Tribal Source Water Protection Plan Guidance Document

Environmental Finance Center
EPA REGION 10

This guidance document was developed by the Environmental Finance Center at RCAC with funding provided by the United States Environmental Protection Agency

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Executive Summary

This guidance document has been prepared to assist tribal systems in protecting their drinking water sources from potential sources of contamination.

According to data from the Indian Health Service (IHS), nearly half (48%) of all homes on tribal land lack access to adequate drinking water, sewage, or solid waste disposal facilities.[1]

Even among those with access to running water or sanitation, many rely on drinking water systems that are not in compliance with the law(s) designed to protect health. According to data from the U.S. Environmental Protection Agency, tribal drinking water systems averaged approximately 60% more water quality violations compared with nontribal water systems.[2]

The disparity is most often due to a lack of funding for operation and maintenance.[3] A recent report by the House Committee on Natural Resources notes that tribes consistently receive the lowest funding per dollar of need out of any jurisdiction in the US.[4] Furthermore, incoming revenues for tribes can be limited; the tax base mostly nonexistent; and the levels of poverty and unemployment high on many reservations.[5]

Lack of access to clean and reliable drinking water has direct implications for tribes and Native families. Three of the largest include impacts to **health**, **education**, and **economic development** of tribes and their families.

There is a complex bureaucracy that a tribe must go through to address water issues common on Native American reservations and on tribal lands. Due to the great amount of need and the limited resources available; it is essential for tribes to protect their own sources and to take quick action when their drinking water system is in trouble.

When a tribe includes source water protection as part of a holistic approach to delivering clean drinking water the benefits include treatment and labor cost savings, improved water security, and other subsequent benefits such as habitat protection, recreational water quality improvements and protected fisheries. Protecting drinking water source quality is generally far less expensive than the cost of designing, installing, maintaining and improving treatment facilities to remove contaminants.

It is with all of these issues in mind that tribes must continue to be vigilant in protecting their drinking water sources.

NOTES

[1] These homes are ranked as deficiency levels 2-5. Email from Indian Health Service to House Committee on Natural Resources Minority Staff on August 2, 2016; *see also* Indian Health Service, Fiscal Year 2018: Justification of Estimates for Appropriations Committees, Department of Health and Human Services, CJ-169 (Jan 11, 2016), https://www/ihs.gov/budgetformulation/includes/themes/newihstheme/documents/FY2017CongressionalJustification.pdf.

[2] ECHO, Analyze Trends: Drinking Water Dashboard, Environmental Protection Agency, https://echo.epa.gov/trends/comparative-maps-dashboarding/drinking-water-dashboard?region=&view=performance&criteria=adv&tribe=All (Aug. 8, 2016); *see also* EPA 2013 National Public Water Systems Compliance Report.

[3] Fiscal Year 2017 Indian Country Budget Request: Upholding the Promises Respecting Tribal Governance: For the Good of the People, National Congress of American Indians 94(2016) http;//www.mcia.org/resources/ncai-publications/NCAI-2017-BudgetReport-Layout-FINAL.pdf(stating that "Tribal compliance with drinking water standards is consistently below those of other community water systems due to lack of funding for operations and maintenance"). This finding was confirmed in a call between the Environmental Protection Agency and the House Committee on Natural Resources Minority Staff on July 26. 2016.

[5] See, e.g., Taxation, National Congress of American Indians, http://www.ncai.org/policy-issue/tribal-governance/taxation (Aug. 11, 2016)

Overview

Most public water systems utilize either groundwater or surface water sources. Generally, these sources are in or near communities where land-use activities could potentially contaminate the water. It is important to have a plan in place that prevents contamination and loss of supply. In doing so, you are helping to protect your customers from exposures to contaminated water. Moreover, prevention is far less costly than responding to a contaminated source after the fact.

By having a proactive **Source Water Protection Plan**, you can increase your success in securing funding for drinking water system improvements and you lower the risk of incurring financial costs associated with source contamination, including:

- Groundwater remediation efforts
- Loss of a developed source
- Increased monitoring requirements
- Purchase of water while locating an alternate supply
- Hydrogeologic studies
- Engineering, construction and equipment costs
- Treatment of contaminated groundwater (if possible)

A **Source Water Protection Plan** is a written document that identifies:

- The area surrounding your source (well, wellfields, springs, or surface water) that must be protected from potential sources of contamination
- Potential contaminants within the Source Water Protection Area
- Prioritization of potential sources of contaminants or susceptibility analysis
- Public engagement process
- Tools to manage the potential contaminant sources
- Contingency planning and emergency response activities

Planning Team Roles & Responsibilities

One of the most efficient ways of developing an effective source water protection plan and program is to engage others in your process. Nearby public water systems, community members, business owners, land use and watershed planners, regulatory agencies, health departments, and technical assistance providers can all provide expertise, funding, or share community knowledge which will lead to the most effective plan. The planning team is responsible for identifying the routine source water protection plan review and update timeframe. The timeframe must include review/update of the inventory of potential contaminate sources (at least every two years) as noted in Step 2 below. **Attach a copy of the approved source water protection plan routine review and update timeframe to the source water protection plan.**

Each member of the planning team has a role to play:

Public Water Systems	Public Water Systems, including Tribal systems, are responsible for preventing contamination and loss of supply. The responsibilities include delineating time-of-travel boundaries, listing known & potential ground water contaminant sources in the defined Wellhead Protection Areas (WHPA), maintaining documentation which notifies all owners and operators of known potential sources of groundwater contamination within the WHPA boundaries, and identifying a contingency plan for providing an adequate supply of potable water if contamination results in a temporary or permanent loss of the source of supply. Public water systems may choose to work with other local jurisdictions and regulatory agencies to develop and implement their WHPA.
Tribes and Local Governments	Tribal governments act as the stewards of land and water. Tribes have both the authority and responsibility for protecting public health. Tribal governments make land use decisions, and oversee the activities on their lands such as mining operations, forestry operations, cattle feed lots, watershed management, nonpoint source pollution, restoration, wetlands, hazardous waste and on site treatment and disposal. There are many tools that Tribal governments utilize to protect their ground water supplies, such as zoning regulations, training, site plan review, building codes, groundwater monitoring, inspection and testing, or requiring bonds to cover spill response or remediation. Local governments have responsibility for implementing wellhead protection through land use planning decisions. Local governments can adopt zoning regulations that limit activities around the water supply, set design or operating standards for facilities in the wellhead protection area, or take other appropriate regulatory approaches.
Wellhead Protection Committees	Because many wellhead protection areas are, at least in part, outside the jurisdiction of the public water system, inter-jurisdictional cooperation is often essential for effective wellhead protection. The committee can include representatives from all affected parties including businesses, other local jurisdictions, media, and regulatory or assistance agencies such as Indian Health Service. The Tribe or local agency responsible for the public water system is most appropriate as the lead agency of the committee. In areas with multiple public water systems, a high degree of coordination is essential. Coordinators of tribal or local programs such as watershed

	management groups should be involved in the wellhead protection implementation efforts beginning in the very early stages. Coordinating efforts may provide significant cost savings when delineating and inventorying.
Health Jurisdictions	Health jurisdictions or regional health authorities (HJs) may have authority and responsibility for protecting public health in your area. Many HJs maintain records on the approval of individual septic systems. Some HJs have assumed responsibility for administering a drinking water program. In some areas, HJs play a lead role in implementing wellhead protection. HJ wellhead protection activities may include assisting in the inventory process, acting as an advocate to the local political jurisdictions, or providing technical assistance to small public water systems.
State Agencies	State health, environmental, or agricultural departments are responsible for protecting public health, protecting the environment and protecting groundwater. These offices oversee the engineering and operational function of many public water systems, oversee programs related to wellhead and groundwater quality protection and programs that control point and nonpoint pollution sources such as confined animal operations. They may have a wellhead protection program, work with other state agencies to host interagency meetings, develop technical assistance documents, conduct grant administration activities, or have pesticide registration, usage, storage, and application, or commercial fertilizer storage, transportation, and use regulations.
Federal Agencies	The U.S. Environmental Protection Agency (EPA) is the lead federal agency for wellhead protection. EPA reviews and approves Tribal, state, and wellhead protection programs. EPA provides federal funding for state wellhead protection programs, develops technical assistance documents, hosts workshops, and has provided grants for wellhead protection to Tribal and local governments.

Include information about your planning team members and their roles and responsibilities in the source water protection plan. You can record your planning team members and their roles and responsibilities in a chart like the example one below:

Organization	Representative Name	Role	Responsible For
Tribal Chairman		*Team Lead, final approval*	*Source Water Protection (SWP) board level advocacy, SWP plan*

			funding, final plan approval
Drinking Water System Manager		*Internal Team Lead*	*Convening the SWP planning team, directing internal SWP plan work,*
Drinking Water System Operator		*Document maintenance and updates*	*Contacting external partners, SWP plan draft, data collection*
Tribe Health Officer			
Tribe Watershed Coordinator			
EPA Primacy Representative			
IHS Representative			

Before we go in-depth with Source Water Protection, routine sanitary surveys are required for all public water systems. During a routine sanitary survey, the surveyor may identify water system deficiencies that threaten the safety and reliability of the drinking water supply, such as:

- Openings in the wellhead
- Holes in the casing or well cap
- Unscreened air vents
- Potential contaminants in the Sanitary Control Area
- Adding chemicals to the drinking water that are not National Sanitation Foundation (NSF) approved for potable water
- Potential cross connections
- Wellhead at risk of being submerged

If any of these deficiencies are identified, it is essential that they are immediately corrected. If the system is unable to correct the deficiencies within the time frame, they must submit a Corrective Action Plan, which outlines when a deficiency is expected to be corrected. In many cases, these are simple tasks such as sealing openings with silicone sealer or replacing a deteriorating screen – but they are the first defense in protecting your source.

Attach a list of system deficiencies (if any) from your system's latest sanitary survey and the action plan to correct those deficiencies to this template.

GETTING STARTED:

Step 1 – Delineate the Source Water Protection Area

Essentially, this step involves creating a map of land area surrounding the source, where spilled or discharged pollutants could filter through the soil into the ground water source.

For those systems that utilize a surface water source, EPA has developed a tool for delineating surface areas which can be found at the following link: WATERSGEO.

There are various methods to use for delineating a Source Water Protection Area:

Method	Required Data
Calculated Fixed Radius	Well pumping rate. Porosity of the aquifer. Lacking a site-specific estimate of aquifer porosity, you may substitute a value of 0.22. Open or screened interval of the well. If the actual screened interval is unknown or the well is constructed with an open interval at its base, use a value of 10 feet.
Analytical Models	Hydraulic gradient, hydraulic conductivity, saturated thickness, and hydrogeological divides. A system analytical model (such as EPA's WHPA Code) can often provide a good approximation of the time-of-travel boundaries.
Hydrogeologic Mapping	Geologic maps, aquifer water level mapping, aquifer pumping test data, hydrogeological reports and well reports.
Numerical Flow/Transport Models	Hydraulic gradient, hydraulic conductivity, saturated thickness, and hydrogeological divides. Geologic maps, aquifer water level mapping, aquifer pumping test data, hydrogeological reports and well reports.

Analytical methods can provide more reliable predictions of groundwater flow than the calculated fixed radius method because they incorporate more site-specific parameters. A water system may have a situation which will require a more sophisticated delineation method, such as if the hydrogeological setting is strongly non-circular due to a bedrock or karst formation or if there are high risk potential contamination sources. If this is true for your system, seek expertise on ground water modeling. For most systems however, the Calculated Fixed Radius method is sufficient.

Since the analytical methods require a certain level of expertise and data that is not easily attainable we are going to focus on the Calculated Fixed Radius method.

The calculated fixed radius method is a way to define a circular area around your source, which is an estimate of the area overlying the groundwater you will pump

through your well over a period of time. The radius of the circle depends on the time it takes groundwater to travel from the edge of the circle to your source.

Here are the **steps to preparing a calculated fixed radius:**

First, obtain a copy of the well log as you will need to know the screened interval length in your well. The "Screened Interval" refers to the length of the screened water inlet in the well through which water is pumped from the aquifer. An example of a Well Log can be found in Appendix B.

Next you will need to determine the annual volume of water pumped. Use **source water meter data** to respond to this question. If your source is unmetered, there are three ways to estimate the annual volume of water your system uses (gal/year).

1.) If you know your **pumping rate** (gal/min) use this calculation to estimate annual usage:

_____ gal/min x 60 min/hr x ____ hr/day x _____ day/year = _____gal/year

2.) If you don't know your pumping rate, use the same calculation, but substitute the **pump capacity** value for the pumping rate.

_____ gal/min x 60 min/hr x ____ hr/day x _____ day/year = _____gal/year

3.) Use the number of service connections on your system in the calculation below. Average household water use varies widely. For planning purposes, estimate 400 gallons a day per connection as an average rate of consumption.

# of service connections	x 400 Gallons per day per connection	x Average use days per year (365 for most)	= Estimated average pumping rate per year
50 connections	x 400 gallons per day per connection	x 365 days per year	=7,300,000 gallons per year.

Next go to the Table for Calculating Time of Travel in Appendix C.

Choose the table with the screened interval length that most closely matches the screened interval length in your well. You must round your numbers to choose the appropriate values for your groundwater travel times. If your screened interval length is exactly between two values, choose the smaller length.

If there is more than one screened interval, add the lengths together and use the sum for this value. If your well is unscreened, or the screened interval is unknown, or your well is constructed with an open interval at its base, use the table with the "Screened Interval = 10 feet."

Next, choose the "annual volume pumped" that most closely matches your own.

After the radius has been determined, locate the source on an application such as Google Earth Pro https://www.google.com/earth/versions/#earth-pro. If you choose to

use Google Earth Pro, you will see an aerial view of the well site and by using the application's measuring tool, you will be able to take measurements to local sources of contamination. You will also be able to outline the 6-month, 1-, 5-, and 10-year time-of-travel zones on the map, these are indicated as follows:

Zone 1 = 6-month & 1-year time-of-travel
Zone 2 = 5-year time-of-travel
Zone 3 = 10-year time-of travel

Example of a Source Water Protection Area with zones identified:

The reason a utility would delineate different zones of concern is because conducting a comprehensive survey for all potential sources of contamination within a large wellhead protection area requires time. It is important to update and redefine the source water protection area and zones when new wells are installed or changes in well production due to ground water changes occur. Conducting an inventory is addressed in the next section.

Source: Washington State Department of Health
Wellhead Protection Guidance Document (DOH-331-018)

Step 2 – Inventory Known and Potential Sources of Contamination

A necessary element of the Source Water Protection Plan is an inventory of all potential groundwater contaminant sources in and around the delineated Source Water Protection Areas. The purpose of the inventory is to identify past, present and proposed activities that may pose a threat to the aquifer. An example inventory form is shown below:

Threat ID	Threat Name	Threat Owner	Location & Distance from Primary Intake	Contaminants & Volume / Discharge Rate	Existing Risk Mitigation Strategies	Threat Level

Some examples of potential pollutant sources are:

- Landfills
- Gas stations & auto salvage yards
- Underground or above ground storage tanks
- Oil pipelines
- Residential or commercial septic systems
- Stormwater runoff from streets and lawns
- Farms that apply pesticides and fertilizers
- Mining operations
- Small livestock areas
- Military or other legacy waste

Inventory efforts should be prioritized using two criteria:

1. **First**, work outward from the wellhead or source. The most intensive efforts should focus on Zone 1, the 6-month and 1-year time-of-travel areas. Then, expand the inventory outward to include Zones 2 and 3.

2. **Second**, focus on high and medium risk facilities and activities in the entire Source Water Protection Area. High risk potential contaminant sources vary, but some types of operations pose a potential threat in almost all settings. For example, underground storage tanks, dry cleaning operations, chemical

wholesale operations and electroplating facilities, all have a high potential for seriously affecting groundwater quality.

The United States Environmental Protection Agency has developed an online mapping tool called DWMAPS to help you locate drinking water providers, potential sources of contamination, and polluted waterways. This application is very easy to use. Users do not need access to special software. Simply use the following link to access DWMAPS:

https://geopub.epa.gov/DWWidgetApp/

Additionally, data may be found by:

- Contacting facility owners or managers directly.
- Contacting tribal, county or city planning departments for information about land uses and facility locations.
- Conducting field searches for some or all of the area being inventoried.
- Utilizing Google Earth Pro, which allows you to see an aerial view and take measurements to local sources of contamination.

As land use activities change over time, updating your Source Water Protection Program will be on ongoing task. The contaminant inventory list **should be updated every two years and notification letters should be re-sent as needed.**

The contaminant inventory in the following example includes:

- Unlined irrigation ditch from an irrigation district
- Edge of a field where herbicides & pesticides may or may not be applied
- Residential septic systems
- Roads
- Livestock areas

Threat ID	Threat Name	Threat Owner	Location & Distance from Primary Intake	Contaminants & Volume / Discharge Rate	Existing Risk Mitigation Strategies	Threat Level
1.a	Septic tank 1	B. Septic	Within 200-feet	Nitrate, sulfate, coliform	Repair septic	
1.b	Septic Tank 2	M. Septic	Within 200-ft	Nitrate, sulfate, coliform	Repair septic	
1.c	Livestock	Farmer J.	Within 200-ft	Nitrate	Remove livestock from area per restrictive covenant	
3	Row Crop Ag	S. Corn	900-ft	Nitrates, Phosphates, coliform	BMPS, easements, Fee simple purchase	
3	Irrigation Ditch	R. Irrigation	900-ft	Nitrates, Phosphates, coliform	Possible water testing	

Threat ID	Threat Name	Threat Owner	Location & Distance from Primary Intake	Contaminants & Volume / Discharge Rate	Existing Risk Mitigation Strategies	Threat Level
4	Road	Example County	Within 200-ft	Spill potential	Notification of source location	

Step 3 – Determine the Susceptibility

Information gathered through the inventory process can be used to evaluate risks posed to the Source Water Protection Area and to prioritize actions and management efforts. When assessing the risks posed by potential contaminant sources, the type of material or activity, quantity, and method of storage and handling should all be taken into account.

To learn about chemical properties and relative health risks of contaminants, EPA maintains a list showing the potential health effects from long-term exposure above the MCL and common sources of contaminant in drinking water. The list can be found at the following site:

https://www.epa.gov/sites/production/files/2016-06/documents/npwdr_complete_table.pdf

After you have identified the potential contaminant sources in the Source Water Protection Area, it is time to start addressing these individually.

- Determine a risk "score" for each potential source.
- Rank each source according to the level of risk associated with it.
- Determine the relative level of threat that a given source poses (high, medium, or low).

Using the example system from previous sections, a risk assessment was made and threat score determined:

Threat ID	Threat Name	Threat Owner	Location & Distance from Primary Intake	Contaminants & Volume / Discharge Rate	Existing Risk Mitigation Strategies	Threat Level
1.a	Septic tank 1	B. Septic	Within 200-feet	Nitrate, sulfate, coliform	Repair septic	High
1.b	Septic Tank 2	M. Septic	Within 200-ft	Nitrate, sulfate, coliform	Repair septic	High
1.c	Livestock	Farmer J.	Within 200-ft	Nitrate	Remove livestock from area per restrictive covenant	High
3	Row Crop Ag	S. Corn	900-ft	Nitrates, Phosphates, coliform	BMPS, easements, Fee simple purchase	Medium
3	Irrigation Ditch	R. Irrigation	900-ft	Nitrates, Phosphates, coliform	Possible water testing	Low

Threat ID	Threat Name	Threat Owner	Location & Distance from Primary Intake	Contaminants & Volume / Discharge Rate	Existing Risk Mitigation Strategies	Threat Level
4	Road	Example County	Within 200-ft	Spill potential	Notification of source location	Low

Similar contaminant sources may need to be managed differently in different Hydrogeologic settings. For example, an activity located over a shallow water table aquifer, where water moves from the land surface to the aquifer in a matter of hours or days, may need to be managed differently than the same activities in an area where a particle of water may take months or years to travel from the surface through a series of confining layers before reaching the aquifer.

Some agencies to contact regarding hydrogeology information:

Groundwater & Geology Information
https://www.pge.com/en_US/residential/customer-service/home-services/renovating-and-building/permit-office-locator/permit-office-locator.page

National Maps of Groundwater Quality
https://water.usgs.gov/nawqa/digmap.html

California Natural Resources Open Data – Groundwater level Monitoring & Water Quality Data
https://data.cnra.ca.gov/group/water

Using this technique, water system managers can develop an initial property list for focusing implementation efforts. The next step is to identify the property owner(s) for the potential contaminant sources so that a notification letter may be sent.

Step 4 – Notify the Public

After identifying potential contaminant sources, water systems must take steps to prevent contaminants from entering their water supply.

Because many water suppliers do not own or control all of the land that falls within their wellhead protection areas, an effective source water protection plan must identify owners and key stakeholders and have the cooperation of those who do have control, such as tribal departments, local government agencies and land owners.

A letter to property owner(s) of the potential contaminant sources should be sent notifying them that they are located within your Source Water Protection Area. An example notification letter is included in Appendix A. It is important to keep documentation showing that the owners have been notified.

Regulatory agencies, including tribal departments, local government agencies, planning departments and those who make land-use decisions should also be informed of your Source Water Protection Area. An example notification letter is included in Appendix A. Keep documentation showing that these agencies have been notified.

Public education is an important part of managing wellhead protection areas. When people understand that their activities might affect the water they drink, they are more willing to change their practices. It is a good idea to post signs reminding the community when they are entering a Source Water Protection Area.

Step 5 – Implement Management Measures

So far you have delineated a Source Water Protection Area, inventoried potential sources of contamination, notified owners of those properties, and notified governmental agencies, what more can you do?

The following are a few tools that tribes and local governments can use to better protect source water:

Best Management Practice. BMPs are voluntary actions with a long tradition of use, especially in agriculture. Technical assistance for farmers wishing to apply them is available.

Bonding. Facilities may be required to post a bond prior to operation in a Source Water Protection Area. The bond can cover costs associated with spill response or remediation efforts.

Building Codes. Local building codes offer protection through special standards applicable to facilities remodeled or constructed in the Source Water Protection Area. Building codes can also require low flow fixtures, backflow preventers and other design features to conserve and protect groundwater.

Contingency Planning. Local governments can develop their own contingency plans for emergency response to spills and for alternate water supply following contamination of the current source.

Design Standards. Design standards typically are regulations that apply to the design and construction of buildings or structures. Use this tool to ensure new buildings are designed not to pose a threat to the water supply.

Groundwater Monitoring. Groundwater monitoring includes selecting appropriate sampling sites sloping up from a well and developing an ongoing water quality monitoring program.

Inspection and Testing. Local governments can use their statutory home rule power to require more stringent control of contamination sources.

Operating Standards. Operating standards are safety or environmental protection regulations that apply to ongoing land-use activities. Such standards can minimize the threat to the Source Water Protection Area for ongoing activities such as the application of agricultural chemicals or the storage and use of hazardous substances.

Public Education. Public education often consists of brochures, pamphlets, or seminars designed to present source water protection problems and protection efforts.

This tool promotes the use of voluntary protection efforts and builds public support for a community protection plan.

Purchase of Property or Development Rights. The purchase of property or development rights is a tool used by some localities to ensure complete control of land uses in or surrounding a Source Water Protection Area. This tool may be preferable if regulatory restrictions on land use are not politically feasible and land purchase is affordable.

Site Plan Review. Site plan reviews are regulations requiring developers to submit for approval plans for development occurring in a given area. This tool ensures compliance with regulations or other requirements made within a Source Water Protection Area.

Source Prohibitions. Source prohibitions are regulations that prohibit the presences or use of chemicals or hazardous activities within a given area. Local governments can use restrictions on the storage or handling of large quantities of hazardous materials within a Source Water Protection Area.

Subdivision Ordinances. Subdivision ordinances are applied to land divided into two or more subunits for sale or development. Local governments use this tool to protect Source Water Protection Areas where ongoing development is causing contamination.

Training and Demonstration. These programs compliment many regulations. For example, training underground storage tank inspectors and local emergency response team, or demonstrating agricultural BMPs.

Waste Reduction. Residential hazardous waste management programs can be designed to reduce the quantity of household hazardous waste being disposed of improperly.

Zoning Ordinances. Zoning ordinances typically are comprehensive land-use requirements designed to direct the development of an area. Many local governments have used zoning to restrict or regulate certain land uses.

Zoning Overlay. Overlay zones can be used with conventional zoning to create special districts to protect the Source Water Protection Area. Overlay zones are applied to areas singled out for special protection. They add regulations to controls already in place.

Source: U.S. Environmental Protection Agency, 1989
Wellhead Protection Programs: Tools for Local Governments (440-6-89-002)

Include in the source water protection plan a summarized and prioritized list of management tools and protection strategies (that will be used to manage potential sources of contamination in your source water protection area) and the implementation timeline for the selected tools and strategies.

You can record your implementation plan and timeline in a chart like the example one below:

Management Tool/Protection Strategy	Implementation Outcome	Priority Level (1 Lowest, 5 Highest)	Proposed Implementation Date
Source Water Protection Area (SWPA) Land Use Regulations Review & Updates	*Review and update (as necessary) of land use and zoning regulations for lands located within the SWPA to prevent the location of potential contaminate sources*	2	*Within one year of source water protection (SWP) plan approval*
SWPA Contaminate Inventory Update	*Routine updates to prevent potential contamination in the SWPA*	1	*Every two years after the SWP plan approval date*
SWPA Contaminate Sources Notification (every two years)	*Routine notification to prevent potential contamination in the SWPA*	2	*Every two years after the SWP plan approval date*
SWPA Waste Disposal Education	*Reduction in illegal dumping in SWMA*	2	*Within two years of SWP plan approval*
SWPA Waste Disposal Inspections and Clean Up	*Timely reporting and remediation of illegal dumping in SWPA*	1	*Within one year of SWP plan approval*
Establish a SWPA Agriculture BMP work group	*Discussion to determine information and resources needed for agricultural BMP for SWPA*	4	*Within two years of SWP plan approval*

Step 6 – Develop Contingency Planning

Water systems must undertake two components of managing the Source Water Protection Area:

- Contingency plans for an alternative supply of water in case the primary well or wellfield (or surface water source) is lost due to contamination.
- Emergency Response Plan.

A contingency plan is used to ensure consumers have an adequate supply of potable water if contamination results in the temporary or permanent loss of the main source of supply.

In a contingency plan identify all existing or potential interties with other public water systems and identify future potential sources of drinking water.

You would also identify the costs associated with the purchase and/or delivery of alternate water supplies so that the system is prepared to meet those costs.

The contingency plan should include cost estimates associated with obtaining short and long term alternative sources of supply. If that analysis shows no alternative sources of supply or interties are available, the contingency plan should clearly state this and proceed to analyzing treatment options for the potential contaminant sources determined to pose the highest risk to the source of supply.

The EPA has created *a Guide to Ground-Water Supply Contingency Planning For Local And State Governments: Technical Assistance Document* that may be helpful in developing your contingency plan located here:

https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=00001PIY.txt

For Emergency Response Planning, the EPA has developed a Water Utility Response On-The-Go Mobile Application and Website. The app makes accessible from the field, information and tools that a water utility operator and their response partners may need during an emergency. It is free, easy to use and can be found at the following site:

https://www.epa.gov/waterutilityresponse/water-utility-response-go-mobile-application-and-website

Attach a copy of the approved contingency plan and emergency response plan that identify alternative water sources to the source water protection plan.

Additional Resources:

- *A Methodology for Locating and Managing Dynamic Potential Source Water Contaminant Data* (Project #4581)
- *Online Source Water Quality Monitoring for Water Quality Surveillance and Response Systems*, abbreviated as *SWM Guidance* hereafter. Additional resources that support a risk assessment are described in *SWM Guidance*.
- *Wellhead Protection Program Guidance Document* (DOH 331-018)
- *Oregon Wellhead Protection Program Guidance Manual*
- *Overview of Drinking Water Protection in Alaska*
- *Idaho Wellhead Protection Plan* (Idaho DEQ February 1997)
- *Benefits and Costs of Prevention: Case Studies of Community Wellhead Protection: Volume I* (813-B-95-005)
- *Benefits and Costs of Prevention: Case Studies of Community Wellhead Protection: Volume II* (813-B-95-006)
- *Business Benefits of Wellhead Protection: Case Studies* (813-B-95-004)
- *Case Studies in Wellhead Protection: Area Delineation and Monitoring* (600-R-93-107)
- *The Wellhead Program: Forerunner to Source Water Protection Efforts across the Nation* (813-F-95-001)

Appendix A – Sample Notification Letters

Sample Notification Letter 1 *To local jurisdictions/agencies/tribes*

Dear (Agency/Local Government):
We are writing to let you know that businesses or facilities that you regulate are in our public water system wellhead protection area. Please take all reasonable steps to ensure that land use activities within this area do not contaminate our drinking water sources.

Our water system has _____ service connections and serves about _____ number of people.

The enclosed map shows the 6-month, and 1-, 5-, and 10-year time of travel boundaries for our Source Water Protection Area. We are also sending you a list of the facilities or activities of concern. Any groundwater contamination that occurs within this wellhead protection area has a high potential to reach our well.

Thank you for your support in protecting our drinking water.

Sincerely,

Sample Notification Letter 2 *To potential source owners*

Dear Homeowner –

To protect the drinking water supply for the customers of _____, we are developing a source water protection plan as required by law. As part of our source water protection plan, we have mapped the area overlying the short-term recharge zone of our drinking water supply.

Most of the well contaminants that commonly cause concern originate above ground, often as the result of human activities. Pesticides, fuels, and industrial chemicals are examples of pollutants that can contaminate a groundwater supply.

Your property has been identified as being located within our Source Water Protection Area. The purpose of this letter is to urge you to be mindful of your use of any pesticides, herbicides, fuel, oils, and other possible contaminants on your property – as this has the potential of impacting our drinking water.

Thank you for your support in protecting our drinking water supply. If you need further information, please contact me at _____.

Sincerely,

Appendix B – Well Log Example

WATER WELL REPORT
Original – Ecology, 1st copy – owner, 2nd copy – driller

ECOLOGY

Construction/Decommission (*"x" in circle*)
○ Construction
○ Decommission *ORIGINAL INSTALLATION Notice of Intent Number* ______

CURRENT
Notice of Intent No. ______
Unique Ecology Well ID Tag No. ______
Water Right Permit No. ______
Property Owner Name ______
Well Street Address ______
City ______ County ______
Location ___1/4-1/4 ___1/4 Sec ___ Twn___ R___ EWM or WWM (circle one)
Lat/Long (s, t, r still REQUIRED) Lat Deg ______ Lat Min/Sec ______
Long Deg ______ Long Min/Sec ______
Tax Parcel No. ______

PROPOSED USE: ☐ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other ______

TYPE OF WORK: Owner's number of well (if more than one) ______
☐ New well ☐ Reconditioned *Method*: ☐ Dug ☐ Bored ☐ Driven
☐ Deepened ☐ Cable ☐ Rotary ☐ Jetted

DIMENSIONS: Diameter of well ______ inches, drilled ______ ft.
Depth of completed well ______ ft.

CONSTRUCTION DETAILS
Casing Installed: ☐ Welded ______" Diam. from ______ ft. to ______ ft.
☐ Liner installed ______" Diam. from ______ ft. to ______ ft.
☐ Threaded ______" Diam. from ______ ft. to ______ ft.
Perforations: ☐ Yes ☐ No
Type of perforator used ______
SIZE of perfs ______ in. by ______ in. and no. of perfs ______ from ______ ft. to ______ ft.
Screens: ☐ Yes ☐ No ☐ K-Pac Location ______
Manufacturer's Name ______
Type ______ Model No. ______
Diam. ______ Slot size ______ from ______ ft. to ______ ft.
Diam. ______ Slot size ______ from ______ ft. to ______ ft.
Gravel/Filter packed: ☐ Yes ☐ No ☐ Size of gravel/sand ______
Materials placed from ______ ft. to ______ ft.
Surface Seal: ☐ Yes ☐ No To what depth? ______ ft.
Material used in seal ______
Did any strata contain unusable water? ☐ Yes ☐ No
Type of water? ______ Depth of strata ______
Method of sealing strata off ______

PUMP: Manufacturer's Name ______
Type ______ H.P. ______

WATER LEVELS: Land-surface elevation above mean sea level ______ ft.
Static level ______ ft. below top of well Date ______
Artesian pressure ______ lbs. per square inch Date ______
Artesian water is controlled by ______ (cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☐ No If yes, by whom? ______
Yield: ______ gal./min. with ______ ft. drawdown after ______ hrs.
Yield: ______ gal./min. with ______ ft. drawdown after ______ hrs.
Yield: ______ gal./min. with ______ ft. drawdown after ______ hrs.
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

Date of test ______
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

CONSTRUCTION OR DECOMMISSION PROCEDURE
Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. Indicate all water encountered. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO

Start Date ______ Completed Date ______

WELL CONSTRUCTION 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.

☐ Driller ☐ Engineer ☐ Trainee Name (Print) ______
Driller/Engineer/Trainee Signature ______
Driller or trainee License No. ______
If trainee, licensed driller's Signature and License no. ______

Drilling Company ______
Address ______
City, State, Zip ______
Contractor's Registration No. ______ Date ______
Ecology is an Equal Opportunity Employer. ECY 050-1-20 (Rev 2/03)

Appendix C: Table for Calculating Time of Travel

10 FOOT Screened Interval	Time of Travel			
Annual Volume pumped (GAL)	6 month (radius in feet)	1 year (radius in feet)	5 years (radius in feet)	10 years (radius in feet)
< 5,000,000	220	310	700	980
10,000,000	310	440	980	1390
20,000,000	440	620	1390	1970
50,000,000	700	980	2200	3110
100,000,000	980	1390	3110	4400
250,000,000	1550	2200	4920	6950
500,000,000	2200	3110	6950	9830

25 FOOT Screened Interval	Time of Travel			
Annual Volume pumped (GAL)	6 month (radius in feet)	1 year (radius in feet)	5 years (radius in feet)	10 years (radius in feet)
< 5,000,000	140	200	440	620
10,000,000	200	280	620	880
20,000,000	280	390	880	1240
50,000,000	440	620	1390	1970
100,000,000	620	880	1970	2780
250,000,000	980	1390	3110	4400
500,000,000	1390	1970	4400	6220

50 FOOT Screened Interval	Time of Travel			
Annual Volume pumped (GAL)	6 month (radius in feet)	1 year (radius in feet)	5 years (radius in feet)	10 years (radius in feet)
< 5,000,000	100	140	310	440
10,000,000	140	200	440	620
20,000,000	200	280	620	880
50,000,000	310	440	980	1390
100,000,000	440	620	1390	1970
250,000,000	700	980	2200	3110
500,000,000	980	1390	3110	4400

75 FOOT Screened Interval	Time of Travel			
Annual Volume pumped (GAL)	**6 month (radius in feet)**	**1 year (radius in feet)**	**5 years (radius in feet)**	**10 years (radius in feet)**
≤ 5,000,000	80	110	250	360
10,000,000	110	160	360	510
20,000,000	160	230	510	720
50,000,000	250	360	800	1140
100,000,000	360	510	1140	1610
250,000,000	570	800	1800	2540
500,000,000	800	1140	2540	3590

Appendix D: Glossary

Aquifer: A geologic formation capable of yielding a significant amount of groundwater to wells or springs. A confined aquifer is located beneath a formation with significantly lower permeability such that water cannot readily move in a vertical direction between the surface and the aquifer.

Aquifer Porosity: Refers to the amount of empty space within a given material. In a soil or rock the porosity (empty space) exists between the grains of minerals.

Best Management Practices: Practices and operating procedures that prevent or reduce the pollution load. They are designed to facilitate voluntary compliance through education.

Contaminant Source: A source discharging pollutants into the environment. Some contaminant sources are not single source and are considered nonpoint sources. Any discernible, confined, or discrete conveyance from which pollutants are or may be discharged, including, but not limited to, pipes, ditches, channels, tunnels, conduits, wells, containers, rolling stock, concentrated animal feeding operations, or vessels are point sources.

Delineation: A wellhead protection area delineation completed during source approval. Calculated fixed radius method can be used, screened area estimated, and pumping rate based on either water right quantity or number of connection.

Groundwater: Water that occurs in subsurface openings in the earth, such as the spaces between particles in unconsolidated deposits or along fractures in consolidated deposits.

Hydrogeology/Hydrogeological: The study of groundwater, with emphasis on its interaction with geologic materials and settings.

Inventory: An inventory completed during the source approval process. At minimum, it must identify all potential and actual sources of groundwater contamination that may pose a threat to the water-bearing zone (aquifer) used by the well, spring, or well field in the 1-year time-of-travel zone, and all high-risk sources within the entire wellhead protection area.

Public Water System: A Group A public water system is one that serves 15 or more connections, or an average of 25 or more person per day for 60 or more days within a calendar year.

Recharge: Surface water that enters into a groundwater system. This can be natural recharge, such as from precipitation, or artificial recharge, such as from irrigation or dry wells.

Recharge Zone: Area in which water reaches the zone of saturation by surface infiltration.

Screen: A metal or plastic slotted tube used to maintain the well openings in unconsolidated aquifer formations and admit water being pumped from the aquifer.

Screen Interval: Refers to the length of the screened water inlet in the well through which water is pumped from the aquifer.

Surface Water Source: Surface waters include streams, rivers, lakes, reservoirs, and wetlands used as a source of drinking water.

Time of Travel: The period used to define the area through which groundwater will move and recharge a pumping well. For wellhead protection purposes, time-of-travel is expressed in years.

Water Table: The water level in the saturated zone where the water pressure is equal to atmospheric pressure. In practical terms, it is equivalent to the static water level.

Well: There are various well types.

> **Bored Wells:** Constructed with screw augers. Usually relatively shallow wells in soft cohesive formation such as clays and silts.
>
> **Cable Tool (Percussion) Wells**: Constructed by raisin and dropping a heavy weight with a chisel bit. Borehole walls must be supported by temporary casing during construction. More common at shallower depths than rotary drilled wells.
>
> **Drilled Wells:** Mechanically constructed wells characterized by the use of rotary, cable tool, or auger rigs for drilling. Often completed to depths greater than possible with other methods.
>
> **Driven Well:** Built by driving a casing with a screened drive point into an aquifer. Used in permeable surface aquifers.
>
> **Dug Well:** Hand-excavated wells, commonly wider and shallower than drilled wells. The sidewalls may be supported by materials such as masonry or concrete rings.
>
> **Jetted Wells:** Constructed by using a high-pressure water jet to cut a hole in unconsolidated materials.
>
> **Lateral Collector Well (Ranney):** A large-diameter well, sunk to the aquifer, with horizontal boreholes drilled out from the central well. More common in thin aquifers in alluvial deposits, especially adjacent to a river.

Rotary Wells: Drilled using circulating fluid (usually water or mud) in the borehole to support the borehole walls during drilling, eliminating the need for temporary casing.

Wellhead: The physical structure, facility, or device at the land surface from or through which groundwater flows or is pumped from water-bearing geologic formations.

Wellhead Protection Area: The surface and subsurface area surrounding a water well, or well field, supplying a public water system, through which contaminants are reasonably likely to move toward and reach the water well or wellfield.

Appendix E: Wellhead Delineation Example

First, obtain a copy of the well log. We need to know the screened interval length. In this example, the well does not have screens or perforations. As noted earlier, <u>if your well is unscreened, or the screened interval is unknown, or your well is constructed with an open interval at its base, use the table with the "Screened Interval = 10 feet."</u>

So in this instance, it would be 10-feet.

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. _____
Water Right Permit No. _____

(1) **OWNER:** Name _____ Address _____

(2) **LOCATION OF WELL:** County _____ ¼ ¼ Sec. _____ T. _____ N., R. _____ W.M.

(2a) **STREET ADDDRESS OF WELL** (or nearest address) _____

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

(4) **TYPE OF WORK:** Owner's number of well (if more than one) _____
Abandoned ☐ New well ☒ Method: Dug ☐ Bored ☐ Deepened ☐ Cable ☐ Driven ☐ Reconditioned ☐ Rotary ☒ Jetted ☐

(5) **DIMENSIONS:** Diameter of well 8 inches.
Drilled 222 feet. Depth of completed well 222 ft.

(6) **CONSTRUCTION DETAILS:**
Casing installed: 8 " Diam. from 0 ft. to 222 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 _____
Type _____ Model No. _____
Diam. _____ Slot size _____ from _____ ft. to _____ ft.
Diam. _____ Slot size _____ from _____ ft. to _____ ft.

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

Surface seal: Yes ☐ No ☐ To what depth? _____ ft.
Material used in seal _____
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? _____ Depth of strata _____
Method of sealing strata off _____

(7) **PUMP:** Manufacturer's Name BERKLEY
Type: SUMP H.P 5 HP

(8) **WATER LEVELS:** Land-surface elevation above mean sea level _____ ft.
Static level 91' ft. below top of well Date _____
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? Lusk Pump
Yield: 45 gal./min. with 3' ft. drawdown after 1 hrs.
" " " "
" " " "
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
2'00	91'				

Date of test 4-5-93
Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.
Airtest _____ gal./min. with stem set at _____ ft. for _____ hrs.

(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
Top Soil	0	5
Soil Sediments	5	160
SAND Sm. Gravel Water	160	180
Cemented Sand Gravel & WATER	180	200
Lg. Gravel Water	200	222

Work started _____, 19 Completed _____, 19

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 _____ (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address _____
(Signed) _____ (WELL DRILLER) License No. _____
Contractor's

Next, we need to know the annual volume of water pumped. Typically, you would just add up twelve months of Source Meter readings to see how much water was pumped for the year. But if your system does not routinely record source meter readings, you could perform the following calculation:

In this example, this is a small community water system with (18) connections.

# of service connections	x 400 Gallons per day per connection	X use days per year (365 for most)	= Estimated average pumping rate per year

18 x 400 = 7,200
7,200 x 365 = 2,628,000 gallons per year.

Next go to the Table for Calculating Time of Travel in Appendix C.

10 FOOT Screened Interval	Time of Travel			
Annual Volume pumped (GAL)	6 month (radius in feet)	1 year (radius in feet)	5 years (radius in feet)	10 years (radius in feet)
< 5,000,000	220	310	700	980
10,000,000	310	440	980	1390
20,000,000	440	620	1390	1970
50,000,000	700	980	2200	3110
100,000,000	980	1390	3110	4400
250,000,000	1550	2200	4920	6950
500,000,000	2200	3110	6950	9830

In this example, the screened interval is 10-ft and the annual volume pumped is less than 5,000,000. So according to the chart, the Time of Travel is as follows:

6-month radius in feet = 220-ft
1-year radius in feet = 310-ft
5-year radius in feet = 700-ft
10-year radius in feet = 980-ft

Now that we know the distances we can map this data using a mapping application such as Google Earth Pro https://www.google.com/earth/versions/#earth-pro The following map shows the Delineated Source Water Protection Area for this system. It is in this area, that you must focus your source water protection efforts.

As you can see, potential contaminants sources include houses with septic systems, lawns, a road, and the edge of a farm where pesticides and herbicides may or may not be applied. You will also want to check for other potential sources of contamination by using EPA's DWMAPS:

https://geopub.epa.gov/DWWidgetApp/


E Badger Rd
Pump House
Well #1
Badger Rd
Goose Gap Rd
E Sunset View Pl SE
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