GW - 114

11/94

WORK PLANS

INVESTIGATIVE

WORK PLAN
FOR ADDITIONAL INVESTIGATION AT THE DOWELL SCHLUMBERGER FACILITY ARTESIA, NEW MEXICO

November 28, 1994

Prepared For:

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Submitted To:

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Western Water Consultants, Inc. has conducted its work and presents these findings in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions. No other representation and no warranty or guarantee is made or intended.

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1.0 INTRODUCTION

1.0 INTRODUCTION

This work plan covers installation of five new ground-water monitoring wells at the Dowell Schlumberger Incorporated (Dowell) facility in Artesia, New Mexico. These wells will consist of two down-gradient monitoring wells and one group of three closely-spaced monitoring wells screened in separate intervals in the shallow subsurface (grouped wells). The work is part of on-going environmental investigation and remediation at the Artesia facility that began in 1989. Previous investigation reports are on file with the New Mexico Environment Department (NMED) - Underground Storage Tank (UST) Bureau.

1.1 Purpose

The down-gradient wells will be used to evaluate the extent of the volatile hydrocarbon plume. The grouped wells will be used to determine if there are any vertical differences in ground-water contaminant concentrations and in hydraulic head. This information will assist in evaluating potential contaminant migration pathways in the shallow alluvium.

1.2 Authorization

These wells were requested by NMED Groundwater Protection and Remediation Bureau in response to a concern regarding the ground water at the Artesia facility. The approximate locations were proposed in a meeting between NMED and Dowell personnel on October 4, 1994.

1.3 General and Site Geohydrology

Dowell's Artesia facility lies within the Roswell ground-water basin and is constructed on Quaternary alluvium deposited by the Pecos River (Fielder and Nye, 1933). The alluvial sediments may be as thick as 190 to 220 feet beneath this site (Welder, 1983). The near-surface stratigraphy (0 to 50 feet below surface) at the facility consists of interbedded reddish to pinkish silt, silty clay, and clay with minor poorly-sorted sand layers. At intervals of several feet within this sequence are 2 to 3-inch thick layers of cream to white earthy gypsum or carbonate. In the saturated zone, these gypsum/carbonate layers contain voids which appear to have been created

or enhanced by dissolution. In earlier Western Water Consultants, Inc. (WWC) reports, these solution-enhanced zones have been termed "rubblized" layers because of their broken and chaotic appearance in core samples.

Ground water is first encountered at the facility approximately 13 to 15 feet below surface and may be partially confined. The majority of the ground-water flow appears to occur in the solution-enhanced gypsum/carbonate layers rather than in the silty clay and clay intervals.

Most of the 16 existing ground-water monitoring wells at the Artesia facility are completed at depths of 30 to 35 feet below surface and contain 10 to 15 feet of screen. However, three deeper wells (MW-4, MW-13, and MW-16 - see Figure 2-1) are completed to approximately 50 feet below surface. In MW-16 west of the office/maintenance shop, an unsaturated interval was encountered from 45 to 50 feet below surface. A similar unsaturated interval from 40 to 44 feet below surface was present in MW-13 located northeast of the office/maintenance shop and approximately 190 feet down-gradient (northeast) from MW-16. Drilling proposed in this work plan is partially intended to determine whether this unsaturated zone is laterally continuous across the facility. It is likely that the unsaturated zone provides a barrier to downward migration of contaminants.

2.0 WELL INSTALLATION

2.0 WELL INSTALLATION

This chapter describes the methods which will be used to install and develop the two down-gradient and the three grouped monitoring wells. Monitoring methods and schedules are also described.

2.1 Well Locations

The two down-gradient wells will be located on platted and dedicated Eddy County right-of-way as far to the northeast of MW-6 and MW-11 as is feasible. The grouped wells will be located on the county right-of-way east of MW-12 on a line between MW-14 and MW-11. The approximate well locations are shown on Figure 2-1. The exact location of the platted and dedicated Eddy County right-of-way will be determined by a licensed land surveyor prior to drilling.

Notice will be given to the Eddy County Special Services Supervisor regarding the nature and scheduling of work on the county right-of-way. Preliminary indications are that formal permission from the county is not necessary although the county wishes to be informed in advance of any activity on county right-of-way (WWC telephone conversation on September 22, 1994 with Eddy County Special Services Supervisor). Prior to commencement of drilling, subsurface utilities will be located by the appropriate service companies and city or county agencies.

2.2 Drilling Methods

Both the down-gradient and the grouped wells will be drilled with an air-rotary drilling rig. The bit used will be sized to allow a minimum annulus around the PVC casing of 2 inches. All well boreholes will be continuously cored.

2.2.1 Drilling and Completion of the Two Down-gradient Wells

The two down-gradient wells will be drilled and completed similarly to existing WWC monitoring wells on site. The total depths of these two new wells are estimated to be 30 to 35

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50 FT. WIDE PLATTED COUNTY RIGHT-OF-WAY

MW-18 DOWNGRADIENT WELL

MW-10 85.05

MW-8 84.97

ROSE GRAVEL PROPERTY

MR. KIDDY PROPERTY

MW-7 84.99

MW-11 84.97

60 FT. WIDE PLATTED COUNTY RIGHT-OF-WAY

MW-19 DOWNGRADIENT WELL

50 FT. WIDE PLATTED COUNTY RIGHT-OF-WAY

CITY WATER LINE

GAS LINE

COMPRESSOR

MW-9 85.33

WASTEWATER TANK

MW-12 85.06

THREE GROUPED WELLS MW-17A MW-17B MW-17C

PILOT HOLE

FRAC SAND SILOS

BULK CEMENT

CEMENT WARE-HOUSE

CONCRETE PAD

WELL EQUIPMENT STORAGE

ACID PLANT

CHEMICAL WARE-HOUSE

DRUM STORAGE

ACID LOADING SLAB

SUMP

MW-15 85.49

MANIFOLD

MW-3 85.15

VACUUM SHED

WASH BAY

WASH BAY SYSTEM

MR. KIDDY PROPERTY

MW-6 85.05

DOWELL FACILITY

MW-13 85.55

MW-14 85.35

GRAVEL PARKING AREA

ABOVE GROUND OIL STORAGE

MW-5 85.90

VACUUM SHED

MANIFOLD

MAINTENANCE SHOP SYSTEM

ROSE GRAVEL PROPERTY

MW-1 86.18

MW-16

MAINTENANCE SHOP

BENCHMARK: ARBITRARY ELEVATION = 100.00 FT.

MW-4 86.19

MW-2 85.91

OFFICE

GRAVEL PARKING AREA

GATE

GATE

RICHEY AVENUE

NOTE: ACTUAL PLACEMENT OF MW-18 MAY BE FARTHER NORTH THAN SHOWN ON MAP, DEPENDING ON LOCATION OF COUNTY RIGHT-OF-WAY.

EXPLANATION

MW-14 85.35	WWC MONITORING WELL LOCATION, IDENTIFICATION, AND GROUND-WATER ELEVATION
MW-6 85.05	REED AND ASSOCIATES MONITORING WELL LOCATION, IDENTIFICATION, AND GROUND-WATER ELEVATION

0 60 FT.

SCALE

BASE MAP MODIFIED FROM REED & ASSOCIATES

FIGURE 2-1

PROPOSED WELL LOCATIONS

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feet below surface if no unsaturated zone similar to that encountered in MW-16 and MW-13 is detected. If such an unsaturated zone is present above 30 to 35 feet below surface in either new borehole, the well will be completed immediately above this interval.

For each well, 2-inch diameter Schedule 80 PVC threaded blank casing and a minimum 10 feet of 0.020-inch factory-slotted screen will be used to construct the well. The borehole annulus will be filled with 12/20-mesh washed silica sand to a minimum of 2 feet above the screen, followed by minimum 3-foot thick seal of 3/8-inch bentonite chips hydrated in place. Bentonite chips may be used to fill the entire annulus above the seal. Alternatively, this interval may be filled with clean cuttings to a depth of 5 feet below surface, where a second 3-foot seal of hydrated bentonite chips will be emplaced. The above-grade surface completion will consist of a locking steel riser sunk approximately 2 feet below grade and cemented into place. The wells will be kept locked except during monitoring activities. A schematic diagram of a typical above-grade well completion is shown on Figure 2-2.

2.2.2 Drilling and Completion of the Three Grouped Wells

Due to the probable thickness of the alluvium beneath the facility (190 to 220 feet), it was decided to employ a phased approach to investigating the vertical extent of hydrocarbon contamination at the facility. The first phase is to determine if vertical head and contaminant concentration differences are present within the shallow alluvium (less than 50 feet below surface). Each of the three grouped wells will be completed at a separate, discrete interval within the shallow alluvium.

Because it is not known whether the unsaturated zone present between 40 and 50 feet below surface in MW-13 and MW-16 is also present northeast of the facility, a pilot hole will be drilled and cored to identify the local stratigraphy prior to drilling the grouped wells. To minimize the potential for spreading contamination vertically, the pilot hole will be drilled approximately 120 to 150 feet east of MW-12, as shown in Figure 2-1, in an area away from the highest contaminant concentrations in ground water. After coring, the pilot hole will be abandoned with bentonite grout tremied into the bottom of the hole.

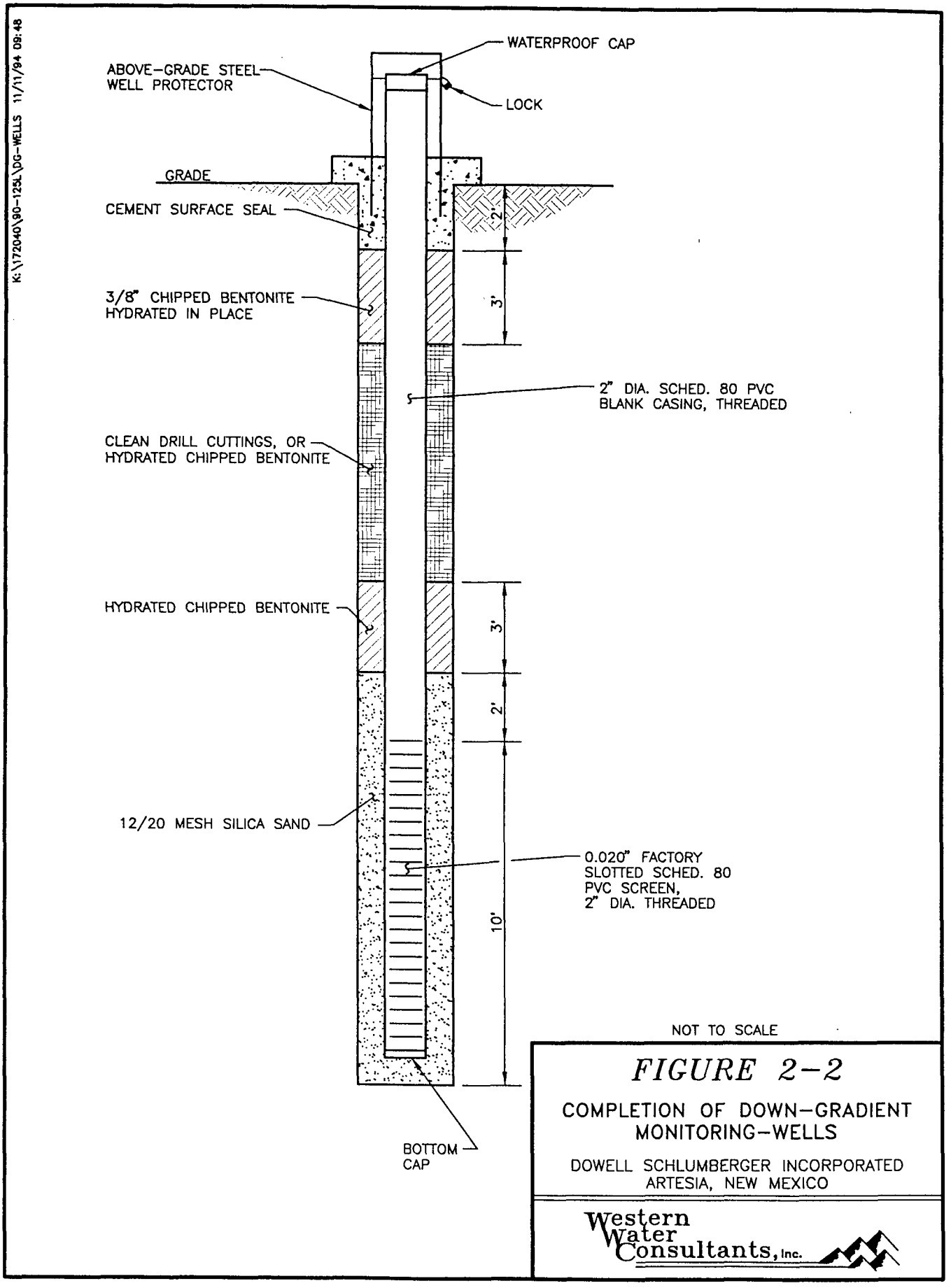

FIGURE 2-2

COMPLETION OF DOWN-GRADIENT MONITORING-WELLS

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The shallowest of the grouped wells will be completed in the uppermost part of the saturated zone from approximately 13 to 18 feet below surface. If an unsaturated zone is detected in the pilot well, the second of the grouped wells will be completed immediately above this zone to evaluate its effectiveness at preventing downward migration of contaminants. Initial estimates are that this zone may be 40 to 45 feet below surface. The third well will be completed immediately below this unsaturated zone, at an estimated depth of 50 feet. If no unsaturated zone is detected in the pilot well above a depth of 50 feet below surface, the second and third wells in the group will be completed at 34 and 50 feet below surface, respectively. The wells will be spaced approximately 5 feet apart. To minimize the potential effects of mobilizing contaminants during drilling, the wells will be situated such that deeper wells are successively down-gradient from the shallowest well.

The first and shallowest of the grouped wells will be drilled and completed in the same manner as the new down-gradient wells, with the exception that only 5 feet of screen will be used (see Figure 2-2). The two deeper grouped wells will be completed by setting and sealing in surface casing prior to drilling into the area to be screened (Figure 2-3). For these two wells, a 10-inch diameter borehole will be drilled to the top of a clay layer approximately 1 to 3 feet above the interval to be screened. Six-inch diameter steel surface casing will be placed in the borehole and pushed 3 to 6 inches into undisturbed clay. The surface casing will be sealed in place with bentonite or cement grout tremied into the bottom of the borehole annulus. All ground water present inside the surface casing will be air-lifted out, and the inside of the surface casing will be washed several times with clean water which will also be air-lifted out prior to further drilling. A 5-inch diameter borehole will then be drilled from the clay at the bottom of the surface casing to the total depth of the well. Five feet of 0.020-inch slotted 2-inch diameter Schedule 80 PVC screen will be threaded to blank 2-inch diameter Schedule 80 PVC casing and inserted inside the surface casing. Washed silica sand (12/20-mesh) will be tremied into place to approximately 1 foot above the top of the screen. The remaining annulus will be filled with bentonite or cement grout tremied into place. Surface completion will be as specified for other new wells.

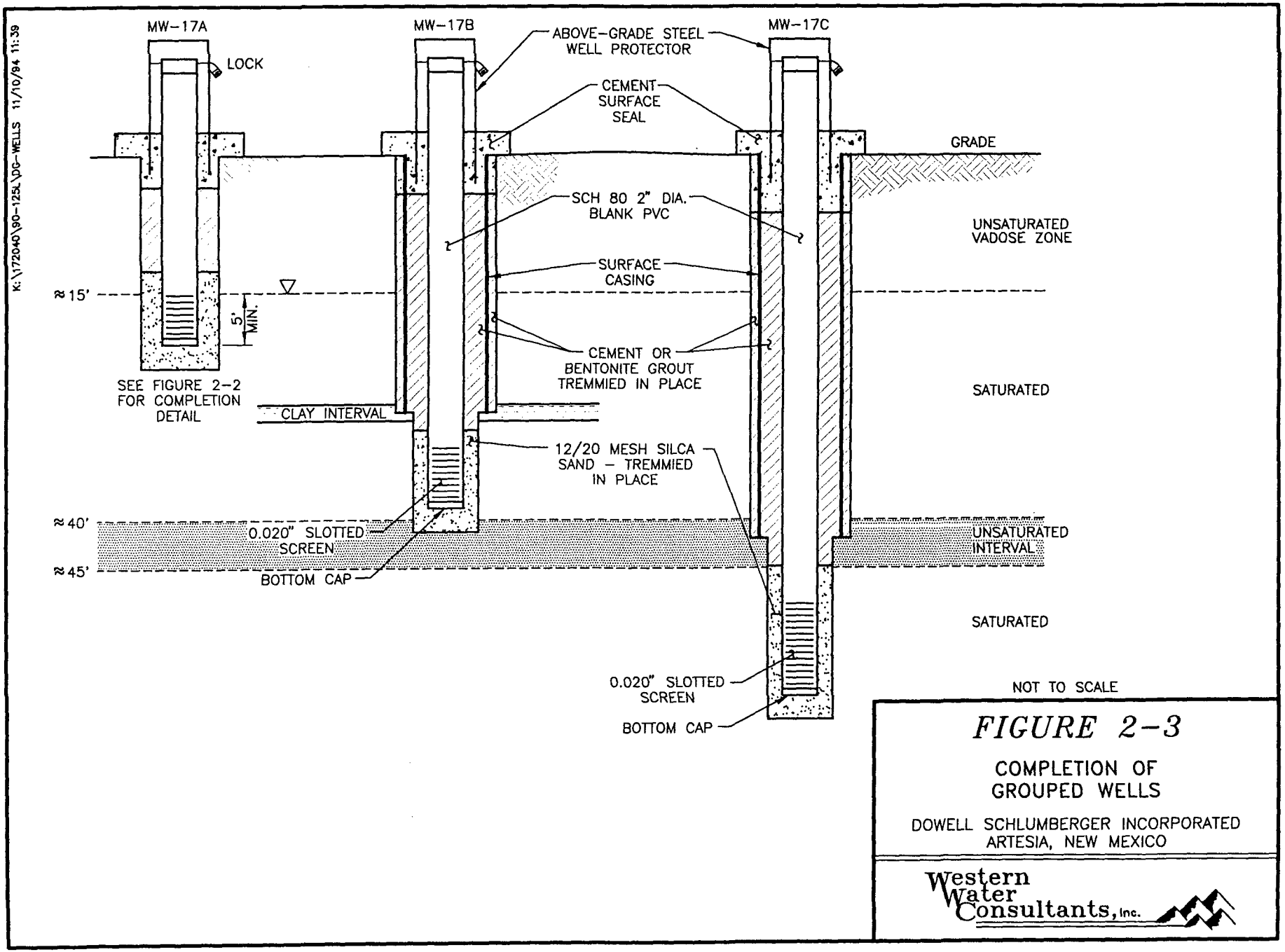

FIGURE 2-3

COMPLETION OF GROUPED WELLS

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All new monitoring wells will be developed by purging a minimum of 10 wellbore volumes from the well using disposable polyethylene bailers. At the discretion of the project geologist, an alternate method of well development such as air-lifting may be used. New monitoring wells will be sampled concurrently with existing monitoring wells during the next regularly-scheduled quarterly ground-water monitoring event in late January 1995.

2.3 Decontamination of Drilling and Sampling Equipment

To prevent cross-contamination, drilling, coring, and sampling equipment will be decontaminated after each borehole, core interval, or sample. Drill bits and pipe will be decontaminated using a high-pressure wash. A wash-bay is available in the northeast corner of the Dowell facility or the drilling contractor may furnish his own wash equipment. Core barrels or split-spoon samplers and soil sampling equipment will be scrubbed in buckets with clean tap water and a soap such as Simple Green or trisodium phosphate (TSP). The final rinse for coring and sampling equipment will be with distilled water.

2.4 Drill Cuttings and Development Water

Drill cuttings and ground water generated during development of monitoring wells will be properly handled and disposed. Contaminated drill cuttings, identified by visual examination and photoionization detector (PID) screening, will be segregated from uncontaminated cuttings. Contaminated cuttings will be stored temporarily in bermed, plastic-lined storage areas pending disposal arrangements. Uncontaminated cuttings will be used to backfill portions of the monitoring well annulus or will be scattered on the ground surface adjacent to the well. Development water will be transported onto Dowell property where it will be poured into galvanized steel stock tanks covered with chicken wire, and allowed to evaporate.

2.5 Logging and Soil Sampling

Each monitoring well boring will be continuously cored to provide accurate information about the subsurface geology, hydrology, and extent of contamination. Cores will be logged by a WWC geologist for grain size and sorting, color, moisture, structure, and presence or absence of hydrocarbon contamination. Soil samples for field headspace analysis will be collected from

each cored interval to screen for the presence of volatile hydrocarbons in the soil. The headspace samples will be analyzed using a PID. In each well borehole, one soil sample for laboratory analysis will be collected from the most contaminated interval as indicated by field PID screening, or from the interval immediately above the saturated zone if no contamination is identified with the PID. Soil samples will be analyzed for volatile hydrocarbons by EPA Method 8240 and for total petroleum hydrocarbons by modified EPA Method 8015 gasoline range. Soil samples will be handled and documented in the same manner as described for ground-water samples in Chapter 3.0 of this work plan.

2.6 Surveying Well Elevations and Locations

The relative ground-surface and top-of-casing elevations will be surveyed for each new well, and the elevations tied to WWC's temporary benchmark at the northeast corner of the maintenance shop building. This temporary benchmark has the arbitrary elevation of 100.00 feet. The top-of-casing elevation will be measured on the north side of the PVC casing and will constitute the measuring point elevation used to measure the depth to water and to calculate the elevation of the water table. The well locations will be determined through surveying or through direct measurement from established landmarks, whichever is appropriate.

2.7 Reporting

An investigation report will be presented to NMED - Groundwater Protection and Remediation Bureau within 60 days after the January 1995 quarterly sampling event. The report will include descriptions of the field activities during drilling of the new wells, tabulation of all soil and ground-water laboratory data, maps illustrating the placement of the new wells, well logs, results of the on-going well survey in a 2-mile radius of the facility, and discussion as appropriate.

3.0 MONITORING

3.0 MONITORING

Ground-water monitoring of the newly-installed wells will include static water level measurements, and collection and analysis of water quality samples. The initial sampling event will occur in late January 1995, concurrent with quarterly sampling of the existing monitoring wells. This will allow adequate time for the new wells to equilibrate with the aquifer after development. Experience has shown that a two to three week period of equilibration is necessary for obtaining initial ground-water samples which are representative of water quality.

Prior to bailing and sampling the monitoring wells, static water levels will be measured from the surveyed measuring point elevation for each well using an oil-water interface probe. This instrument will detect free-phase hydrocarbons if they are present in the well. To minimize cross-contamination between wells, the probe will be decontaminated with distilled water if no product is detected and with a detergent/water wash if product is present. For the same reason, the sequence of measurement will be from least to most contaminated wells.

Using dedicated disposable polyethylene bailers, three well volumes of water will be purged from each well prior to collection of ground-water samples for laboratory analysis. Purge water will be placed in on-site galvanized steel stock tanks covered with chicken wire and allowed to evaporate.

Ground-water samples will be collected, sent to a Denver, Colorado laboratory and analyzed for volatile organics by EPA Method 8240. Sample collection will follow typical industry practices and WWC protocols, which include sample labelling and documentation, immediate placement of samples into a cooler with ice, preparation of chain-of-custody documents, and prompt shipment or delivery to the analytical laboratory. As each well is sampled, field measurements of ground-water temperature, conductivity, pH, and dissolved oxygen will be collected.

It is proposed that the January 1995 quarterly monitoring event include analyses for major dissolved inorganic cations (sodium, potassium, calcium, magnesium, and iron) and anions (chloride, sulfate, carbonate, and bicarbonate). These analyses should be conducted on a one-time basis from all new and existing monitoring wells. The analytical results may provide useful

additional data for defining the ground-water flow system at the facility and for evaluating remediation alternatives.

4.0 PROPOSED SCHEDULE

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The following is the proposed schedule of activities for this additional well installation and sampling described herein:

- drilling and well development - as soon as drilling arrangements can be made after receipt of approval of this work plan from NMED;
- initial sampling of the new wells - late January 1995 concurrent with quarterly sampling of all site monitoring wells;
- subsequent sampling - concurrently with quarterly sampling of other monitoring wells at the facility.

For the newly-installed wells, quarterly monitoring will be conducted for one year to provide a sufficient database from which to determine if additional work is necessary.

REFERENCES

REFERENCES

Fielder, A. G., and Nye, S. S., 1933, Geology and ground-water resources of the Roswell artesian basin, New Mexico: United States Geological Survey Water-Supply Paper 639.

Welder, G. E., 1983, Geologic framework of the Roswell ground-water basin, Chaves and Eddy Counties, New Mexico: Technical Report 42, New Mexico State Engineer, Santa Fe, New Mexico, 28 p.