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Environmental Services

DISCUSSION OF MINIMUM HORIZONTAL WELL SEPARATION DISTANCES IN CALIFORNIA DEPARTMENT OF WATER RESOURCES (DWR) WELL STANDARDS

The following is a discussion of the applicability of using DWR Minimum Horizontal Well Separation Distances in the draft Low-Threat UST Case Closure Policy.

Page 12, Section 8 (Separation) of the DWR California Well Standards (Bulletin 74-90) states "All water wells shall be located an adequate horizontal distance from known or potential sources of pollution and contamination," and lists eight bulleted sources. The first five bulleted sources are for sanitary, industrial or storm sewers, septic tanks and leach fields, barnyards and stable areas, and feedlots.

The last three bullets are:

- Solid Waste Disposal sites;
- Above and below ground tanks and pipeline for storage and conveyance of petroleum products or other chemicals; and,
- Storage and preparation areas for pesticides, fertilizers, and other chemicals.

"The following horizontal separation distances are generally considered adequate where a significant layer of unsaturated, unconsolidated sediment less permeable than sand is encountered between ground surface and ground water. These distances are based on present knowledge and past experience. Local conditions may require greater separation distances to ensure ground water quality protection."

The above paragraph from the Well Standards indicates that the DWR did not consider the minimal horizontal separation distances to be fixed and, instead, that they should be modified as conditions warranted and that the separation distances are dependent upon the lithology.

The following unlabeled table appears at the bottom of page 12 of the above mentioned reference. The four rows of the table include separation distances for sewer, septic, cesspool or seepage pit, and animal or fowl enclosure conditions, but do not list separation distances for the last three bulleted items (see above).

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Potential Pollution or Contamination Source	Minimal Horizontal Separation Distance Between Well and Known or Potential Source
Any sewer line (sanitary, industrial, or storm; main or lateral)	50 feet
Watertight septic tank or subsurface sewage leaching field	100 feet
Cesspool or seepage pit	150 feet
Animal or fowl enclosure	100 feet

The greatest separation distance of 150 feet (for separation from a cesspool or seepage pit) appears to have been selected by the authors of the SWRCB draft Low-Threat UST Case Closure Policy as a default worst case scenario. However, the origin of the 150 foot distance appears to be a "rule of thumb" separation distance needed to protect a water source from a biological hazard or pathogen source (coliform bacteria, viruses, etc.).

History of Well Standards

The DWR has responsibility for developing well standards under the California Water Code Section 231, enacted in 1949.

The DWR's *Abstract of Laws and Recommendations Concerning Water Well Construction and Sealing in the United States* (Recommendations), dated April 1955, is a survey of the well standards of 40 states, 38 California counties, and 55 California cities. The Recommendations include a summary of the recommendations of the Federal Housing Authority; Federal Security Agency, Public Health Service; Montague Pipe Company; American Water Works Association; United States Public Health Service; and the Conference of State Sanitation Engineers. The Recommendations listed separation distances from various other government agencies and organizations, but did not establish well separation distances.

California statewide standards for water wells were first published in 1968 as DWR Bulletin 74, Water Well Standards: State of California; this was the first document to list minimum horizontal separation distances. A revised edition of Bulletin 74 was published in 1981 as Bulletin 74-81. Until 1990, the California Water Well Standards were found in Department of Water Resources Bulletin 74-81 and the Cathodic Protection Well Standards in Bulletin 74-1. In 1990, the Department published Bulletin 74-90 as a supplement to Bulletin 74-81 and as a replacement for parts of the Water Well Standards in Bulletin 74-81. Also, Bulletin 74-90 replaced Bulletin 74-1 for Cathodic Protection Well Standards and added a new section on Monitoring Well Standards.

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DWR Minimum Horizontal Separation Distances Are Based on the Removal of Pathogens

Pathogens do not survive long in microbially active, aerated soil. The well separation standards were originally written as guidance for the removal of pathogens, not protection from petroleum or other chemical contaminants, and the mechanism for removal of pathogens is different than that for protection from petroleum or chemical contaminants. Removal of pathogens relies on filtration, adsorption or adhesion (mechanical separation which works well on bacteria and viruses), whereas removal of a petroleum contaminant relies on other processes effective at the molecular level, and mechanical separation probably has little effect at the molecular level.

Well Separation Diagrams

The following diagrams illustrate problems that arise from using a fixed separation distance between a source and a well, or receptor.

Please contact Olivia Jacobs or Robert Nelson, at Clearwater Group (510-307-9943), if you have any questions.

Sincerely,

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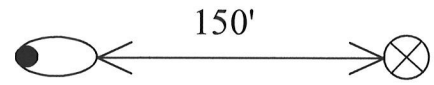
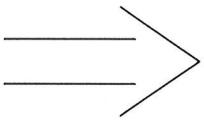
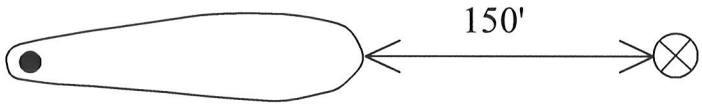
Senior Geologist





Groundwater
Flow Direction

Problem: Same Separation Distances Used For
Small Plume and Large Plume



Legend

- Source
- Well Location
- Plume

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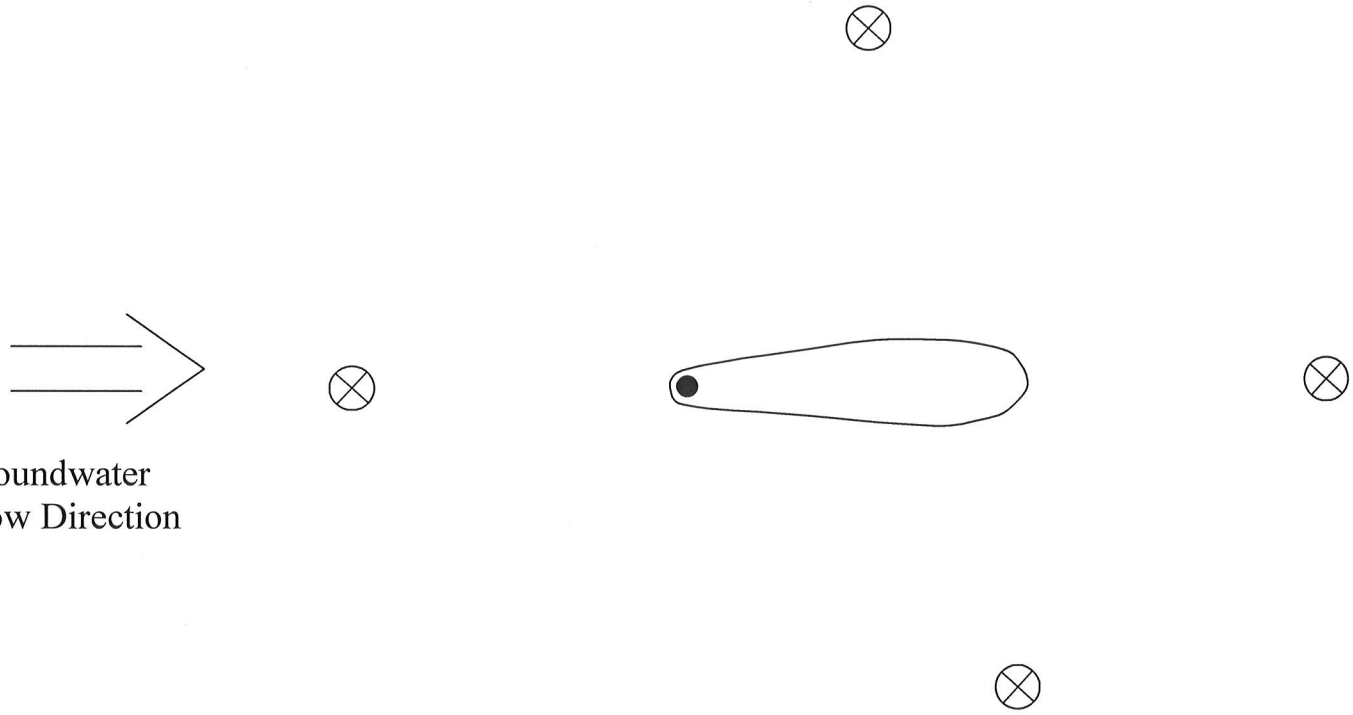
Figure Date 3/12	Figure 1



Groundwater
Flow Direction

Problem: Same distance used for well locations regardless of position relative to plume. All wells shown are 150' from plume. Well directly down-gradient from plume would be impacted more readily than cross-gradient or up-gradient wells.

Legend

- Source
- Well Location
- Plume

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Figure Date 3/12	Figure 2

Groundwater
Flow Direction

Problem: Risk Relative to a Detached Plume;
Is it permissible to install a well between the source and the detached plume?

Legend

- Source
- Well Location
- Plume

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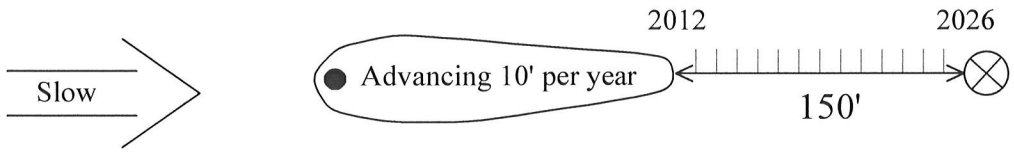
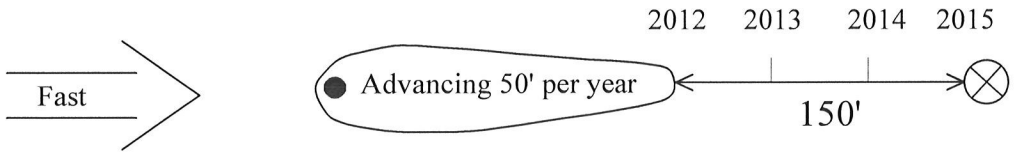
Figure Date 3/12	Figure 3



Groundwater
Flow Direction



Problem:
Same separation distance is used for a slow spreading old plume and a fast spreading young plume. Contamination would reach the well at the fast spreading young plume before it reached the well at the slow spreading old plume

Legend

- Source
- Well Location
- Plume

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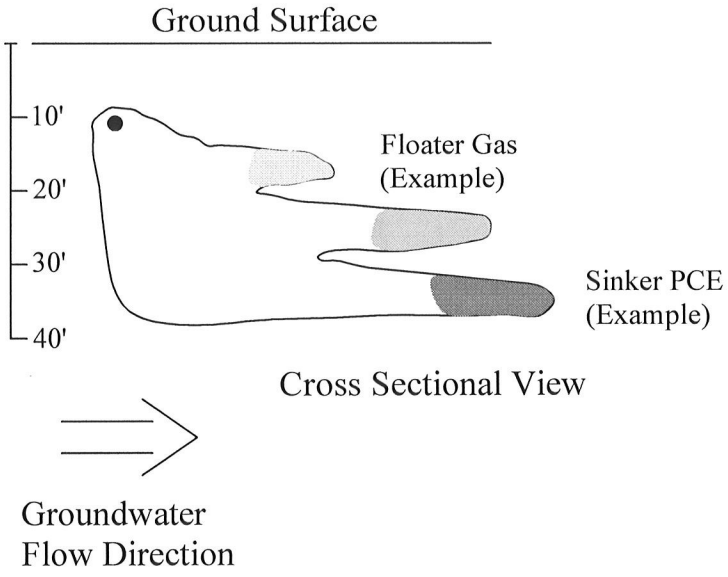
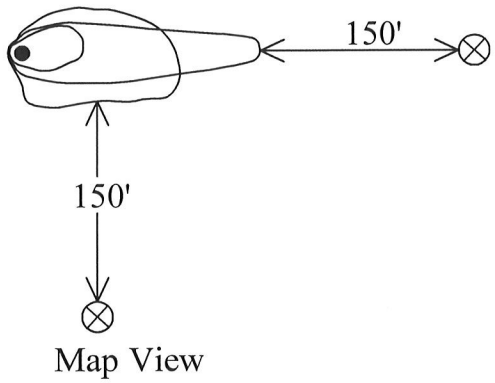
Figure Date **3/12**	Figure **4**

Outline of plume has to be defined for each aquifer and maybe for each different contaminant layer. (Combined maximum horizontal extent of each layer).





Legend

- Source
- Well Location
- Plume

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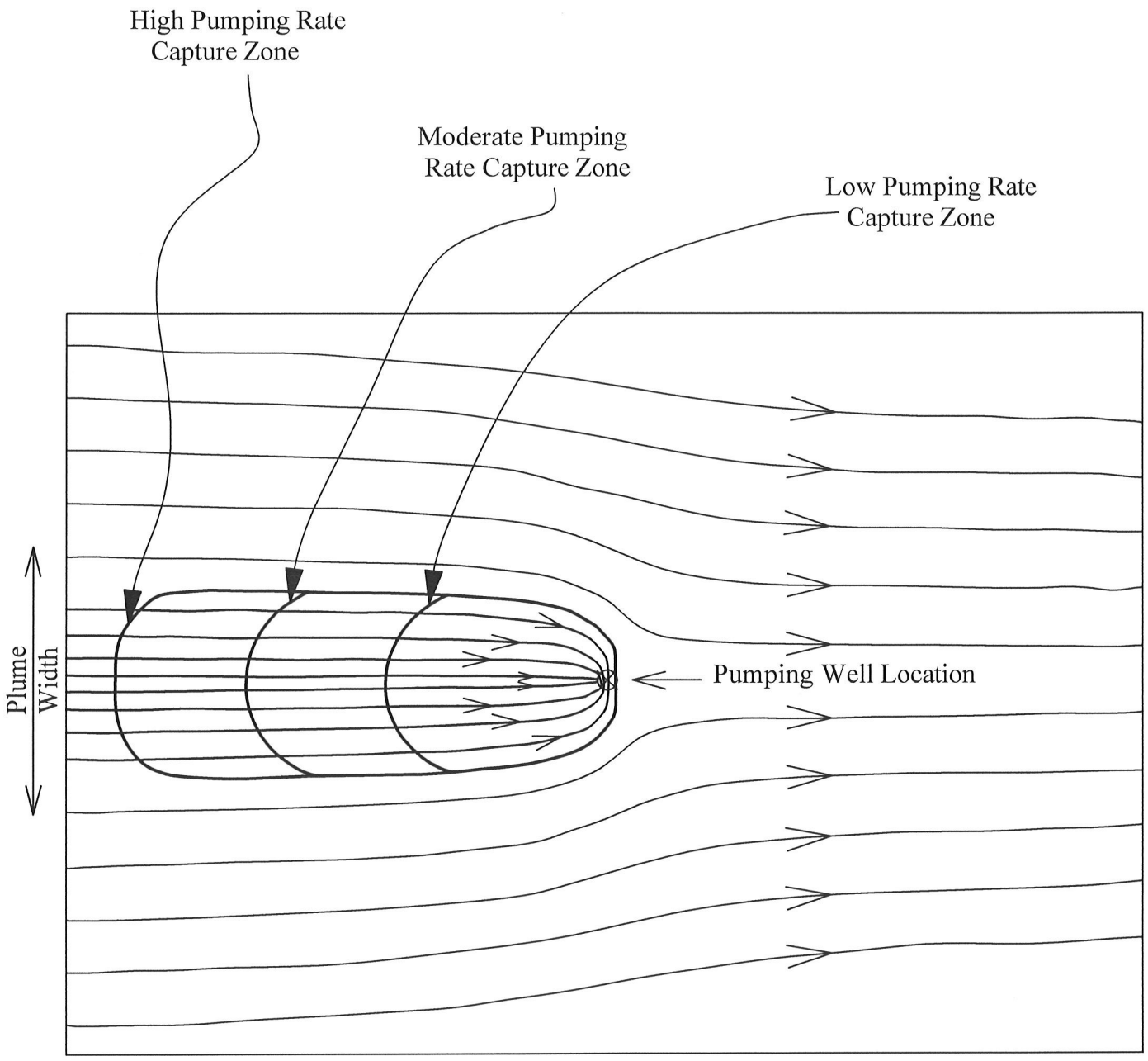
Figure Date **3/12**	Figure **5**



Expansion of well capture zone in up-gradient direction with increased pumping rate

Plan View
Not To Scale

Legend

> Direction of groundwater flow

⊗ Well Location

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Figure Date **3/12**	Figure **6**