

APPENDIX G

Guidelines for the Identification, Location, and Evaluation of Deep Well Conduits

San Francisco Regional Water Quality Control Board 1986 Staff Memo prepared by Tom Berkins

Identification, Location, and Evaluation of Public Water Supply Wells, Private Wells, Agricultural Wells,
Abandoned wells, and Potential Well Conduits

PURPOSE

The purpose of this guideline is to provide information to guide responsible parties to fuel leak, solvent, toxics, and other groundwater contamination sites, and owners of sites with potentially contaminating activities in the identification, location, and evaluation of Public Water Supply Wells, Private Wells, Agricultural Wells, Abandoned wells, and Potential Well Conduits. Water wells in Santa Clara County are susceptible to contamination from a variety of contaminant sources. In addition these wells and improperly destroyed and abandoned wells can serve as for contamination to migrate from shallow aquifers to deep aquifers. These guidelines are based on the scope of investigations and history of contaminant migration at a variety of Superfund, solvent, and fuel leak sites in Santa Clara County. The basis of these guidelines is from the "Berkins Memo", dated July 3, 1986 San Francisco Regional Water Quality Control Boards Memorandum.

INTRODUCTION

Since 1980 groundwater investigations have been required for over 3000 spills and releases of industrial solvents, fuels, and other chemicals in Santa Clara County. Contamination associated with these sites has been detected in over large portions of the shallow aquifer (first encountered groundwater) and in a number of deep (C aquifer or deeper) monitoring and water supply wells to depths exceeding 500 feet. The contamination of the deep aquifer in many instances migrated through improperly abandoned wells and water wells screened across several water bearing units located within the shallow aquifer contamination plumes. It is important to note that contaminants from the shallow aquifer zones (less than 100 feet) can reach deeper aquifer zones (greater than 200 feet) even though there may be a relatively clean aquifer zone and a substantial aquitard in existence between the shallow and deeper aquifers.

The importance of a properly conducted well survey cannot be overly stressed. Extensive investigation of water wells and potential conduits within a minimum of 2000 feet around a groundwater contamination site shall be required. It is important to note that the Santa Clara Valley Water District does not have records of all wells and these records cannot be solely relied upon.

The scope of the investigation to be conducted at each site will depend on the extent of contamination (known and unknown), available information, and the degree of uncertainty.

DISCUSSION ON WELL STANDARDS AND HISTORICAL PRACTICES FOR THE CONSTRUCTION AND DESTRUCTION OF WELLS

The first well standards in California were adopted in 1968. It is important to note that this was a recommended standard and was not required. It is reasonable to conclude that the majority of municipal and domestic water wells installed prior to the promulgation of the well standards are not documented and may not be properly constructed with adequate seals. Wells destroyed prior to 1968 were likely not properly destroyed.

The District through its Ordinance 90-1 administers both the state well standard and the District's well standard designed to deal with specific problems encountered in the Santa Clara Valley.

GUIDELINES FOR CONDUCTING WELL SURVEY

The following steps outline the minimum level of effort that should be considered for a well and potential conduit survey within a 2000 foot radius of a groundwater contamination site.

I. IDENTIFICATION OF WELLS

A. Records of Map Search

Typically, sites located in the Santa Clara Valley have relied solely upon the records of the District to obtain information regarding the location and status of any known wells in the vicinity of a site. However, the District records are incomplete. Thus, the first step of the potential conduit investigation should involve a more thorough search of all available records and maps. The following sources of information should be utilized to gather all available data existing on potential conduits:

1. Santa Clara Valley Water District
 - a. Active well printout
 - b. Well location map
 - c. Inactive well files
 - d. Destroyed well files
 - e. Abandoned well files
 - f. Field canvas for Salt Water Intrusion Prevention Program
2. U.S. Geological Survey
 - a. Library
 - b. Water Resources Division
3. California Department of Water Resources
4. "Groundwater in the Santa Clara Valley, California"—William O. Clark, 1924
5. Local Well Drillers
6. U.S. Department of Agriculture
7. U.S. Army Corps of Engineers
8. City and County Offices
9. Historic Sanborn Insurance Maps

The information obtained from the various sources listed above should be compiled in a technical report. It would be useful to summarize the results of the records and map search in a table, including the following information:

- Well number
- Source of information
- Water quality data
- Water level data
- Total depth
- Screened interval(s)
- Gravel pack interval(s)
- Sanitary seal
- Well construction method(s)

- Date installed
- Top of casing elevation
- Pump information (type, capacity, depth, etc.)
- Log availability (driller's, lithologic, geophysical, and TV)
- Owner
- Status
- Condition
- Comments
- Period of usage
- Pumping rate
- Accessibility
- Location
- Casing (type, diameter(s), etc.)
- Date destroyed, if applicable
- Use (domestic, irrigation, etc.)

It would also be useful to list the wells by status, for example:

- a. Wells officially listed as properly destroyed under a District permit
- b. Active wells, including seasonal or standby wells
- c. Inactive wells
- d. Abandoned wells, location known but method of abandonment unknown
- e. Abandoned wells, location unknown and method of abandonment unknown

B. Aerial Photography Search

Upon completion of the records and map search, a thorough search and review of historical aerial photographs should be conducted. Analysis of aerial photos has proven useful in identifying wells which were previously unknown (i.e., not found in the records or map search). The aerial photo search has also been shown to be useful in locating wells for which records were available but the well location was uncertain. Conducting the aerial photo search after the records search will enable one to better locate wells for which records exist but the location is uncertain. I recommend that all sites conducting the records and map search should also conduct the aerial photo review. The time and effort to be spent in this regard should be determined on a case-by-case basis.

Historical aerial photos should be obtained dating back to the period prior to residential and industrial development at the site. It is also important to obtain aerial photos taken intermittently over time (e.g., 1940, 1945, 1950, 1955, etc.). It would also be preferable to obtain aerial photos taken over a shorter time period during the period of residential growth in the area. Aerial photos with the smallest scale (i.e., greatest resolution) are obviously of much more use than larger scale photos. Oblique photos are very useful since they are usually taken from lower altitudes and, therefore, are in more detail for identifying wells, storage tanks, etc.

The following is a list of sources where aerial photos can be obtained or reviewed:

1. Local aerial surveyors (Aero-Geodetic and Pacific Aerial Surveys)
2. City and County Planning Departments
3. University's library, map room
 - a. U.C. Berkeley and U.C. Santa Cruz
 - b. Stanford University
 - c. University of Santa Clara

- d. Whittier College, Geology Department, "Fairchild Collection"
- e. San Jose State
- 4. U.S. Geological Survey, Western Mapping Center, Menlo Park
- 5. U.S. Department of Agriculture, Agriculture Adjustment Administration photos (these may be available at the university libraries).
- 6. Santa Clara Valley Water District
- 7. National Archives
- 8. Soil Conservation Service
- 9. U.S. Army Corps of Engineers

In general, the aerial photos obtained from the local aerial surveyors and the city/county files will have a greater resolution. However, the university libraries will have a larger collection and will probably cover a greater time period (i.e., photos prior to 1960). It should be understood that it may not be necessary to contact each of the above sources if adequate photo coverage (time period and resolution) can be obtained from one or two sources.

II. LOCATING AND GATHERING ADDITIONAL INFORMATION ON WELLS

A. Door-to-Door and Field Survey

It is likely that a majority of the information requested as part of the records and map search will not be available. In addition, it is also likely that the exact location of some wells will not be known. Thus, it probably will be necessary to conduct a more thorough investigation to determine the exact location of a well and also to gather additional data. A field survey and door-to-door survey are the only methods available to obtain this information. It should also be noted that door-to-door surveys have proven most useful in identifying wells which were not previously known to exist.

At a minimum, I recommend that a door-to-door survey be conducted of all residences, businesses, etc., located within the contamination plume (in all aquifers). It would also be prudent to expand the survey boundary (perhaps 1,000 feet cross-gradient and 2,500 feet downgradient of the known plume) to account for uncertainties associated with historical gradients and unknown extent of the plume.

The person conducting the survey should attempt to gather all the information requested as part of the records and map search (see page 2). It may be useful to develop a form which could be given to each household/business, listing all the requested information. The survey form used in the City of Mountain View is attached for your reference. I recommend that all the information requested as part of the records and map search be included on the survey form. I also recommend taking a picture(s) of the well and/or well site when conducting the survey.

B. Metal Detector/Magnetometer

Based on the results of the door-to-door survey and aerial photo search, it may be possible to identify the general location of a well. In certain cases, the use of a metal detector may prove useful in locating wells which are covered over. The use of a metal detector was instrumental in locating improperly abandoned agricultural wells located under a concrete parking garage in Mountain View. An attempt should be made to uncover any well identified by the metal detector to the extent technically feasible.

The results of the door-to-door survey, including copies of any survey forms, should be documented in a technical report. A map showing the known and/or general location of all identified wells should also be provided.

III. EVALUATION OF POTENTIAL CONDUITS

Based on the results of the well identification and location program, it may then be appropriate to conduct an evaluation to determine a well's potential to act as a conduit. All wells located during the field survey that are found to be in a condition that is adequate for sampling and downhole inspection should be investigated. An attempt should be made to uncover any wells if the general location is known. An attempt should also be made to unplug wells (e.g., remove silt and/or surface concrete plugs which may be present) in order to conduct a proper investigation. Wells which have a potential to be a conduit should be investigated. It may be appropriate to conduct the following investigations on such wells:

- A. Borehole television inspection
- B. Natural gamma log
- C. Water quality and water level sampling

As part of the water quality sampling, the discharger may also want to consider time series sampling. It may also be appropriate to conduct "packer tests" for wells which are screened in more than one aquifer. Pumps which may be present in the wells should be removed to obtain access to the well for depth sounding, geophysical logging, TV inspection, water quality sampling, and water level measurement, as appropriate.

Based on the results of the potential conduit evaluation, it may be necessary to destroy certain wells. If the results of the evaluation indicate that a well is screened in a single discrete aquifer and is not contaminated, it may be useful to utilize that well for future monitoring purposes. General criteria which may be used to decide whether to destroy a well include:

- A. The well is located within the known contamination plume
- B. Groundwater at the well is contaminated
- C. The well is screened and/or gravel packed in more than one aquifer
- D. Well depth

Similar to the identification and location portions of the potential conduit investigation, the results of the evaluation of potential conduits should be submitted in a technical report. The report should include all data, maps, logs, interpretation of logs, etc. In addition, the rationale for excluding any wells from a complete investigation and evaluation should also be provided.