Black & Decker (U.S.), Inc.

Work Plan for Soil and Groundwater Remediation Design Investigation Hampstead, Maryland Facility

WESTON
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WORK PLAN FOR SOIL AND GROUNDWATER REMEDIATION DESIGN INVESTIGATION HAMPSTEAD, MARYLAND FACILITY

Prepared for:

Black & Decker (U.S.), Inc.

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SECTION 1

BACKGROUND

An environmental investigation was initiated in 1987 at the request of Black & Decker (U.S.), Inc. (B&D) for its Hampstead, Maryland Facility. The investigation was conducted by Roy F. Weston, Inc. (WESTON) in several phases which culminated in the submission of an Environmental Investigation Report (April, 1989) submitted to the Maryland Department of the Environment. The investigation of the site groundwater quality, hydrogeology, and potential source areas indicated that:

- A PCE plume is present primarily on the western half of the facility, while TCE is present in groundwater primarily in the northeastern part of the facility.
- Groundwater is predominantly migrating along the hydraulic gradient both in the saprolite and bedrock to the south-southwest.
- A minor component of groundwater flow on the northeastern corner of the facility may be directed east toward State Route 30.
- Soils located in the area of the former underground storage Tank Farm 2 contain PCE, TCE and petroleum hydrocarbons. This area may be a continuing, relatively low-level source of groundwater contamination.
- Other potential source areas investigated were found not to be contributing significant contaminants to the environment.

Based on these conclusions, remediation strategies to recover and treat the contaminated groundwater on-site and prevent its off-site migration and to excavate and treat the contaminated soil in the Tank Farm 2 area were proposed in the 1989 Environmental Investigation Report. Details of the proposed remediation strategies are presented in this Work Plan. The groundwater remediation plan, proposed as a pump and treat well system, and its implementation are discussed in Section 2, including plans for field activities to develop design information for the remediation system. The soil remediation plan incorporates the use of low temperature thermal treatment. Plans for its implementation are discussed in Section 3. A schedule is presented in Section 4.

SECTION 2

GROUNDWATER REMEDIATION

2.1 SUMMARY OF PREVIOUS FINDINGS

Previous investigations have confirmed that the volatile organic constituents in groundwater at the Black & Decker Hampstead facility are tetrachloroethene (PCE) and trichloroethene (TCE). Data collected from 24 monitor wells and B&D production wells indicate that largely separate plumes of PCE and TCE exist. They are present in both the shallow water-bearing zone and in the deeper fractured bedrock to a depth of 150 feet along the local hydraulic gradient.

As shown in Figure 2-1, TCE has been detected primarily in the groundwater on the eastern half of the facility. Concentrations of TCE in excess of 1 ppm in monitor wells RFW-12 and RFW-8 delineate a plume possibly originating at the former aboveground TCE storage tank and/or Tank Farm 2 and extending south toward the lagoons. Hydrogeologic data indicate that in addition to flow toward the lagoon, a component of groundwater flow from the northeast corner of the plant, adjacent to RFW-8, may be directed east toward State Route 30.

As shown in Figure 2-2, PCE is the predominant constituent on the western half of the plant site. The highest concentrations, in excess of 1 ppm, appear to be limited to a small area that includes production Well No. 7. Lower concentrations were detected in wells across most of the site. PCE was not detected in the upgradient wells, in wells along the eastern site boundary or in wells on the northwestern side of the stream. However, PCE concentrations between 50 and 100 ppb were detected in wells adjacent to the western site boundary.

2.2 REMEDIATION PLAN OVERVIEW

The groundwater remedial plan involves the development of a pump and treat system designed to restrict potential off-site migration, recover and treat contaminated groundwater from the B&D property. A system of recovery wells, both existing and to be installed are proposed for the eastern and western site boundaries. The new well(s) will be completed in high yielding, water-bearing zones in order to produce a hydraulic barrier to groundwater and avoid contaminant flow off-site.

The concept of developing a hydraulic barrier is based on groundwater hydraulics. A barrier is created during pumping as the water surface surrounding the well forms a "cone of depression", inducing groundwater to flow toward the well. Depending on the pumping rate and the aquifer characteristics at the well

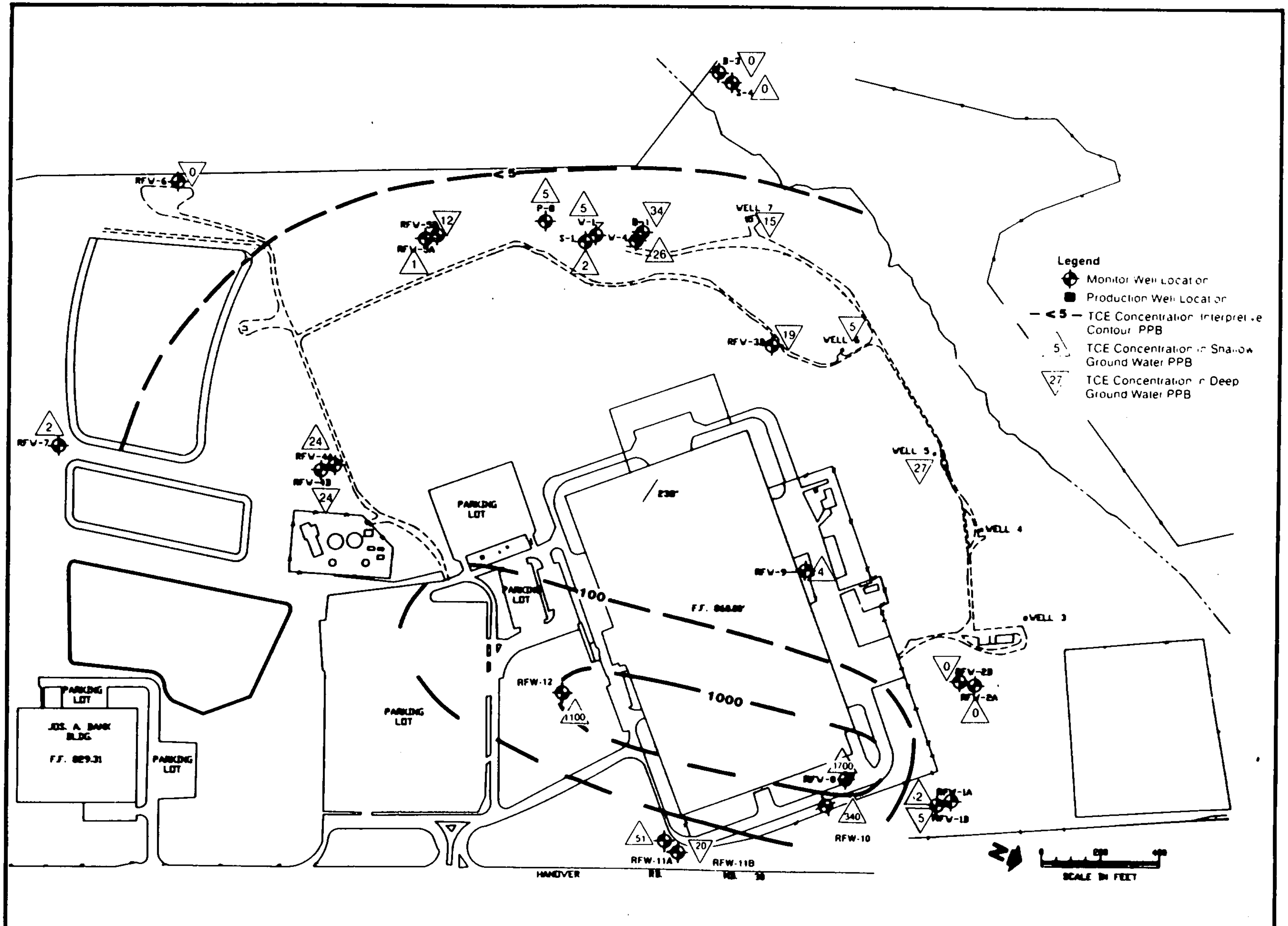

FIGURE 2-1 TCE CONCENTRATION IN GROUNDWATER 7/88 AND 12/88, BLACK & DECKER, HAMPSTEAD, MD

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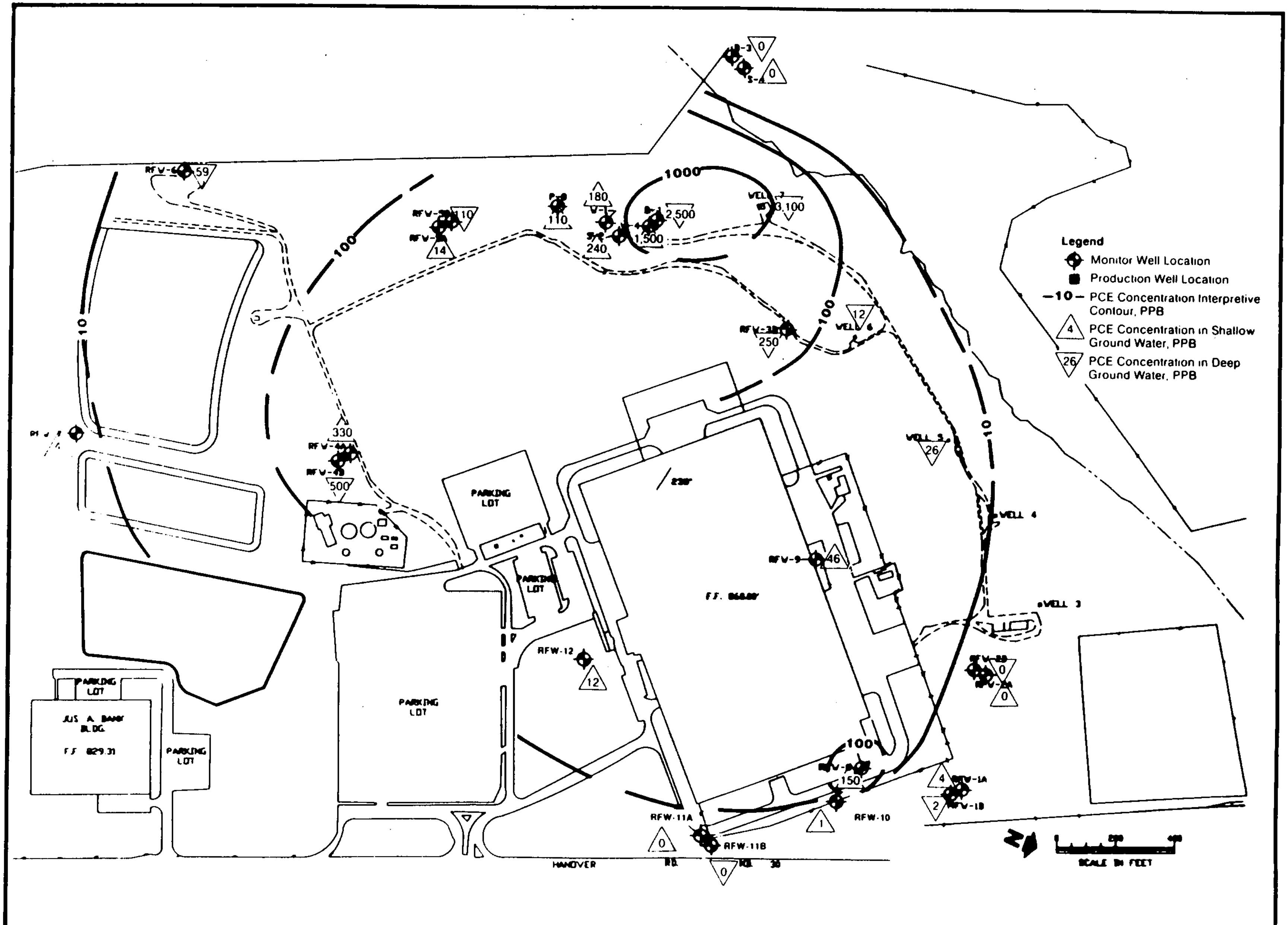

FIGURE 2-2 PCE CONCENTRATION IN GROUNDWATER 7/88 AND 12/88, BLACK & DECKER, HAMPSTEAD, MD

location, the cone of depression will vary in size and shape. When the area of influence of the well or wells is sufficient, the contaminated groundwater directed toward the eastern and western B&D site boundaries will be intercepted by the cone(s) of depression and recovered by the well system.

The remedial plan for the B&D site involves testing the area of influence of existing, relatively high yielding monitor wells and installing and testing additional well(s) in locations proximal to both the site boundaries and the highest areas of contamination. Evaluation of this data will allow design of an "optimal" recovery system, providing adequate hydraulic control while not needlessly depleting groundwater resources. Because it is difficult to predict well yields at a given location in a fractured-bedrock aquifer system such as is present in the area (even along fracture trends, where higher yields can be anticipated, areas of pumping influence can be difficult to predict), the remedial design investigation will be implemented in three stages. Each stage is contingent in detail upon the results of the previous stage in order to efficiently construct the hydraulic barriers. The stages of design investigation are proposed as follows:

2.2.1 Stage 1 Design Investigation

- Evaluate the effectiveness of monitor well RFW-12 as a recovery well for the eastern part of the facility by conducting a pumping test on the well. The critical factor in the evaluation will be identifying the area of hydraulic influence obtained by pumping RFW-12.

- Construct an "ideal" recovery well on the southwestern boundary of the property in an expected high yield fracture zone, south of production well 7. Perform a pumping test to evaluate the extent of pumping influence achieved.

2.2.2 Stage 2 Design Investigation

- If hydraulic influence in the area of Tank Farm 2 cannot be achieved by pumping RFW-12, construct and test an additional bedrock recovery well in the vicinity of Tank Farm 2.

- If hydraulic influence on the west side cannot be achieved by pumping at the western "ideal" recovery well, evaluate the use of an additional pumping well by pump testing existing deep monitor well RFW-5B.

2.2.3 Stage 3 Design Investigation

- If necessary, based on the results of Stage 2, complete the evaluation of the hydraulic influence by development of an analytical flow model and placement of additional wells as indicated by the results of the model.

Procedures for the Stage 1 effort are described in Subsection 2.3. The Stage 2 effort is outlined in Subsection 2.4. Stage 3, if required, can be designed only with information specifically obtained from the Stage 1 and 2 results and is not discussed in the Work Plan. Implementation of the remedial system, including final design and construction is discussed in Section 2.5.

Following completion of the Stage 1 effort, a summary letter report will be submitted presenting initial findings and any changes necessary in the Stage 2 program based upon the Stage 1 results.

2.3 STAGE 1 DESIGN INVESTIGATION

Stage 1 consists of:

- Pumping test and sampling to evaluate the use of RFW-12 as a recovery well in the eastern part of the facility.
- Installation and testing of an "ideal" recovery well, RFW-14, in the western part of the facility.

2.3.1 RFW-12 Evaluation

Monitor well RFW-12 was selected as a potential recovery well because of:

- Potential high yield as indicated by previous pumping conducted during installation and sampling.
- The relatively high concentration of TCE in groundwater samples from this well, and its favorable location within the indicated TCE impacted area.

The relatively high yield of RFW-12, in excess of 40 gpm (estimated), can be attributed to its partial completion in a fractured quartz vein encountered in weathered schist immediately above competent rock. At the site, quartz veins in general appear to serve as preferred migration pathways within both the saprolite and bedrock. The possibility exists that the residual quartz veins within the saprolite extend into competent rock, serving as conduits between water migrating in the pore spaces within the saprolite and water migrating within the fractured bedrock.

The relatively high concentration of TCE in groundwater sampled from RFW-12 indicates that the water-bearing quartz vein may represent a preferred pathway for groundwater from the former

TCE storage tank and RFW-8 areas. This is supported by results of groundwater analyses from lower-yielding downgradient wells closer to RFW-8 which had lower TCE concentrations then the RFW-12 sample by one to two orders of magnitude.

Evaluation of RFW-12 to determine the area of influence during pumping, its potential as a recovery well, and the hydraulic parameters of the aquifer will be accomplished by two tasks:

- Pumping test.
- Time series sampling.

2.3.1.1 Pumping Test

Evaluation of RFW-12 will consist of a short duration stepdraw-down test followed by an approximately 72 hour constant-rate pumping test. The purpose of the step-drawdown test is to evaluate the performance of RFW-12 at various discharge rates. The measurements of drawdown versus discharge obtained from the test will be used to calculate values of specific capacity. This information can be used to determine if the well performance is sufficient to conduct a constant-rate test and if so, to select an efficient pumping rate for the test.

The constant-rate test will be used to evaluate the hydraulic influence of RFW-12 and to estimate hydraulic parameters of the aquifer. While pumping the well at the preestablished rate, measurements of drawdown versus time in observation wells (monitor wells RFW-8, -11A, -11B and 10) as well as in RFW-12 will be used to calculate the radius of the cone of depression and indicated aquifer transmissivity.

The test will be conducted with a stainless-steel submersible pump with a capacity of at least 50 gal/min. Dedicated tubing will be used to route discharge water to a nearby sewer for eventual treatment in the facility's wastewater treatment plant. An in-line fitting will be used for regulating and measuring discharge rates of the pump and to provide an outlet for sam- pling. Water level and elapsed time data will be collected using an automated data collection system, the In-Situ SE2000 Hermit Data logger.

Prior to use, all down-hole equipment will be decontaminated using a steam cleaner, according to the WESTON Quality Assurance/Quality Control (QA/QC) procedures as described in the September 1987 Work Plan.

After the data is collected and reviewed, the appropriate method(s) for evaluation of the results and calculation of aquifer parameters will be selected and applied. Again, the primary focus will be upon evaluation of the most efficient method to obtain hydraulic influence in the area of concern as discussed above.

2.3.1.2 Time-Series Sampling

During the constant-rate pumping test at RFW-12, the well discharge will be sampled at approximately four sequential time intervals and analyzed for VOCs. The samples will be collected following a logarithmic distribution as the rate of spread of area of pumping influence decreases with time. The analysis will be used as an indication of the proximity of higher concentrations of contaminants to the pumping well, as the area of influence expands during pumping. The results can then be used to evaluate the efficiency of the well in recovering contaminated groundwater and the probable trend in composition. Samples will be collected directly from the pump discharge tubing into laboratory prepared glassware. Time intervals selected for sampling will be determined based on the pumping rate and drawdown in both the RFW-12 and observation wells. Appropriate QA/QC samples will be included in the VOC analysis. The standard WESTON QA/QC procedures will be followed as described in the September 1987 Work Plan.

2.3.2 RFW-14 Location, Installation, Evaluation

Installation of a well to recover contaminated groundwater adjacent to the western site boundary is necessary. Previous pumping tests of nearby Production Well No. 7, which exhibited the highest PCE concentrations and has the highest specific capacity of wells on site, have indicated that the area of influence of this well alone is not sufficient to serve as a hydraulic barrier to flow on the western boundary.

As shown in Figure 2-3, fracture trace analysis has revealed the potential presence of two fractures zones, partially delineated by the stream valley, intersecting several hundred yards southwest of Production Well No. 7. A well is proposed to be installed close to the intersection of these fractures for two reasons.

- A well located in a highly fractured zone may potentially intercept several preferred groundwater migration pathways, resulting not only in a high well yield but also an extensive area of influence.

- The area is ideally located proximal to the observed highest PCE concentration levels and the western site boundary.

Several tasks have been proposed to locate, construct, and evaluate an "ideal" recovery well in this zone.

These tasks include:

- Geophysical survey.
- Well installation using air rotary drilling techniques.
- Pumping test.
- Time-series sampling.

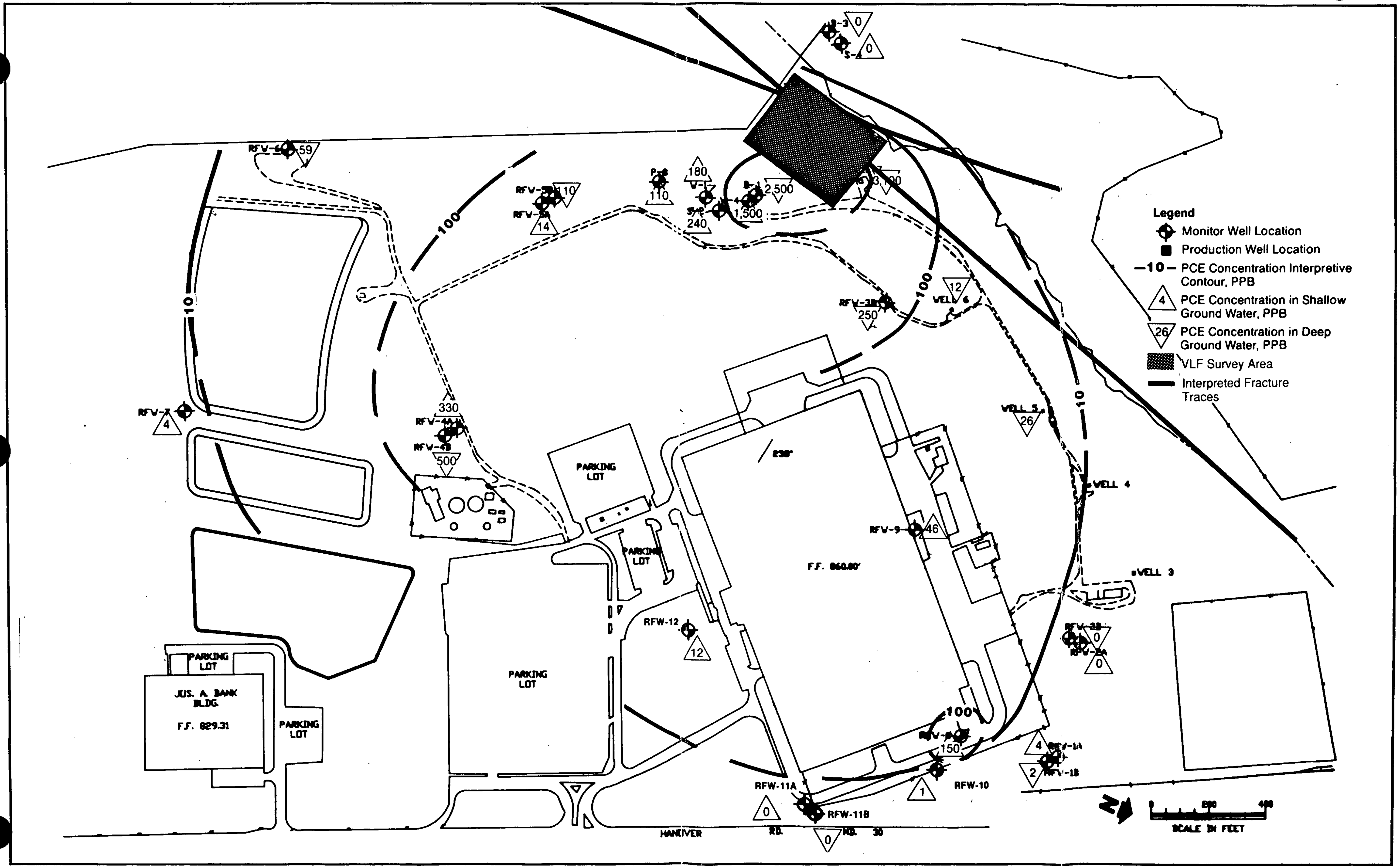

FIGURE 2-3 APPROXIMATE VLF SURVEY

2.3.2.1 Geophysical Survey

The objective of the geophysical survey is to provide information to assist in finding the optimal location for proposed recovery well RFW-14, by locating near-surface, water-bearing fracture zones in an approximate 10 acre area southwest of Production Well No. 7. Fractures will be delineated employing the Very Low Frequency Electromagnetic (VLF) technique. For the survey, an ABEM Wadi instrument will be used to measure fluctuations in the horizontal and vertical components of the magnetic field in the area, compared to the magnetic field transmitted by the VLF station. Although a relatively new technique, the VLF has been proven effective in locating relatively large-scale fractures through mapping trends of contrasting conductivity. A brief summary describing the VLF method is presented in Appendix A.

Using the VLF technique, measurements will be taken at 10 foot intervals along a 100 by 100 foot grid or as allowable by site conditions. The approximate grid area is depicted in Figure 2-3. Data collected in the survey will be used to produce profiles of conductivity contrasts that will be interpreted to predict the potential location of specific water-bearing zones. If results of the VLF survey do not provide adequate resolution for location of pilot holes for the recovery well, the VLF interpretation may be refined by conducting and evaluating an electromagnetic terrain conductivity or electric earth resistivity survey over a specific area of the grid where fractures are suspected to be present.

2.3.2.2 Well Installation

Based on the geophysical survey(s) a pilot hole(s) will be drilled at location(s) identified as being associated with water-bearing fractures. These "temporary wells" will be used to estimate yields of the water-bearing zones prior to installing a permanent recovery well.

The pilot hole(s) will be advanced a minimum of 25 feet into competent schist bedrock with a 6-inch bit using an Ingersol Rand (or equivalent) air rotary rig. Dependent on site conditions, clearing of obstructions from these locations may be required prior to mobilizing the drilling rig. Temporary casing will be set at approximately 70 to 100 feet below ground surface, at the transition between competent and weathered schist to maintain the borehole integrity.

Yields of water-bearing zones encountered during drilling will be estimated by surging the borehole with air and visually approximating the flow rate. If the yield is determined to be sufficient (i.e., 50-100 gpm) the temporary casing will be removed and the borehole will be redrilled to allow for the installation of an 8-inch recovery well (RFW-14). Low-yielding pilot holes will be abandoned by back-filling with a portland cement/bentonite grout.

Construction details for the RFW-14 recovery well are illustrated in Figure 2-4. Steel surface casing will be set above significant water-bearing zones. If the pilot hole testing indicates significant water-bearing zones in the weathered schist, the recovery well will be screened in both upper and lower water-bearing zones. Well development will be accomplished by surging the open borehole with air prior to setting the well screen and by pumping the well once it is complete. A licensed surveyor will establish the elevation and location of the top of casing of RFW-14 based on the permanent benchmark on-site.

During pilot hole and recovery well installation the WESTON QA/QC program established in the September 1987 Work Plan will be followed. This program includes the steam cleaning of all down-hole equipment prior to drilling or the use of dedicated equipment and materials.

2.3.2.3 Pumping Test

Evaluation of the recovery well (RFW-14) will consist of a short duration step-drawdown pumping test followed by a maximum two week constant-rate pumping test. As in the RFW-12 evaluation, the step-drawdown test will be conducted to evaluate the performance of the recovery well at various discharge rates and to select an efficient pumping rate for the constant rate test.

The constant-rate test, used to evaluate the hydraulic influence of RFW-14 and estimate hydraulic parameters of the aquifer, will be conducted in a manner similar to the test of RFW-12. Observation wells to be monitored during the test will include Well No. 7, RFW-5A, RFW-5B, RFW-6, and B-1. All production wells on-site will be idle during the tests.

Procedures for equipment decontamination and for performing the test outlined previously and established by the WESTON QA/QC program will be followed. Discharge from the pump during the test will be routed through the air stripper currently in use at the site and will be used in the plant for meeting regular needs.

2.3.2.4 Time-Series Sampling

As in the RFW-12 evaluation, during the constant-rate pumping test of RFW-14, the well discharge will be sampled at approximately seven sequential time intervals, dependent upon the actual test length, and analyzed for VOCs to characterize the quality of groundwater intercepted by the well's expanding area of influence. The samples will be collected using a logarithmic distribution as the rate of spread of the cone decreases with time.

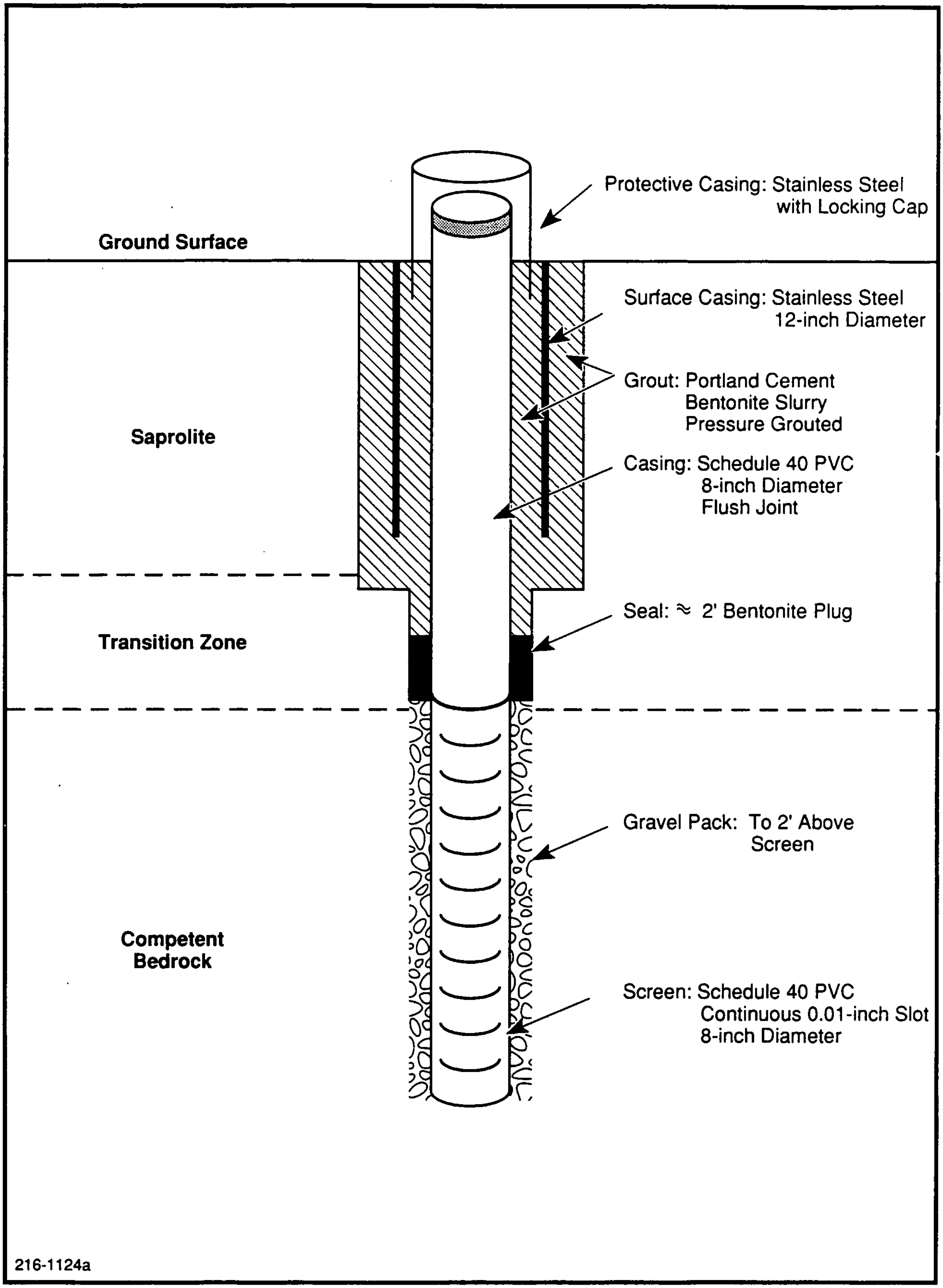

FIGURE 2-4 APPROXIMATE CONSTRUCTION SPECIFICATIONS RFW-14

Samples will be collected from the pump's discharge hose and placed directly into laboratory prepared glassware. Time intervals selected for samples will be included in the VOC analyses. Applicable WESTON QA/QC procedures will be followed as described in the September 1987 Work Plan.

2.4 STAGE 2 DESIGN INVESTIGATION

Following the completion of the Stage 1 effort, a summary letter report will be submitted presenting the initial findings and plans for Stage 2. The Stage 2 tasks will be implemented if evaluation of either RFW-12 or RFW-14 indicates that additional wells are needed to create a hydraulic barrier along the eastern or western site boundaries, respectively.

Stage 2 as preliminarily planned consists of:

- Location, installation, and evaluation of recovery well RFW-15 on the eastern site boundary.

- Pumping test and sampling to evaluate the use of RFW-5B as a recovery well near the western site boundary.

Any changes in Stage 2 tasks will be based on Stage 1 results, and will be included in the letter report.

2.4.1 RFW-15 Location, Installation, Evaluation

If a sufficient area of influence cannot be achieved by the pumping of RFW-12, an additional well will be located, constructed, and evaluated on the eastern property boundary. Information collected in the evaluation of RFW-12 will be used in conjunction with a fracture trace analysis to locate RFW-15. RFW-15 will be located:

- In a potential high yield water-bearing fracture.

- Proximal to the highest TCE concentration levels near the eastern site boundary.

As used in the RFW-14 installation, pilot hole(s) will be drilled at identified locations so that yields of the water-bearing zones encountered can be estimated prior to installing a permanent recovery well. Construction details and procedures will be similar to those presented for the RFW-14 recovery well.

If yields from water-bearing fractures are determined to be sufficient, a 6-inch I.D. recovery well will be installed according to specifications in Figure 2-5. Procedures for the well's installation and development will be similar to procedures used to install RFW-14.