Work Plan for Extraction System Expansion
Former Rifkin Property and
The Sherwin-Williams Facility
Emeryville, California

May 20, 1999
6215.99-009

Prepared for
The Sherwin-Williams Company
1450 Sherwin Avenue
Emeryville, California

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May 20, 1999

6215.00-009

Mr. Mark Johnson
Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, California 94612

Subject: Work Plan for Expansion of the Groundwater Extraction System on the Former Rifkin Property, Emeryville, California

Dear Mr. Johnson:

LFR Levine·Fricke (LFR) has prepared this work plan on behalf of the Sherwin-Williams Company (Sherwin-Williams). This work plan presents the scope of work associated with the expansion of the groundwater extraction system (GWES) on the former Rifkin property in Emeryville, California. This work plan is submitted pursuant to the requirements of SCR Order No. 98-009, issued by the Regional Water Quality Control Board (RWQCB) on February 19, 1998, and the settlement agreement between Sherwin-Williams and Chiron.

The purpose of the expansion of the GWES on the former Rifkin property is to capture contaminated groundwater from the shallow water-bearing zone near the southern Rifkin property boundaries with Sherwin-Williams. This expansion requires installation of three groundwater extraction wells, conveyance piping for extracted groundwater, supplied air to operate the groundwater extraction pumps, and associated equipment and appurtenances such as well vaults, pumps, and valves. In addition, one monitoring well will be installed on the former Rifkin property and two piezometers will be installed on opposite sides of the slurry wall between the Sherwin-Williams and former Rifkin properties.

If you have any questions or comments regarding this report, please call Larry Mencin at (216) 566-1768 or me at (510) 652-4500.

Sincerely,

Michael B. Marsden, R.G., C.HG.
Senior Hydrogeologist

Enclosure

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CERTIFICATION

All information, conclusions, and recommendations in this document have been prepared under the supervision of and reviewed by an LFR Levine · Fricke California Registered Geologist.

5-17-99

Michael B. Marsden, R.G., C.HG. Date
Senior Hydrogeologist
California Registered Geologist (6536)

1.0 INTRODUCTION

LFR Levine · Fricke (LFR) has prepared this work plan on behalf of the Sherwin-Williams Company (Sherwin-Williams). This work plan presents the scope of work associated with the expansion of the existing groundwater extraction system onto the former Rifkin property in Emeryville, California (Figure 1). This work plan is submitted pursuant to the requirements of SCR Order No. 98-009, issued by the Regional Water Quality Control Board (RWQCB) on February 19, 1998 and the Sherwin-Williams and Chiron settlement agreement. The existing groundwater extraction and treatment system (GWETS) is currently in operation at the Sherwin-Williams facility adjacent to the former Rifkin property .

The purposes of the expansion of the groundwater extraction system (GWES) on the former Rifkin property is to enable the system to act as a hydraulic barrier and to extract contaminated groundwater from the shallow water-bearing zone on the former Rifkin property south of the "B" line (Figure 2). This expansion requires the installation of three groundwater extraction wells, conveyance piping for extracted groundwater, supplied air to operate the groundwater extraction pumps, and associated equipment and appurtenances such as well vaults, pumps, and valves. In addition, one monitoring well will be installed on the former Rifkin property and two piezometers will be installed on opposite sides of the slurry wall between the Sherwin-Williams and former Rifkin properties. All work will be conducted in accordance with the Quality Assurance Project Plan (ENTRIX 1998) and the Health and Safety Plan (LFR 1998a).

The following sections provide the objectives and scope of the proposed work, and a summary of field activities and health and safety considerations. The proposed schedule for field activities is given in Figure 4. Appendix A presents a summary of the modeling conducted to determine the optimum extraction well scheme. Appendix B provides the technical specifications of the GWES. Additional background (site history and contaminant distribution) on the Sherwin-Williams and former Rifkin properties is given in the Current Conditions report (LFR 1998b), the Remedial Investigation Workplan Addendum (ENTRIX 1999), and Revised Evaluation of Existing Interim Remedial Measures report (LFR 1998c).

2.0 OBJECTIVES

The objectives of the expansion of the GWES onto the former Rifkin property are as follows:

1. Capture groundwater affected by Sherwin-Williams contaminants of concern in the shallow water-bearing zone on the former Rifkin property south of the "B" line (Figure 2).
2. Develop a hydraulic capture zone to prevent the migration of affected groundwater north of the "B" line.

3. Develop a hydraulic capture scenario that minimizes migration of affected groundwater already on the former Rifkin property.

4. Meet the above objectives while maintaining an inward gradient across the slurry wall (Figure 4).

If necessary, it may be possible to increase the pumping rate from extraction wells within the slurry wall to maintain an inward gradient. Currently, the treatment system is operating at approximately 10 gallons per minute (gpm) but has a 30 gpm capacity.

The objective of the installation of an additional monitoring well (north of the "B" line) and two piezometers is to provide additional data to more effectively monitor these objectives including: hydraulic capture, existing contaminant distribution, and future plume movement on the former Rifkin property.

3.0 SCOPE OF WORK

The scope of work for the GWES expansion and monitoring well and piezometer installation includes the following tasks.

- Pre-field work activities – subcontractor procurement and underground utility survey
- Removal of surface and subsurface asphalt and concrete at extraction well, monitoring well, and piezometer locations
- Conduct CPT borings
- Extraction well installation and development
- Monitoring well and piezometer pair installation and development
- Groundwater sampling of new extraction and monitoring wells
- Extraction system construction
- Expanded GWES start up
- Disposal of drill cuttings and excavated materials

4.0 FIELD WORK ACTIVITIES

The following sections describe the field work activities during the GWES expansion at the former Rifkin and Sherwin-Williams properties.

4.1 Pre-Field Work Activities

The appropriate permits will be obtained from the City of Emeryville and from Alameda County Public Works before extraction wells, monitoring wells, and piezometers installation and construction activities begin.

Underground Services Alert (USA) will be notified before subsurface investigations and well installation activities begin, so that the locations of public utilities can be identified. A private underground utility locator will identify the locations of subsurface structures and utility lines at each proposed well location and along the piping trenches before subsurface investigation activities commence.

4.2 Concrete Cutting

Under the supervision of LFR, a contractor will saw, cut and remove the asphalt and concrete from the proposed well and trench locations. It is estimated that the thickness of asphalt and concrete at the former Rifkin property is 1.5 feet (ft). Work will be conducted in compliance with the Health and Safety Plan (HSP; LFR 1998) discussed in Section 5.0.

4.3 CPT Borings

CPT borings will be drilled next to each of the three proposed extraction well locations (Figure 2) under the supervision of an LFR geologist. CPT borings will be extended to a depth of 30 ft below ground surface (bgs), and the data collected from the CPT borings will be used to select the location and screened interval of each extraction well.

The CPT probe, which is attached to a string of steel pipe segments, will be pushed into the ground using a truck-mounted hydraulic ram with a maximum reaction of 25 tons. The probe will be advanced at an approximate rate of 2 centimeters per second, while measurements are recorded continuously and relayed directly to an on-board computer. Lithologic and hydrologic data based on cone tip resistance, sleeve friction, probe inclination, and pore water pressure measured by the cone-tipped probe are printed out by the computer as the probe advances. Upon completion, the extraction wells will be installed at the same location as the CPT borings.

4.4 Extraction Well Installation

Three A-zone extraction wells (EX-11, EX-12, and EX-13) will be completed to a depth of approximately 25 feet bgs using the hollow-stem auger drilling method. Figure 2 shows the proposed locations of the three extraction wells. The number and location of the extraction wells on the Site were proposed to meet the following objectives:

- Remove groundwater from areas containing the highest concentration of arsenic in the shallow water-bearing zone near the boundaries of the former Rifkin property and the Sherwin-Williams facility.
- Provide effective capture of groundwater as far north as the "B" line defined by wells MW-3 and RP-5.
- Reduce the travel distance of high concentrations of arsenic before extraction.

The effectiveness of the proposed well scheme in accomplishing the objectives above was evaluated using a two-dimensional MODFLOW model (Appendix B). Modeling results were discussed with Chiron and the RWQCB in a series of meetings.

As discussed in Section 4.3, CPT borings will be used to verify the location of the proposed extraction wells. Confirmation of a minimum thickness of one foot or greater of coarse-grain sediment in the CPT boring will be required prior to installation of the extraction wells. If the proposed location of the extraction well is not appropriate based on the CPT data, the extraction well location will be adjusted after collecting additional CPT data.

Soil samples will be collected continuously during the drilling of the extraction wells for characterization of subsurface lithology. Soil samples will be monitored with an organic vapor meter (OVM) to assess for the presence of volatile organic compounds (VOCs) in the soil for health and safety purposes. Drilling and sampling equipment will be steam cleaned before use at each new extraction well location.

Extraction wells will be completed with 6-inch-diameter stainless steel casings in 12-inch-diameter boreholes, with approximately 20 ft of slotted screen extending from approximately 5 to 25 ft bgs. After a well casing has been placed in a borehole, the well annulus opposite the screened interval will be backfilled with clean sand to approximately 1 foot above the top of the perforations. The grain-size distribution of the sand pack will be selected for compatibility with the selected slot size of the well screen. A 0.01-inch slotted screen will be used if the sand pack is a 2/12 sand and a 0.02-inch slotted screen will be used if the sand pack is a No. 3 sand. Approximately 2 ft of bentonite pellets will be placed above the sand pack to isolate the screened interval from material above and inhibit the entrance of grout into the sand pack. Concrete will be placed in the remainder of the borehole. A locking, traffic-bearing cover will then be placed over the top of the casing to protect the integrity of the well.

Soil cuttings generated during drilling will be stored in soil bins and left on site until an appropriate disposal facility is identified pending analytical results.

4.5 Monitoring Well and Piezometer Installation

One monitoring well (LF-31) will be completed to a depth of approximately 25 ft bgs at the location shown on Figure 2. The purpose of this monitoring well is to delineate the extent of the arsenic plume between existing site wells RP-2 and MW-3, evaluate

contaminant concentrations north of the "B" line and southwest of the arsenic plume emanating from Horton Street, evaluate the capture zone of extraction wells EX-11, EX-12, and EX-13.

Two piezometers (LF-PZ21 and LF-PZ22) will be installed on opposite sides of the slurry wall between the Sherwin-Williams and former Rifkin Properties at the locations shown on Figure 2. The purpose of this piezometer pair is to monitor the horizontal groundwater gradient across the slurry wall in the vicinity of the proposed extraction well EX-11.

The hollow-stem auger drilling method will be used to install the monitoring well and the piezometers. All augers and sampling equipment will be steam cleaned before use at each well location. Soil samples will be collected continuously, and will be used to characterize the subsurface lithology. Drill cuttings will be monitored with an OVM to test for the presence of VOCs in the soil for health and safety purposes.

Monitoring wells and piezometers will be completed with 2-inch diameter polyvinyl chloride (PVC) casing in an 8-inch diameter borehole, and completed to a depth of approximately 25 ft bgs. After the casing has been placed in the borehole, the well annulus opposite the screened interval will be backfilled with clean sand to a height of approximately 1 foot above the top of the perforations. The grain-size distribution of the sand pack will be selected to be compatible with the selected slot size of the well screen. A 0.01-inch slotted screen will be used if the sand pack is a 2/12 sand and a 0.02-inch slotted screen will be used if the sand pack is a No. 3 sand. Approximately 2 ft of bentonite pellets will be placed above the sand pack to isolate the screened interval from material above and inhibit the entrance of grout into the sand pack. A concrete grout will be placed in the remainder of the borehole. A locking cover will then be placed over the top of the casing to protect the integrity of the well.

Soil cuttings generated during drilling will be stored in soil bins and left on site until an appropriate disposal facility is identified based on analytical results.

4.6 Well and Piezometer Development

The newly installed extraction wells, monitoring wells, and piezometers will be developed by bailing, swabbing, and pumping to remove sediment from around the well and enhance hydraulic communication with the surrounding formation.

During well development, approximately 10 well volumes of water will be purged from each well. Specific conductance, pH, and temperature will be measured, and observations concerning the quantity and clarity of purged water will be recorded during purging to assist in the evaluation of groundwater quality. After well development, the water level in the well will be measured. All developing and sampling equipment will be steam cleaned before use at each well.

Groundwater generated from well development will be discharged into the existing GWTS.

4.7 Well and Piezometer Surveying

A licensed surveyor will survey top-of-casing elevations (NAD 83 system) and the horizontal location of the new extraction wells, monitoring wells, and piezometers.

4.8 Groundwater Sampling

Groundwater samples will be collected from the new extraction wells (EX-11 through EX-13) and monitoring well LF-31. Groundwater samples will be collected in compliance with the QAPP (ENTRIX 1998) and submitted to Curtis and Tompkins of Berkeley, a California-certified laboratory, for chemical analysis on a standard laboratory turnaround schedule of two weeks. Groundwater samples will be analyzed for CAM-17 metals using EPA Method 6000/7000 series, SVOCs using EPA 8270, VOCs using EPA Method 8260, TPHg using EPA Method 5030 GCFID, and TPHd using EPA Method 3510/3550. The groundwater samples will be filtered in the laboratory before all metals analyses.

4.9 Extraction System Construction

The general contractor will construct the extraction system expansion as follows:

- saw, cut and remove the existing surface and subsurface asphalt and concrete
- excavate, backfill (using the specified material), and repave the trenches
- load the excavated soil into bins
- install well vaults and junction boxes, pneumatic extraction well pumps, and other wellhead components
- install all above-ground and below-ground valves, piping, support, air supply and water discharge hoses, and manifold at the existing GWTS

The contractor will pressure test all new discharge hoses and fittings installed on the former Rifkin property. Hydrostatic pressure testing of the underground piping shall be performed after back-filling the pipe section.

The well vaults will have spring actuated lids that will be secured with custom-shaped bolts to prevent vandalism and enhance safety.

A construction engineer will be onsite for the start of construction work during all subsurface activities and periodically during above-ground construction activities. The construction engineer will monitor the contractor's work to verify that the requirements of the contract documents are fulfilled.

The construction engineer will prepare daily construction reports describing the progress of the contractor's work, equipment, personnel, weather conditions, and other pertinent information applicable to construction. The construction engineer will also prepare correspondence to the contractor regarding technical and contractual issues, as necessary. Photographs will be taken to further document the progress of the contractor's work. The resident engineer will review shop drawings and submittal data on materials and equipment supplied by the contractor to confirm that these items comply with the specifications (Appendix B).

4.10 Waste Management

Waste soils that will be produced during the installation of wells and piezometers and construction of the expanded GWES will be characterized and disposed at an appropriate disposal facility.

Waste solids will be stored on site in soil bins. A composite sample will be collected from each bin and sent for analysis by a California-certified laboratory to profile the waste solids. Based on the analytical results, LFR will coordinate with an appropriate landfill facility for disposal of the waste solids.

4.11 Extraction System Start-Up

LFR engineering technicians will implement necessary modifications to the existing GWTS before start up of the expanded GWES. Necessary modifications may include the installation of additional filters and valves, and the implementation of air supply and level-control modifications at the treatment system.

Upon start up, LFR technicians will observe the condition and flow rate of groundwater extracted from each of the new extraction wells on the former Rifkin property. In addition, a hydrologic study to evaluate well yields and extent of hydraulic capture zones (including monitoring wells along the "B" line) will be conducted. The hydrologic study will consist of using the pressure transducer and data loggers during system start-up to continuously monitor groundwater levels in the three new extraction wells, monitoring wells (MW-3, RP-2, RP-4, and RP-5), proposed monitoring well LF-31, and selected monitoring wells and piezometers.

As part of the hydrologic study, LFR will conduct a total of four tests, one for each extraction well and a fourth on all three extraction wells combined. Pumps will be set equivalent to the highest possible well yield. The extraction pumps will run at 1 gpm for 48 continuous hours and the well recovery will be monitored for 24 hours. Flow rate and total extracted groundwater will also be monitored. For the initial drawdown portion of the test, the extraction well data logger and surrounding wells will be set to logarithmic measurement intervals, tapering to a constant 10-minute interval after 100 minutes. Measurements will be made periodically using hand-held electric water-level probes to correlate the electronic data to the top-of-casing elevations, and to verify proper data logger operation. Hydrologic study activities are summarized in the following table.

Hydrologic Study Activity	Duration	Objective
Complete round of groundwater levels	1 day, prior to system start-up	Evaluate baseline groundwater level conditions
EX-11 maximum yield test	48 hrs of pumping; 24 hrs recovery	Evaluate yield and capture zone of EX-11
EX-12 maximum yield test	48 hrs of pumping; 24 hrs recovery	Evaluate yield and capture zone of EX-12
EX-13 maximum yield test	48 hrs of pumping; 24 hrs recovery	Evaluate yield and capture zone of EX-13
EX-11, EX-12, and EX-13 maximum yield test	48 hrs of pumping	Evaluate yield and capture zone of new extraction wells
Complete round of groundwater levels	1 day, a minimum of 2 weeks following system start-up	Evaluate the effect of the new wells on former Rifkin property groundwater gradients

5.0 HEALTH AND SAFETY

Activities at the former Rifkin property and the Sherwin-Williams facility will be conducted in compliance with the HSP and applicable Occupational Safety and Health Administration (OSHA) regulations. Access to the specified work area will be limited to authorized personnel. All personnel entering the work area will sign the signature page in the HSP, indicating they have read and accept the health and safety practices outlined in the plan. Real-time air monitoring devices will be used to analyze for airborne contaminant concentrations every 30 minutes in the workers' breathing zones while intrusive activities are being conducted. Action levels have been established in the HSP for VOCs and dust levels.

5.1 Air Monitoring

On-site worker exposure to airborne contaminants will be monitored during all intrusive site activities. A calibrated photoionization detector (PID) equipped with a 10.6 electron volt (eV) lamp or flame ionization detector (FID) will be used to monitor any changes in exposure to VOCs. A miniature real-time aerosol monitor (mini-RAM) will be used to monitor exposure to total dusts. Ambient air will be routinely monitored during site activities to evaluate concentrations of VOCs and total dusts in the worker's breathing zones. If VOCs and/or total dusts are detected above predetermined action levels specified in the site HSP, the action items designated in the HSP will be followed.

5.2 Personal Air Monitoring

Personal air monitoring will be conducted to quantify potential worker exposure to the following target compounds. Air samples for metals will be collected using active sampling techniques in accordance with National Institute of Occupational Safety and Health (NIOSH) method 7300, and air samples for VOCs will be collected using passive diffusion badges. The samples will be collected during the first three days of intrusive activities and when needed thereafter as determined by the nature of site activities.

5.3 Noise Monitoring

To minimize disturbances to neighbors, LFR and the contractors will take the necessary steps, procedures, and means as required to prevent abnormal noise levels. In addition, work will only be conducted during normal business hours (8:00 a.m. to 6:00 p.m.). Noise levels will be routinely monitored with a sound level meter.

5.4 Dust Control

To minimize inhalation hazards, LFR and the contractors will take the necessary steps, procedures, and means as are required to prevent abnormal dust conditions. Dust control will be by sprinkling, use of dust suppression, modifications of operations, or any other means acceptable.

5.5 Site Cleaning

Throughout the period of work, LFR and the contractors will keep the work site free and clean of all rubbish and debris, and will promptly remove from the work area all unused and rejected materials, concrete, plaster and debris.

6.0 PROJECT SCHEDULE

Figure 4 shows a timeline for activities associated with this Work Plan. This schedule was prepared for the Work Plan based on experience for previous work conducted at the site. The schedule may be modified depending on the length of time required for Work Plan approval by the RWQCB.

REFERENCES

ENTRIX. 1988. Quality Assurance Project Plan for the Sherwin-Williams Facility, Emeryville, California. April 27.

———. 1999. Remedial Investigation Workplan Addendum, Sherwin-Williams Facility, Emeryville, California. June ??.

LFR Levine · Fricke. 1998a. Health and Safety Plan for Site Investigation Activities at the Sherwin-Williams Facility, Emeryville, California. July 2.

———. 1998b. Draft Current Conditions Report, Sherwin-Williams Facility, Emeryville, California. June 19.

———. 1998c. Revised Evaluation of Existing Interim Remedial Measures and Work Plan for Implementation of Future Interim Remedial Measures, Sherwin-Williams Facility, Emeryville, California. August 7.

RWQCB. 1998. Adoption of Site Cleanup Requirements, Order 98-009. Signed by Loretta K. Barsamian. February 18.

Map Source:
The Thomas Guide
Alameda/Contra Costa Counties
Street Guide and Directory

THE SHERWIN-WILLIAMS COMPANY, EMERYVILLE, CALIFORNIA

Site Location Map

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Figure 1

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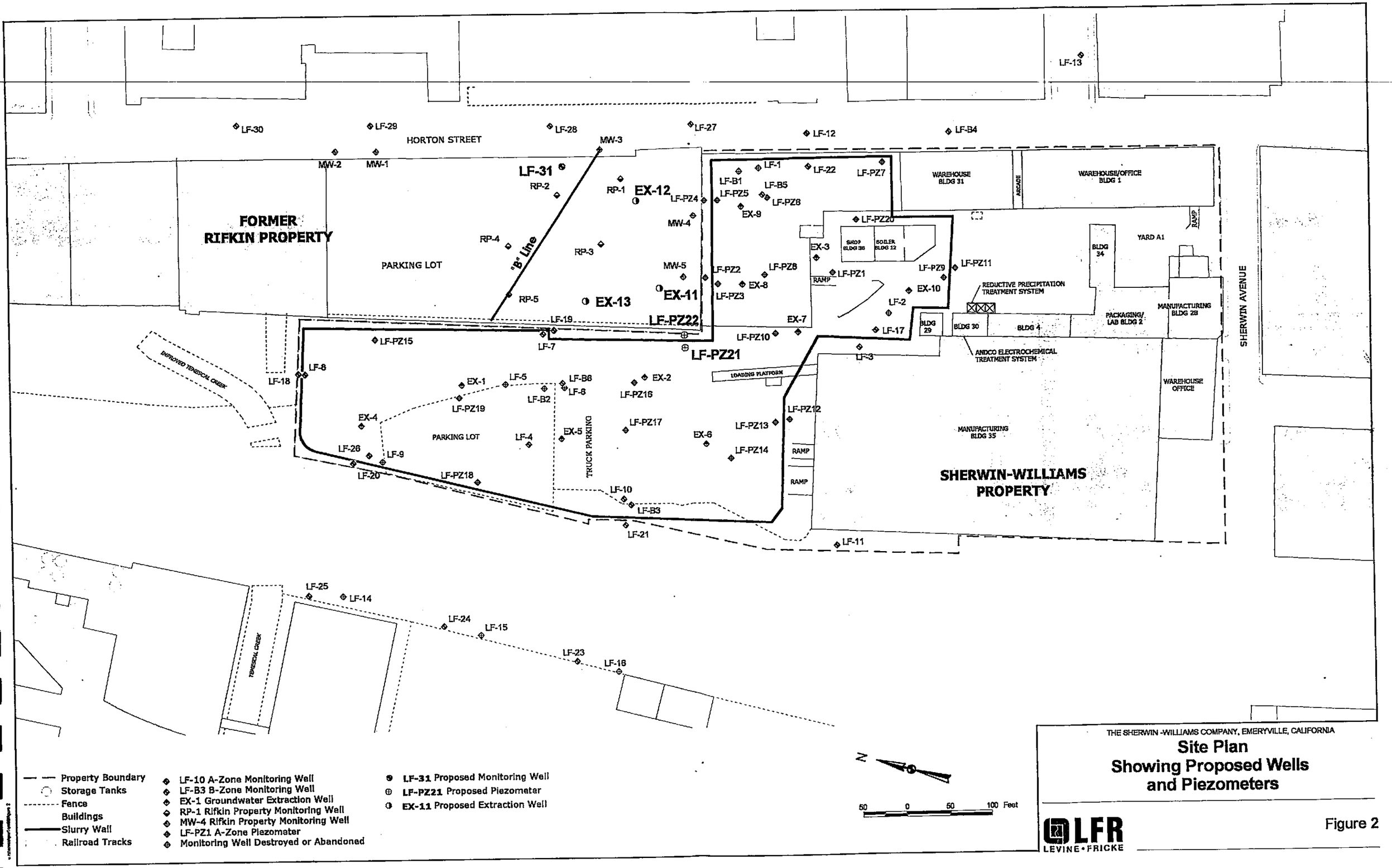

THE SHERWIN -WILLIAMS COMPANY, EMERYVILLE, CALIFORNIA

Site Plan Showing Proposed Wells and Piezometers

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Figure 2

30 0 30 60 90

SCALE IN FEET
SCALE: 1"=30'-0"

HORTON STREET (60' WIDE)

EXISTING BUILDING #31

FOR TYPICAL WELL PENETRATION AND PUMP INSTALLATION

EX-12

EX-9

CB

CB #38 EXISTING

#12 BUILDING

#17

FORMER RIFKIN PROPERTY

NEW U.G. 4" CASING TO BE INSTALLED

EX-11

EX-3

MH

NEW OVERHEAD 4" CASING TO BE INSTALLED USING EXISTING PIPE SUPPORT BRIDGE.

PROBABLE LOCATION OF UNDERGROUND ELECTRICAL LINE. CHIRON TO VERIFY EXACT LOCATION IN CHIRON UTILITY PLANS

EX-8

RAMP

EX-10

MSE INFLUENT TANK

#29

#30

MSE TREATMENT SYSTEM

EX-13

NEW U.G. 4" CASING TO BE INSTALLED

FOR TIE-IN CONNECTION

CB

EX-7

MH

ANDCO TREATMENT SYSTEM

BUILDING #4

RD

RD

ANDCO INFLUENT TANK

TEMESCAL CREEK

CB

CB

CB

CB

EX-2

PLATFORM 16.2 TOP

ATTACH DISCHARGE OF WELLS TO PVC PIPING LEADING TO MSE AND ANDCO INFLUENT TANKS AND AIR SUPPLY TO WELLS FROM PLANT AIR SUPPLY AS PER INSTRUCTIONS INCLUDED WITH WELL PUMPS.

EX-1

EX-4

CB

CB

21"

CB

21"

18"

EX-5

CB

EX-6

NEW OVERHEAD 4" CASINGS TO BE INSTALLED USING EXISTING BUILDING TO SUPPORT PIPES.

SHERWIN-WILLIAMS PROPERTY

BUILDING #35

CB

18" RCP STORM DRAIN

CB

18" RCP STORM DRAIN

CB

LEGEND

- FENCING
- PROPERTY LINE
- EXISTING EXTRACTION PIPING
- NEW ABOVE GROUND EXTRACTION PIPING
- BELOW GROUND EXTRACTION PIPING WITH SPARE
- NEW BELOW GROUND EXTRACTION PIPING
- SLURRY WALL
- RAILROAD TRACK
- STORM DRAIN
- EX-12 NEW GROUNDWATER EXTRACTION WELL
- EX-1 EXISTING GROUNDWATER EXTRACTION WELL
- MH MAN HOLE
- RD ROOF DRAIN
- CB CATCH BASIN

NOTE:
LOCATION OF EXTRACTION WELLS BASED ON PRELIMINARY DESIGN. LOCATIONS MAY BE MODIFIED UPON COMPLETION OF FINAL DESIGN AND/OR DUE TO FIELD CONDITIONS.

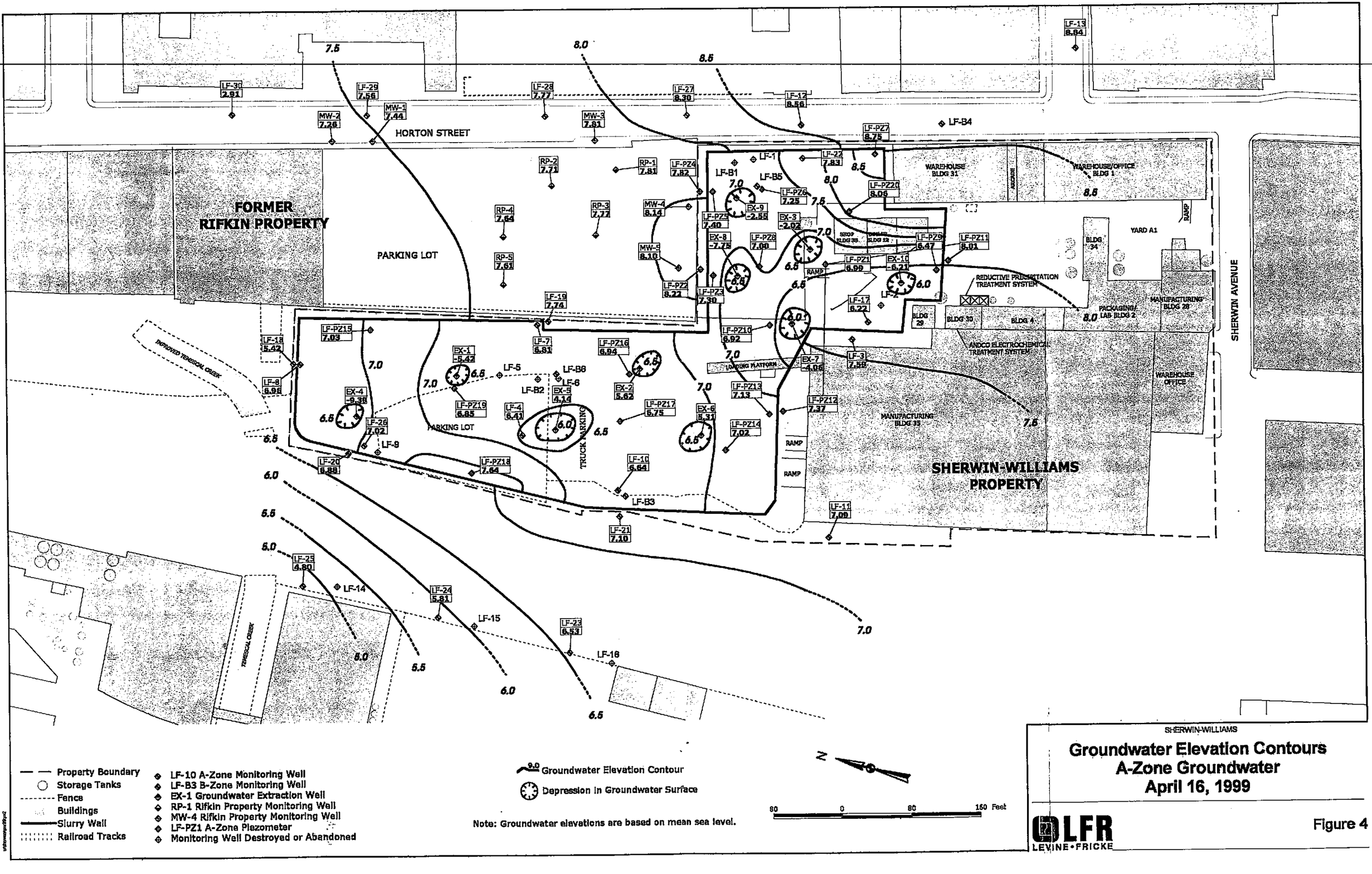
J:\ENGCAD\SHERWIN\8427.99\FIGURES.DWG BORDER\D000BDR.PCP 04/21-99

THE SHERWIN-WILLIAMS COMPANY, EMERYVILLE, CALIFORNIA

Wells and Piping Layout

LFR LEVINE-FRICKE

Figure 3



SHERWIN-WILLIAMS

Groundwater Elevation Contours
A-Zone Groundwater
April 16, 1999

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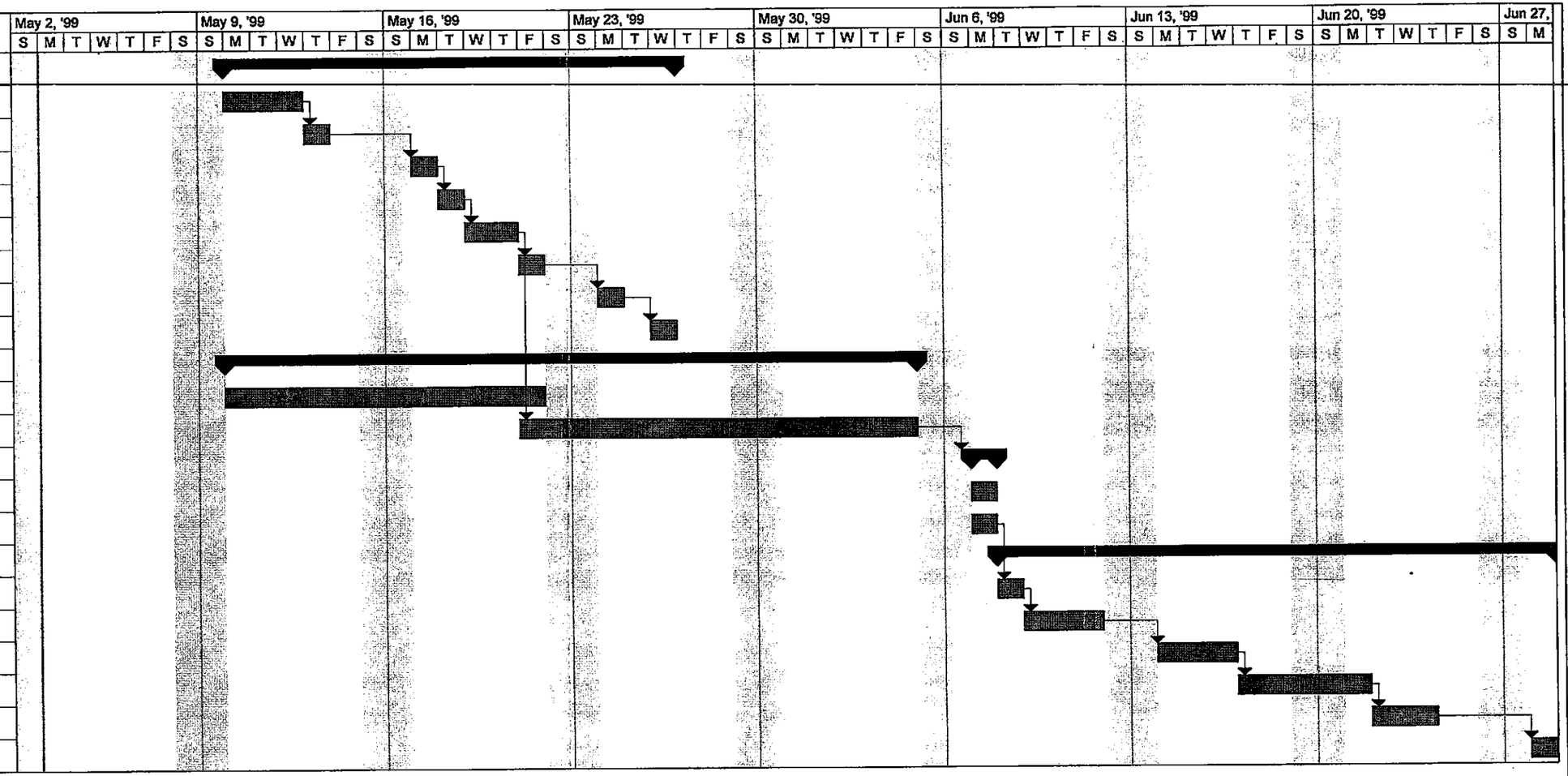
Figure 4

ID	Task Name
1	**Well installation activities**
2	Pre-field activities (mark and notify USA)
3	Private underground utility survey
4	Concrete coring
5	CPT borings
6	Extraction well installation
7	Monitoring well and piezometer installation
8	Well development
9	Well sampling
10	**Extraction system construction activities**
11	Construction on Sherwin-Williams
12	Construction on former Rifkin property
13	**Waste management and miscellaneous activities**
14	Characterize waste from bins
15	Survey wells
16	**Extraction system start-up**
17	Full round of water levels
18	EX-11startup monitoring
19	EX-12 startup monitoring
20	EX-13 startup monitoring
21	EX-1, EX-12, and EX-13 startup monitoring
22	Full round of water levels



Project: Work Plan Schedule
Date: Mon 5/3/99

Task | Progress | Summary | Rolled Up Split | Rolled Up Progress | Project Summary
Split | Milestone | Rolled Up Task | Rolled Up Milestone | External Tasks

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Figure 5

Proposed Work Plan Schedule
Extraction System Expansion
Former Rifkin Property, Emeryville, California

Appendix A

MEMORANDUM
FORMER RIFKIN PROPERTY MODELING
APRIL 20, 1999

LFR
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Date: April 20, 1999 **INTEROFFICE MEMORANDUM**

To: Mike Marsden

From: Bill Carson, Eric Nichols, Thomas Zakaria

Subject: **Former Rifkin Property Modeling**

This discussion addresses the results of the MODFLOW modeling used to define the capture zones for different groundwater extraction scenarios at the former Rifkin property located north of the Sherwin Williams site on Horton Street, Emeryville. The objectives of this analysis are to evaluate alternate pumping scenarios to remove the highest concentrations of arsenic in groundwater located on the former Rifkin property, and to provide effective capture of groundwater as far north as the "B" line defined by wells MW-3 and RP-5. An additional objective is to reduce the travel distance of high concentrations of arsenic prior to extraction. The locations of monitoring wells and the concentrations of arsenic at the former Rifkin property are shown on Figure 1 (LFR 1998).

Idealization

The geologic and hydrogeologic idealization used to construct the MODFLOW model is based on representing the variations in thickness of sand across the model domain by varying the transmissivity. The model uses a uniform thickness, and variations in transmissivity are represented by variations in hydraulic conductivity. The magnitude and locations of these variations are derived from the interpretation of sand thickness from boring logs and CPT logs. Spatial variations in hydraulic conductivity were also adjusted during calibration of the model. The interpretation of sand thickness based on compilations from the "Workplan Addendum Sherwin-Williams Facility (Entrix 1999)", and is attached as Figure 2. Additional sand thickness data were obtained from Treadwell & Rollo (1998)

Boundary conditions

Constant-head boundaries are used to create the general hydraulic gradient across the domain. The inflow constant head boundary condition varies from 7 to 8.5 feet from north to south and is located in the southeastern corner of the model domain. The outflow constant head boundary condition is set to 5.85 feet and is located in the northwestern corner of the domain. This creates an overall groundwater flow from the southeast to the northwest. The slurry wall surrounding the Sherwin Williams facility is represented by a no-flow boundary. This boundary condition is specified along the western border of the model domain.

Calibration

The model was calibrated by minimizing the difference between the calculated steady-state heads within the model domain and the observed water levels in October 1998, as shown of Figure 3 (LFR 1999). The results of this calibration are shown on Figure 4. The residuals posted on the map are the difference between the calculated head and observed water levels for October 1998. The maximum residual is -0.33 feet at MW-3.

The calibrated hydraulic conductivity (K) values are shown on Figure 4. These values range from 16 ft/d to 100 ft/d, which is within the range of values expected for silty sands to fine sands. Because the simulated flow field is constrained by idealized constant-head conditions at the upgradient and downgradient model boundaries, the calibration depends primarily upon the spatial pattern and the relative changes in K, rather than on the absolute magnitude of K. Other combinations of K values could result in a similar level of calibration, provided that the spatial pattern and relative changes are similar to those shown in Figure 4.

Location of Proposed Extraction Wells

Three extraction wells are proposed to meet the objectives. Proposed wells EXTR-1 and EXTR-2 are located near the highest observed concentrations of arsenic in shallow groundwater at the former Rifkin property. EXTR-3 was located to extend the capture zone west to the "B" line. Figures 4 through 10 show the locations of the proposed extraction wells EXTR-1, EXTR-2 and EXTR-3.

Results of analysis

Figures 5 through 10 show six different pumping scenarios at the former Rifkin property. The flow lines on each figure represent the simulated capture zones for each scenario. Pumping scenarios 1 through 3 show the change in the capture zone as additional pumping wells are activated. Pumping scenarios 4 through 6 shows the sensitivity of the model to changes in pumping rates of the proposed extraction wells. Each pumping scenario is summarized in the following table.

Scenario	Pumping Wells	Rate (gallons per minute)	Drawdown (feet)
1	EXTR-1	1.0	0.45
2	EXTR-1	1.0	0.67
	EXTR-2	1.0	0.60
3	EXTR-1	1.0	0.89
	EXTR-2	1.0	0.77
	EXTR-3	1.0	0.85
4	EXTR-1	0.5	0.45
	EXTR-2	0.5	0.39
	EXTR-3	0.5	0.42
5	EXTR-1	1.5	1.43
	EXTR-2	1.5	1.20
	EXTR-3	1.5	1.29
6	EXTR-1	1.5	1.14
	EXTR-2	1.0	0.90
	EXTR-3	1.0	0.96

Drawdown at a pumping well is calculated based on Thiem's equation for steady state flow to a well, assuming an effective well diameter of 1.0 foot. This is shown below:

$$h_w = h_{cell} - \frac{Q_w}{2\pi T_{cell}} \ln\left(\frac{r_e}{r_w}\right)$$

where h_w = *head at the well*
h_{cell} = *head in the model cell*
Q_w = *pumping rate*
T_{cell} = *transmissivity*
r_e = *radius of the cell where average head for the cell will occur (for square cells r_e = cell width/4.81)*
r_w = *effective radius of the well*

Based on field observations of current extraction wells at the Sherwin-Williams site, the actual drawdowns at the proposed extraction wells will likely be greater than the drawdowns predicted by the above analysis. The drawdown predictions assume a perfectly efficient well, however, the proposed extraction wells are likely to have some well loss.

Figure 7 shows that pumping scenario 3 provides extraction of the highest arsenic concentration located near RP-1 and MW-5 and also provides capture of groundwater as far north as the "B" line. Figure 8 through Figure 10 show the sensitivity of capture zones to changes in pumping rate. Figure 8 shows that reducing the pumping rate at the proposed extraction wells to 0.5 gpm will reduce the capture zone significantly and the capture will not extend to the "B" line. Figure 9 shows that increasing the pumping rate to 1.5 gpm at each of the proposed extraction wells will create a capture zone that encompasses most of the modeling domain. Figure 10 shows that increasing the pumping rate of EXTR-1 to 1.5 gpm, while keeping the pumping rates at EXTR-2 and EXTR-3 at 1.0 gpm, respectively, results in a predicted capture area that may extend somewhat beyond the "B" line.

Based on these simulation results, pumping scenario 3 provides the best results. To show the estimated drawdowns created by this pumping scenario, a drawdown contour map was created. This map was produced by subtracting the simulated steady-state calibrated head condition (Figure 4) from the simulated steady-state pumping condition (Figure 7). The drawdown contour map is shown as Figure 11.

To estimate the time frame needed to reach steady-state pumping conditions, two transient simulations were conducted. The first simulation assumed a high estimated storage coefficient of 0.12, such as would occur under water table conditions. A storage coefficient if this magnitude would produce the slowest expected response.The results are presented for 60 days, 90 days, and 120 days in Figures 12, 13 and 14, respectively. The water levels are at a steady state by about 120 days of pumping.

The second simulation assumed a low estimated storage coefficient of 0.001, such as would occur under confined conditions. A storage coefficient if this magnitude would produce the fastest

expected response. The results are presented for 1 day, 3 days, and 6 days in Figures 15, 16 and 17, respectively. The water levels are at a steady state after about 3 days of pumping.

Based on these simulations, steady-state drawdown conditions are expected to be achieved between 3 and 120 days after pumping begins.

The travel times of groundwater for pumping scenario 3 are depicted on Figure 18. The travel times are based on an effective porosity of 0.2. Between each arrow on Figure 18, the travel time is approximately one year. The travel time from the upgradient boundary condition to the extraction wells is in general less than one year. Total transit time for uncaptured groundwater to flow from the upgradient model boundary to the downgradient model boundary varies from three to eight years. The travel times estimated by the model are inversely proportional to the value for transmissivity used in the model. The actual travel time could vary significantly from these estimates. This model only represents groundwater flow, and does not simulate other contaminant fate and transport processes. As a result, the estimated travel times presented in this simulation do not represent the transport time for groundwater contaminants.

Conclusions

This model provides an estimate of the groundwater capture zone and pumping rates necessary to achieve capture of dissolved arsenic in groundwater at the former Rifkin property. Based on this analysis, pumping scenario 3 meets the objectives. Because this model is only an estimation of groundwater flow conditions at the former Rifkin property, the actual observed drawdowns, well yields, and capture zones may vary significantly from the model predictions.

List of Attached Figures

Figure 1 – Distribution of Arsenic in Groundwater, 0 – 16 feet Below Ground Surface, Former Rifkin Property Investigation August 1998

Figure 2 - Geologic Interpretation of Sand Thickness, Former Rifkin Property (ENTRIX 1999)

Figure 3 – Groundwater Elevation Contours, A-Zone Groundwater October 16, 1998

Figure 4 - Calibrated Steady State Simulation

Figure 5 - Steady State Pumping Scenario 1

Figure 6 – Steady State Pumping Scenario 2

Figure 7 - Steady State Pumping Scenario 3

Figure 8 - Steady State Pumping Scenario 4

Figure 9 - Steady State Pumping Scenario 5

Figure 10 – Steady State Pumping Scenario 6

Figure 11 – Steady State Pumping Scenario 3 – Drawdown

Figure 12 – Transient Pumping Scenario after 60 Days

Figure 13 – Transient Pumping Scenario after 120 Days

Figure 14 – Transient Pumping Scenario after 180 Days

Figure 15 – Transient Pumping Scenario after 1 Day

Figure 16 – Transient Pumping Scenario after 2 Days

Figure 17 - Transient Pumping Scenario after 3 Days

Figure 18 – Travel Times, Steady State Pumping Scenario 3

References

ENTRIX. 1999. Workplan Addendum – Sherwin-Williams Facility. January.

Treadwell & Rollo. 1998. Arsenic Investigation Report, South BGR Property. October.

LFR. 1998. Current Conditions Report Sherwin-Williams Facility, Emeryville, California. June 19.

LFR. 1999. Quarterly Groundwater Monitoring Report Sherwin-Williams Facility, Emeryville, California. January 28.

HORTON STREET

FORMER RIFKIN PROPERTY

TEMESCAL CREEK OVER FLOW

"B" Line

SHERWIN-

11/09/93
11/08/93
11/06/93
02/25/98
02/26/98
07/15/93
07/13/93
07/16/93
04/05/94
07/14/93
07/19/93
03/02/98
06/10/93
07/06/94
11/12/96
04/04/94
07/20/90
06/09/93
02/27/98
1/12/96
?

Estimated distribution of Arsenic in A-Zone Groundwater above 5 ppm

Estimated distribution of Arsenic in A-Zone Groundwater between 1 and 5 ppm

Estimated distribution of Arsenic in A-Zone Groundwater between 0.1 and 1 ppm

Estimated distribution of Arsenic in A-Zone Groundwater between 0.05 and 0.1 ppm

12/31/97
Date a groundwater sample was collected
Monitoring well location

12/31/97
Date a groundwater sample was collected
Grab groundwater sampling location

Note: (1) Only sample locations where at least one groundwater sample was analyzed for Arsenic are shown.

(2) Distribution of Arsenic is based on the concentrations detected in the most recent groundwater samples collected at each location. Grab groundwater and older monitoring well data is used qualitatively in this analysis, for purposes of identifying the nature and extent of Arsenic.

parts per million (ppm) = milligrams per liter (mg/l)

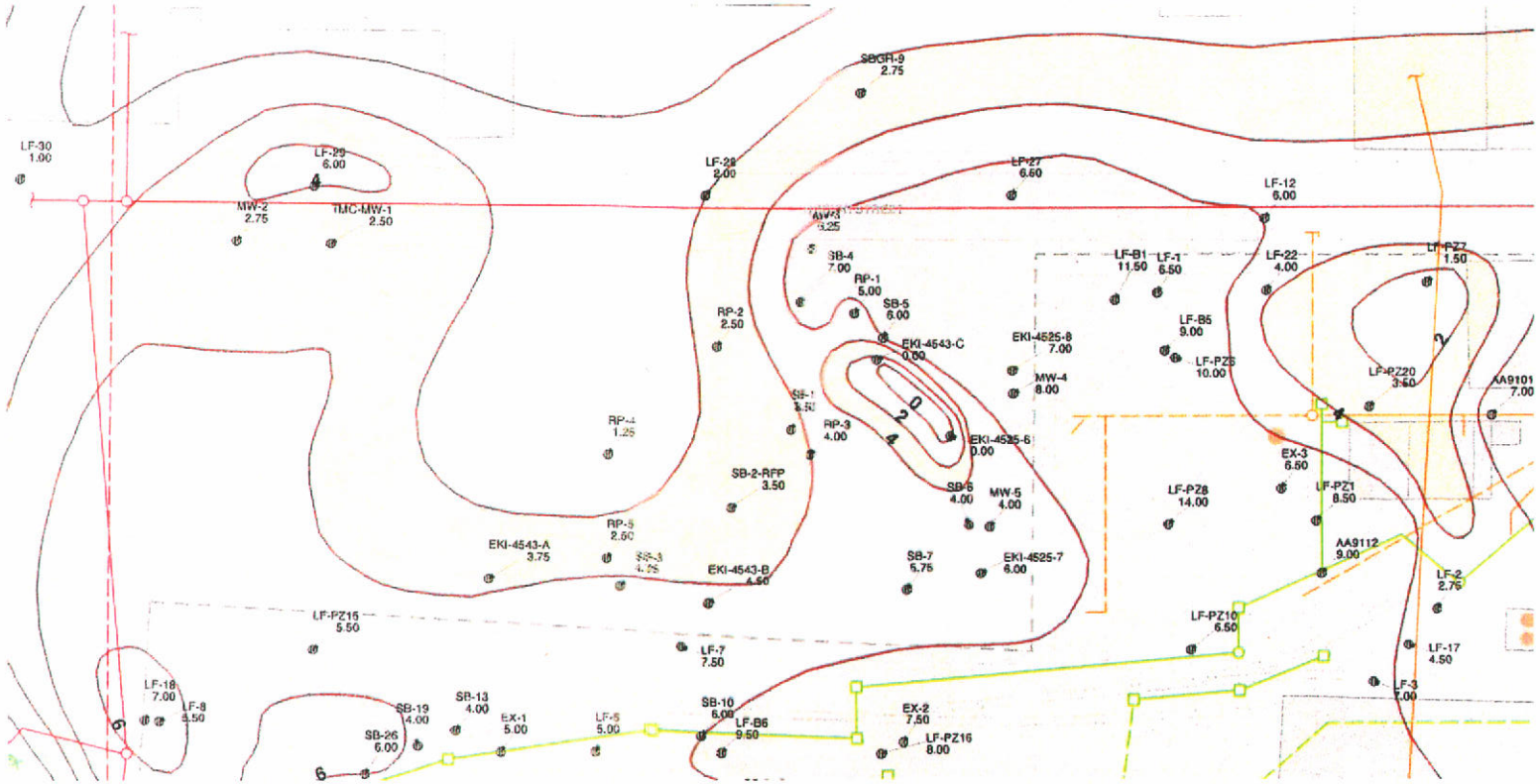
30 0 30 Feet

SHERWIN-WILLIAMS

Distribution of Arsenic, A-Zone Groundwater

LFR LEVINE • FRICKE

Figure 1



LEGEND

Lateral Conduits - Category I (See CCR):

- Catch Basin
- Manhole
- Abandoned Sanitary Sewer Line
- Abandoned Storm Drain Line
- Storm Drain Line
- Sanitary Sewer Line

Lateral Conduits - Category II (See CCR):

- Manhole
- Abandoned Sanitary Sewer Line
- Storm Drain Line
- Sanitary Sewer Line

Other

- Isolith Contours at 2 Foot Intervals (dashed when estimated)
- Greater that 6 feet of Sand/Gravel
- >4 - 6 feet
- >2 - 4 feet
- >0 - 2 feet
- 0 feet
- Sample Locations

SHERWIN-WILLIAMS

A-Zone Isolith Sand and Gravel Below Fill (Entrix 1999)

LFR LEVINE • FRICKE

Figure 2

6215K105.CDR 032699

LF-30 2.95
MW-2 6.23
LF-29 6.35
MW-1 6.25
LF-28 6.58
MW-3 6.64
LF-27 7.43
LF-12 7.64
LF-PZ7 7.79
LF-B4
HORTON STREET
RP-1 6.64
RP-2 6.82
LF-22 6.30
LF-1
LF-B1
LF-B5
LF-PZ5 6.80
LF-PZ6 6.44
LF-PZ4 6.88
EX-9 6.77
LF-PZ20 6.33
LF-PZ9 6.01
RP-4 6.43
RP-3 6.56
MW-4 7.16
EX-3 -2.00
FORMER RIFKIN PROPERTY
PARKING LOT
MW-5 6.81
RP-5 6.42
LF-PZ2 6.82
LF-PZ3 6.04
LF-PZ8 5.74
LF-PZ1 5.59
LF-2
EX-8 5.87
LF-PZ15 4.16
LF-7 3.89
LF-19 6.48
LF-18 4.30
EX-1 -5.42
EX-2 -5.22
LF-PZ10 5.60
LF-17 5.88
EX-7 5.76
LF-3 5.93
LF-8 4.13
LF-5
LF-B6
LF-6
LF-B2
LF-PZ16 3.57
EX-4 4.24
LF-PZ19 4.84
LF-4 4.07
EX-5 4.05
LF-PZ12 5.63
LF-PZ13
PARKING LOT

— — Property Boundary
Storage Tanks
- - - - - Fence
Buildings
Slurry Wall
Railroad Tracks

LF-10 A-Zone Monitoring Well
LF-B3 B-Zone Monitoring Well
EX-1 Groundwater Extraction Well
RP-1 Rifkin Property Monitoring Well
MW-4 Rifkin Property Monitoring Well
LF-PZ1 A-Zone Piezometer
Monitoring Well Destroyed or Abandoned

Groundwater Elevation Contour
Depression in Groundwater Surface

Note: Groundwater elevations are based on mean sea level.

N

40 0 40 80 Feet

SHERWIN-WILLIAMS

Groundwater Elevation Contours
A-Zone Groundwater
October 16, 1998

LFR LEVINE-FRICKE

Figure 3

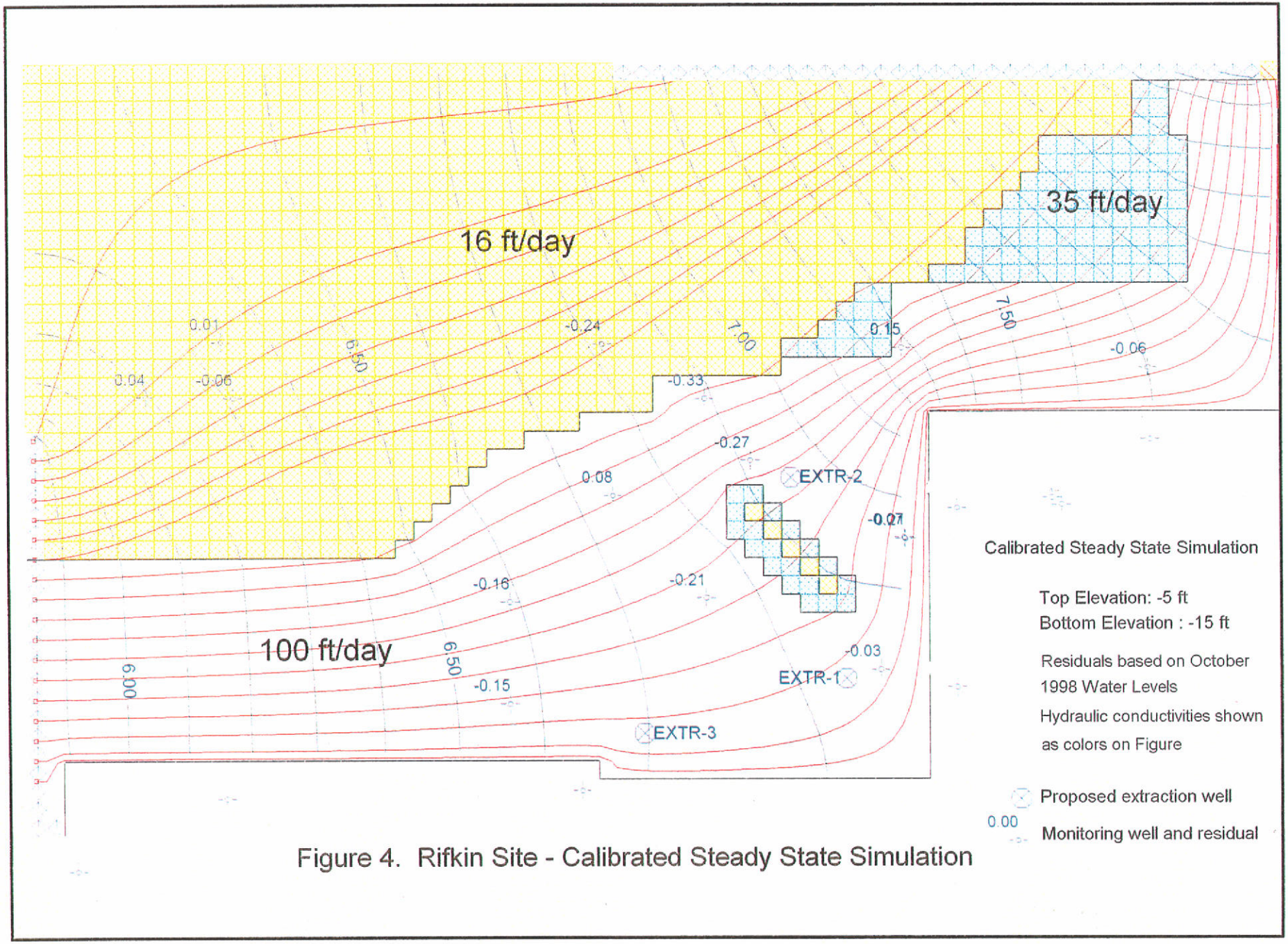


Figure 4. Rifkin Site - Calibrated Steady State Simulation

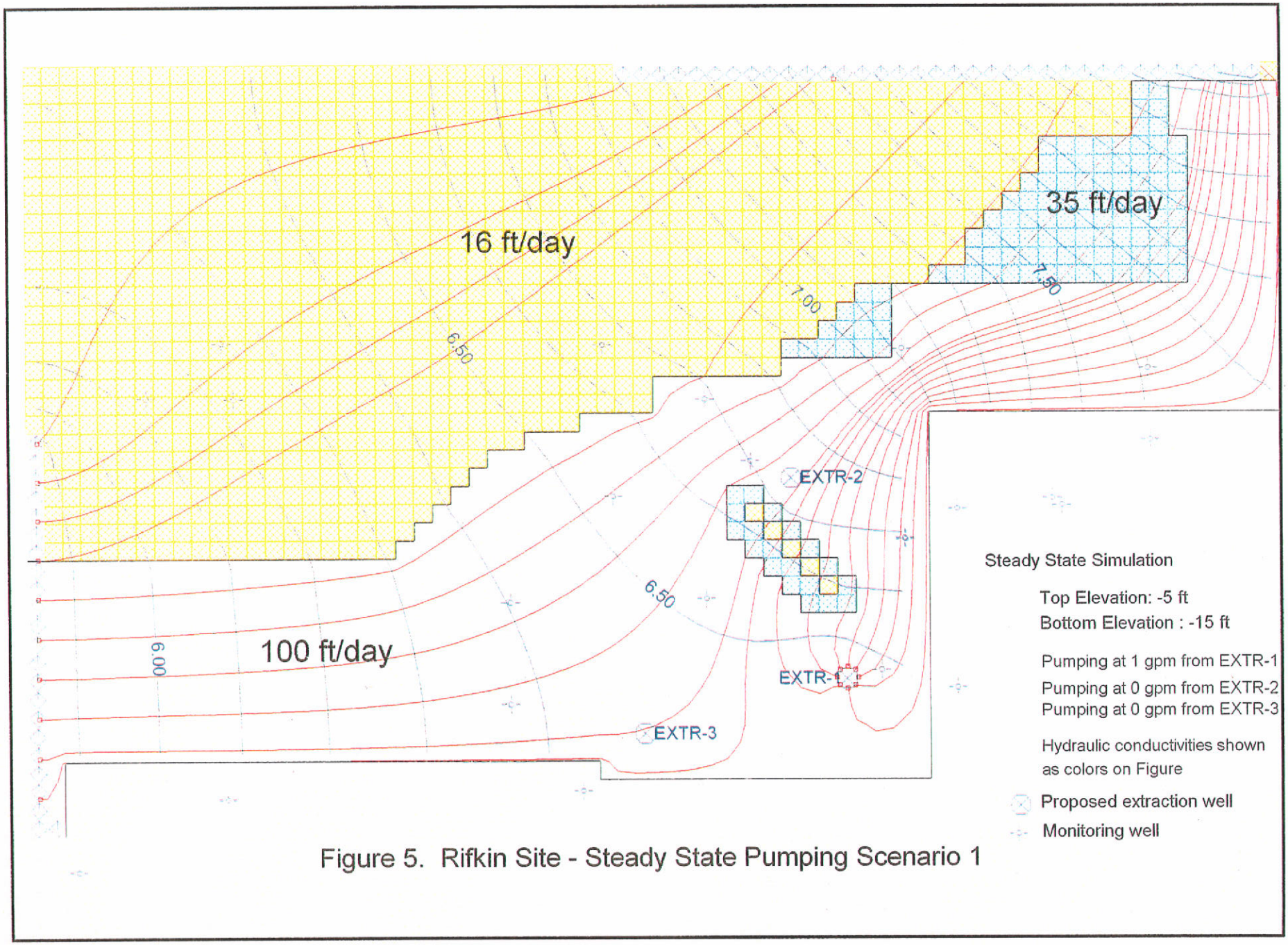


Figure 5. Rifkin Site - Steady State Pumping Scenario 1

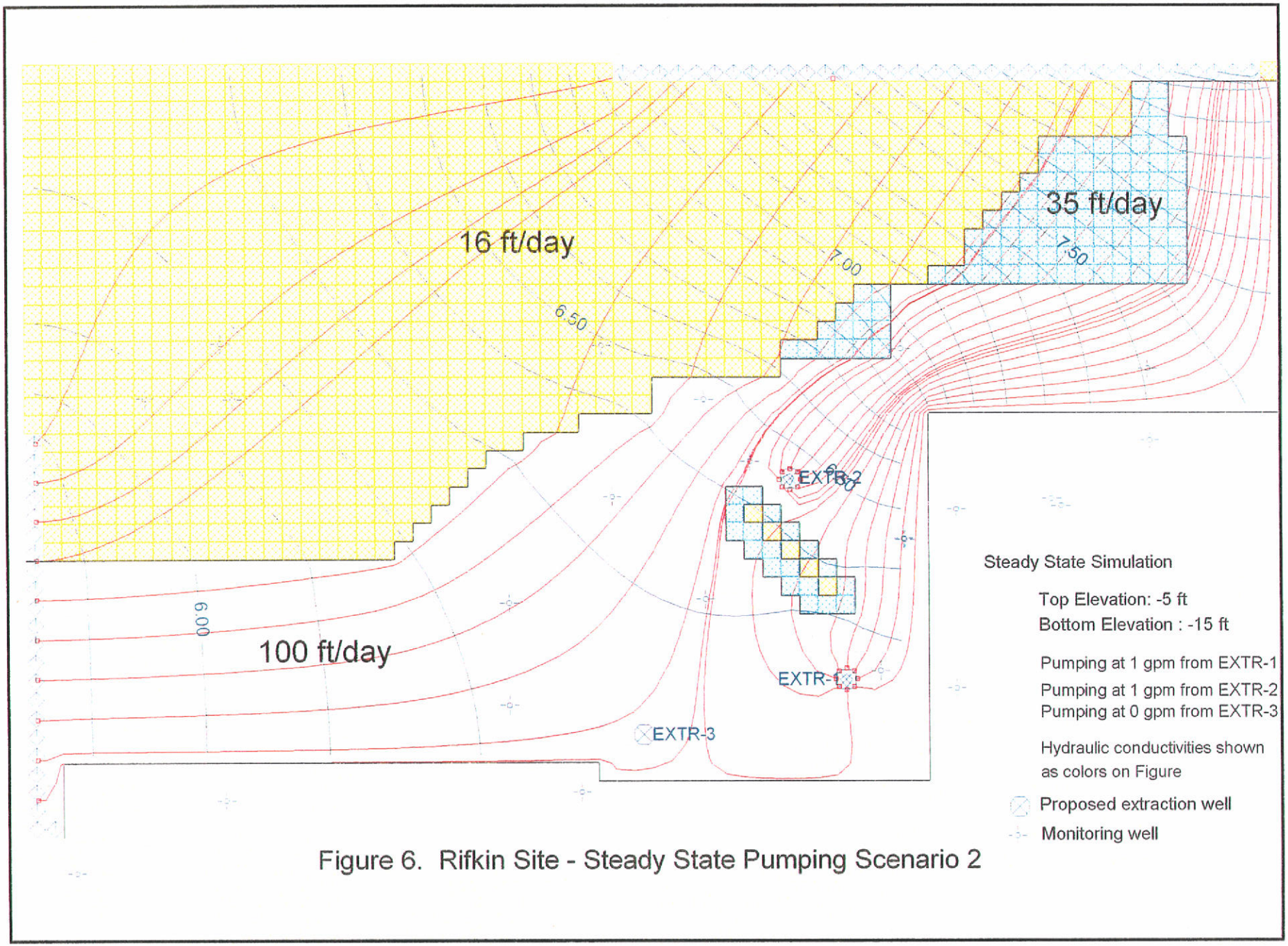


Figure 6. Rifkin Site - Steady State Pumping Scenario 2

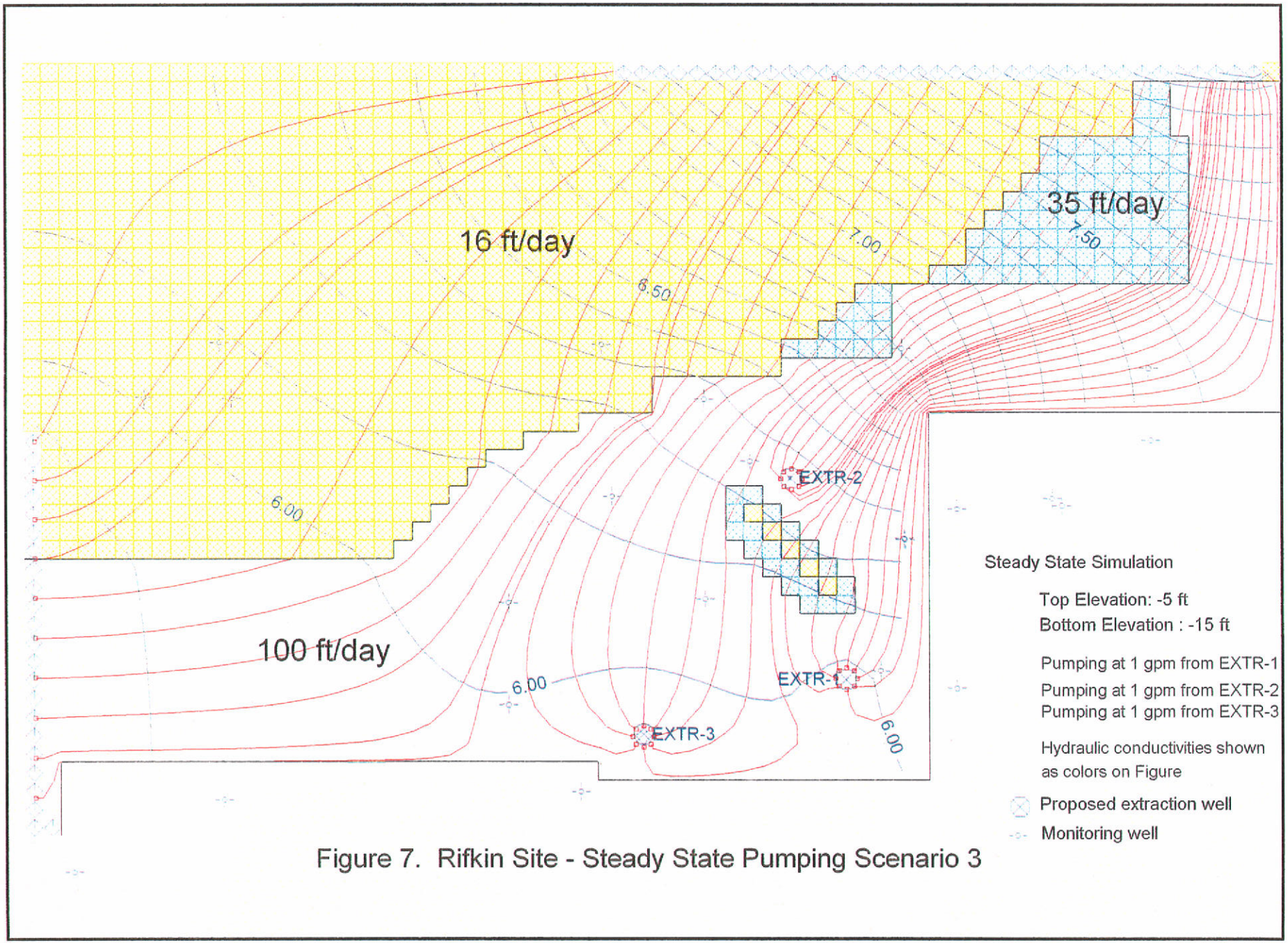


Figure 7. Rifkin Site - Steady State Pumping Scenario 3

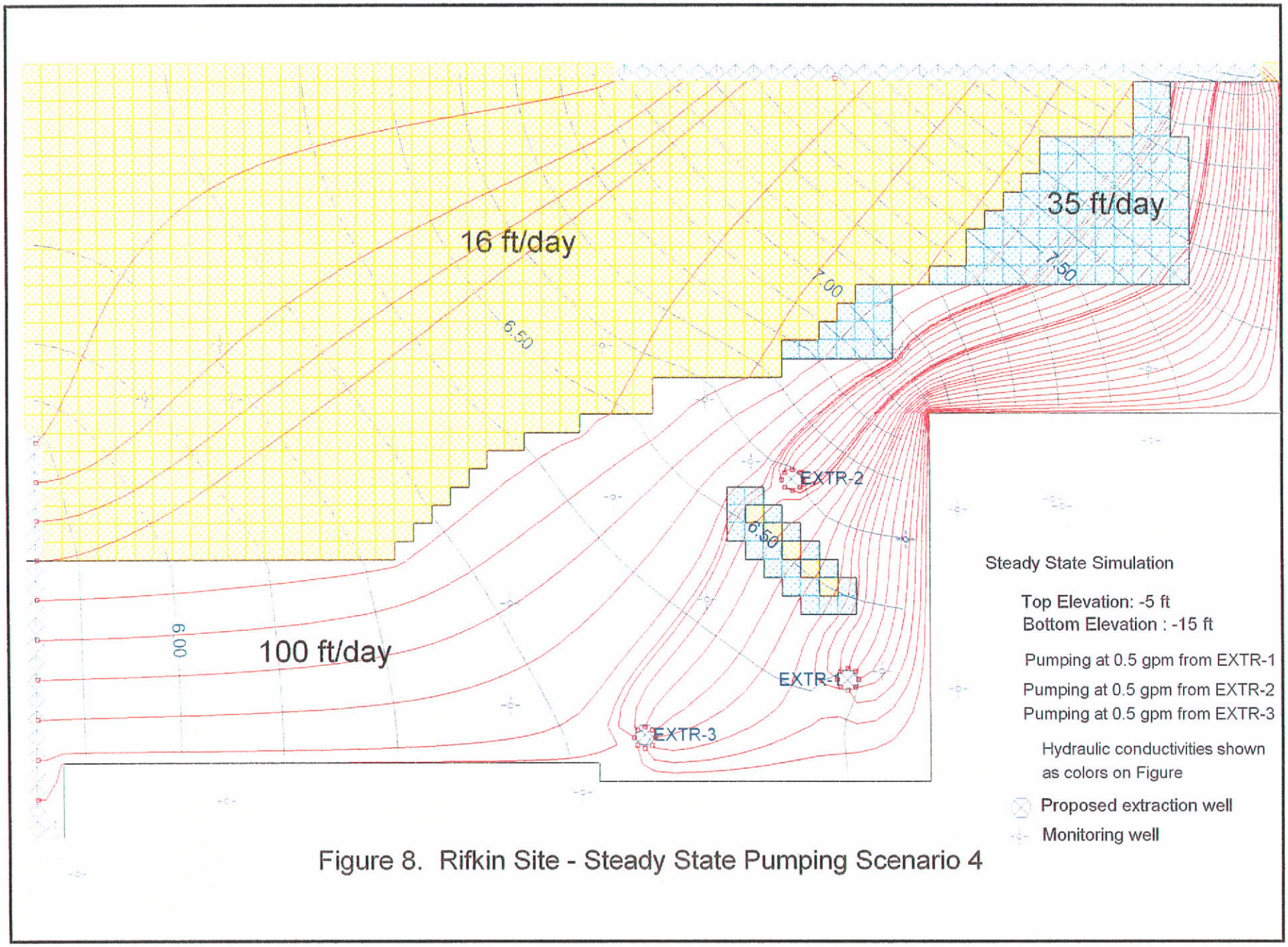


Figure 8. Rifkin Site - Steady State Pumping Scenario 4

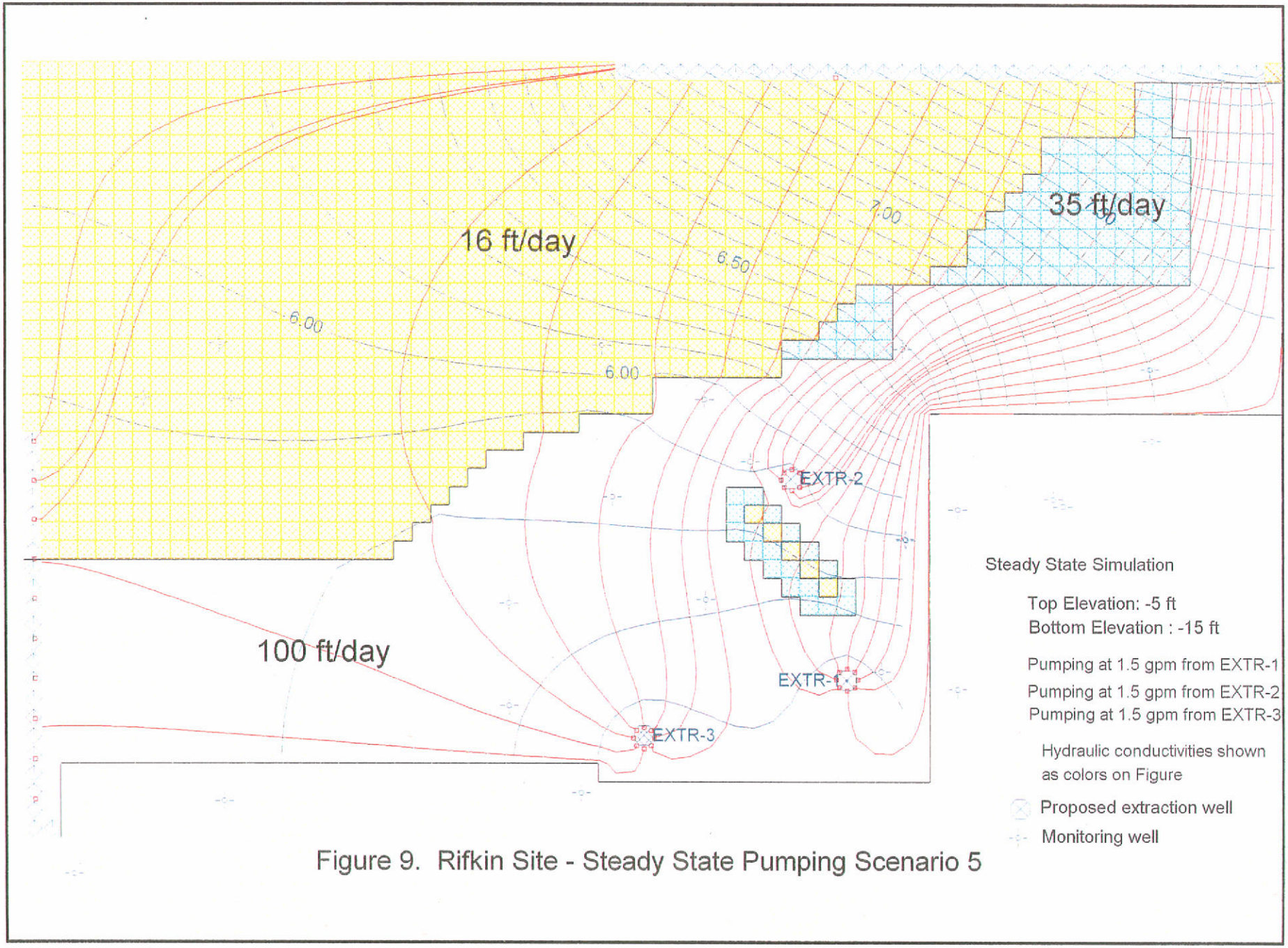


Figure 9. Rifkin Site - Steady State Pumping Scenario 5

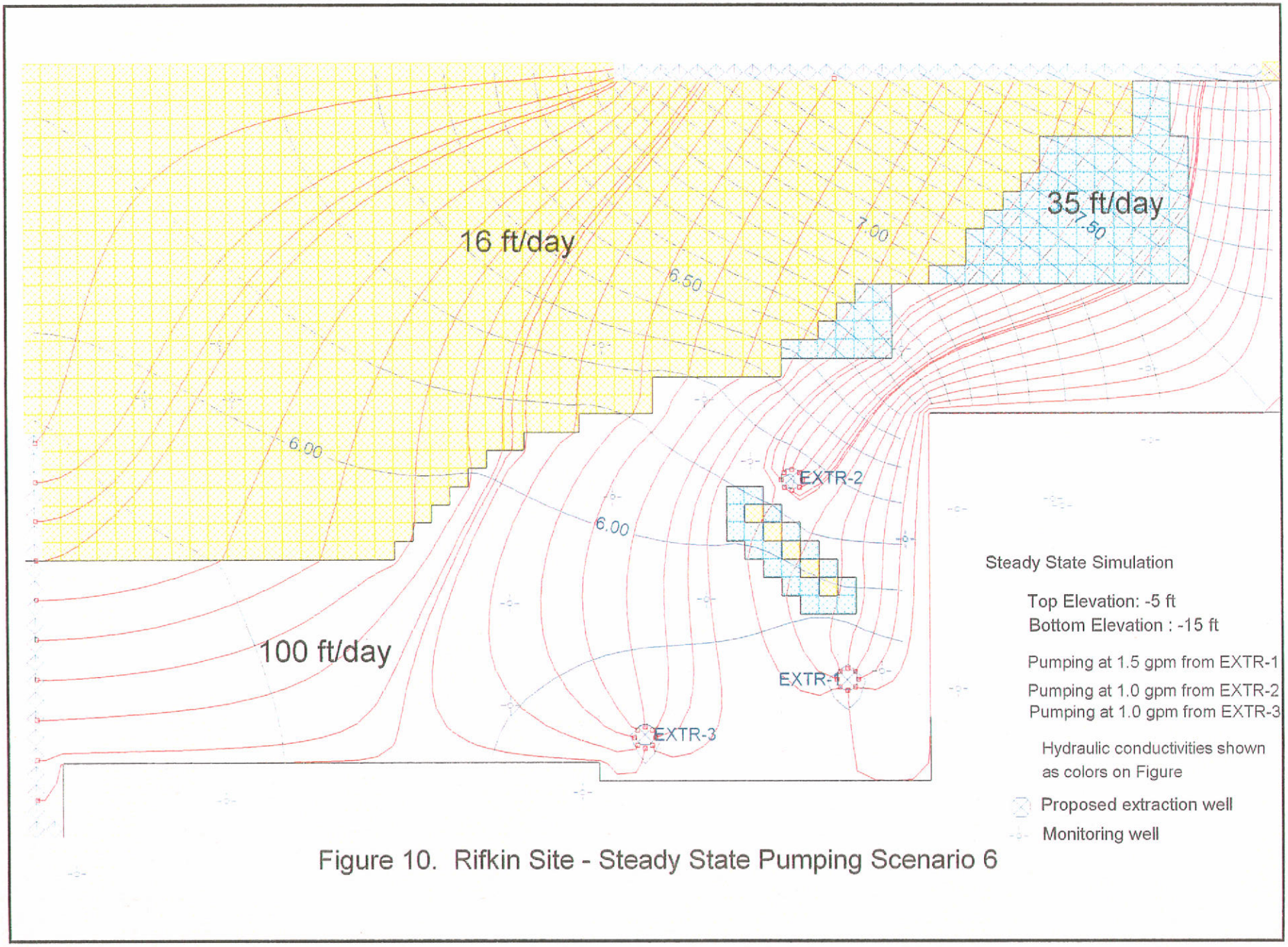


Figure 10. Rifkin Site - Steady State Pumping Scenario 6

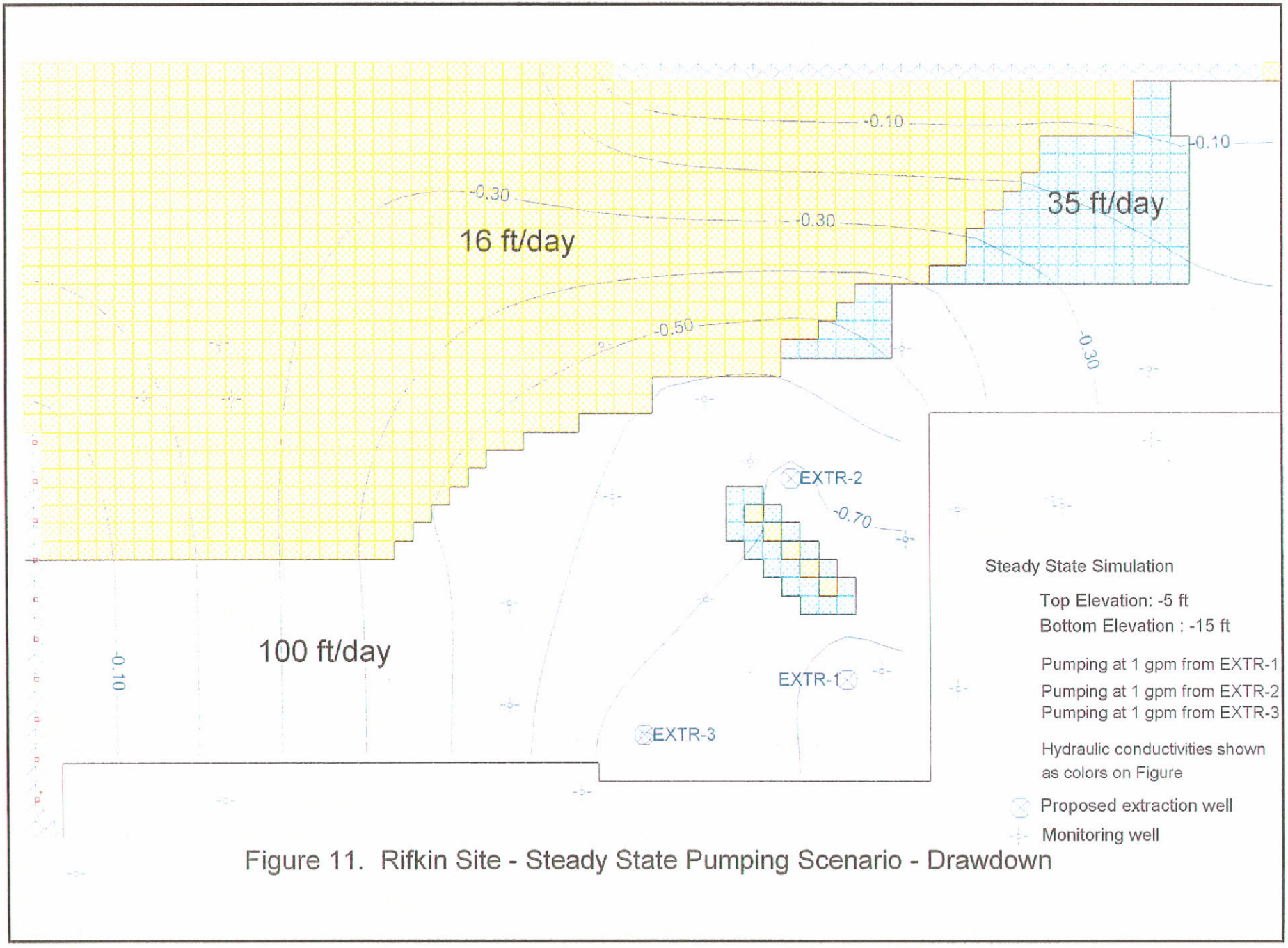


Figure 11. Rifkin Site - Steady State Pumping Scenario - Drawdown

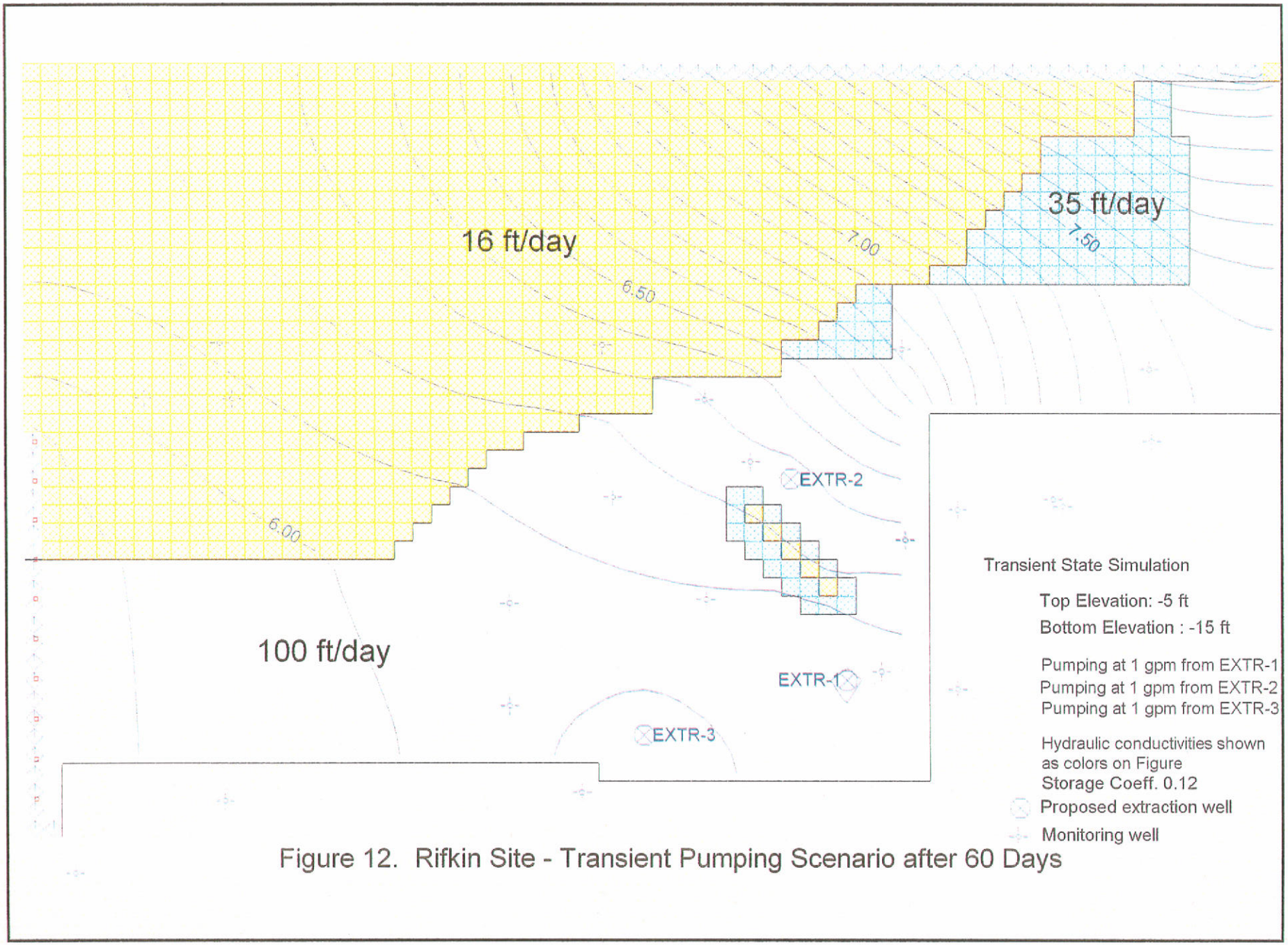


Figure 12. Rifkin Site - Transient Pumping Scenario after 60 Days

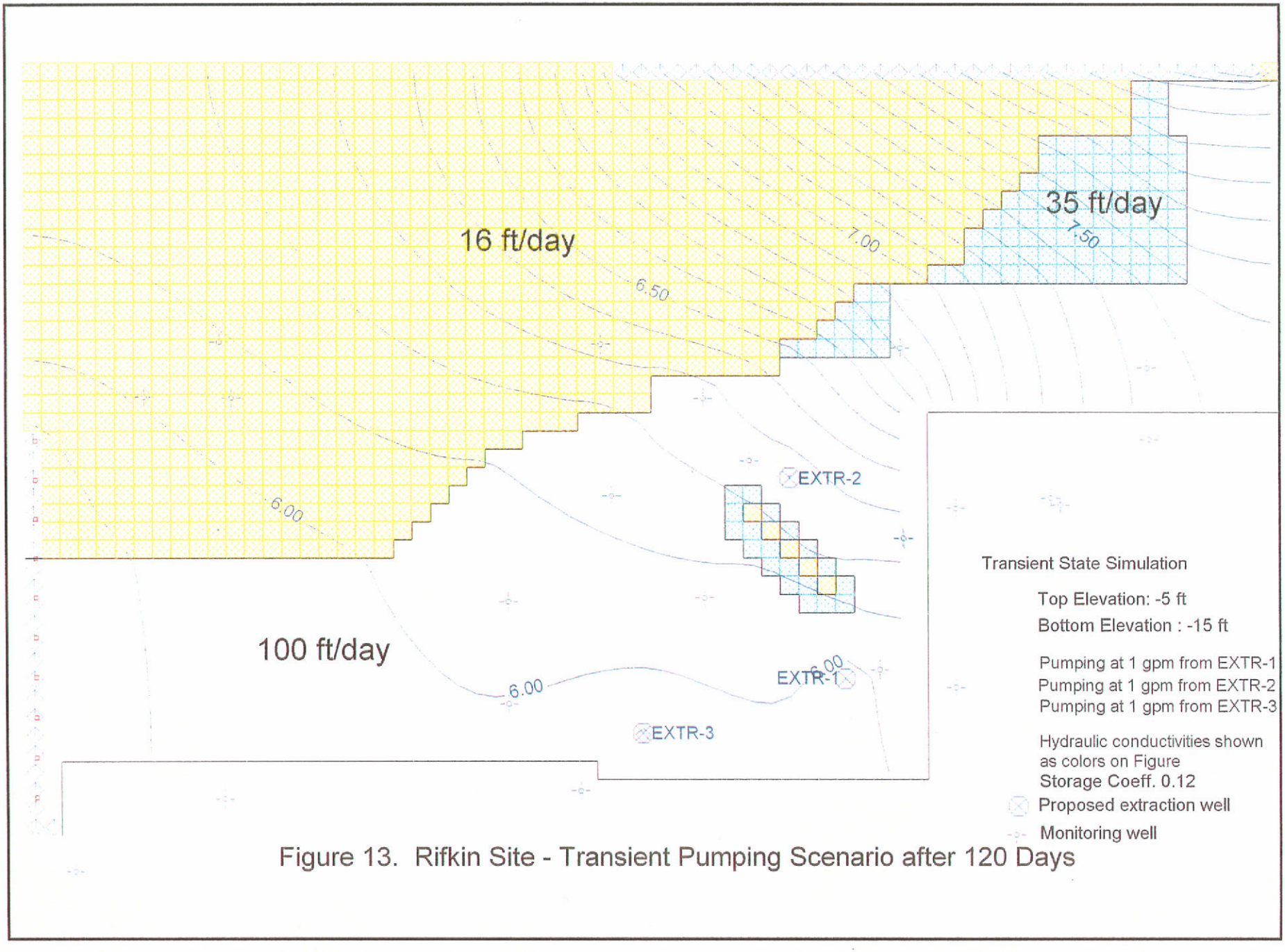


Figure 13. Rifkin Site - Transient Pumping Scenario after 120 Days

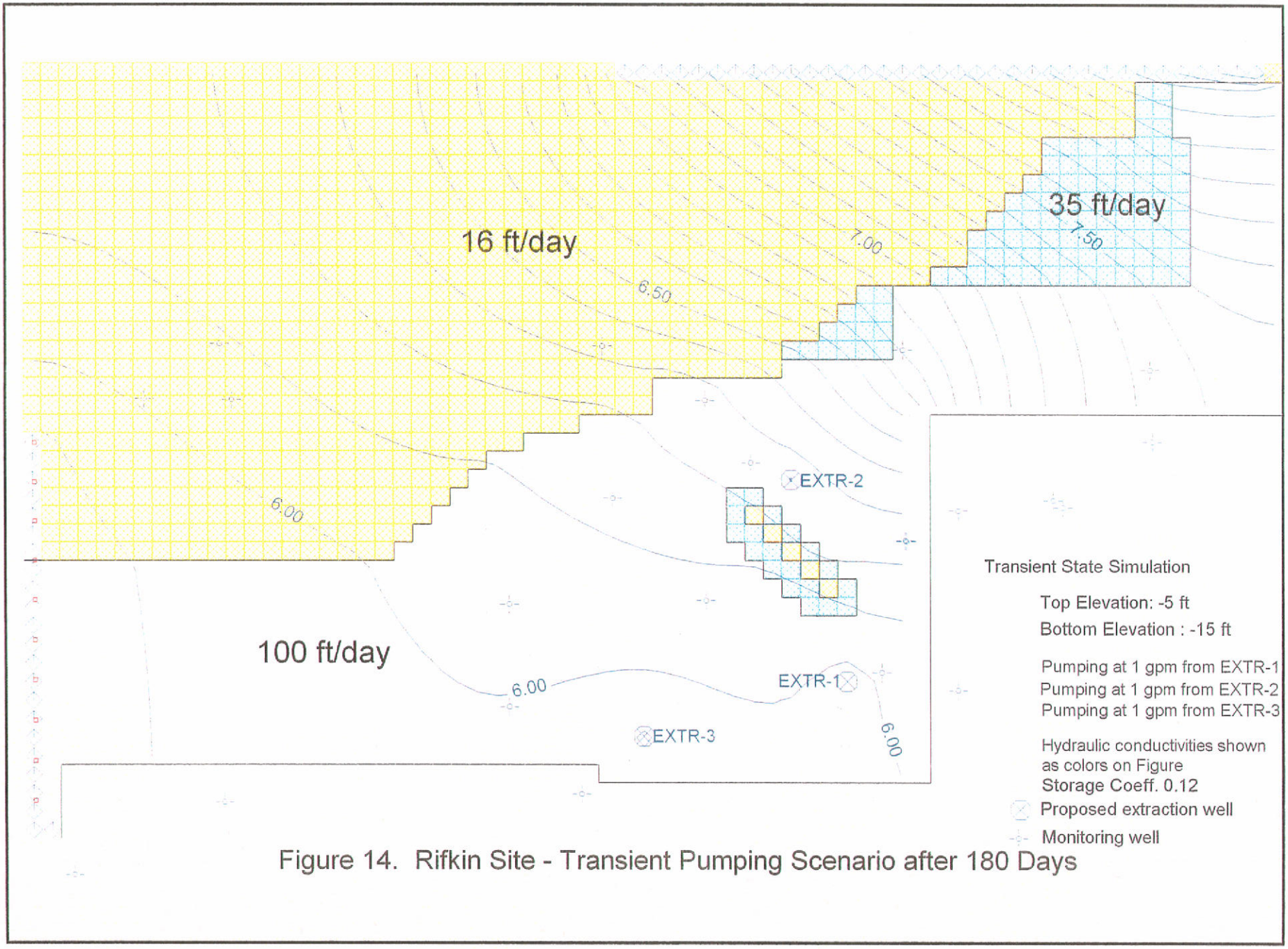


Figure 14. Rifkin Site - Transient Pumping Scenario after 180 Days

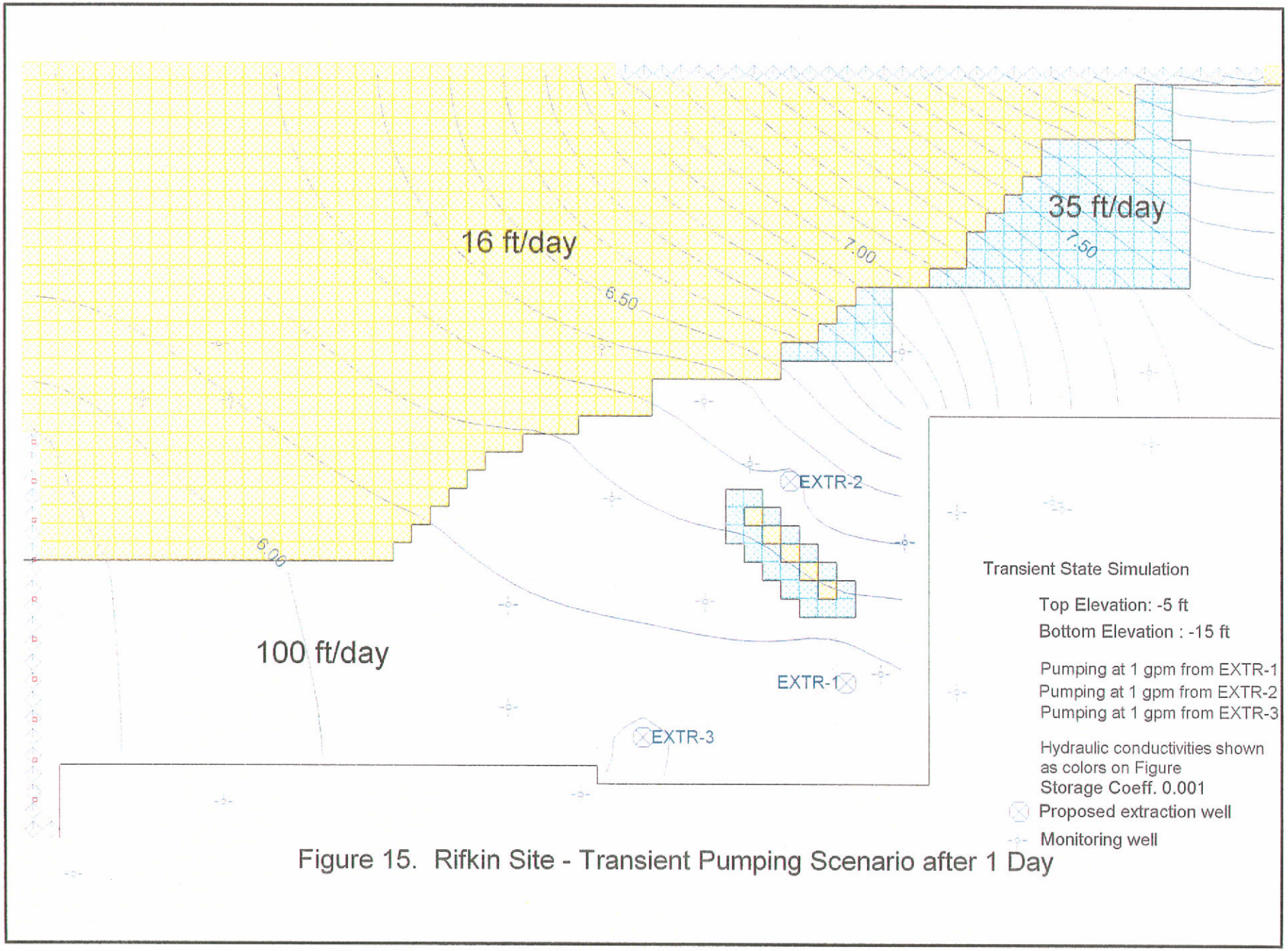


Figure 15. Rifkin Site - Transient Pumping Scenario after 1 Day

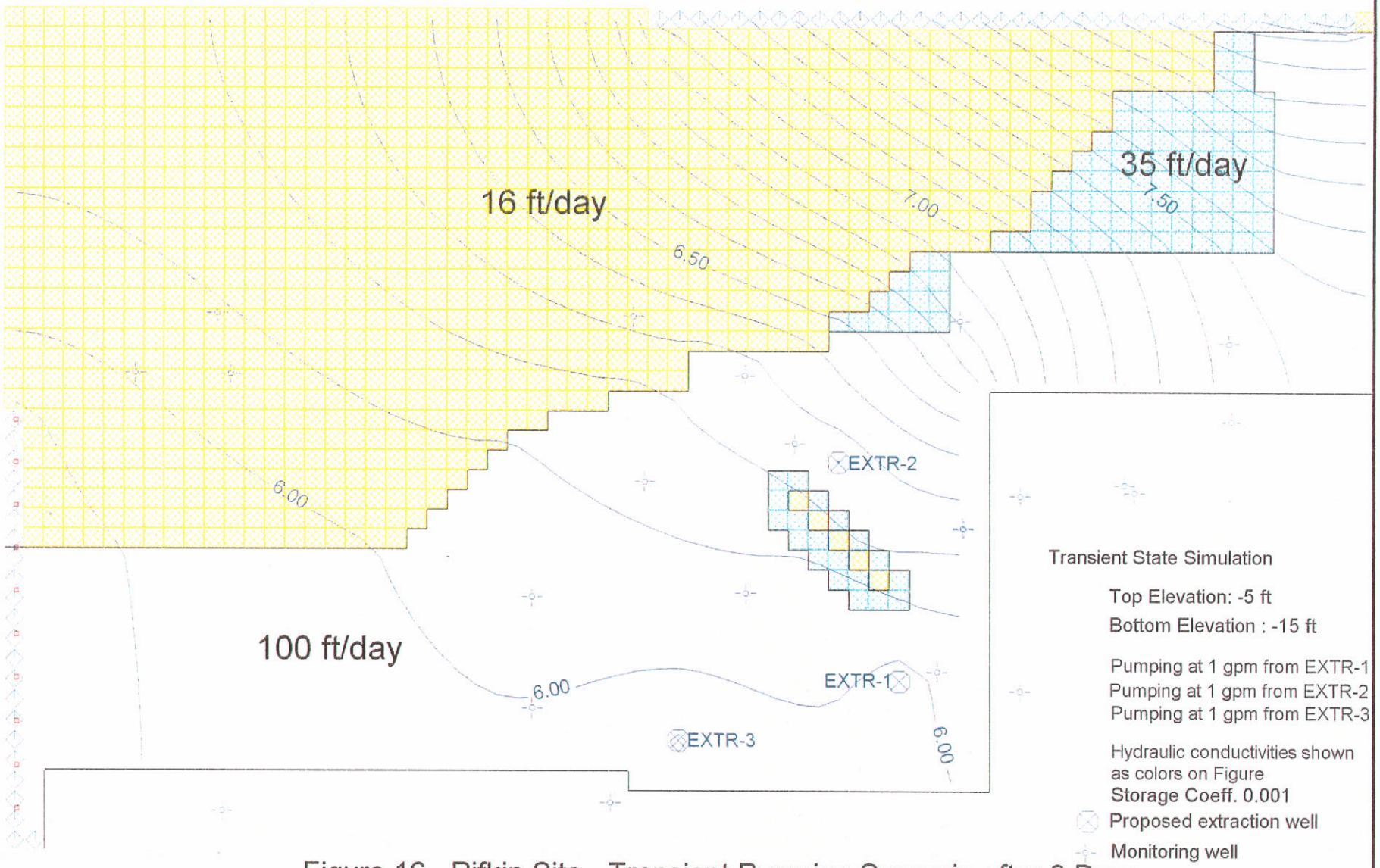


Figure 16. Rifkin Site - Transient Pumping Scenario after 3 Days

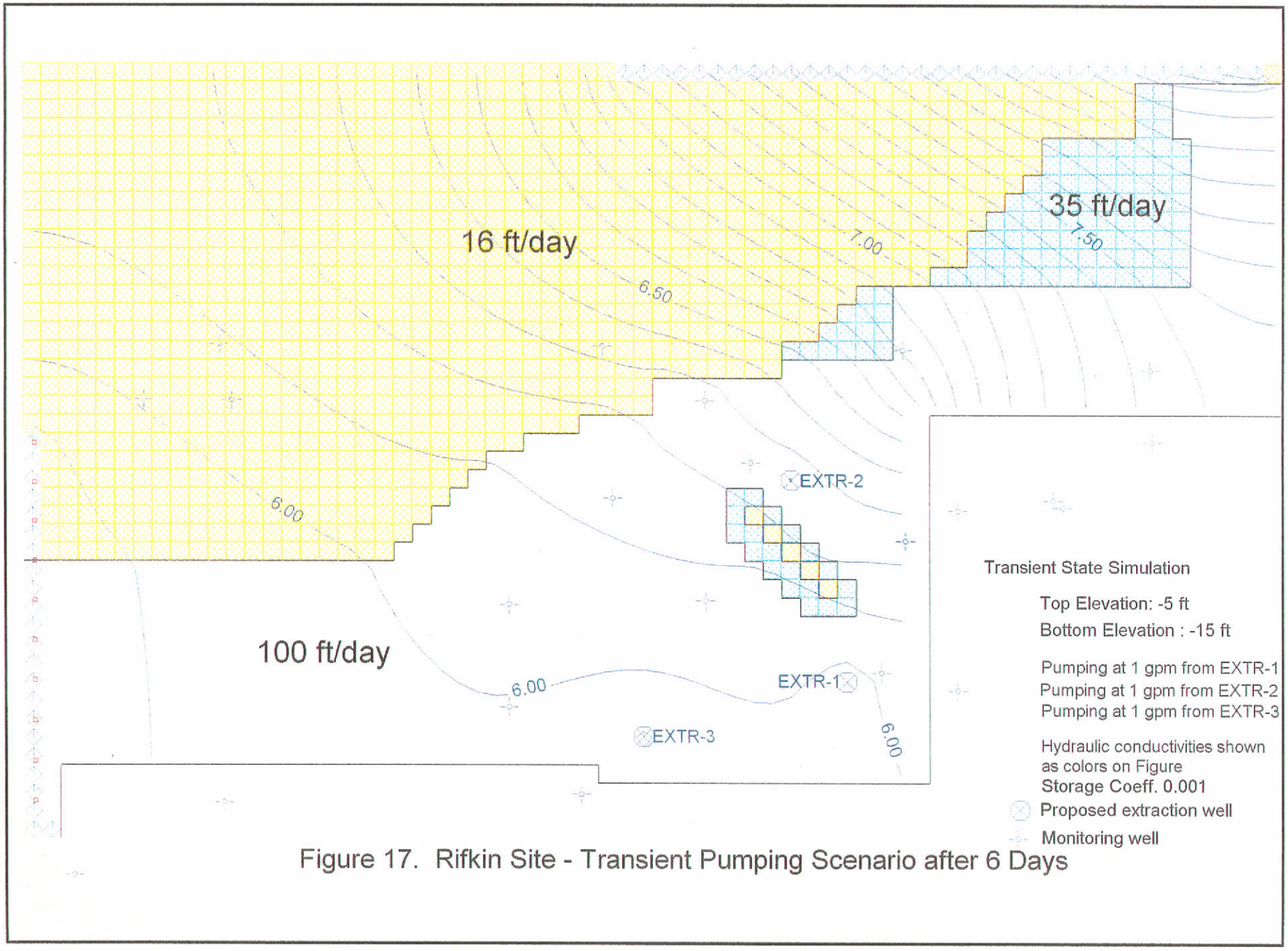


Figure 17. Rifkin Site - Transient Pumping Scenario after 6 Days

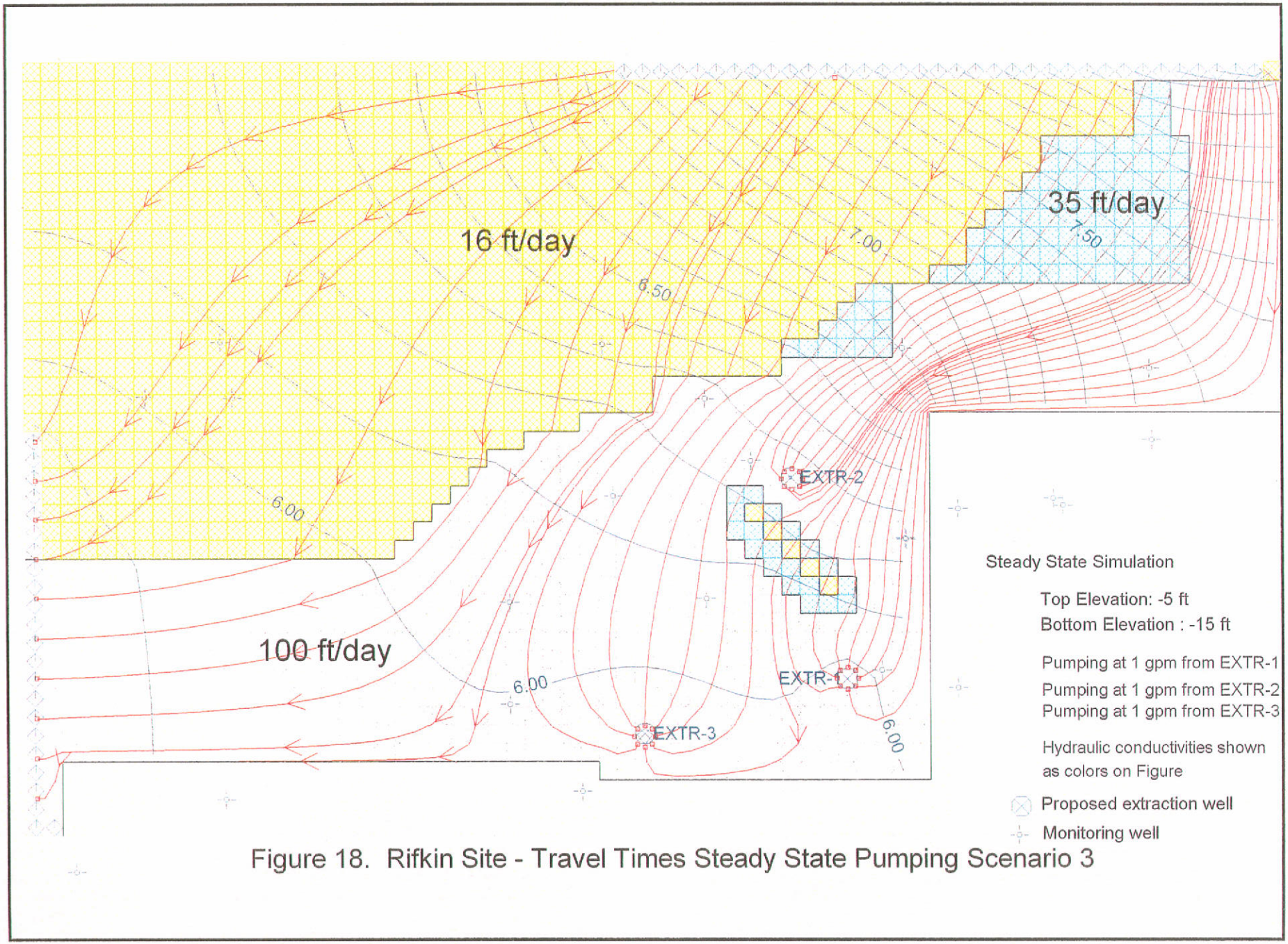


Figure 18. Rifkin Site - Travel Times Steady State Pumping Scenario 3

Appendix B

TECHNICAL SPECIFICATIONS
GROUNDWATER EXTRACTION SYSTEM EXPANSION
FORMER RIFKIN PROPERTY
MAY 4, 1999

Technical Specifications
Groundwater Extraction System Expansion
Former Rifkin Property
Emeryville, California

May 4, 1999
6427.99-002

Prepared for
The Sherwin-Williams Company
101 Prospect Avenue
Cleveland, Ohio 44115

CONTENTS

DIVISION 1 – SPECIAL CONDITIONS

1–1 General

The Contractor shall provide all labor, materials, tools, equipment, transportation, and services as noted below, and shall perform all work required for completing the work covered in the contract in a satisfactory and professional manner as described in these specifications. The extraction wells will be drilled by others prior to the start of work. A summary of the work items for the project are described as follows:

1. The Contractor shall clear the construction area of materials and debris.

2. The Contractor shall install pumps, piping, and concrete vaults with H-20 traffic-rated covers in the three new groundwater wells, and pumps, and piping in the three existing groundwater extraction wells as shown in the Plans. The Contractor shall install H-20 traffic-rated vault covers at the existing extraction well heads, as shown in the Plans.

3. The Contractor shall install groundwater extraction piping which includes, but is not limited to, piping from the groundwater extraction wells to the treatment system. The piping shall be installed in trenches (which the Contractor shall excavate, backfill, and replace to grade) and installed at the former Rifkin property as indicated on the Plans. The Contractor shall verify the location of all existing underground utilities prior to construction.

4. The Contractor shall provide and install air supply piping and valves for connection with the Sherwin-Williams facility air supply piping, to the groundwater extraction system expansion pressure/regulator branches as shown in the Plans.

5. The Contractor shall provide and install all flow meters and isolation valve branches for connection to the existing equalization tanks as shown in the Plans.

6. The Contractor shall install approximately 90 feet of steel casing protector (provided by the Engineer) as shown on the Plans.

7. All excavation work shall be completed in accordance with applicable requirements of Occupational Safety and Health Administration (OSHA) Health and Safety Regulations (29CFR1910.120). The Contractor shall prepare and be responsible for the implementation of a Site Health and Safety Plan for their operations at the Site.

8. The Contractor shall obtain all required federal, state, county, and city permits.

1–2 Location of Project

The work is located at the Sherwin-Williams Site, 1450 Sherwin Avenue, and the adjacent former Rifkin property, in Emeryville, California; as shown on the site map in the Plans.

1–3 Coordination of Work

The Contractor shall maintain overall coordination for the execution of the work. The Contractor shall notify his subcontractors of the required schedule for the project and shall be responsible for all parties maintaining these schedules or for coordinating required modifications.

The Sherwin-Williams Site will remain operating while the work is in progress. The Contractor shall perform its work to minimize impacts on plant production, Rifkin property activities and current site workers.

1–4 Special Trenching Conditions

Only 100 feet of trenching shall be under construction at any one time. All trenching construction shall be fully completed as per the specifications before starting construction on the next 100 ft section. Substantial steel plates with adequate trench bracing shall be used to bridge across trenches in and near traffic areas and throughout residential areas where trench backfill and temporary patch have not been completed during regular working hours. The contractor shall be prepared to segregate soils because of high potential concentrations of chemicals of concern.

Six months after completion of the work, the Contractor shall return to the Site and inspect the trench areas for subsidence and cracks in the asphalt cement and pavement. The Contractor shall repair the trench and pavement at any locations where subsidence or cracking is identified by the Engineer. Any repair work shall be approved by the Engineer. The contractor must coordinate on a daily basis with the Engineer to proceed with work. The contractor must not interrupt daily operations at the facility.

All work associated with asphalt and concrete saw cutting/jack hammering must be performed between the hours of 9 am and 5 pm to minimize potential disturbances to surrounding residences/businesses.

1–5 Construction Stakes, Lines, and Grades

It is the Contractor's responsibility to properly lay out the work in conformance with the Plans and Specifications. Distances and measurements, except elevations and structural dimensions, shall be made on horizontal planes.

1–6 Pre-Construction Conference and Progress Meetings

Prior to receipt of the Notice to Proceed, the Engineer will arrange a pre-construction conference at the Engineer's office to be attended by the Contractor's superintendent, the Engineer and his representatives, major subcontractors, and others involved in the execution of the work. The purpose of this conference shall be to establish a working understanding between the parties and to discuss the Contract Schedule, shop drawing submittals and processing, bid items, applications for payment and their processing, and such other subjects as may be pertinent for the execution of the work.

The Contractor shall furnish a progress report for the Engineer at the end of each week, and shall have all data required by the Contract Documents filled in and completed prior to the progress meeting or report. The Engineer and Contractor will discuss the progress estimate for the purpose of partial payment at the progress meeting. The Engineer will process the request for partial payment or invoice in accordance with these Specifications after the Contractor submits the progress estimate.

1–7 Construction Schedule and Bid Schedule

A. CONSTRUCTION SCHEDULE

Prior to the start of the work, the Contractor shall submit a Construction Schedule to the Engineer for his review. The Construction Schedule shall be calendar-based and shall indicate the critical path for the execution of the work within the Contract Time. The Construction Schedule shall indicate the time of starting and completion of each major activity or phase of the work and such intermediate phases as necessary for well-defined control points.

If, in the opinion of the Engineer, the Contractor has fallen behind the accepted Construction Schedule, the Contractor shall take such steps as may be required, including but not limited to increasing the number of personnel, shifts, and/or overtime operations; and/or amount of construction equipment until such time as the work is back on schedule. He shall also submit such supplementary schedule or schedules as may be deemed necessary to demonstrate the manner in which the approved rate of progress will be regained, all at the Contractor's expense.

B. BID SCHEDULE

In conjunction with the submittal of the Proposal, the Contractor shall submit a Bid Schedule for the work, including quantities and unit prices. The Bid Schedule form is included as part of the Proposal. The aggregate of these extended prices shall equal the lump sum contract price.

The Contractor's completion of this schedule shall be satisfactory to the Engineer and shall subdivide the work into the component parts specified on the Bid Schedule form

appended to the Proposal. Upon approval by the Engineer, the schedule shall become the basis for preparing monthly pay estimates.

1–8 Shop Drawings and Submittals

A. GENERAL

In ample time for each to serve its purpose and function, the Contractor shall submit to the Engineer such schedules, reports, drawings, lists, literature samples, instructions, directions, guarantees, shop drawings, layout diagrams, catalog data, manufacturer's materials, test reports, laboratory test data and information in sufficient detail to show complete compliance with all specified requirements. Such information shall be furnished to the Engineer covering, but not limited to, items under the Materials and Equipment List. The Contractor, at his own expense, shall make the changes in the required drawings that may be necessary to conform to the Contract Documents. Prior to the Engineer's review of such drawings, any work which the Contractor may do on the fabrications covered by the same shall be at his own risk, as the Engineer will not be responsible for any expense or delays incurred by the Contractor for changes to make the same conform to the Contract Documents.

B. MATERIALS AND EQUIPMENT LIST

The following is a list of materials and equipment for which submittals are required:

- submersible pneumatic well pumps
- piping, pulling "L"s, tees, elbow fittings, and pipe supports
- valves and pressure/regulator
- subsurface vaults and traffic-rated covers
- electrical wiring and conduit
- solenoid valve(s)
- flow meters
- well cable
- trench backfill material
- asphaltic concrete/concrete mix
- extraction well covers

C. SUBMITTALS

Five copies of shop drawings and data shall be submitted to the Engineer. The submittal shall clearly indicate the specific area of the Contract Documents for which the submittal is made. One copy received by the Engineer will be returned to the

Contractor's representative at the job site. The Engineer's notation of the action which he has taken will be noted on the returned copy.

The above drawings, lists, prints, samples, and other data shall become a part of the Contract Documents, and a copy of the same shall be kept with the job site Contract Documents. The materials furnished shall be in conformance with the specifications herein. However, the Engineer's review of the above drawings, lists, prints, specifications, samples, or other data shall in no way release the Contractor from his responsibility for the proper fulfillment of the requirements of this Contract, nor from fulfilling the purpose of the installation, nor from his liability to replace the same, should it prove defective or fail to meet the specified requirements.

Drawings of minor or incidental materials and equipment may not be required by the Engineer. The Contractor shall furnish the Engineer tabulated lists of such fabrications and equipment, showing the names of the manufacturers and catalog numbers, together with samples or general data as may be required to permit determination as to their acceptability for incorporation in the work.

The Contractor shall make submittals to the Engineer prior to installation of said components and in a timely manner for the work to be completed within the specified Contract Time.

The Engineer will endeavor to expedite submittal review of the critical material and equipment items that may impact the schedule to aid in reducing submittal processing time.

1–9 Temporary Facilities

A. GENERAL

The Contractor shall provide all temporary facilities and utilities required for execution of the work, protection of employees and public, protection of the work from damage by fire, weather or vandalism, and such other facilities as may be specified or required by any legally applicable law, ordinance, rule, or regulation.

B. UTILITIES

1. Electrical

The Contractor shall arrange with the Engineer what electrical service requirements are necessary for the project. The Contractor shall provide, at his own cost, a space generator for electric power required for construction, testing, general and security lighting, and all other purposes.

2. Water Supply

The Contractor can use Sherwin-Williams facility water for construction and drinking purposes during the construction period.

3. Lighting

The Contractor shall provide temporary lighting in all work areas sufficient to maintain a lighting level during work hours not less than the lighting level required by California OSHA standards.

4. Sanitary Conveniences

The Contractor is permitted to use sanitary conveniences at the Sherwin-Williams Site for the use of all persons at the Site of the work.

1–10 Site Health and Safety Plan

A. GENERAL

The Contractor understands that the nature of the work to be performed under these contract documents is potentially hazardous. In performance of the work the Contractor shall, as a minimum, satisfy all federal, state, and local statutes, regulations, and ordinances, regarding health and safety, including medical record retention requirements.

The Contractor shall provide and perform the work in accordance with its own Health and Safety Plan for the Site.

1. Description

There is a potential to encounter metals and VOC-affected soils during excavation work. All subcontractors shall be responsible for their own health and safety programs and the health and safety of their own employees.

2. Work Included

The Contractor shall prepare and implement a detailed and site-specific Site Health and Safety Plan describing all precautions that shall be taken by the Contractor to minimize the site hazards to the Contractor's personnel and subcontractors and to visitors or property.

3. Reporting of Emergency Events

Oral and written notice shall be made to the Engineer if any event occurs which harms or has a risk of harm to on-site workers, public health, or the environment. This does

not take the place of, or preclude, the Contractor's other emergency reporting requirements. Such events will include but not be limited to:

- hazards not included in the Site Health and Safety Plan
- accidents
- illnesses which could be related to work
- hazards caused by unusual weather conditions
- failure of protective equipment (instruments and personal protection)

B. PRODUCTS

1. Site Health and Safety Plan

The Site Health and Safety Plan shall be consistent with all application local, state and federal health standards and guidelines including, but not limited to, the OSHA and amendments thereto, the National Institute of Occupational Safety and Health (NIOSH), and the U.S. Environmental Protection Agency (EPA), and CAL/OSHA. The plan shall be sufficient to protect on-site and off-site personnel from the potential physical and chemical hazards particular to the Site.

As a minimum, the following shall be addressed in the Site Health and Safety Plan:

a. A short description of the project and planned activities shall be provided.

b. Site safety management, including the responsibilities and qualifications of the site health and safety officer, key project personnel, and the site chain of command.

c. The personal protection plan which will describe the protective clothing and equipment to be worn by personnel during site operations.

d. The monitoring of site personnel for containment exposure to maintain the proper level of personal protection, including action levels of protection.

e. Decontamination procedures for personnel and equipment at different levels of protection.

f. Documentation of all safety-related site activities including implementation of the Site Health and Safety Plan, environmental and personal monitoring, site conditions, training programs, medical surveillance, injuries and illness.

g. Specific site hazards and necessary safe work practices.

h. Site Contingency Plan for safe and effective response to site emergencies including a list of emergency contacts, phone numbers, and map showing route to hospitals or clinics.

Comprehensive site investigations have been conducted in the project area over the years. The data will be available to the Contractor for his review at the Engineer's office for use in preparing the Site Health and Safety Plan.

2. Equipment

All required health and safety equipment identified in the Site Health and Safety Plan shall be supplied and made available by the Contractor to all site personnel, regulatory representatives, and all authorized visitors. Such items include protective clothing and equipment, first aid kits, fire extinguishers, warning signs, barricade tape, illumination, potable water, toilet facilities, and other equipment as required to protect the health and safety of all site personnel, regulatory representatives, and authorized visitors.

Excavations on the project site from which the public is excluded shall be marked or guarded in a manner appropriate for the hazard.

C. EXECUTION

Within 3 days of the execution of the contract, the Contractor shall submit his Site Health and Safety Plan to the Engineer for documentation of compliance with the contract documents. The receipt of these items in no manner implies that the Engineer or the Owner has reviewed, approved, or otherwise inspected the materials submitted.

At the preconstruction conference, the Contractor shall make an oral presentation of the Site Health and Safety Plan to the Engineer. The presentation shall include details of the plan, procedures to be followed, individual responsibilities, equipment to be furnished, etc.

The Contractor shall be responsible for the proper execution of the Plan. The Engineer, however, will notify the Contractor's site health and safety officer if, in his or her professional opinion, it is determined that the Contractor's Site Health and Safety Plan is not being adequately implemented or observes other unsafe practices.

1-11 Traffic Control

The Contractor shall be responsible to implement traffic control in accordance with the Plans and local, state and federal regulations.

1–12 Project Security

The Contractor shall make adequate provision for the protection of the work area against fire, theft, violence and vandalism, and for the protection of the public against exposure to injury.

1–13 Dust Control

The Contractor shall take whatever steps, procedures, or means as are required to prevent abnormal dust conditions being caused by his operations in connection with the execution of the work; and on any unpaved road which the Contractor or any of his subcontractors are using, excavation or fill areas, demolition operations, or other activities. Control shall be by sprinkling, use of dust palliatives, modifications of operations, or any other means acceptable to the Engineer and agencies having jurisdiction.

1–14 Site Cleaning

Throughout the period of construction, the Contractor shall keep the work site free and clean of all rubbish and debris, and shall promptly remove from the Site, or from property adjacent to the Site of the work, all unused and rejected materials, concrete, plaster and debris.

The Contractor shall dispose of non-hazardous surplus materials, waste products and debris at an appropriate disposal facility and shall make necessary arrangements for such disposal at the Contractor's expense.

Upon completion of the work, and prior to final acceptance, the Contractor shall remove from the vicinity of the work all plant, waste products, debris, surplus materials and equipment belonging to him or used under his direction during construction.

1–15 Contract Record As-Built Drawings

The Contractor shall maintain at the Site, available to the Engineer, one copy of the Contract Documents, Drawings, Shop Drawings, Change Orders and other modifications in good order and marked in red pencil to record all changes made during construction. These as-built drawings shall be submitted to the Engineer upon completion of the project and final acceptance for the project shall be subject to receipt and approval of the as-builts. During the progress meetings, such record documents shall be reviewed to ascertain that all changes have been recorded.

In addition to changes made during construction, the Contractor shall also mark-up the as-built drawings in red pencil, providing details on the electrical utilities installed. These details shall include size of all conduits installed, the number and size of wiring

in the conduit, the location and size of junction boxes, and any other details pertinent to the electrical installation.

1–16 Contract Time

The Contractor is notified that The Sherwin-Williams Company is under order from the RWQCB to implement construction and installation of the groundwater extraction system expansion as part of the approved action plan. As such, if delays in construction develop which inhibit attainment of the RWQCB's deadline, fines or other enforcement actions may result.

Time is of the essence in completion of the project and, if necessary, the Contractor shall schedule extra manpower or equipment or work overtime operations as required to meet the Construction Schedule.

The Contract Time shall be thirty (30) calendar days commencing 48 hours from the Contractor's receipt of the Notice to Proceed plus approved extensions. No time extension will be allowed for the first three (3) days lost due to adverse weather.

1–17 Easements and Work Restrictions

The Contractor is notified that the approximate location of existing utilities shown on the drawings are based on available information and the locations have not been verified by the Engineer. The Engineer makes no claim as to the accuracy of the location of existing utilities or whether all existing utilities are shown on the drawings. The Contractor shall contact Underground Services Alert and/or other utility locator services, as appropriate, to verify the location of existing utilities in the public and private rights-of-way. The costs for the use of underground utility locator services shall be paid by the Contractor.

1–18 Site Access

Site access to the former Rifkin property will be coordinated by the Engineer with the Sherwin- Williams Company and the Chiron Corporation.

1–19 Final Test Operation

After all the equipment is installed and the entire extraction and treatment system is ready to operate, the Contractor shall test all equipment for a period of seven days under actual operating conditions. The seven-day test period shall be initiated within the 60-day Contract Time but not necessarily completed during this period. All defects of materials installed by the Contractor or defects in the Contractor's worker skill level which appear during this test period shall be corrected by the Contractor. After such corrections the seven day test will be repeated until all deficiencies are corrected. Final

DIVISION 2 – SITEWORK

2–1 General

The provisions herein shall apply to all demolition, clearing, pavement removal, grading, excavation, filling and backfilling, and the construction of all utility lines, fences, junction boxes, trenches, and other construction work associated with connection of wellhead structures to the point of discharge. Existing improvements, adjacent property, utilities and other facilities shall be protected from injury or damage resulting from the Contractor's operations.

2–2 Compaction Control and Testing

Maximum density, as used in these Specifications, shall be defined as the maximum density obtained in the laboratory by ASTM D 1557, Method C, Modified Proctor using a 10-pound rammer and 18-inch drop. In-place density of compacted backfill will be determined in the field by ASTM D 1556, or by nuclear density test procedures per ASTM D 2922 and ASTM D 3017.

It shall be the responsibility of the Contractor to accomplish the specified compaction for backfill, fill, etc. It shall be the responsibility of the Contractor to control his operations by testing to verify and confirm that he has achieved the designated degree of relative compaction as described within the requirements of these Specifications. This testing shall be performed simultaneously with installation of the backfill. The Contractor's tests shall be performed by a soils testing laboratory acceptable to the Engineer. Field testing shall be performed under the supervision of the Engineer and shall be scheduled to accommodate the Engineer.

The Contractor shall provide for development of compaction curves and independent testing of soil compaction at his own expense. The testing company and methods shall be approved by the Engineer prior to initiation of backfill operations.

As a minimum the Contractor shall provide compaction tests in both the bedding and backfill at a spacing of every 100 feet along the utility trenches and in a minimum of three locations at each street crossing. All test results shall be provided to the Engineer. If compaction fails to meet the requirements set forth above, the Contractor shall remove and replace the backfill at proper density or shall bring the density up to specified level by other means acceptable to the Engineer. Subsequent testing required to confirm that the reconstructed backfill has been brought up to specified density shall be paid for by the Contractor. The Contractor's confirmation tests shall be paid for by the Contractor. The Contractor's confirmation tests shall be performed in a manner acceptable to the Engineer.

2–3 Clearing and Grubbing

Areas where construction is to be performed and other areas as shown on the Plans or specified shall be cleared of all fences, lumber, walls, stumps, brush, roots, weeds, trees, shrubs, rubbish, rocks, broken concrete and other objectionable material. Clearing and grubbing of such materials shall be performed in advance of grading operations, to minimize any interference or obstruction which would impede execution of the work. The Contractor shall satisfy himself regarding the character and amount of all material to be cleared and grubbed and all costs for said work and disposal of such materials shall be borne by the Contractor.

Stockpiles, borrow areas or other earthwork required temporarily by the erection of Contractors for completion of all construction facilities shall be filled or removed, as the case may be, upon the completion of the work and leveled to meet the existing contours of the adjacent ground.

Organic material above the ground surface accrued from clearing and grubbing operations shall not be incorporated in fills and backfills. Brush, roots, weeds, shrubs and other vegetation above the soil surface shall be removed for disposal in an acceptable landfill off site.

2–4 Removal of Water

The Contractor shall provide and maintain at all times during construction ample means and devices with which to promptly remove and promptly dispose of all water entering the excavation, trenches or other parts of the work, whether the water be surface water or under groundwater. No concrete shall be laid in water, nor shall water be allowed to rise over them until the concrete or mortar has set at least 24 hours. The Contractor shall dispose of the water from the work in a suitable manner without damage to adjacent property. No water shall be permitted to drain into work areas or on-site catch basins. Any water removed which may contain chemical components similar to those found in wells shall be stored and sampled before disposal. Such water may not be discharged to local storm drains. Provisions to discharge such water to the existing treatment system may be coordinated with the Engineer.

2–5 Shoring

Where necessary, trenches and other excavations shall be properly shored and braced to furnish safe and acceptable working conditions, protect existing and new structures, and maintain existing slopes, fills and open excavations. The bracing shall be so arranged as not to place any stress on portions of the completed work until the general construction thereof has proceeded far enough to provide ample strength. Any damage to new or existing structures or utilities occurring through settlements, water or earth pressures, slides, caves, or other causes due to failure or lack of sheeting, shoring, or bracing or improper bracing, or through negligence or fault of the Contractor in any other manner shall be repaired by the Contractor at his own expense.

The Contractor shall submit for the acceptance by the Engineer, in advance of all excavations of depth in excess of 5 feet, a detail plan showing the design of sheeting, shoring, bracing, sloping or other provisions to be made for worker protection from the hazard of caving ground and protection of structures during the excavation. If such plan varies from the shoring system standards established by the Industrial or Safety Orders of the authority having jurisdiction, the plan shall be prepared by a registered civil or structural engineer.

Nothing in this section shall be deemed to allow the use of shoring, sloping, or protective system less effective than that required by the Occupational Safety and Health Act. All excavations shall be performed, protected and supported as required for safety and in the manner set forth in the operation rules, orders and regulations prescribed by OSHA.

2–6 Pipe Excavation, Bedding, and Backfill

A. EXCAVATION

Excavation for wellhead structures, valves, underground utility boxes, or other appurtenances shall be sufficient to leave at least 12 inches clear between their outer surfaces and the embankment or excavation face. Backfill with earth under vaults, tanks, underground utility boxes or valves will not be permitted. Any unauthorized excess excavation below the elevation indicated for foundation of any structure shall be filled with compacted sand, base material, or concrete, at the expense of the Contractor.

For trench excavations the clear width of the trench for pipe and conduit shall be a minimum of 4 inches and a maximum of 6 inches beyond the outside pipe or conduit on either side of the trench.

Where the wellhead vaults, utility manhole and trench excavation is made below the grade required to accommodate the bedding material, the trench bottom shall be restored to the proper grade by backfilling and compacting the backfill to 90 percent of maximum density, at the expense of the Contractor. Backfill material shall be sand as specified herein.

Before laying pipes that are to be located in fill, the fill shall first be placed and compacted to not less than 1 foot above the top of pipe or conduit or as shown in the Plans. After placing and compacting the fill, the trench for the pipe or conduit shall be excavated through the fill and fine graded as required hereinafter.

Existing asphalt pavements and concrete to be removed to facilitate trenching or other underground construction work shall be cut by a wheel cutter clay spade, pavement saw or other device capable of making a neat, straight and smooth cut without damaging adjacent pavement not to be removed. The Engineer shall approve the cutting device and its manner of operation.

Where any concrete curb and gutter, valley gutter, or sidewalk needs to be removed to permit trenching, the same shall be replaced to the nearest construction joints with new concrete Class A curb, gutter, or sidewalk to the same dimensions and finish as the original construction that was removed. Expansion joints shall be the same spacing and thickness as on the original construction.

Concrete slab infill to replace concrete removed during trenching shall be 4-inches thick with 6-inch by 6-inch welded wire fabric W1.4 x W1.4. Dowels 6 inches into the existing slab and 6 inches into the slab infill shall be provided with #3 rebar at 48 inches on center for any Section of slab infill greater than 2 feet in width. The perimeter of the slab infill concrete shall be caulked. Concrete shall be class CE as specified in Division 3.

Substantial steel plates with adequate trench bracing shall be used to bridge across trenches in and near traffic areas and throughout residential areas where trench backfill and temporary patch have not been completed during regular working hours. Cold patch asphalt shall be used to construct transition ramps on either side of the steel trench plates. Access to fire hydrants must be maintained at all times.

Where cover over piping does not meet the minimum requirements shown on the Plans, the piping shall be encased in a steel pipe. The space between the carrier piping and the steel casing shall be filled with sand. A casing seal shall be provided at each end of the casing pipe.

B. BEDDING AND BACKFILL MATERIALS

1. Bedding Material

Except as otherwise specified, bedding material under and around the pipe shall be clean, coarse, natural sand which is nonplastic when tested in accordance with ASTM D 424. Between 90 and 100 percent of this sand shall pass a No. 4 sieve, and not more than 5 percent shall pass a No. 200 sieve. As an alternative to sand, the Contractor may use a pea gravel composite material with a minimum sand equivalent of 30, subject to review and approval by the Engineer. Where groundwater is encountered during trenching, the bedding material shall consist of 1-1/2-inch drain rock in place of sand or pea gravel composite material.

2. Aggregate Base

Aggregate base material used for backfill shall conform to Class II aggregate base in accordance with the latest edition of the California State Specifications, Section 26.

3. Asphalt Concrete

Asphalt concrete shall be as specified elsewhere in Division 2, Section 9.

C. BEDDING AND BACKFILL PLACEMENT

All bedding and backfill materials and specifications shall conform to these specifications. The Contractor shall take all necessary precautions in the placement and compaction of the bedding material to prevent displacement of the pipe. In the event there is movement or floating, the Contractor shall, at his own expense, re-excavate, re-lay, and backfill all pipe so affected.

The Contractor shall install magnetic detector tape as shown on the drawings and centered over the pipe(s) and conduit in all trenches.

Typical trench sections are specified on the Plans for trenching across paved streets, in non-paved areas, and in landscaped areas. All pipe bedding and backfill materials shall conform to the applicable detail for that area as shown on the Plans. All bedding material shall be compacted to 90 percent of its maximum density unless indicated otherwise on the Plans.

2–7 Earthwork

A. GENERAL

The work covered by this Division consists of furnishing all labor, equipment, supplies and materials and in performing all operations in connection with the following: loosening, excavating, filling, grading borrow, hauling, subgrade preparation, compacting, and all other operations pertaining thereto for site grading and trenching and the installation of junction boxes, pipelines, and structures incidental to the completion of the work. The Contractor shall furnish, place, and remove all sheeting and bracing, pumping and draining of excavations, the supporting of structures above and below ground, the handling of all water encountered in the excavations, the backfilling, compacting of materials around structures, backfilling of all trenches and pits, and all other incidental earthwork. Such work shall also be considered as part of this Division.

The Contractor shall satisfy himself with regards to the quality and quantity of rock, gravel, sand, silt, water and other inorganic or organic material deemed suitable for the use intended. The quantities required for the excavation of soil materials, installation of backfill materials, and the associated costs shall be included in the Contractor's bid prices for execution of the work. Material quantities derived from site excavation, borrow areas, or imported quarry materials shall be estimated by the Contractor and included as part of the bid price of this work.

B. EXCAVATION

Excavation shall consist of the satisfactory loosening, removing, loading, transporting, depositing, and compacting in the final location all materials, wet and dry, necessary to be removed for purposes of construction. The furnishing, placing and removing of all

sheeting and bracing; all pumping, draining and handling of water encountered in the excavations; the supporting of structures above and below ground shall be considered as part of the bid price for this work. All hazardous and non-hazardous excavated materials which are not required for fill and backfill, or which are unsuitable for fill or backfill, shall be disposed of by the Engineer, at his expense and responsibility, and in a manner acceptable to the Engineer.

C. COMPACTED FILLS

Fills, embankments or backfills, herein designated as fills, shall be constructed at the locations and to the lines and grades indicated on the Plans. The completed fill shall correspond to the shape of the typical sections shown on the Plans or shall meet the requirements for the particular case. Material for fills shall be obtained from cut sections or borrow from a source as selected by the Contractor and accepted by the Engineer. The maximum particle size shall not exceed 4 inches. The fill material shall be free of leaves, grass, roots, stumps and other vegetable matter.

All compacted fills shall be placed in successive layers of loose material not exceeding 8 inches in depth after compaction. No portion of the backfill shall be compacted by ponding and jetting. Each layer shall be brought to optimum moisture content for maximum density before compaction by rolling. If any material is placed that does not have correct moisture content, it shall be removed and replaced. Soft, spongy or springy material causing areas that "pump" when heavy loads pass over them shall be removed and replaced with suitable material. Dry material that will not "ball" shall be removed and replaced. These two conditions shall be considered as sufficient evidence without further testing that the moisture content is not correct and the material shall be removed.

Each layer shall be spread uniformly by the use of a road machine or other accepted device and rolled with an acceptable tamping roller, heavy pneumatic compactor, or vibratory plate device, until thoroughly compacted to not less than the specified density. Fill that is to be compacted and is inaccessible to rollers shall be compacted with pneumatic, vibrating, or other tamping equipment.

2–8 Asphalt Concrete Paving

Asphalt concrete paving shall be AR-4000 grade, type B and shall conform to the requirements of Section 39 entitled "Asphalt Concrete" in the latest edition of the State of California Standard Specifications.

The existing pavement shall be cut and trimmed beyond the trench walls as shown on the plans. After placement of the required Class 2 aggregate base and prior to placement of new asphalt, a light tack coat with a Grade SS-1h anionic emulsion shall be placed on the trimmed edges.

Placement of asphalt concrete surfacing shall conform to the requirements of Section 39 entitled "Asphalt Concrete" in the latest edition of the State of California Standard Specifications and these special provisions. All asphalt concrete paving placed within and parallel to city streets shall be a minimum thickness of 4 inches or equal to the existing section, whichever is greater. All asphalt concrete paving placed at street crossings shall be a minimum thickness of 6 inches. Asphalt concrete shall be placed and compacted in lifts not to exceed a thickness of 2 inches measured from the compacted lift.

Asphalt concrete shall be placed only when the subgrade is dry, free of all debris, vegetation, dirt, roots, and other deleterious materials, and when ambient air temperature exceeds 50°F at ground surface. The subgrade shall be kept well drained at all times, and shall be free of ruts, depressions, or other irregularities prior to paving. No asphalt concrete shall be placed when the weather is rainy or foggy. The Contractor shall remove and patch all existing paved surfaces which settled, were broken, or otherwise damaged before paving as directed by the Engineer.

The Contractor shall not pass equipment over any pipe, conduit, utility line, sewer main or lateral, or other structure before it is protected by adequate, properly compacted fill material. Any damage resulting to said facilities shall be deemed the responsibility of the Contractor and as such shall be promptly repaired at his expense.

The finished surface shall match existing slopes and shall be smooth, and free of any ridges, indentations, ruts, or other irregularities when completed. Grade and slope shall be verified by means of a string-line, straightedge, or other appropriate measuring device. The transverse slope of the finished surface shall be uniform to a degree such that no depression greater than 0.02 foot in a total length of 12 feet exists. Pavement shall be warped to match the edge of all concrete vaults, boxes or other structures as necessary.

All equipment used in the paving operation shall be of sufficient weight rating to provide the necessary compaction and shall be in good operating condition. No stains, oil, dirt or other deleterious material shall be incorporated into the finished surface. All painted traffic markings and wheel-stops shall be replaced following installation of the upper lift of asphalt concrete.

DIVISION 3 – CONCRETE

3–1 General

Except as otherwise specified, concrete shall be composed of Portland cement, fine aggregate, coarse aggregate and water so proportioned and mixed as to produce a plastic, workable mixture in accordance with all requirements of this section and suitable to the specific conditions of placement. The proportions of material shall be such as to secure the lowest water: cement ratio which is consistent with good workability, a plastic, cohesive mixture and one which is within the specified slump range. The proportion of fine and coarse aggregates shall be such that the ratio of the coarse to the fine shall be not less than 1.0 nor more than 2.0, nor shall the amount of coarse aggregate be such as to produce harshness in placing or honeycombing in the structures. Air entrained concrete shall not be used. Maximum slump will not exceed 4 inches unless otherwise approved by the Owner's Representative.

Concrete work, including detailing and reinforcing, shall be in accordance with the best standard practices and as set forth in the ACI Building Code, Manuals and Recommended Practices.

All concrete materials shall be so delivered, stored and handled so as to prevent damage to the materials and the inclusion of foreign substances. Packaged materials shall be delivered and stored in original containers until ready for use. Material containers or materials showing evidence of water or other damage shall be rejected.

3–2 Concrete Classes and Strength

Concrete shall be of five classes, herein referred to as Classes A, B, C, CE and D, which shall be as specified herein and which shall be used in the respective places called for in these Specifications. Class C concrete may be used for fill for unauthorized excavation, for thrust blocks and ground anchor for piping, for bedding of pipe and when noted on the Plans. Class A concrete shall be used for slabs on grade. Class B concrete may be used where Class A concrete is required, if high-early-strength is desired, at the Contractor's option. Class D concrete shall be used for precast concrete items. Class CE concrete shall be used for electrical conduit encasements. All other concrete, unless specified or noted otherwise, shall be Class A concrete.

Table A

Class	Compressive Strength @ 28 Days (psi)	Max. Net Water Content Per Sack of Cement (gallons)	Min. Cement Per Yard of Concrete (sacks)	Consistency Range in Slump (inches)
A, Type II cement	3,500	6.0	6.0	2 1/2 to 4
B, Type III cement	3,500	6.0	6.0	2 1/2 to 4
C	2,500	8.0	4.5	3 to 6
CE	2,500	8.0	6.0	3 to 6
D	4,500	5.5	7.0	3 to 4

Any concrete that is pumped shall meet all the requirements of these Specifications. In no case shall concrete be placed which shows a slump outside the limits indicated in the table.

Classes A, C, CE and D concrete shall be made with Type II low alkali cement. Class B concrete shall be made with Type III cement.

3–3 Concrete Materials

A. FINE AGGREGATE

Fine aggregate for concrete or mortar shall consist of clean, natural sand or sand prepared from stone or gravel. Deleterious substances shall not be present in excess of the following percentages by weight of contaminating substances. In no case shall the total exceed 3 percent.

Removed by decantation (dirt, silt, etc.)	3 percent
Shale	1 percent
Clay lumps	1 percent

Fine aggregate shall not contain strong alkali nor organic matter which gives a color darker than the standard color when tested in accordance with ASTM C 40. Fine aggregate shall have a fineness modulus not less than 2.50 nor greater than 3.00. Except as otherwise specified, fine aggregates shall be graded from coarse to fine in accordance with the requirements of ASTM C 33.

B. COARSE AGGREGATE

Coarse aggregate shall consist of gravel or crushed stone made up of clean, hard, durable particles free from calcareous coatings, organic matter, or other foreign substances. Thin or elongated pieces having a length greater than five times the average thickness shall not exceed 15 percent by weight. Deleterious substances shall not be present in excess of the following percentages by weight, and in no case shall the total of all deleterious substances exceed 2 percent.

Soft fragments	2 percent
Shale	1 percent
Coal and lignite	1/4 percent
Clay lumps	1/4 percent
Material finer than No. 200 sieve	1/2 percent*

*Except that when material finer than No. 200 sieve consists of crusher dust, the maximum amount shall be one percent.

Except as otherwise specified or approved in writing by the Owner's Representative, coarse aggregate shall be graded as specified in ASTM C 33, size No. 57.

Coarse aggregate for Class CE concrete shall be graded in accordance with ASTM C 33, size No. 8.

C. WATER

Water for concrete shall be clean, free from oil, alkali, acid, organic matter or other deleterious substances.

D. PORTLAND CEMENT

Except as otherwise specified, all Portland cement shall conform to the specifications and test for Portland cement ASTM C 150, Type II, Low Alkali. Only one brand of cement shall be used for exposed concrete in any individual structure.

E. PAYMENT

Payment for concrete shall be considered as included in the various contract items requiring concrete and no separate payment will be made therefor.

3–4 Testing and Submittals

Concrete is expected to reach a higher compressive strength than that which is indicated in 3-2 Table A herein. The Contractor shall test the slump of concrete using slump cone (ASTM C 143) or Kelly ball (ASTM C 360). The Owner's Representative may require the Contractor to take test cylinders and test the concrete to determine whether the concrete complies with the standards of quality specified herein, at the Contractor's expense. Such tests, if made, shall be in accordance with ASTM C 31, ASTM C 39 and ASTM C 172 in a laboratory approved by the Owner's Representative.

The Contractor shall submit concrete materials data and prior typical concrete strength data from the concrete supplier prior to pouring any concrete. The Owner's Representative may waive the Contractor's concrete testing requirements if the data from the concrete supplier provides sufficient evidence that the concrete will comply with the specifications herein. Notwithstanding the foregoing, the Owner's Representative may have test cylinders taken and tests made on the concrete even if data provided by the concrete supplier is accepted by the Owner's Representative, and such testing costs will be borne by the Owner's Representative.

3–5 Concrete Forms

A. GENERAL

Forms shall be so constructed that the finished concrete will conform to the shapes, lines, grades and dimensions indicated on the Plans. It is intended that the surface of the concrete after stripping shall present a smooth, hard and dense finish that will require a minimum amount of finishing. Sufficient number of forms shall be provided so that the work may be executed rapidly and present a uniform appearance in form patterns and finish. Forms shall be clean and free from all dirt, debris, concrete, etc., and shall be coated with an approved form of oil, if required, prior to use or reuse.

Information on the Contractor's proposed forming system shall be submitted in such detail as the Owner's Representative may require to assure himself that the intent of the Specifications can be complied with by the use of the proposed system.

Vertical forms shall remain in place a minimum of 36 hours after the concrete is placed. If, after 24 hours, the concrete is sufficiently hardened to resist surface damage, the vertical forms may be removed. Horizontal forms, or forms supporting concrete, shall remain in place for at least seven days, and more when specifically required.

Form ties for the forming system selected shall be the cone-snap tie or flat bar type as manufactured by a recognized manufacturer of concrete forming equipment. Forms shall be tied together at not less than 2-foot centers vertically and horizontally. Wire ties or wood spreaders of any form shall not be used. Ties shall be of a type that will accurately tie, lock and spread the forms. Forms and ties shall be designed to withstand concrete pressures without bulging, spreading or lifting of the forms. The approved

form tie shall be of such design that when the forms are removed, no metals shall be within ¾ inch of any surface. Holes in the forms for ties shall not allow leakage during pouring. All forms must be held to a tolerance of plus or minus ½ inch during and after concrete is placed.

B. PAYMENT

Payment for concrete form work shall be considered as included in the various contract items requiring concrete and no separate payment will be made therefor.

3–11 Curing Concrete

A. GENERAL

All surfaces of concrete being water cured shall be kept constantly and visibly moist day and night for a period of not less than seven days and nights. Each day the forms remain in place may count as one day of water curing. No further curing credit will be allowed for forms in place after contact has once been broken between the concrete surface and the forms. Ties shall not be loosened during the period when concrete is being cured by leaving the forms in place. The Owner's Representative shall be notified prior to stripping of forms.

B. PAYMENT

Payment for curing concrete shall be considered as included in the various contract items requiring concrete and no separate payment will be made therefor.

3–12 Cement Mortar and Grout

A. GENERAL

Cement mortar or grout for the repair of imperfect concrete work, filling of holes left by form bolts or ties, and the filling of voids around items through the concrete, etc., shall consist of cement and sand mixed in the same proportions used for the concrete being repaired, with only sufficient water required to give the required consistency. In no case shall the water-cement ratio be more than that specified for the concrete being repaired.

In the case of mortar being used for patching or repairing exposed concrete surfaces which are not to be painted or which will not be submerged in water, sufficient white cement shall be used to make the color of the finished patch match that of the surrounding concrete. Bolt and tie holes shall be filled with dry-pack mortar, well-tamped into the holes. For dry-pack mortar, only enough water shall be used so that the resulting mortar will crumble to the touch after being "balled."

Concrete surfaces shall be roughened, cleaned and thoroughly wet before grout or mortar is placed, or, where indicated on the Plans or specified, a bonding agent shall be applied to the clean, roughened surface before placing the mortar or the grout.

Grout for spreading over the surfaces of construction joints sealing at the manhole connection or cold joints shall consist of sand and cement with no more water used than allowed by the water-cement ratio specified for the concrete.

Particular care shall be exercised in placing cement mortar or grout since it will be expected to furnish structural strength or an impermeable water seal or both. Cement mortar or grout that has not been placed within 30 minutes after mixing shall not be used. Grout for which the mix is not otherwise specified shall be mixed in the proportions of one part cement to four parts of concrete sand.

B. PAYMENT

Payment for cement mortar and grout shall be considered as included in the various contract items requiring concrete and no separate payment will be made therefor.

3–13 Finishing

A. GENERAL

The finish for concrete work shall be steel trowel finish free from trowel marks. The finish shall be smooth and free from depressions, irregularities, shrinkage cracks, or other

blemishes. A light broom finish may be used at the option of the Contractor to provide a slip-resistant surface. The surface shall slope to the edge of the slab. Surface slope shall be less than or equal to 1%.

B. PAYMENT

Payment for cement mortar and grout shall be considered as included in the various contract items requiring concrete and no separate payment will be made therefor.

3–14 Anchor Bolts

A. GENERAL

Cast-in-place anchor bolts shall be set when concrete is poured. Anchor bolts embedded in concrete shall be accurately spaced as shown on the Plans, with bolts truly normal to the surfaces from which they project. Anchor bolts shall not touch reinforcing steel. Where anchor bolts are within ¼-inch of reinforcing steel, anchor bolts shall be insulated with not less than three wraps of 10-mil PVC tape in the area adjacent to the reinforcing steel. Anchor bolts shall be stainless steel conforming to ASTM A 307.

Unless otherwise noted, all anchor bolts drilled into existing concrete walls, columns, panels and pad shall be a minimum size of 5/8 inch and epoxy-bonded into a drilled hole. Bolts shall be expansion sleeve type, with compressive washer larger than drilled hole. Epoxy shall be a two-component adhesive and may be mixed with clean sand as per Section 83-1.02B of the Caltrans Specifications.

B. PAYMENT

Payment for anchor bolts shall be considered as included in the various contract items requiring concrete and no separate payment will be made for these items.

DIVISION 5 – SPECIAL EQUIPMENT

5–1 General

The Contractor will provide all equipment as shown in the Plans for the groundwater extraction system. The Contractor is responsible for the installation and hook-up (both mechanical and electrical) for the extraction system according to the manufacturer's instructions. It is the responsibility of the Contractor to interface with the manufacturer as required to complete the installation and start-up of the system. The extraction system, pneumatic pumps, and pressure/regulator will be manufactured by QED Environmental Systems, Inc. (QED), of Ann Arbor, Michigan. The Contractor shall be responsible for scheduling delivery for installing this equipment. The Engineer shall be responsible for ordering and procuring the casing steel protector to be installed by the contractor as outlined in the Plans.

5–2 Groundwater Extraction System

The Contractor shall install the groundwater extraction system equipment as shown on the Plans, as directed by manufacturer's instructions, and as specified herein. The system shall be pneumatically operated using air supplied by the existing Sherwin-Williams facility compressor.

The groundwater extraction system shall include three total fluids well pumps, QED Controllerless pumps, for 6-inch diameter extraction wells. The Hammerhead Pump and appurtenances consist of the following items (see Bill of Materials in the plans for part numbers):

- Qty (3) Hammerhead Short Version Pumps
- Qty (3) 30' of jacketed nylon tubing (3/4 inch and 3/8 inch lines) hose per extraction well
- Qty (3) Pressure Regulator Kits (includes filter element)
- Qty (3) Quick Connect kits for pump
- Qty (3) Quick Connect kits for wellhead
- Qty (3) Well Caps for Hammerhead Pumps

Three new well pumps shall be installed in the extraction wells EX-11, EX-12, and EX-13 as shown in the Plans. The fluid and air hoses connecting the extraction wells to the treatment system shall be installed inside 4-inch-diameter, Schedule 80, PVC casing. The casing shall be purchased and installed by the Contractor. The casing shall be installed in a trench as shown on the Plans. Hose connections shall be quick-connect brass fittings. Hose specifications are as follows:

- Qty (1) 3/8-inch I.D. Air supply hose green, Goodyear No. 2214 Instagrip 300 pounds per square inch (PSI) Flame Resistant or approved equal
- Qty (1) 3/4-inch I.D. Discharge hose black, Goodyear No. 1565* Instagrip 300 PSI WP or approved equal

5-3 Connection of Extraction System to the Existing Groundwater Treatment System

The Contractor shall install the groundwater extraction system equipment as shown on the Plans, as directed by manufacturer's instructions and as specified herein. Upon final design of the treatment system, a tank will be identified to receive the extracted groundwater. The connection of each solenoid valve wiring will be installed by others.

DIVISION 15 – PIPING, VALVES, COMPONENTS AND SPECIALTIES

15–1 General

Piping shall be installed as indicated on the Plans. If the Contractor desires to change any of the piping layouts as shown on the Plans, he shall submit to the Engineer, for approval, his detailed proposed layouts.

Any piping which does not meet Specifications or has been rejected shall be removed from the job site and disposed of by the Contractor at the Contractor's expense.

Where new fittings are to be cut into or connected to existing piping the Contractor shall furnish and install the necessary sleeves, flanges, nipples, couplings, fittings, etc., needed to accomplish the cutting-in or connections, whether specifically indicated on the Plans or not. At a minimum, straight pulling "L"s shall be installed at 60-feet intervals unless noted differently on the Plans or as specifically approved by the Engineer.

The Plans shall be taken as diagrammatic for piping that is not shown in detail. Sizes of piping and their locations are indicated, but it is not intended to show every offset and fitting nor every structural difficulty that will be encountered during the installation of the work.

The Contractor shall furnish such components as may be necessary to provide a complete and operable system.

All piping which penetrates concrete shall be provided with a galvanized steel pipe sleeve to provide a minimum clearance of 1/2 inch from the penetrating pipe.

Pipe ends shall be prepared, and connections made, in strict accordance with the manufacturer's instructions. Pipe and fittings shall be assembled so there will be no distortion or springing of the pipelines. Flanges, unions, flexible couplings and other connections shall come together at the proper orientation. The fit shall not be made by springing any piping nor shall orientation alignment be corrected by taking up on any flange bolts. Flange bolts, union halves, flexible connectors, etc., shall slip freely into place. If the proper fit is not obtained, the piping shall be altered to fit.

The interior of all pipelines, above or below grade, shall be thoroughly cleaned of all matter and other debris to the satisfaction of the Engineer.

Regardless of any previous testing, any leaks developing before the end of the one year warranty period shall be repaired by the Contractor at the Contractor's expense.

B. PIPE SUPPORTS

Pipe supports shall be install as shown on the Plans and in conformance with these Specifications.

All pipe work shall be suspended and supported in such a manner as to prevent sagging or overstressing of pipe and connections. Furthermore, all piping shall be supported so that no item of the piping system will transfer any load or stress to any equipment. All piping and conduit run above grade shall be anchored as shown on the plans and as approved by the Engineer. At a minimum, all piping not in trenches shall be secured or anchored on 5-foot intervals unless noted differently on the Plans or as specifically approved by the Engineer. Pipe slopes shall be as indicated on the plans.

All pipe supports shall be galvanized steel, or painted and coated with a suitable epoxy coating manufactured by the Sherwin-Williams Company. The Contractor shall submit pipe support coatings for approval by the Engineer.

C. MEASUREMENT AND PAYMENT

1) Measurement

The pipe work to be performed under these Specifications will be listed in the bid schedule by size, or size and class, and whatever other information is necessary for identification.

Pipe supports will be measured per complete pipe support as shown on the Plans.

2) Payment

Full compensation for conforming to these requirements for installation of piping, valves, and supports shall be included in the contract unit prices paid and no additional compensation will be allowed thereafter. Unit prices will be paid in accordance with the schedule of values.

15–2 Buried Piping

The approximate locations of existing utilities are shown on the drawings. The location of the utilities is based on available information and has not been verified by the Engineer. The Engineer makes no claim as to the accuracy of the location of existing utilities or whether all existing utilities are shown on the drawings. The Contractor shall employ an underground utility locator service to verify the location of existing utilities in the public and private right-of-ways.

Where not otherwise indicated on the Plans, all buried lines shall be laid with a minimum of a 3-foot cover without air traps or humps. Where two lines of similar

service run parallel to each other, they may be laid in the same trench as close together as possible and still provide adequate room for jointing.

The laying of the pipe shall be in finished trenches free of water or debris and shall be commenced at the lowest point. Pipe shall be laid on a smooth and firm foundation to ensure uniform bearing under the full length of the barrel. All adjustments to line and grade shall be made by scraping away or filling in under the pipe.

Before excavation is started for any run of underground piping, the Contractor shall locate and expose all existing structures, piping, conduit, etc. which intersect the line of the piping, to avoid possible damage to these during excavation operations and so that it may be determined if there will be any conflicts in location. In the event of conflicts in location or grade or both, between new and existing piping, the Contractor shall notify the Engineer immediately and shall make adjustments in location or grade of new piping as approved by the Engineer. These adjustments, including additional fittings, shall be made at the Contractor's expense.

Excavation, bedding, piping and backfill shall be as specified under Division 2 of these Specifications.

Each pipe shall be carefully inspected immediately before it is installed and all defective pipe shall be rejected.

15–3 Polyvinyl Chloride (PVC) Pipe

Except as otherwise specified herein, or as called for on the plans, PVC pipe and fittings shall conform to the following requirements.

All groundwater piping shall be Schedule 80 PVC, 4-inch I.D. diameter, unless otherwise specified in the Plans. All PVC pipe shall conform to the requirements of ASTM D-1785, Type 1 (normal impact), Grade 1 (high chemical resistance), and U.S. Products Standards PS 21-70 and shall be solvent welded. All PVC pipe delivered to the job site shall be plainly marked as to nominal pipe or tubing size, type class, schedule or pressure rating, and manufacturer.

The Contractor shall be responsible for installing approximately 90 feet of steel casing protector (provided by the Engineer) as shown on the Plans.

All fittings shall be Schedule 40 or Schedule 80 PVC pipe, dependent upon application, conforming to ASTM D-2467 standards and shall be socket type for solvent or fusion welding.

Extruding and molding material for the PVC pipe shall be virgin material containing no scrap, regrind, or rework material. Clean rework material generated by the manufacturer's own operations may be used as long as the end product meets the requirements of this specification.

All above-ground pipe and fittings shall be coated with a heavily pigmented white exterior latex paint applied thick enough to assure an opaque coating. **Any paints or coatings shall be Sherwin-Williams products.**

15–4 PVC Pipe Testing

The Contractor shall pressure test all new flexible discharge hose with water at 150 percent of its rated pressure for 5 minutes, then reduce the pressure to 100 percent of rated pressure for a minimum duration of four hours. Hydrostatic pressure testing of underground discharge hose shall be performed after backfilling the pipe section. The Contractor shall notify the Engineer a minimum of 24 hours prior to performing the pressure testing. If any drop in pressure is noted after one (1) hour, then the Contractor shall repair, at their expense, any leakage as required. The Contractor shall repeat the test procedure until the discharge hose passes the test to the satisfaction of the Engineer. Following satisfactory completion of hydrostatic testing on primary piping, the underground secondary containment PVC piping shall be pressure-tested to 10 PSI for one (1) hour. All water shall be properly drained from the secondary containment system to provide a dry system. Regardless of the results of any previous testing, a one-year warranty period shall apply, such that any leaks developed before the end of a one-year period shall be repaired by the Contractor between the hours of 9:00 a.m. and 5:00 p.m. at the Contractor's expense.

Test Records: Records shall be made of each piping system installation during the test. Records shall include:

1. Date of test.
2. Description and identification and/or location of piping tested.
3. Test fluid.
4. Test pressure.
5. Remarks and notes to identify leaks (type and location).
6. Repairs made on leaks.
7. Results of retest.
8. Certification by Contractor and signed acknowledgement by Engineer.

15–5 Valves and Other Appurtenances

A. GENERAL

The Contractor shall furnish and install all pressure and solenoid valves and counters where indicated on the Plans, as called for in these Specifications, or as required for proper orientation of the equipment in general. Unless otherwise indicated on the Plans or specified in other sections of these Specifications, valves and meters shall conform to the requirements as specified herein.

The method of connection of the pressure and solenoid valves and counters for each extraction well shall be as detailed on the Plans. In general, unless otherwise indicated on the Plans or specified, all valves and meters shall have NPT threaded connections or suitable to connect by special unions which must be provided by the Contractor. Where proper operation and utilization of equipment and facilities requires installation of valves not shown or specified, the Contractor shall provide and install, upon approval by the Engineer, valves similar and comparable to valves specified for similar and comparable duty in other parts of the project, at the Contractor's expense.

The Contractor shall furnish all labor, materials and equipment necessary to install the valves and meters as shown and described in the Plans and Specifications.

The Contractor shall furnish all incidental materials necessary for installation of the valves and meters such as flange gaskets, flange bolts and nuts, valve boxes and covers, etc.

The Contractor shall provide the necessary struts, concrete bases, and blocking to support the valves and meters in their installed positions.

B. EQUIPMENT

1) Pressure/regulator valve with cycle counter

All pressure/regulator valves shall include filter elements and be provided by QED Environmental Systems, Inc. (contact Dave Kaminski at 925-930-7610 or 800-624-2026).

2) Quick Connect Kit for QED Hammerhead Pump

All quick connect kits for the QED Hammerhead pumps shall be provided by QED Environmental Systems, Inc. (contact Dave Kaminski at 925-930-7610 or 800-624-2026). The kits should include quick connect for the discharge of pump, the mating quick connect for 3/4 inch liquid hose, quick connect and 1 foot of hose for pump air supply, and mating quick connect for 3/8 inches air hose.

3) Quick Connect Kit for Well Head

All quick connect kits for the well head assembly shall be provided by QED Environmental Systems, Inc. (contact Dave Kaminski at 925-930-7610 or 800-624-2026). The kits should include quick connect for discharge of 3/4 inch liquid hose, mating quick connect ending with a 3/4 inch MPT, quick connect for 3/8 inches air supply hose, and mating quick connect ending with a 1/4 inches MPT.

4) Well Cap for QED Hammerhead Pump

Well caps shall be obtained from QED Environmental Systems, Inc. (contact Dave Kaminski at 925-930-7610 or 800-624-2026).

5) Solenoid Valve

Each solenoid valve shall be Dayton-general purpose, model #3A433, or equivalent.

6) Ball Valves

Ball valves shall be DynaQuip with threaded connections rated to not less than 150 psi, or approved equal.

7) Flow Meters

Flow meters shall be PMM-Multi-Jet Series-5/8 inches Precision meters with low flow accuracy. The flow meters shall be provided by Frank A. Olsen Co. or other supplier.

8) Extraction Well and Tie-In Vaults

Three new extraction well vaults shall be installed at extraction wells EX-11, EX-12, and EX-13 as shown in the Plans. The vaults shall be 2 ft long by 3 ft wide by 2 ft deep I.D. vaults without bottom, with galvanized adjustable frame and torsion hinged galvanized traffic cover. The vaults shall be available through Utility Vault at 925-846-8183.

15–7 Underground Utility Boxes

The Contractor shall supply and install reinforced, pre-cast concrete utility boxes at the well heads. The utility box frame and cover for the extraction wells shall be installed as indicated in the Plans. The boxes shall have nominal inside dimensions of at least 24 inches by 36 inches by 24 inches deep with no bottom. The utility boxes shall be H-20 high impact, traffic-rated with a hinged, one-piece, galvanized steel, checker plate, torsion-spring-assisted cover. The boxes and cover shall be Utility Vault 2436 LA-special or approved equal. The well vault lids will be supplied with custom-shaped bolts to prevent vandalism and enhance safety.

Unless otherwise noted in the plans, utility boxes shall be set approximately 1/4 to 1/2 inch above grade to minimize infiltration of surface water into the box. Contractor shall

provide a smooth transition of asphalt, to the edge of the box as approved by the Engineer and shall provide pipe and conduit penetrations as required through the utility box.

15–8 Pump Safety Cable

Pump Safety Cable shall be 3/8-inch link chain or approved equal.