

Preliminary Wellhead Protection Area Delineation

As required by the wellhead protection (WHP) rule (part 4720.5130, subpart 1), public water suppliers proposing NEW MUNICIPAL WELLS must complete 1) a preliminary delineation of the WHP area (WHPA) for the proposed well, and 2) an assessment of the impacts that existing land and water uses located within this area may have on the aquifer serving the well. The preliminary WHPA and assessment are to be submitted to the Minnesota Department of Health with the construction plan for the proposed well. The purpose of this form is to assist water suppliers in delineating the preliminary WHPA and preparing the assessment.

Form Guidance

Getting Started

Option 1 – Use existing groundwater flow model:

If the municipality already has a wellhead protection plan, and the proposed well will be completed in the same aquifer and geographic area covered by the groundwater flow model used to delineate the city's WHPA, then we recommend the flow model be used to determine the preliminary WHPA rather than the simple calculations presented in this worksheet. Please contact the appropriate MDH district hydrologist to discuss this option. If that option is appropriate, then use the model-generated preliminary WHPA in Part 2 of this form to assess land and water use.

Option 2 – If an existing model is not used, the preliminary WHPA is calculated using the following:

- A map showing the location of the proposed municipal well. This map should be at least 1:24000 scale or greater detail.
- An estimate of the projected annual demand to be met by the new well.
- A copy of the well construction diagram showing the proposed well construction and the anticipated geology. From this diagram, you will be estimating:
 - the anticipated length of open interval of the well (or length of well screen) and
 - whether the aquifer is confined or unconfined.
- For wells proposed to be completed in unconfined (or water-table) aquifers, you will also need to determine the local direction of groundwater flow.

Note: An aquifer is considered confined or semi-confined when it exhibits artesian conditions. One simple method of determining whether an aquifer is confined is to compare the depth to the aquifer's water level with the depth to the stratigraphic top of the aquifer. If the water level is closer to the land surface than the top of the aquifer, then it is considered confined. Water-level information contained on the records of local wells (having similar construction as the proposed municipal) can be used to evaluate whether the aquifer is confined or unconfined. Confined conditions generally occur where at least several feet of low permeable materials, such as clay or shale, overly the top of the aquifer. Unconfined conditions generally occur in near-surface aquifers or where an aquifer is in direct hydraulic connection with surface-water features such as rivers and lakes.

Part 1: Calculating Preliminary WHPA Boundaries

PWS ID _____ PWS Name _____

Date _____ Completed by _____

Step 1

Estimate the expected annual volume of water (Q_{gpy}) to be pumped by the proposed well and multiply by ten. This represents the projected volume of water pumped during the next ten years. If your estimate is in gallons, convert it to cubic feet by dividing by the number of gallons per cubic foot.

$$\text{Projected 10-year Demand} = Q_{10\text{yrs}} = \frac{Q_{\text{gpy}}}{7.48 \text{ gallons/ft}^3} \times 10 \text{ years} = \text{_____ ft}^3$$

Step 2

Estimate the effective porosity (n_e) of the aquifer serving the proposed well. If aquifer porosity is not known, select the value from the table corresponding to the material which best represents the aquifer which the well will be completed in.

Aquifer Material	Typical Porosity Value
sand and gravel	.30
sand or sandstone	.25
carbonate bedrock	.10
fractured bedrock	.10

$$\text{Effective Porosity} = n_e = \text{_____}$$

Step 3

From the well construction diagram, estimate the anticipated length of the open interval (or length of well screen) for the proposed well.

$$\text{Length of Open Interval} = L = \text{_____ feet}$$

Step 4

Using the estimate of Q_{10yrs}, n_e, and L determined in Steps 1-3, calculate the radius of the preliminary WHPA using the following equation:

$$\text{Maximum Radial Distance of the WHPA} = r_{\text{WHPA}} = \sqrt{\frac{Q_{10 \text{ yrs}}}{(n_e)(L)(\pi)}} = \text{_____ feet}$$

where $\pi = 3.14$

Step 5

On a map showing the location of the proposed well, draw a circle around the well using the radial distance calculated in Step 4.

For confined aquifers or where the radius calculated in Step 4 is greater than ½ mile (greater than or equal to 2,640 feet), this area represents the preliminary WHPA. For unconfined aquifers where the calculated radius is less than ½ mile, continue to Step 6.

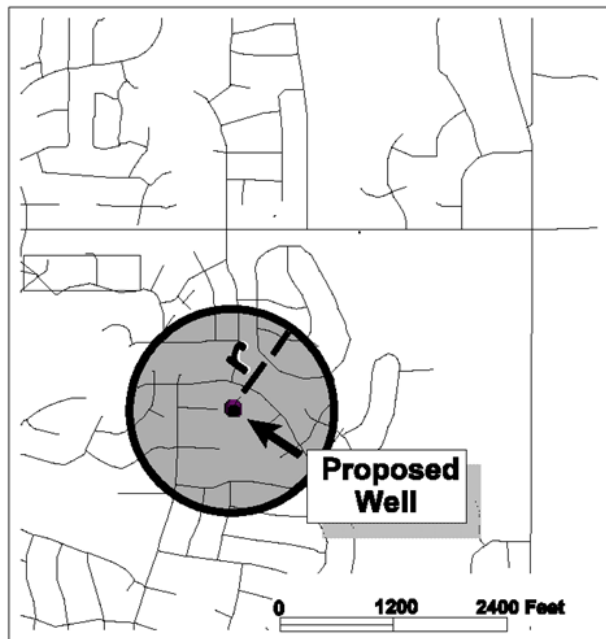
Example

$$Q_{10\text{yrs}} = 250,000,000 \text{ gallons} = 33,422,460 \text{ ft}^3$$

$$n_e = .25$$

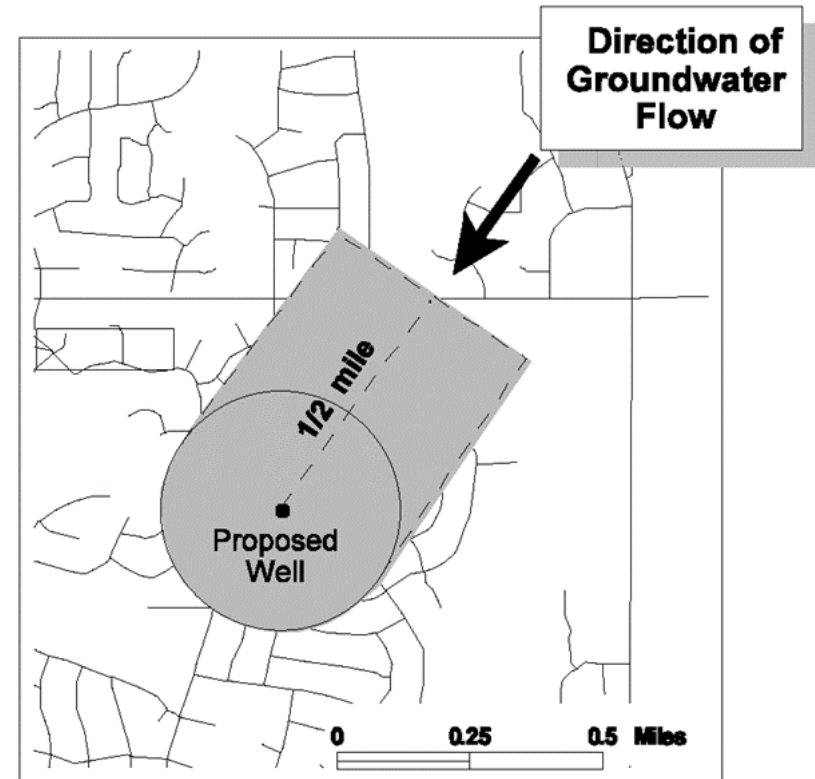
$$L = 30 \text{ feet}$$

$$r_{\text{WHPA}} = \sqrt{\frac{33,422,460 \text{ ft}^3}{(.25)(30 \text{ ft})(\pi)}} = 1190 \text{ feet}$$



Step 6

Unconfined aquifers. Determine the upgradient direction of local groundwater flow relative to the proposed well site. Project the diameter of the circular area calculated in Step 5 for a distance of ½ mile into the upgradient direction.



Note: For information regarding the local direction of groundwater flow in unconfined aquifers, please call (651) 201-4700.

Part 2: Assessing the Impacts of Existing Land Use and Water Use

1. Estimate the percentage of the following land use within the preliminary WHPA determined in Part 1.

Percentage	Land Use
	Agricultural
	Commercial
	Industrial
	Mining
	Open Space
	Recreational
	Residential
	Open Water/Wetlands
	Other

2. Is the preliminary WHPA served by city sewer and water?
- All of it
- Some of it
- None of it
3. Are there high capacity wells using the same aquifer within a mile of the proposed well site?
4. Are you aware of any reported groundwater contamination in the preliminary WHPA? If so, explain.
5. Do you think existing land or water uses may impact water quality in the proposed municipal well? Explain