



New Mexico Source Water and Wellhead Protection Toolkit

November 27, 2013

Introduction

Source Water Protection is a voluntary option created by Congress in the Safe Drinking Water Act amendments of 1996 that encourages public water systems to partner with states to protect sources of drinking water supply. The purpose of this toolkit is to provide public water systems in New Mexico with standardized and comprehensive procedures and templates for monitoring and protecting their water sources. New Mexico public water systems are not required to use these templates. Other templates are available, and water systems also may create their own custom format.

This toolkit provides specific step-by-step procedures to:

- create a Source Water Protection Team;
- update the Source Water Assessment;
- develop, or update, a Water Conservation Plan;
- develop, or update, an Emergency Response Plan;
- develop, or update, a Source Water Protection Plan; and
- develop a public education and outreach plan.

Public water systems, and the consumers they serve, should benefit from this planning process as it provides tools and training for development of local knowledge and expertise. Upon completion of this process, public water systems and the consumers they serve should have attained a greater level of self-sufficiency in monitoring and protecting their water resources.

The U.S. Environmental Protection Agency (EPA) recommends that a watershed approach to source water protection be considered ([EPA, 1997](#), page 1-10). If a watershed approach is utilized, and if multiple public water systems are involved, some portions of this template may apply to all of the systems while other portions will need to be prepared for each system.

How To Use This Toolkit

The collaborating organizations have created these step-by-step templates as a roadmap to assist public water systems in assessing and protecting their water sources. These templates are being provided in NM Word so that water systems have the discretion to scale the templates up or down as deemed appropriate.

For convenience, these templates can be completed and submitted to NMED as stand-alone elements, or as a comprehensive Source Water and Wellhead Protection Plan. Areas where the user may add information are **highlighted in gray**. Areas that are not relevant, or for which no information exists, should be left blank. If so desired, the information added to this template can be cut and pasted into a separate document prepared in a report format that does not contain the user steps and instructions.

Additional Information

The websites for the collaborating agencies can be accessed by clicking on the logos at the top of the first page of this toolkit. To contact the NMED Drinking Water Bureau, Source Water and Wellhead Protection Program, call 505-476-8620, or go to http://www.nmenv.state.nm.us/dwb/water_protection/Index.htm.

Selected Internet resources from various organizations are listed below (press the Ctrl button and click on the link).

EPA Program Resources
Safe Drinking Water Act
Drinking Water Regulations
Wellhead Protection Guidance
Source Water Protection Webpage
Source Water Protection Guidance Document for State Programs
Federal Funding Opportunities for Source Water Protection
NM State Program Resources
NMED Drinking Water Bureau Drinking Water Watch
NM EIB Drinking Water Regulations, 20.7.10 NMAC
NM State Engineer Water Use and Conservation

Hydrogeologic Resources
NMED Source Water Protection Atlas
NM State Engineer Water Rights Reporting System (WATERS Database)
NM Bureau of Geology Bibliography of Geology
US Geological Survey Science in Your Backyard, NM Transport of Anthropogenic and Natural Contaminants to Supply Wells Maps of Estimated Nitrate and Arsenic Concentrations for Basin-Fill Aquifers in the Southwestern USA
NM Water Resources Research Institute
Funding Resources
EPA Federal Funding Opportunities for Source Water Protection
NMED Water Infrastructure Portal

Acknowledgement

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Step 1.C – Gather Information on Measured Water Levels, Production Rates and Well

Pump Tests

- Static and pumping water levels inside supply wells
- Production rates in gallons per minute (gpm) for wells and springs; this is a measurement of what the source is capable of producing, not the actual rate of water withdrawn
- Water well pump (aquifer performance) tests

Water Source Hydraulic Data Table – Add extra lines for other parameters. Copy and paste this table as many times as needed for additional sources or multiple measurement dates for the same source. This table can also be replaced with a custom MS Excel spreadsheet developed by the Source Water Protection Team.

	Source/date	Source/date	Source/date	Source/date	Source/date
Depth to water (feet below ground surface)					
Production rate (gpm)					
<u>Pump test parameters</u>					
Transmissivity					
Hydraulic conductivity					
Storativity					

Step 1.D – Gather Information on Regional Hydrogeology

- NM Bureau of Geology, Bibliography of Geology <http://geoinfo.nmt.edu/libraries/gic/bibliography/home.cfm>
- NMED Source Water Protection Atlas <http://gis.nmenv.state.nm.us/SWPA/>
- NMED Surface Water Quality Bureau, stream surveys, TMDL documents <http://www.nmenv.state.nm.us/swqb/>
- Identify information on the depth to groundwater, direction of groundwater flow, groundwater geochemistry.
- Identify areas with declining water levels, land subsidence, or natural geologic contamination.

Hydrogeologic Reports and Documents – Insert more lines if needed.

Aquifer Sensitivity and Geologic Maps, Optional – Refer to Appendix A for step-by-step instructions on how to use the Source Water Protection Atlas to generate custom maps.

Paste screen image of aquifer sensitivity map here.

Paste screen image of geologic map here.
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If possible, use the same area and scale for preparing all maps.

Step 2 – Define the Source Water Protection Area

For the purpose of defining Source Water Assessment Areas, Congress directed that the States use, “all reasonably available hydrogeologic information on the sources of the supply of drinking water in the State and the water flow, recharge, and discharge and any other reliable information as the State deems necessary to adequately determine such areas...” [Section 1543(a)(2)(A)]

- From the Source Water Protection Atlas, <http://gis.nmenv.state.nm.us/SWPA/>, that is zoomed into the community. With both the aquifer sensitivity and geology layers turned off, turn on the imagery base map, view the image, and then turn on the topographic map and view that image. Select the base map that is most suitable. Note that all data layers showing permitted facilities and contamination sites (potential sources of contamination, PSOCs) are automatically turned on when the Atlas opens up.
- For groundwater systems, use the “draw circle” button in the tool bar to draw a circle around a water supply well. A circle radius of 1 mile is recommended, but the Source Water Protection Team may find that larger or smaller radii, or a polygon, are more appropriate. A more sophisticated delineation of the Source Water Protection Area also could be created by using a hydrogeologic model that incorporates the hydraulic gradient and aquifer properties, and that calculates contaminant travel times in the vicinity of a supply well.
- Save, copy and paste map screen image below using the procedures in Appendix A.

Paste screen image of Source Water Protection Area map here.
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- For surface water systems, refer to Appendix B for detailed guidance on defining a Source Water Protection Area.

Step 3 – Inventory Potential Sources of Contamination (PSOCs) within Protection Area

- Attempt to identify PSOCs that are not included in the Source Water Protection Atlas. These PSOCs could include geologic rock formations that are known to contaminate

groundwater, areas of naturally occurring groundwater contamination, and manmade PSOCs that are not included in the Atlas. These additional PSOCs might be located by reviewing old Source Water Assessments and Sanitary Surveys, hydrogeologic reports (Steps 1.A and C above), and by conducting field surveys.

- If no additional PSOCs are identified, copy and paste the map image below.
- If additional PSOCs are identified, copy the map generated in Step 2 above into MS Paint or into a computer aided drafting (CAD) program. Add the additional PSOCs to the map using symbols that do not duplicate those used in the Atlas. Copy and paste the revised map image below.

Paste screen image of revised Source Water Protection Area/PSOC map here.

Water Conservation Plan

For the _____ Water System
PWS Number NM-_____

- Review existing plan, or develop new plan, with decision making board and community.
- Consider tiered rate structure that prices water service according to cost and usage.
- Assess water audit and leak detection programs, need for installation of water meters at each connection
- N.M. Office of the State Engineer, Water Conservation Guide for Public Utilities
<http://www.ose.state.nm.us/water-info/conservation/pdf-manuals/nm-water-manual.pdf>
- Cut and paste, or append, Water Conservation Plan as desired.

Emergency Response Plan

For the _____ Water System
PWS Number NM-_____

An Emergency Response Plan is required for water systems that serve more than 3,300 persons, and recommended for all systems.

- NMED template - <http://www.nmenv.state.nm.us/dwb/tools/Index.htm> (under the heading of “Emergency response & security”).
- RCAC template (to be modified for New Mexico) - <http://www.rcac.org/assets/.online%20materials/ERP%20Template%20for%20Public%20ODW%20Systems.pdf>.
- Review existing plan, or develop new plan, with decision making board and community.
- Procedures for various types of emergencies.
- Federal, state and local contacts.
- Options for alternative water sources.
- Directions on how and where tankers can deliver water into distribution.
- Identify local/regional water haulers approved by NMED.
- Provisions to deliver bottled water to elderly or ill persons.
- Cut and paste, or append, Emergency Response Plan as desired.

Source Water and Wellhead Protection Plan

For the [redacted] Water System
PWS Number NM-[redacted]

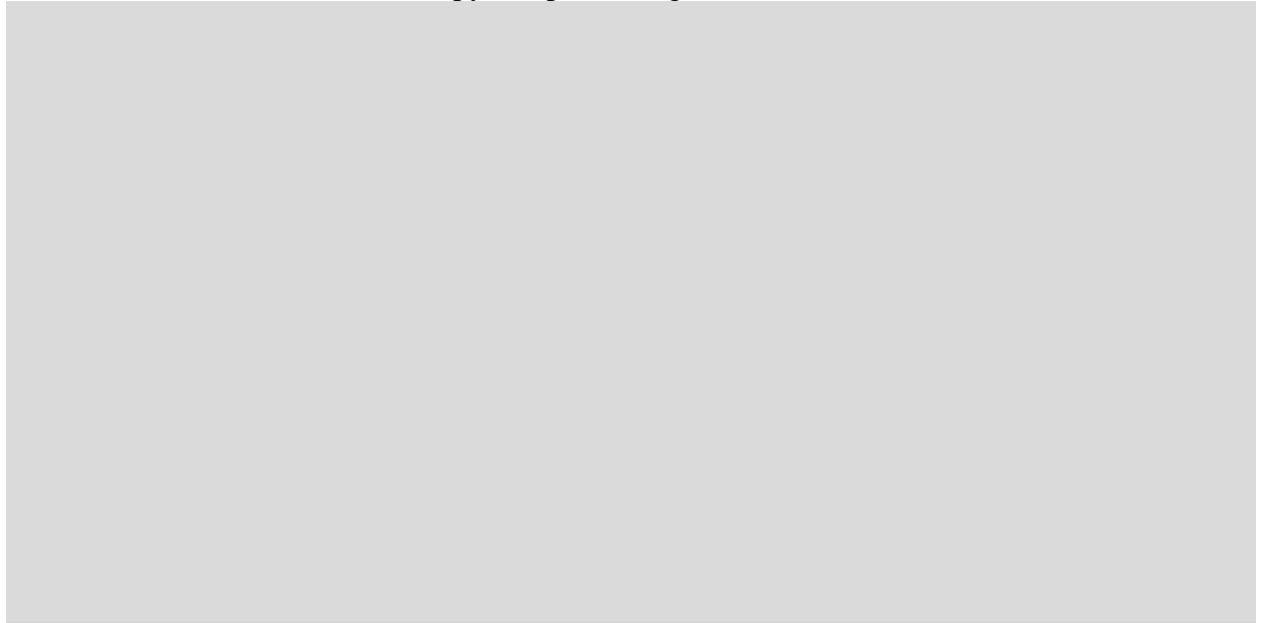
The Source Water Protection Team is now ready to utilize the information gathered in previous documents to prepare a comprehensive Source Water and Wellhead Protection Plan.

Step 1 – Describe Water Sources and Hydrogeology

- List and describe active and inactive water sources.
- Summarize hydrogeology including the quantity and quality of water produced from each source.
- Compare water source production rates with amounts of water delivered to consumers (Source Water and Wellhead Assessment, Steps 1.A and 1.C).
- Describe any historical changes in water chemistry, depth to water, production rates and/or direction of groundwater flow that have been observed, and discuss the impact that these changes may have on the sustainability of existing sources.
- If microbiological detections have occurred, describe what measures were taken to eliminate these detections.
- Identify the need, if any, to develop additional water sources in the future.
- List relevant reports and other references, and provide a copy of each document to the water system for filing and future reference.

Water Sources and Hydrogeology

(add lines, copy and paste images or tables, as needed)



Step 2 – Prepare a Source Water Monitoring Plan

- Propose a monitoring plan of sufficient detail to detect future changes in source water chemistry or production rates, and identify the resources needed to put the plan into action.
- Quarterly monitoring for water levels in all supply wells is recommended. Appendix C explains how to measure and graph water levels.
- Quarterly monitoring of specific conductance in all sources is recommended. Appendix D explains how to measure and graph specific conductance.
- Monthly measurement or estimation of production rates (gpm) is recommended.
- Monthly withdrawal (total gallons) is recommended.
- Dedicate a field book or journal to record all measurements.
- Assess the need for well performance testing.
- Identify the equipment, monitoring access points and other resources that will need to be purchased or installed to put the monitoring plan into action.

Source Water Monitoring Plan

(add lines, copy and paste images or tables, as needed)

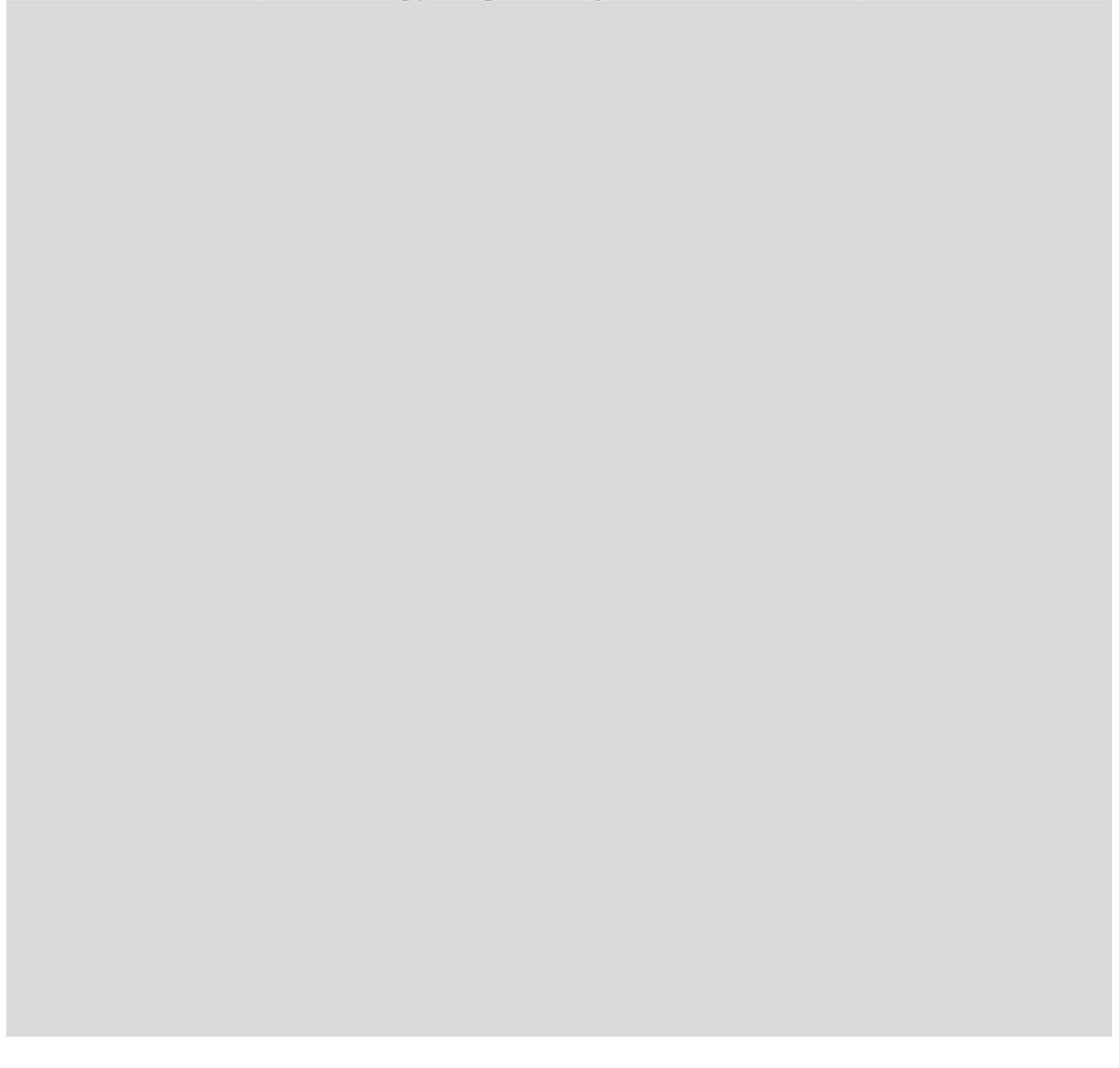


Step 3 – Prepare a Plan to Monitor and Control PSOCs

- Review monitoring data from federal, state and local regulatory agencies for sites within the Source Water Protection Area that either have permits or are being cleaned up.
- Participate in regulatory meetings and hearings on facilities within the Protection Area.
- Conduct periodic field surveys and update map of PSOCs.
- If the water system has authority, evaluate need and options for land-use restrictions, ordinances or other controls within the Source Water Protection Area.

PSOC Monitoring and Control Plan

(add lines, copy and paste images or tables, as needed)



Step 4 – Submit Proposed Source Water Protection Plan to NMED

- NMED will provide public notice, period of 30 days for public comment, and take final action on Source Water Protection Plan.

Step 5 – After approval by NMED, implement Source Water Protection Plan

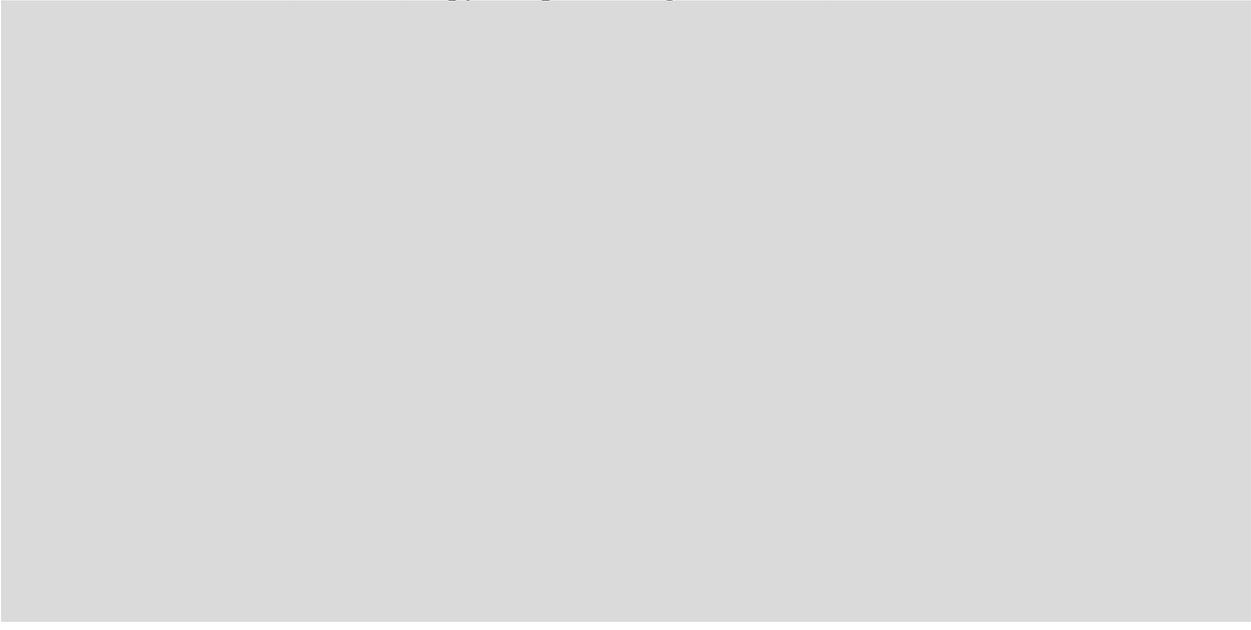
- Develop schedule for implementation.
- Assign responsible party for each action.
- Explore options to fund implementation:
 - N.M. Water Infrastructure Portal <http://swim.nmenv.state.nm.us/SWIM/index.php>
 - Federal funding options <http://go.usa.gov/TDg3>.
- Track progress.
- Measure results.
- Update plan every 5-7 years.

**Source Water and Wellhead Protection
Public Outreach and Education Plan**

For the _____ Water System
PWS Number NM-_____

Options include meetings, advertisements, flyers, brochures, posters, questionnaires, community and school events.

Public Outreach and Education Plan
(add lines, copy and paste images or tables, as needed)



APPENDIX A

Using the Source Water Protection Atlas To Make Maps for Source Water Assessments and Protection Plans

Open the Source Water Protection Atlas, <http://gis.nmenv.state.nm.us/SWPA/>. Zoom into the community of interest, turn data layers on and off to show desired features, and select the base map most suitable for the application. If using Internet Explorer, simply right-click the map image on your screen, select “Save picture as” and save the image to your hard drive where the image can be copied and pasted into this template. Once pasted, right click the image to re-size to approximately 4” high by 6.75” wide, or to whatever size is desired. Another option would be to copy the map image with a snipping tool and paste it into this Template. The legend for the Source Water Protection Atlas is included below so that it can be included with each map screen image that is copied from the Atlas.

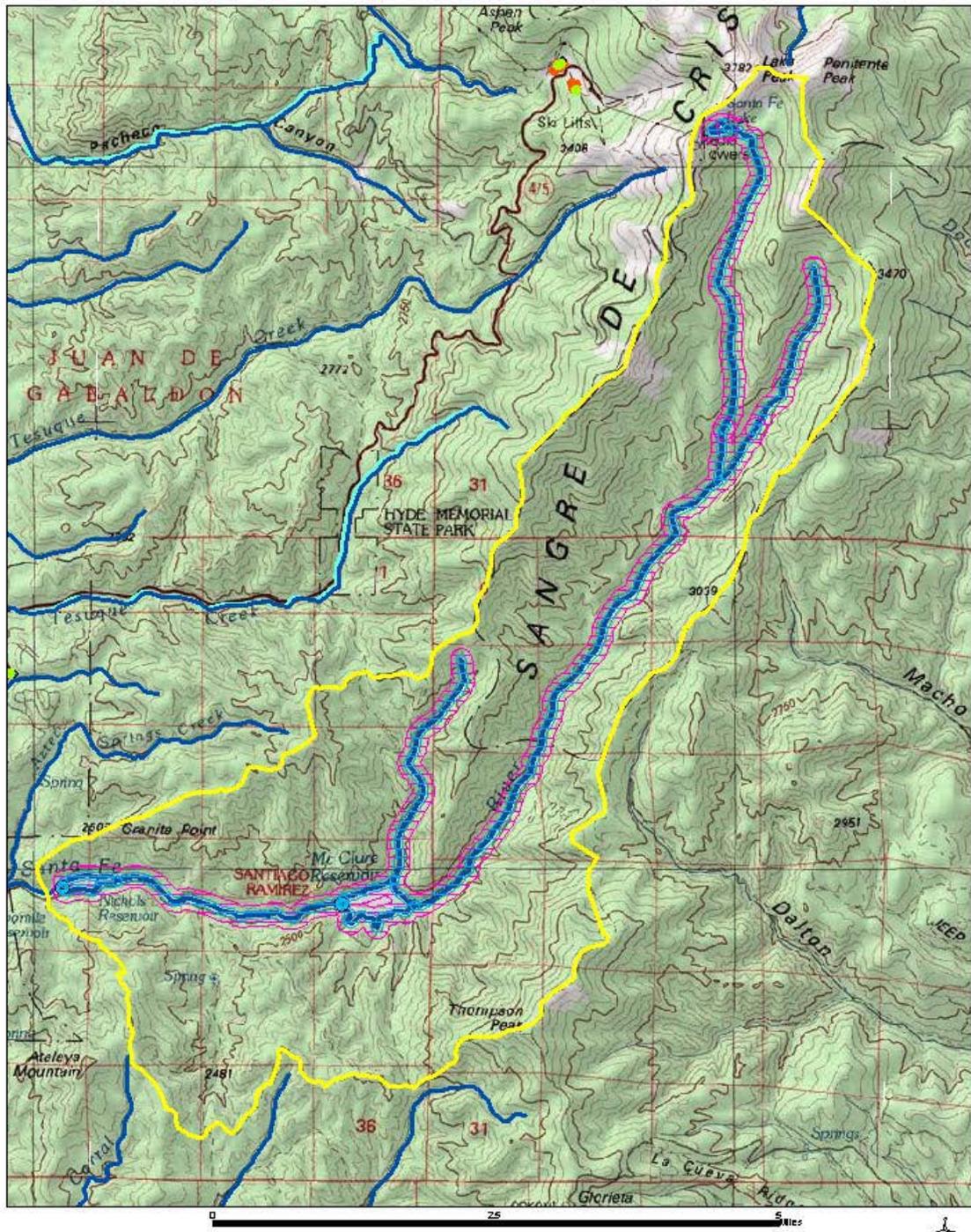
Source	Update	Layer
USGS	daily	<input checked="" type="checkbox"/> Active Fire Perimeters
USFS	2013	<input checked="" type="checkbox"/> Burn Severity <input type="checkbox"/> Burn Severity
		<input checked="" type="checkbox"/> Unchanged
		<input checked="" type="checkbox"/> Low
		<input checked="" type="checkbox"/> Moderate
		<input checked="" type="checkbox"/> High
Census	2010	<input checked="" type="checkbox"/> Counties
Census	2010	<input checked="" type="checkbox"/> Roads
USGS	04/30/2010	<input checked="" type="checkbox"/> Lakes and Streams
DWR	10/24/2013	<input checked="" type="checkbox"/> Active Drinking Water Sources
DWR	10/24/2013	<input checked="" type="checkbox"/> Inactive Drinking Water Sources
SWDB	3/29/2012	<input checked="" type="checkbox"/> Animal Feeding Operations
SWDB	7/12/2011	<input checked="" type="checkbox"/> Abatement Sites
SWDB	6/8/2005	<input checked="" type="checkbox"/> Brownfields
HWB	2/24/2012	<input checked="" type="checkbox"/> Hazardous Waste Facilities
SWDB	1/22/2013	<input checked="" type="checkbox"/> Groundwater Permits
PSTR	3/9/2012	<input checked="" type="checkbox"/> Underground Storage Tank Facilities
PSTR	3/13/2012	<input checked="" type="checkbox"/> Leaking Underground Storage Tank Sites
SWB	unk	<input checked="" type="checkbox"/> Landfills
SWDB	11/1/2013	<input checked="" type="checkbox"/> NPDES Permits
SWB	unk	<input checked="" type="checkbox"/> Solid Waste Facilities
SWDB	8/27/2013	<input checked="" type="checkbox"/> Voluntary Remediation Sites
SWDB	2012	<input checked="" type="checkbox"/> Impaired Lakes
SWDB	3/29/2012	<input checked="" type="checkbox"/> Impaired Streams
USGS	2011	<input checked="" type="checkbox"/> Digit Names <input type="checkbox"/> Watersheds
		<input type="checkbox"/> Digit Names
		<input type="checkbox"/> Digit Names
LWB	1989	<input checked="" type="checkbox"/> Aquifer Sensitivity
NMBS&B	2003	<input checked="" type="checkbox"/> Geology

APPENDIX B
Defining a Source Water Protection Area
For a Surface Water System

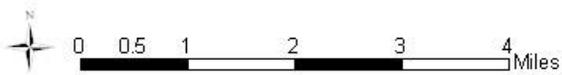
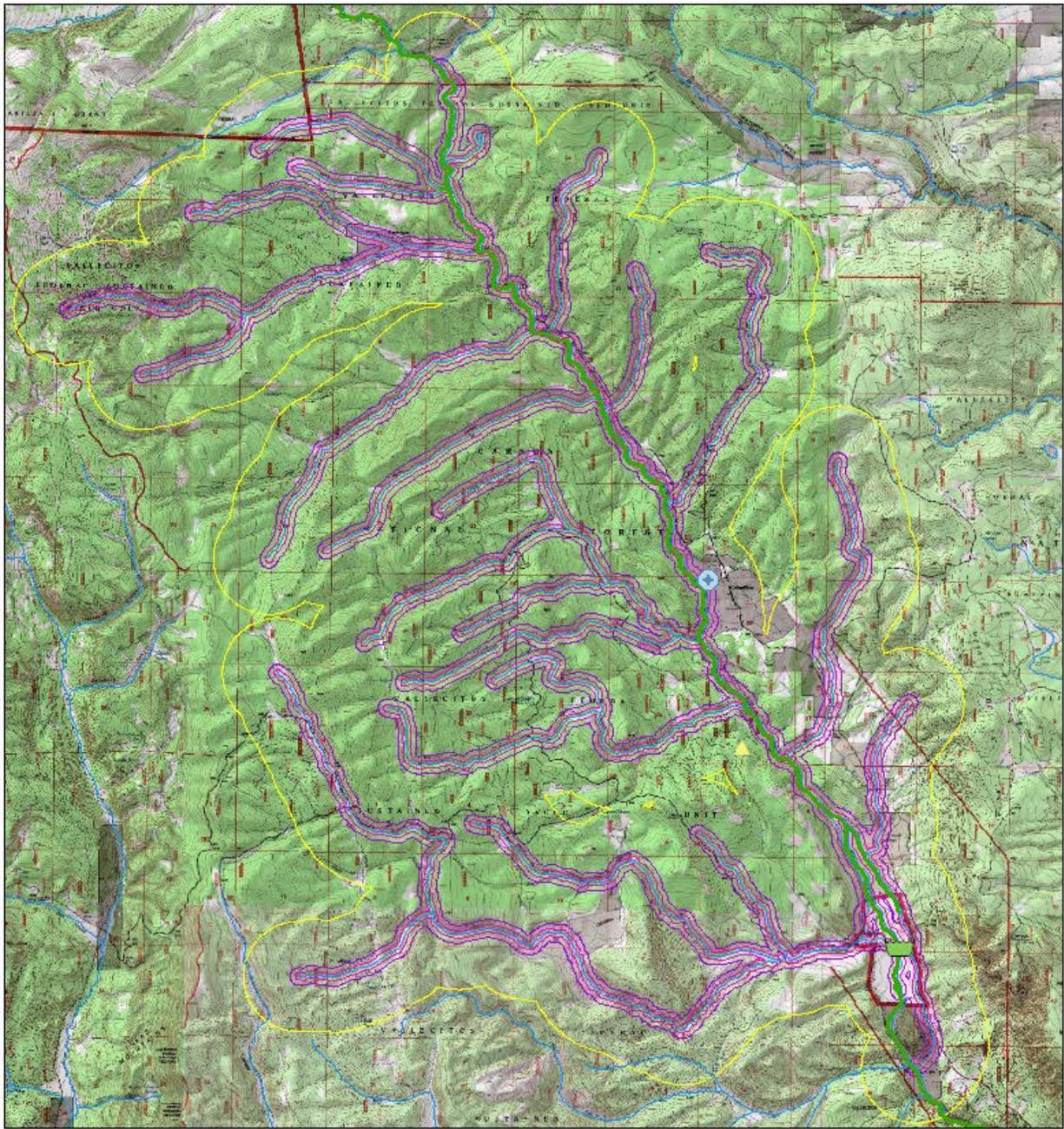
Source water protection areas for surface water systems are delineated according to watershed area, and subdivided into “buffer zones” established at fixed linear distances from the active stream channel.

Type A Watersheds are defined as those having an area under thirty square miles. The entire watershed is delineated according to topographic or U.S. Geological Survey 8-Digit Cataloging Units. Buffer zones within the watershed are defined as follows: Buffer Zone A is a 200 foot-wide strip of land paralleling either bank of an active stream channel and/or extending from the mouth or inlet of an impoundment to the uppermost boundary of the watershed; Buffer Zone B is a 300 foot-wide strip of land beginning at the outside margin of buffer Zone A; and Buffer Zone C is the balance of the land area extending to the topographic boundary. (See Example A p. 2)

Type B watersheds are defined as having an area over thirty square miles, The entire watershed is delineated according topographic or U.S. Geological Survey 8-Digit Cataloging Units; however; PSOC inventories and susceptibility analysis criteria are applied only to that portion of the watershed defined as a Critical Stream Segments. Critical Stream Segments are defined as the reach of the watercourse beginning 500 feet below a public water system intake and extending for a distance of ten miles upstream. Zones A, B, and C are defined within the Critical Stream Segments as follows: Zone A is a 200 foot-wide strip of land paralleling either bank of an active stream channel; Buffer Zone B is a 300 foot-wide strip of land paralleling an active stream channel and beginning at the outside margin of Buffer Zone A, and Buffer Zone C is a ½ mile-wide corridor of land paralleling either bank of an active stream channel, but excluding buffer zones A and B. You may decide to customize or use another delineation method to produce the maps or use these to satisfy the requirements for this Step. Geographical Information Systems ArcView 8.0 was used to generate the maps. (See Example B p.3)



Example A: Type A Watershed.

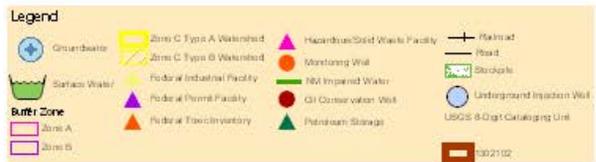


1:89,646

Vallecitos MDWCA Area of Delineation / WSS# 03521

The information depicted characterizes data available from multiple sources, including current Sanitary Surveys and state and federal databases. No assertion of the accuracy of the databases is made by NMED-DWB.

NMED-Drinking Water Bureau, 2004



Example B: Type B Watershed

APPENDIX C

How to Measure and Graph Water Levels

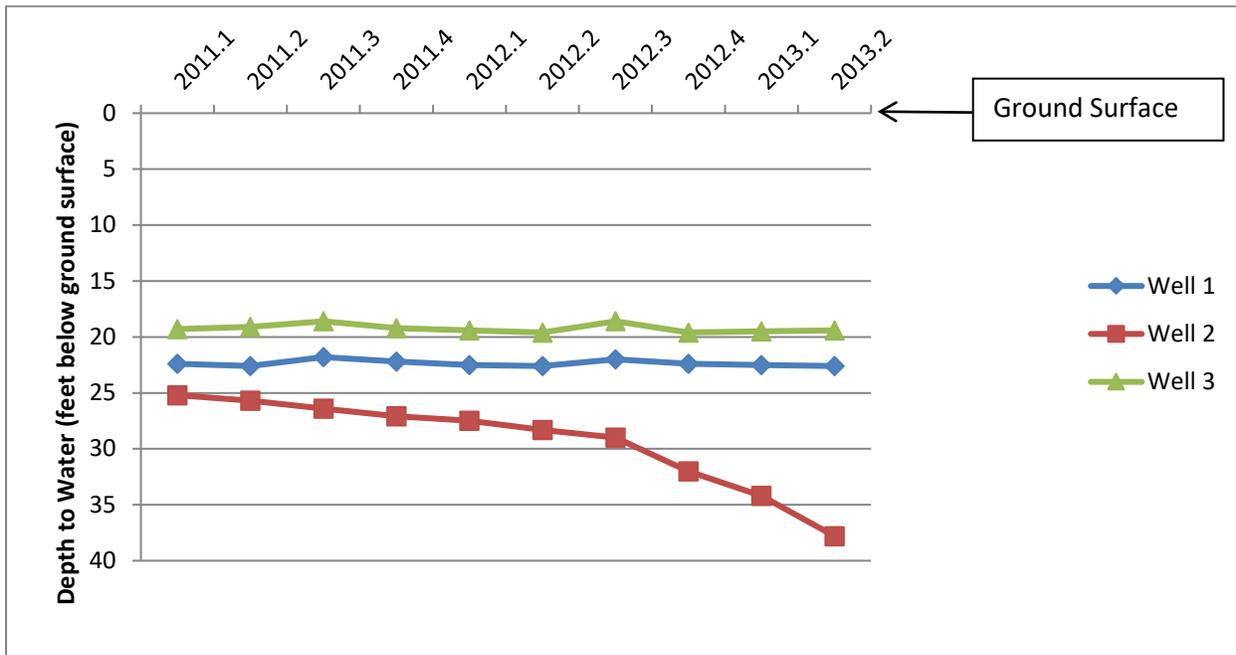
Regular monitoring and recording of both the static and pumping water levels in your wells is an important step in securing a sustainable and reliable water supply and extending the life of your pump. Early detection of changes in water level will allow for faster diagnosis of problems and help prevent them from becoming an emergency. There are several options for measuring the depth to water in a well. No one way is best for all circumstances. Ease of use, initial expense, maintenance, and accuracy vary depending on the instrument chosen. Below are 5 types of well measuring devices and brief explanation as to their operation.

For many of the measuring tools, a fixed reference point should be marked on the casing or access port and recorded in the depth log book. To prevent contamination, measuring devices that are lowered into the well should be disinfected with a dilute bleach solution before and after use and properly stored.

1. **Tape and chalk:** Apply blue carpenters chalk to the lower 3-4 ft. of a steel measuring tape. Lower into the well casing until the end of the tape is about 2 ft. submerged. Read the depth to water from the reference point to the end of dry length of tape. The chalk will make reading the water level easier. Repeat until you get to measurements within 0.01 ft. Make sure to disinfect the tape before and after each use.
2. **Electrical measuring tape:** Electrical measuring tape has two electrical wires separated by a small gap at the end. Water in the well will complete the electrical circuit, activating an audio or visual indicator. Measure from the reference point. As with the steel tape, disinfection between uses is required to prevent contamination.
3. **Sonic well sounder:** Sonic well sounders measure the depth to water level by bouncing sound wave off the surface of the water. No disinfection is required because nothing is lowered into the water. In order to obtain accurate measurements with this instrument, the average air temperature inside the well must be known. Note that the air temperature inside the well is not dependent of ambient air temperature at the surface.
4. **Air-line pressure gauge:** Air-line pressure gauges, unlike steel and electrical tapes, are installed fixed to the well. A pipe is lowered at least 10 feet below the lowest anticipated water level, and preferably to the level of the pump. To take a measurement, air is forced down the pipe until maximum pressure is achieved. At this point the air pressure in the line is balanced by the water pressure due to depth the line is submerged. Depth can then be measured by reading the pressure from the gauge.
5. **Pressure transducer:** Pressure transducers are lowered into the water and left in place. They use strain gauges to measure the depth they are submerged. They can be connected to a digital data logger to produce continuous readings. Periodic calibration is required to ensure that accuracy does not diminish over time due to stretching of the cable.

Water level measurements should be plotted into a hydrograph, a graph of water-level measurements over time. Figure 1 is a hydrograph that can be copied and edited for one or more wells. The depth-to-water values on the Y-axis start at zero at the top of the graph (ground surface) and increase downward so that the graph line follows upward and downward water level fluctuations. The term 2011.1, for example, is the first quarter of calendar year 2011. To edit the data, right-click the graph and then click “edit data”. A spreadsheet will open up in which the graph data can be edited.

Figure 1. Hydrograph Template. This graph shows hypothetical quarterly water-level measurements in supply wells.



APPENDIX D

How to Measure and Graph Specific Conductance in Source Waters

The ability of water to conduct electricity is proportional to the mineral (electrolyte) content of water. If the mineral content of water increased, so will its conductivity. Since the electrical conductivity of water is also related to temperature, most instruments will convert the field conductivity to specific conductance, conductivity at a standard temperature of 25°C.

It is important to measure specific conductance in source waters as this may provide evidence of water quality deterioration that can be related to either natural or manmade contamination or to groundwater depletion. In areas of groundwater depletion, the groundwater mineral content sometimes increases as water levels in the aquifer decline.

A variety of field conductivity meters are on the market, some of which also can test for other important parameters such as temperature, pH and oxidation-reduction potential.

Figure 2 is a specific conductance graph that can be copied and edited for one or more wells. The term 2011.1, for example, is the first quarter of calendar year 2011. To edit the data, right-click the graph and then click “edit data”. A spreadsheet will open up in which the graph data can be edited.

Figure 2. Specific Conductance Graph Template. This graph shows hypothetical quarterly specific conductance measurements in supply wells.

