwater manuals allows the vadose zone to be used as part of the treatment train.
- The other is to implement stormwater treatment best management practices, as required by Section S.8(D) of the Industrial Stormwater General Permit[262]. Stormwater treatment prior to discharge is implemented in this permit as a corrective action after sampling has found pollutants in the discharge.

[261] https://fortress.wa.gov/ecy/ezshare/wq/permits/ISGP_PermitFINAL.pdf
[262] https://fortress.wa.gov/ecy/ezshare/wq/permits/ISGP_PermitFINAL.pdf

Requirements for treatment of stormwater discharge to UIC wells apply statewide. Requirements for treatment of stormwater discharge that is not to UIC wells apply where the stormwater permits[263] apply.

Comment: The term "salmon-bearing streams" is used in a few spots in the document, and limits the scope of why stream-base flows should be maintained. The scope of why stream-based flows should be maintained should be increased in breadth to encompass greater than only the salmonids.

Response: We agree that streamflow is important beyond salmon-bearing streams. Streamflow is important for wildlife and plants, including endangered species. The GMA supports using an ecological approach, and streamflow is a buttress of ecological systems. Groundwater is connected to other critical areas and natural landscape issues, including floods, landslide hazards; channel migration hazards; habitat; and surface water quality.

- **City of Redmond**

  Comment: It would be helpful to include a section providing methodology to determine the CARA, and guidance on suggested levels of protection for different time-of-travel zones within CARA.

  Response: The City of Redmond has completed an extensive review of Critical Aquifer Recharge Areas and has developed a map based on modeling and public review. Redmond has designated two Critical Aquifer Recharge Areas, I and II. Classification I is for the area of groundwater that travels to a city well within five years, and Classification II is for the area of groundwater that travels to a city from within five to ten years, plus additional sensitive areas.

  Redmond's municipal code requires additional protection in Classification I areas.

  Here are some comments I would have for jurisdictions who have not completed the excellent work that Redmond has.

  CARAs for cities are generally of two types. One is the well head protection area time-of-travel for wells, and the other is the boundary of the drinking water aquifer. For example, the City of Vancouver has designated two CARAs – One for wellhead protection zones and the other for the rest of the city, since the aquifer that provides their drinking water underlies the city.

  While the entire aquifer is not necessarily required to be designated as a CARA, the pragmatic and economic need to prevent pollution suggests that a city may want to

[263] https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Stormwater-general-permits

designate the aquifer within city limits as a CARA, and require pollution prevention for uses that may generate contaminants if they leak, spill, or are otherwise released to the ground.

In the absence of science, that assesses where drinking water sources are located, the precautionary approach is needed to avoid contaminating the public drinking water supply, which includes individual residential wells, small water systems, and large water systems.

On time-of-travel zones: The closer to a water well a use is, the faster contaminants may reach the well. So many jurisdictions have stricter requirements in the one and five-year time-of-travel zone, and some use the ten-year time-of-travel zone. In my opinion, it is better to protect more and require pollution prevention more broadly, especially since many time-of-travel zones are calculated circles and do not account for groundwater flow rates or direction specifically.

So in summary, if it were me, I would prevent pollution throughout the city using ordinances that require best management practices where chemicals are used, handled, transported, or transferred between containers. I think there is a case for certain prohibitions or conditional approval with mitigation of high-risk uses within the five or ten-year time-of-travel zone to a well.

I would want the city to give itself authority to inspect and enforce to require corrective actions.

I would also want to have good maps of where drinking water is being used including both municipal and non-municipal users of groundwater. I would want good maps of aquifers within the city so I could let people know they are doing business over a drinking water aquifer. The guidance has suggestions for resources on how to do these.

Along with the City of Redmond, the City of Spokane and the City of Vancouver both have excellent programs as examples.

Comment: Some municipalities may need help to determine the proper level of effort for protection based on the time-of-travel.

Response: If it were me, I would follow the above response for development ordinances, and prioritize inspections and corrective action in well head protection areas.

Comment: Another major topic that would be of use to municipalities is guidance to address impacts on groundwater quantity from climate change.

Response: This is an evolving and complex topic. Major studies have been done to determine the impacts of climate change on groundwater. In my opinion, there are two main impacts: 1) Change in recharge regime that relates to timing and amount of recharge. This impacts groundwater discharge to streams and also flooding that occurs when groundwater levels are too high; 2) Groundwater mining during drought (or otherwise)

causes groundwater levels to drop. This is an increased risk when large water users must turn away from surface water sources to use groundwater. In addition, population growth requires more water.

Making development decisions about water availability in the face of climate change is not easy. The first step is understanding the water resources, tracking water levels, and tracking recharge sources. Some jurisdictions are turning to aquifer storage as a result. Water conservation requirements would be a good idea.

RCW 36.70A.172 Critical areas—Designation and protection—Best available science to be used. (1) In designating and protecting critical areas under this chapter, counties and cities shall include the best available science in developing policies and development regulations to protect the functions and values of critical areas. In addition, counties and cities shall give special consideration to conservation or protection measures necessary to preserve or enhance anadromous fisheries.

(2) If it determines that advice from scientific or other experts is necessary or will be of substantial assistance in reaching its decision, the growth management hearings board may retain scientific or other expert advice to assist in reviewing a petition under RCW 36.70A.290 that involves critical areas. [2010 c 211 s 3; 1995 c 347 s 105.]

Effective date—Transfer of power, duties, and functions—2010 c 211: See notes following RCW 36.70A.250.

Finding—Severability—Part headings and table of contents not law—1995 c 347: See notes following RCW 36.70A.470.

Protect Your **PRIVATE WELL**

Many Americans receive their drinking water from a private well. These wells are not regulated by EPA or required to follow EPA's standards. If you use a private well, there are steps you can take to protect your water and ensure the safety of your drinking water.

How to **PROTECT** Your Well

TEST YOUR WELL WATER ANNUALLY

Have your water tested annually for contaminants.

Always use a state certified laboratory for testing.

If contaminant levels exceed a drinking water standard, retest the water supply immediately and contact your public health department for assistance.

How to **PREVENT** Well Water Pollution

Keep hazardous chemicals out of septic systems and away from your well

Pump and inspect septic systems as recommended by your local health department

Install a sanitary seal and slope the area around the well to drain surface runoff

Hire a certified well driller for any new well construction or modification

How to **REMEDIATE** Your Well

If your well is contaminated or damaged, consult with your public health department, certified well inspector, and/or licensed well contractor to determine options for repair and remediation. Potential solutions include:

Disinfectants to remove germs and microbes.

Filters or other on-site treatment processes.

Identifying a new water source.

Digging a new, deeper well.

PAY ATTENTION to Your Well Surroundings and **ASK QUESTIONS**

Find out about facilities that may pollute your drinking water.

Attend planning or zoning meetings and ask questions about how your water sources will be protected.

Ask to see a project's environmental impact statement. Check if water sources have been addressed.

HOW WELLS CAN BECOME CONTAMINATED

Wells can become contaminated by sources around your well and your community. A few examples include:

AROUND YOUR WELL

Fuel tanks

Lawns—fertilizers, pesticides, and herbicides

Septic tanks and sewer lines

Swimming pool chemicals

AROUND YOUR COMMUNITY

Factories and industrial manufacturing

Farms and animal feedlots

New construction and mining operations

Cemeteries

For more information, visit: **epa.gov/privatewells**

Source Water Protection

Sanitary Control Area Protection

331-453 • Revised 11/30/2022

What is a sanitary control area?

The area immediately surrounding your well or spring that is most susceptible to contamination is called the sanitary control area (SCA). You must maintain an SCA of at least 100 feet around wells and 200 feet around springs.

The SCA is your first line of defense in keeping contaminants out of your drinking water system. You must control and monitor this area regularly to ensure that things going on closest to your source do not threaten your water quality. In the long run, prevention costs much less than installing treatment or a new source. This is not just a matter of regulation but can also expose you legally if, due to improper care or monitoring, contamination occurs and harms people.

Your SCA is part of a larger protective boundary called the source water or wellhead protection area. This area collects and transports not just water, but also potential contaminants, to your drinking water source.

Sanitary control area protection

You must control your SCA both legally and physically. This means you should either own the land around your water source or, if someone else owns it, have an enduring legal agreement in place that limits land uses and activities in that area. The resources list below includes a separate publication about this.

The SCA immediately surrounding a well or surface water intake is part of a larger protective boundary called the source water or wellhead protection area.

It also means that you cannot allow potential contaminant sources within the SCA. If you can't avoid or remove potential contaminant threats, we may require that you:

- Take steps to lessen the severity of the threat,
- Increase water quality monitoring,
- Install treatment, and/or
- Find a new drinking water source.

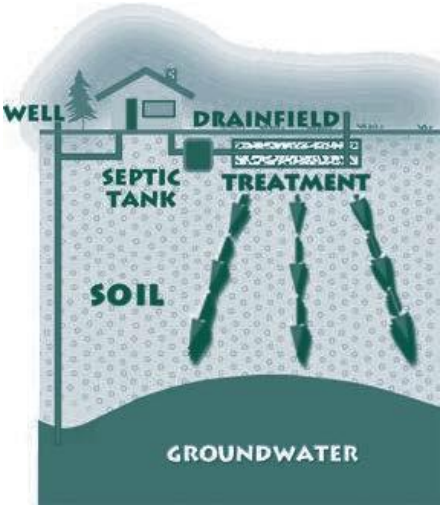
We consider the following factors when evaluating whether a potential contaminant source can remain in your SCA:

1. The nature of the potential contamination and the risk of release.
2. Source construction details including well depth, source construction, subsurface geology and other factors that could protect the source from contamination.
3. Distance from the potential contaminant source to the drinking water source.
4. Other relevant information.

Water systems must also develop a source water or wellhead protection plan to protect drinking water sources from contamination and loss of supply. The plan defines the protection area, identifies potential contaminant sources and includes management strategies to prevent contamination and loss of supply.

Common sanitary control area threats

Some common activities and land uses can threaten your source with contamination. Your well is more susceptible to contamination if it is shallow, poorly constructed, located in highly permeable soils, or served by surface water or groundwater under the influence of surface water. Below are some common threats to your SCA and some ways to protect your drinking water source. The best solution is to remove the threat. If that isn't possible, ask your regional office to help you find another workable solution.



Failing septic tanks can affect groundwater quality.

Sewer and septic systems

Sewer lines, drain fields, and septic tanks could leak and contaminate your drinking water source, resulting in severe illness or even death. Therefore, preventing this type of contamination is one of our highest priorities.

Ways to prevent or minimize the risk of contamination include:

- Remove the threat from your SCA, if possible.
- Sleeve the sewer line within another watertight line, or encase the sewer line in concrete.
- Increase coliform monitoring so you can detect problems early.
- Install disinfection treatment (with a CT of 6 according to agency requirements).


Do not store hazardous materials in the SCA.

Hazardous materials

Businesses, homeowners and water system personnel may use, store and dispose of hazardous wastes and materials. These include gasoline or diesel fuel, used motor oil, heating oil, cleaning products, pesticides, herbicides, and fertilizers. If they accidentally enter your drinking water supply, these hazardous wastes and materials are dangerous to public health.

To prevent or minimize contamination:

- Do not store chemicals there.
- Do not dispose of or apply hazardous waste or materials there.
- Install double-walled storage tanks, or provide other secondary containment.
- Install permanent on-site leak detection equipment.

Landfills and dumps

Everyday garbage can contain pathogens (bacteria, viruses, etc.); nutrients; and hazardous materials such as solvents, pesticides, fertilizers, pharmaceuticals, and paints. Leaks from landfills, dumps, and dumpsters could threaten nearby drinking water sources. Even properly constructed municipal landfills could leach hazardous materials, causing a plume, or large area of underground contamination, that could eventually reach your drinking water source.

To prevent or minimize contamination:

- Site wells and intakes at least 1,000 feet away from landfills.
- Remove dumpsters from your SCA.

Sewer waste by-products

Wastewater spray (sludge) irrigation or surface application of dry sludge is a way to recycle treated sewer waste. Even though the waste is treated, it can tend to increase nitrogen which then soaks into the soil and can contaminate groundwater. Do not apply sewer waste by-products in the SCA.

Cemeteries

Common burial practices use formaldehyde and other chemicals that pose a cancer threat for embalming. Studies show that these chemicals may leach from cemeteries into groundwater. If your SCA is near a cemetery, contact your regional office for guidance.

Animal waste, pens, feed lots and dead animals

If you see evidence of animals in your SCA, be concerned. Animal waste and dead animals could contaminate your source with bacteria and nutrients and make your customers ill.

To prevent or minimize contamination:

- Keep animals out of your SCA using fences or other means, which may include non-chemical controls to keep wild animals from invading your source.
- Install linings and walls around waste holding ponds.
- Increase coliform monitoring so you can detect problems early.
- Install disinfection treatment (with a CT of 6 according to agency requirements).

Unused and abandoned wells

All wells are a direct conduit to your groundwater and distribution system. Unused or abandoned wells that have not been properly decommissioned are often not monitored or maintained properly, increasing the likelihood of source contamination. Proper decommissioning means removing the well from active service and sealing it off from your distribution system and groundwater source. See resources listed below for more information.

Roads, parking areas, and landscaping strips

Petroleum products, chemicals, and metals can leak or be spilled and accumulate on paved surfaces like roads and parking lots, and chemicals can be used for landscaping maintenance.

To prevent or minimize contamination:

- Do not store vehicles or motorized equipment like lawn mowers in your SCA.
- Slope and pave surfaces away from the source.
- Install closed drainage systems. Do not install or allow stormwater infiltration ponds within your SCA.
- Install protective barriers (such as cones or poles) around the source to protect from vehicle damage.
- Post "no-spray" signs.

Noxious weeds

State law gives our state and local noxious weed control boards broad authority. Occasionally, a board might insist that a water system spray to kill noxious weeds in its SCA. Unfortunately, there's nothing in the law that requires them to consider or act in the best interests of source water protection. To avoid such conflicts, it's best for you to become familiar with both the state noxious weed lists (see WAC 16-750-005 through -015) and your local list, which varies by county. Continuously inspect your SCA(s) to remove any noxious weed starts before they establish.

Important: Giant Hogweed is highly phototoxic and requires special handling. Do not touch it without first looking up instructions for removal techniques to protect your employees or landscapers. Certain other weeds may be toxic as well. Do not compost noxious weeds; instead, place them in the trash.

For more information

Department of Health Office of Drinking Water
Eastern Regional Office 509-329-2100
Northwest Regional Office 253-395-6750
Southwest Regional Office 360-236-3030

Department of Ecology
Well Construction and Licensing (regional contacts on webpage)
Well Decommissioning

Free Technical Assistance
Evergreen Rural Water of Washington 360-462-9287

Relevant Rules and Publications
Washington Administrative Code citations.

- Chapter 173-160 WAC Minimum standards for construction and maintenance of wells.
- Chapter 246-203 WAC General sanitation.

- WAC 246-290-135 Source water protection (Group A).
- WAC 246-291-125 Groundwater source approval (Group B).

Our publications are online at doh.wa.gov/drinkingwater.

- *Legal Protections for your Sanitary Control Area* 331-048 (PDF).
- *Wellhead Protection Program Guidance Document* 331-018 (PDF).
- *Abandoned Wells: Problems and Solutions* 96-br-097 (PDF) Department of Ecology.