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OUR JOB 86012

# FINAL REPORT

# EXTENT OF GROUNDWATER DEGRADATION

# JENSEN AND WEST

# FRESNO, CALIFORNIA

BSK & Associates

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February 9, 1987 OUR JOB 86012

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SUBJECT: FINAL REPORT
EXTENT OF GROUNDWATER DEGRADATION
JENSEN AND WEST
FRESNO, CALIFORNIA

Dear Sir:

This report transmits the results of our current investigation to date for completion of the groundwater portion of this project. The reports contains conclusions regarding the lateral and vertical extent of groundwater degradation.

If you have any questions or comments in this regard, please do not hesitate to contact us.

Respectfully submitted,
BSK and Associates


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cc: City of Fresno, Dan Trafican
City of Fresno, Joe Sallee

Enclosures

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JENSEN AND WEST
FRESNO, CALIFORNIA

## ITEM 1. STATEMENT OF THE ISSUE

### Introduction

The City of Fresno operates a landfill at Jensen and West in Fresno, California. The landfill is currently nearing closure. Under the Subchapter 15 regulations for landfills in the State of California, a groundwater monitoring program is required in conjunction with the landfill. The initial groundwater monitoring program, installed by BSK and Associates, indicated the presence of contamination within close proximity of the landfill at the initial groundwater contact.

Pursuant to this determination of the presence of contamination, additional wells have been installed to further delineate the lateral and vertical extent of contamination. In conjunction with this phase of the work, four clusters of three permanent wells, each 50', 100' and 150' deep have been constructed. The purpose of the well clusters has been primarily with regard to the vertical extent of contamination. In addition, a series of temporary wells were constructed at succeeding horizontal intervals away from the landfill to assist in the determination of the lateral extent of contamination.

The following outline is intended to report on the status of the project as of the completion of this report:

### Outline for Geotechnical Investigation (Adapted from RWQCB)

I. QUALITY ASSURANCE PROGRAM

a. Description of program which includes a description of procedures used for sampling, sample preservation, chain of custody, chemical analyses, use of split and spiked samples, and data reduction. Explain any deviations from recommended U. S. Environmental Protection Agency methods.

Completed __X__ Partially Completed _____ Not Completed _____

b. Detection limits of analyses.

Completed __X__ Partially Completed _____ Not Completed _____

II. WASTE CHARACTERIZATION

a. Develop a list of contaminants of concern. Include a discussion of methods used to determine them. Include literature references and/or the results of sampling and analyses and rationale for selection of the contaminants.

Completed __X__ Partially Completed _____ Not Completed _____

b. Establish quantity of contaminants to be investigated.

Completed __X__ Partially Completed _____ Not Completed _____

III. GEOLOGY AND HYDROLOGY OF THE AREA

a. Soil Types

Completed __X__ Partially Completed _____ Not Completed _____

b. Existence of clay layers or aquitards

Completed __X__ Partially Completed _____ Not Completed _____

c. Ground water occurrence (confined, unconfined, perched).

Completed __X__ Partially Completed _____ Not Completed _____

d. Depth to groundwater. Historical fluctuations.

Completed __X__ Partially Completed _____ Not Completed _____

e. Groundwater gradients.

Completed __X__ Partially Completed _____ Not Completed _____

IV. LATERAL AND VERTICAL EXTENT OF CONTAMINANTS IN SOILS

a. A description of the work accomplished to identify contaminants and their limits.

Completed __X__ Partially Completed _____ Not Completed _____

b. Supporting data to determine extent of contaminants (location of borings, sampling interval, sampling and analysis data, etc.)

Completed __X__ Partially Completed _____ Not Completed _____

c. Identification of lateral and vertical boundaries of contaminants in soils including contaminant concentrations. Include relationships of soil contaminants to normal and maximum ground water elevations.

Completed __X__ Partially Completed _____ Not Completed _____

d. Identification of explosive potential.

Completed __X__ Partially Completed _____ Not Completed _____

V. LATERAL AND VERTICAL EXTENT OF GROUND WATER DEGRADATION

a. A description of the work accomplished to identify the extent of plume of ground water degradation.

Completed __X__ Partially Completed _____ Not Completed _____

b. Supporting data used to define the extent of degradation (well locations, well construction data, sampling and analysis, etc.)

Completed __X__ Partially Completed _____ Not Completed _____

c. Identification of vertical and lateral boundaries of the plume of degradation including determined contaminant concentrations. This section should include the rationale for location of the plume boundaries.

Completed __X__ Partially Completed _____ Not Completed _____

VI. CLEANUP OF SOIL CONTAMINATION

a. Establish criteria for soil contamination cleanup. Determine background levels and action levels set by regulatory agencies.

1. Explosive potential

Completed __X__ Partially Completed _____ Not Completed _____

2. Groundwater contamination through leaching or rise in groundwater table.

Completed __X__ Partially Completed _____ Not Completed _____

b. Establish extent of cleanup based upon lateral and vertical extent of contamination previously defined and cleanup criteria previously defined.

Completed __X__ Partially Completed _____ Not Completed _____

c. Establish method of cleanup.

Completed __X__ Partially Completed _____ Not Completed _____

d. Establish time schedule of cleanup

Completed _____ Partially Completed _____ Not Completed __X__

e. Establish cost estimate of cleanup

Completed _____ Partially Completed _____ Not Completed __X__

f. Implement cleanup program.

Completed _____ Partially Completed __X__ Not Completed _____

g. Establish cleanup completed.

Completed _____ Partially Completed __X__ Not Completed _____

h. Post-cleanup monitoring

Completed _____ Partially Completed __X__ Not Completed _____

VII. CLEANUP OF GROUNDWATER DEGRADATION

a. Establish criteria for groundwater degradation cleanup. Determine background concentrations and action levels set by regulatory agencies.

Completed __X__ Partially Completed _____ Not Completed _____

b. Establish extent of cleanup based upon lateral and vertical extent of contamination previously defined and cleanup criteria previously defined.

Completed __X__ Partially Completed _____ Not Completed _____

c. Establish method of cleanup.

Completed _____ Partially Completed __X__ Not Completed _____

d. Establish time schedule of cleanup

Completed _____ Partially Completed _____ Not Completed __X__

e. Establish cost estimate of cleanup

Completed _____ Partially Completed _____ Not Completed __X__

f. Implement cleanup program.

Completed _____ Partially Completed _____ Not Completed __X__

g. Establish cleanup completed.

Completed _____ Partially Completed _____ Not Completed __X__

h. Post-cleanup monitoring

Completed _____ Partially Completed _____ Not Completed __X__

Facility Description

The City of Fresno Landfill is an approximate 90 acre site located on West Avenue between Jensen and North Avenues. It is located in Township 14 South, Range 19 East, Section 19. The landfill is bounded on the east and west by primarily agricultural property and on the north and south by primarily residential property.

The landfill dates from the 1930's. It was the first sanitary landfill operation in the United States. The landfill pioneered the concept of burial of refuse with daily cover in cells, as opposed to open burning dumps prevalent at that time frame.

At the time of its inception, the landfill was primarily located north of Annadale Avenue. The depth of burial was about 10 to 15 feet below the surrounding terrain. The landfill was subsequently expanded to an area south of Annadale Avenue. The depth of the pit was increased substantially in this area, to about 35 feet below the surrounding grade. The landfill has been constructed below grade in primarily an open vertical cut; this puts the edge of the landfill materials quite close to the property lines.

The crossing of Annadale Avenue include the burial of the irrigation ditch which previously ran down Annadale. The ditch was converted to a concrete pipe, buried in undisturbed soils, and the landfill was expanded.

The surrounding terrain is quite flat and contains large areas of surface irrigated agriculture. In the past, problems with drain water accumulation have occurred near the landfill, particularly on the north end of the west side. The area along West Avenue, approximately at the previous intersection with Annadale, also represents an area of poor drainage from the standpoint of stormwater runoff.

The Fresno Colony Canal passes in close proximity to the landfill. It is located east of West Avenue.

The landfill reaches a maximum point about 60 feet above the surrounding terrain. At this time, the landfill is very close to closure and final cover has been or will be applied soon.

A landfill expansion was proposed in the 1970's. However, this expansion was never constructed.

## Previous Work

The U.S. Geological Survey performed testing of a well approximately one quarter mile from the landfill in conjunction with their investigation of water quality in the Fresno-Clovis metropolitan area. The well is designated as 14S/20E-A1. The results of these water quality tests are given in a later report section.

In addition, the USGS has determined pertinent information regarding aquifer properties within the vicinity of the landfill. The information is summarized below.

TABLE I: GENERAL AQUIFER PROPERTIES

| Location | Gradient Direction | Specific Yield % | | | Permeability gals/day/sf | | | Gradient ft/ft |
|---|---|---|---|---|---|---|---|---|
| | | 0'-50' | 50'-100' | 100'-200' | 0'-50' | 50'-100' | 100-200' | |
| T14S, R19E | W, SW | 10.7 | 12.5 | 13.2 | 538 | 682 | 740 | 0.0011-0.0 |

At the time the deep pit south of Annadale was constructed, Twining Laboratories was retained to evaluate the permeability and separation characteristics between the base of the deep pit and the groundwater table. Their report, dated July 14, 1971, indicated the presence of three non-permeable strata of soil to separate solid waste from groundwater. Based upon this information and the regulations enforced at the time in question, the pit was used for disposal of solid waste.

A report for a potential landfill expansion was prepared by CH2M/Hill, dated December 16, 1975. The report addressed the agricultural property immediately adjoining the deep pit area south of Annadale. The report concluded that there was no potential for degradation of groundwater quality as a result of historical operation of the existing disposal site. It was concluded that the presence of low permeability clays beneath the disposal site expansion and the lack of deep percolation of precipitation indicate that there should be no degradation of groundwater quality from future operations of the disposal site as proposed.

BSK and Associates was retained in 1983 to provide an initial assessment of potential groundwater contamination and methane gas migration. The groundwater assessment included the installation of five groundwater monitoring wells on the edge of the landfill, as well as one background well. The wells were installed to sample the first contact with groundwater. The wells detected contamination in excess of State standards for drinking water adjoining the landfill and a more comprehensive program, to determine the lateral and vertical extent of contamination, was undertaken.

The methane gas migration has been partially addressed by the installation of a cutoff trench on the north and south sides of the landfill near the adjoining residential properties.

The detailed work completed to date as it pertains to groundwater includes:

-the installation of 6 initial groundwater monitoring wells. These monitoring wells include both upgradient and downgradient sampling locations at the edge of the landfill. The locations of the wells are shown on Figure 1. These monitoring wells draw water samples from the approximate 50 foot depth.

-the performance of general mineral analyses on the samples obtained from the 6 groundwater monitoring wells. These data are summarized in Appendix "A".

-the determination of the general groundwater gradient and soil permeability. The general groundwater gradient under the landfill has been determined to be 1 foot in 1200 feet in the direction from east to west. The permeability of the upper aquifer has been determined to be between 1 and 3 feet per day. This yields an anticipated groundwater flow, disregarding irrigation pumping, of 1 foot per year.

-the performance of general mineral and EPA 601 series groundwater analyses on the 6 groundwater monitoring wells as well as the residence immediately north of the landfill. The results are shown in Appendix "A".

-the performance of general mineral, EPA 601 and Title 22 organics testing on samples from the 6 on-site monitoring wells and 10 surrounding domestic wells. The domestic wells were also tested for bacteriological contamination. The results are shown in Appendix "A".

-the performance of general mineral, 601 and Title 22 organics on a surface water sample taken from immediately adjacent to the landfill on the south side as shown on the Site Plan, Figure 1.

-the installation of 4 additional well clusters around the landfill. Each well cluster consists of 3 wells sampling from nominally 50, 100 and 150 feet from the existing ground surface. Two of the well clusters are substantially upgradient of the site and two are in close proximity downgradient.

-the installation of 19 additional temporary wells at succeeding intervals of 50 to 100 feet away from the landfill. These wells sampled from the first groundwater contact. The groundwater was tested for volatile organics in accordance with the EPA 601 series.

Work completed by others to date includes;

-groundwater analyses of residences south of the landfill along North Avenue. The State Department of Health has taken samples from domestic and irrigation wells from the residences between 2100 W. North and 2188 W. North. Their analyses have included general minerals and volatile organics. These test data are shown in Appendix "A".

-groundwater analyses of Well-1, installed by BSK, sampled by the Regional Water Quality Control Board, and tested by Radian Corporation. The results are shown on Appendix "A".

## ITEM 2. MONITORING NETWORK

### Regional Geology

The surface soils are classified as oxidized older alluvium of Quaternary Age. The soils were deposited as alluvial fans of internittent streams north of the Kings River. The Older Alluvium of Pleistocene and probable Holocene Age, outcrops in most of the area. The Older Alluvium is mostly coarser grained than the underlying deposits and may be divided into oxidized and reduced deposits. The Regional Geologic Map is shown on Figure 3.

A deep section through the site would show that the oxidized Older Alluvium extends to a typical depth of 500 feet. The Older Alluvium is comprised of numerous interbedded layers of sand, silty sand, silt and occasional clays. The sand aquifers appear to be fairly continuous and are largely interconnected throughout most of the Fresno area.

Within the Central Valley, the principal clay strata separating deep groundwater regimes is the E-Clay or Corcoran Clay. The E-Clay or Corcoran Clay does not extend as far east as Fresno.

Below the Older Alluvium and extending to the basement complex are Continental Deposits of Quaternary and Tertiary Age. The upper portion of the Continental Deposits generally contains fresh water, with brackish water expected at a depth of about 1500 feet.

The basement complex is likely composed of igneous and metamorphic rocks and occurs at a depth of about 4500 feet.

Regional Geohydrology

The Fresno area uses groundwater for municipal and agricultural purposes. The depth to domestic wells may be quite shallow, with numerous older wells on the order of 100 to 150 feet deep. Typical high capacity agricultural wells would be about 200 to 300 feet deep.

The fact that the major confining clay strata (A-Clay through E-Clay) do not extend to the site indicate that the site contains one large aquifer system. The Fresno area is considered to contain a single, sole source aquifer.

The State Department of Water Resources maintains records for water levels in wells. The following summarizes the recent historical trends for groundwater levels near the site based upon State records, using an assumed ground surface elevation of 265.

TABLE II: HISTORICAL RECORDS ON GROUNDWATER LEVELS

| Date | Groundwater Elevation | Groundwater Depth, feet | Groundwater Gradient |
|---|---|---|---|
| Spring, 1985 | 220 | 45 | NW |
| Fall, 1984 | 222 | 43 | WNW |
| Spring, 1984 | 222 | 43 | WNW |
| Fall, 1983 | 221 | 44 | WNW |
| Spring, 1983 | 218 | 47 | WNW |
| Fall, 1982 | 218 | 47 | WNW |
| Spring, 1982 | 218 | 47 | WNW |
| Fall, 1981 | 213 | 52 | WNW |
| Spring, 1981 | 213 | 52 | W |
| Spring, 1980 | 220 | 45 | WNW |
| Fall, 1979 | 215 | 50 | WNW |
| Spring, 1979 | 216 | 49 | WNW |
| Fall, 1978 | 209 | 56 | WNW |
| Spring, 1978 | 210 | 55 | WSW |
| Fall, 1977 | 200 | 65 | WNW |
| Spring, 1977 | 213 | 52 | W |
| Spring, 1963 | 215 | 50 | NW |

The historical trends indicate a relatively stable groundwater table varying from 45 to 65 feet deep, with a tendency to rise in recent years. The gradient is relatively stable, ranging from west to northwest in direction.

Groundwater quality in the area is generally considered to be good, with the exception of nitrate problems associated with agricultural usages. The groundwater is considered to be of calcium magnesium bicarbonate type. The following table summarizes the results of previous tests on a well, one quarter mile from the site.

TABLE III: GROUNDWATER QUALITY
WELL 14S/20E-19A1

| | |
|---|---|
| Date | 7-63 |
| pH | 7.7 |
| Calcium mg/l | 81 |
| Magnesium mg/l | 18 |
| Sodium mg/l | 27 |
| Potassium mg/l | 7.3 |
| Sulfate mg/l | 18 |
| Chloride mg/l | 48 |
| Fluoride mg/l | 0.2 |
| Nitrate mg/l | 25 |
| Boron mg/l | 0.08 |
| Silica mg/l | 74 |
| Alkalinity mg/l | 283 |
| Total Dissolved Solids mg/l | 437 |
| Hardness mg/l CaCO3 | 276 |

## Soil Profile

The soil profile encountered a highly variable subsurface condition. The soil strata were typically thin and likely discontinuous over large areas, particularly in the shallow subsurface profile.

The soil types ranged from silty sand to clayey sand to silt to clay to sand. Because of the oxidized nature of the alluvium, there were occasional zones of cementation encountered. Above the contact with groundwater, the soil types tended to the more fine grained soils, whereas larger zones of sand aquifers were encountered below the groundwater table. The presence of a single large aquifer below the site, however, was not confirmed by the test holes. A portion of the deep wells encountered very minimal amounts of sand aquifer materials, making well development and sampling difficult.

For more detailed descriptions of the soil profile, the test well and test hole logs, given in Figures 7 through 35, should be consulted.

## Groundwater Occurence

The shallow groundwater monitoring wells installed in 1983 (W-1 through W-6) indicated that the depth to first groundwater was typically 45 to 50 feet at the site. In addition, the permeability, as determined by borehole permeability tests, was determined to be between 1 and 3 feet per day. The gradient was determined to be about 1 foot in 1200 feet from east to west.

Subsequent temporary monitoring wells (300-series, 400-series, 500-series and 600-series) have encountered groundwater at depths varying from 35 feet to 55 feet.

The permanent cluster monitoring wells (UW-1, UW-2, DW-1 and DW-2) have indicated piezometric levels of 47 to 49 feet below grade.

## Rationale for Location of Groundwater Wells

The first set of groundwater monitoring wells were installed immediately adjacent to the landfill. A total of 5 wells were installed to sample the first groundwater at the site. In addition, a single background well was installed at about 600 feet away from the landfill. The wells near to the landfill were all within 10 feet of the edge of the landfill. The locations were selected as contamination is most frequently found in landfill environments on top of the groundwater table immediately adjacent to the landfill. As a result of the findings of the initial monitoring program, additional groundwater monitoring was required.

The second monitoring period was primarily monitoring of existing domestic or agricultural wells on sites within one mile of the landfill. The wells which were tested were selected for testing by the Fresno County Health Department. The monitoring indicated that the presence of contamination was in close proximity to the landfill. Additional monitoring wells in close proximity to the landfill were required.

The third monitoring well sequence was a series of cluster wells to determine the extent of contamination defined in the first two phases of the work. Initially four well clusters were installed, with provision for additional clusters. The results of the wells would be intended to determine the lateral and vertical extent of contamination. The original locations were based upon the assumption that contamination would decrease with distance from the landfill.

During the initial stages of the cluster well testing program, it became apparent that the original assumption (declining contamination with distance away from the landfill) was not valid. Instead, there was an increase in contaminants away from the landfill for a certain distance. Due to the expense of the cluster well installation, it was decided that temporary wells would be installed to determine the lateral extent of contamination for this phase of the work and that the additional permanent cluster wells would be installed at some time in the future.

## ITEM 3. MONITORING WELL TECHNOLOGY

### Permanent Groundwater Well Construction

The permanent single groundwater monitoring wells (W-1 through W-6) were installed using hollow stem auger from a truck mounted Mobile B-53 drilling rig. The wells were drilled to a depth of 10 to 20 feet below groundwater entry and the single monitoring well was installed through the hollow stem augers prior to extraction of the augers.

The permanent cluster groundwater monitoring wells were drilled with a truck mounted, CME 75 drilling rig using an 11 inch diameter rotary wash and bentonite drilling methods. Each well location consisted of a three well cluster. The depth of well screens is at 0 to 20, 50 to 70, and 100 to 120 feet below the zone of groundwater entry. As the depth to groundwater is typically 45 to 50 feet, the wells are at nominal depths of 50, 100 and 150 feet.

In the three well cluster, the wells were installed within a single deep well with appropriate grouting to seal off the various layers.

Figure 5 contains the monitoring well design for the typical cluster well.

### Temporary Well Construction

The temporary wells were drilled with 8 inch diameter hollow stem auger from a truck mounted CME-75 or a track mounted Mobile B-40 drill rig. The test well was drilled to a point about 10 feet below first groundwater entry. The water level in the augers were allowed to stabilize and a sample of the water was bailed from the hole with a teflon bailer. The hole was grouted shut on completion.

### Groundwater Well Materials

The well casing diameter is 2 inches. The bottom 10 to 20 feet is 0.020 inch, machine slotted, Schedule 40 PVC pipe. All pipe joints are threaded. The remainder of the well casing is threaded, 2 inch diameter Schedule 80 PVC pipe. The drilled hole diameter is nominally 8 to 11 inches.

The gravel pack consists of nominal 8 mesh sand, washed and processed. The gravel pack extends from the bottom of the well screen to a point 5 feet higher than the top of the screen.

## Groundwater Well Backfill and Seals

After completion of the gravel pack, the remainder of the hole was filled with grout and a locking cap was provided at the ground surface.

In the multiple well cluster, the gravel pack is first set around the deep well screen. Grout is tremied into the hole until the top of the grout reaches the lower portion of the second well gravel pack. The grout is allowed to harden overnight. The second well screen is then inserted, gravel pack is added to a point 5 feet above the well screen, and grout is tremied into the hole until the top of the grout reaches the third sampling location. At that point the grout is allowed to harden overnight. The third well screen is inserted into the hole, the hole is gravel packed to a point 5 feet above the screened portion of the hole and the remainder of the hole is grouted to the ground surface.

The principal problem which has been associated with this type of deep multiple well installation has been cave in of the upper hole while the lower grout hardens. In that case, the hole is cleaned out again by using the drill steel to recirculate drill fluid to the bottom of the hole.

## Groundwater Well Development

The wells were developed using compressed air. The development continued until visually clear water was observed from the hole. As it is not possible to determine the amount of flow from the first water entry zone, it was necessary to charge the shallow holes hole with potable water on occasion to facilitate the well development.

## Dedicated Pumps

The cluster wells were installed with dedicated pumps to facilitate sampling. The dedicated pumps are Well Wizard brand, 1.75 inch diameter bladder pumps. The bladders and internal components of the pumps are comprised of teflon and stainless steel. The bladders are actuated by compressed air through a controller box, the compressed air does not come into contact with the sample.

In the other permanent wells, a similar pump was used for obtaining the sample. However, as the pump was not dedicated, a cleaning procedure was required between locations.

## ITEM 4. GROUNDWATER SAMPLING, STORAGE AND PRESERVATION

### Shallow Permanent Wells Groundwater Sampling

The following procedures were used in obtaining field samples from permanent wells without dedicated pumps (W-1 through W-6):

Equipment Checklist

Portable air compressor____
Well Wizard pump___
Controller Box___
Portable electrical conductivity meter____
Well depth probe____ Tank of clean water____
Portable pH meter____ Portable thermometer___
EPA 601 sampling vials____
Title 22 Organics sampling bottles___
Metals sampling bottles____
General minerals plus inorganics sampling bottles____
Pencil or waterproof marking pen____ Notebook____
Styrofoam ice chest___ Blue ice for ice chest___

Procedure

1. Measure static water level in well with reference to top of well casing to 1.0 inch accuracy using well depth probe. Also measure stickup of top of casing above surrounding grade.

2. Disassemble and completely clean out pump and flush tubing with clear water. Reassemble pump and wash down exterior. Lower pump in hole. Turn pump on.

3. At intervals of about ten minutes, take readings of electrical conductivity, pH, and temperature. Record the readings on the accompanying table. Use deionized water to clean out field measuring devices. Deionized water is in pH sampling kit.

4. When readings have reasonably stabilized, take samples. Each bottle contains a test specific conditioning reagent; therefore do not attempt to condition bottle by swirling water prior to sampling. Simply fill all bottles. Fill the glass vials so that the meniscus is above the top of the vial; when cap is placed on vial, carefully examine the vial to see that no air bubbles are present. The remainder of the sampling bottles (brown glass, quart plastic, pint plastic, or 4 ounce plastic) should contain a small amount of air at the top of the sample.

5. Shut off pump. Remove pump from hole.

6. Mark all samples. Keep independent sample record on following worksheet.

7. Store samples in styrofoam container during the day. Do not allow samples to be in water directly. Keep samples cool, constant temperature. Avoid vigorous shaking.

8. Arrange for testing laboratory to receive samples on same day as taken. Make copy of data sheet for your personal files. Attach the original of this document to the laboratory test request form. Fill out chain of custody forms.

## Permanent Cluster Wells Groundwater Sampling

The following procedures were used in obtaining field samples from permanent wells with dedicated pumps:

### Equipment Checklist

Portable air compressor____
Controller Box___
Portable electrical conductivity meter____
Well depth probe____ Tank of clean water____
Portable pH meter____ Portable thermometer___
EPA 601 sampling vials____
Title 22 Organics sampling bottles___
Metals sampling bottles____
General minerals plus inorganics sampling bottles____
Pencil or waterproof marking pen____ Notebook____
Styrofoam ice chest___ Blue ice for ice chest___

Procedure

1. Measure static water level in well with reference to top of well casing to 1.0 inch accuracy using well depth probe. Also measure stickup of top of casing above surrounding grade.

2. Connect controller box. Turn pump on.

3. At intervals of about ten minutes, take readings of electrical conductivity, pH, and temperature. Record the readings on the accompanying table. Use deionized water to clean out field measuring devices. Deionized water is in pH sampling kit.

4. When readings have reasonably stabilized, take samples. Each bottle contains a test specific conditioning reagent; therefore do not attempt to condition bottle by swirling water prior to sampling. Simply fill all bottles. Fill the glass vials so that the meniscus is above the top of the vial; when cap is placed on vial, carefully examine the vial to see that no air bubbles are present. The remainder of the sampling bottles (brown glass, quart plastic, pint plastic, or 4 ounce plastic) should contain a small amount of air at the top of the sample.

5. Shut off pump. Disconnect controller box.

6. Mark all samples. Keep independent sample record on following worksheet.

7. Store samples in styrofoam container during the day. Do not allow samples to be in water directly. Keep samples cool, constant temperature. Avoid vigorous shaking.

8. Arrange for testing laboratory to receive samples on same day as taken. Make copy of data sheet for your personal files. Attach the original of this document to the laboratory test request form. Fill out chain of custody forms.

Temporary Wells Groundwater Sampling

The following procedures were used in obtaining field samples from temporary wells (300-series, 400-series, 500-series, 600-series):

## Equipment Checklist

Teflon Bailer____
Tank of clean water____
Well depth probe____
EPA 601 sampling vials____
Pencil or waterproof marking pen____ Notebook____
Styrofoam ice chest___ Blue ice for ice chest___

## Procedure

1. Clean hollow stem auger. Drill hole to about ten feet below contact with groundwater table. Measure water level. Allow water level to stabilize.

2. Completely clean out teflon bailer with clear water. Bail out sample.

3. Fill the glass vials so that the meniscus is above the top of the vial; when cap is placed on vial, carefully examine the vial to see that no air bubbles are present.

4. Remove augers and grout hole.

5. Mark all samples. Keep independent sample record on following worksheet.

6. Store samples in styrofoam container during the day. Do not allow samples to be in water directly. Keep samples cool, constant temperature. Avoid vigorous shaking.

7. Arrange for testing laboratory to receive samples on same day as taken. Make copy of data sheet for your personal files. Attach the original of this document to the laboratory test request form. Fill out chain of custody forms.

## ITEM 5. CHEMICAL LABORATORY TESTING

### Contaminants of Concern

The contaminants of concern have generally been established by the Fresno County Health Department. These potential contaminants include the volatile organics as represented by the EPA 601 and general mineral tests. On occasion, constituents such as inorganics, EPA 602, Title 22 organics and EPA 602. In addition, domestic wells have been sampled for bacterialogical contamination.

### Test Methods, Detection Levels and Action Levels

In testing for water or soil contamination, there are several important concepts that should be understood in order to discuss the data. These concepts include background levels, degradation, action levels, detection levels and interference.

Background levels are considered to be the levels present without the influence of the project in question. Usually, the background levels are those levels which are naturally occurring. In some instances, the prior usage of the site or usage of surrounding sites may result in background levels which are not naturally occurring. To a certain extent, all general mineral constituents and metals are naturally occurring. The volatile organics, purgeable halocarbons, and acid or base/neutral extractables are naturally occurring in some instances.

Degradation occurs where the level of a constituent in the soil or water, in an area influenced by the project, exceeds the background level. There are statistical procedures for determing whether the difference is statistically significant; however, the procedures are questionable because of the preponderance of false positives generated by the procedures. State regulations generally do not allow degradation.

Action levels are levels set by the governing agency which may not be exceeded. They are typically set for drinking water, although other levels are set for other purposes (e.g. to distinguish hazardous waste from designated waste). Although state regulations do not allow degradation, it is usually the action levels which are enforced. One complicating factor is that the state of California lists about 1000 items as hazardous but has set action levels for about 100. The EPA has a general set of 129 Priority Pollutants, but has set only a few action levels.

Detection levels are those minimum levels which are measured in the laboratory test. Laboratory tests are to be selected such that, for items which have a defined action level, the detection level is less than or equal to the action level. The nominal detection levels are levels which may be obtained under relatively ideal laboratory conditions, particularly samples which have no interference.

Interference occurs when the level of other materials in the soil or water is so high as to mask the presence of the contaminant of concern.

BSK and Associates is an approved water laboratory by the State of California Department of Health Services for Bacteriology and General Chemical Testing. The testing performed by BSK and Associates on the water samples falls under the heading of inorganic and volatile organic chemical analyses. Brown and Caldwell is an approved water quality laboratory by the State of California for analyses; they have performed tests for BSK during the course of this project.

Chemical tests for alkalinity, arsenic, cadmium, calcium, carbonate, cyanide, chloride, chromium, conductivity, copper, hardness, iron, lead, magnesium, manganese, mercury, nickel, nitrate, pH, potassium, surfactants, thallium, total dissolved solids, selenium, silver, sulfate, and zinc were performed in the BSK laboratory for this project.

All testing under our direction was performed in accordance with the test methods recommended by the U. S. Environmental Protection Agency. The testing included the EPA 601, 602, Title 22 organics, general minerals, inorganics, test series.

Alkalinity and carbonate were tested in accordance with Method 310.1, approved for NPDES. The method is based upon a a titrimetric analysis at a pH of 4.5. The sample is not filtered, diluted, concentrated, or altered in any way. Alkalinity may be a naturally occurring constituent of groundwater.

Ammonia nitrogen was determined in accordance with Methods 350.1 and 350.2, approved by NPDES. Method 350.2 includes the preliminary distillation procedure. Alkaline phenol and hypochlorite react with ammonia to form indophenol blue that is proportional to the ammonia concentration.

Arsenic was determined using method 206.3 approved for NPDES and SDWA. The method determines arsenic through atomic absorption and gaseous hydride. The gaseous hydride method determines inorganic aresenic when present at some concentrations. Arsenic in the sample is first reduced to the trivalent form using SnCl2 and converted to arsine, AsH3, using zinc metal. The gaseous hydride is swept into an argon-hydrogen flame of an atomic absorption spectrophotometer. Arsenic may be a naturally occurring constituent in groundwater. The action level for drinking water is 50 micrograms per liter (parts per billion).

The determination of bacteriological content was made in accordance with method 908a of the Standard Methods for Water and Wastewater. The method is also known as the Standard Total Coliform Multiple-Tube MPN Test Method. Bacteriological content of groundwater may result from principally septic origins and are usually an indicator of a nearby failed septic system.

Chemical oxygen demand was determined in accordance with the 1979 Hach Handbook of Water Analysis, approved by the EPA. The method includes digestion in the COD Digestion Vial and analysis with the colorimeter. The COD Digestion Vial includes sulfuric acid and mercuric salts.

Chloride was determined in accordance with Method 325.2, approved for NPDES. The method is based upon a colorimetric analysis, using automated ferricyanide AAII. Chloride may be a naturally occurring constituent of groundwater.

Conductance was determined using Method 120.1 approved for NPDES. The specific conductance of a sample is measured by use of a self-contained conductivity meter. Results are referenced 25 degrees C. Conductance is a naturally occurring constituent.

Fluoride was determined in accordance with EPA 340.2. This method is potentiometric and ion selective.

Mercury was determined by using Method 245.1 approved for NPDES and SDWA. The method requires a manual cold vapor technique. In addition to inorganic forms of mercury, organic mercurials may also be present. Potassium permanganate is used to oxidize these compounds. Mercury may be a naturally occurring constituent of groundwater.

Nitrogen and nitrate was determined by using Method 353.2 approved for NPDES and SDWA. A filtered sample is passed through a column containing granulated copper-cadmium to reduce nitrate to nitrite. The nitrite (that originally present plus reduced nitrate) is determined by diazotizing with sulfanilamide and coupling with N-(1-naphthyl)-ethylenediamine dihydrochloride to form a highly colored azo dye which is measured colorimetrically. Separate, rather than combined nitrate-nitrite, values are obtained by carrying out the procedure first with, and then without, the Cu-Cd reduction step.

The determination of pH was made according to method 150.1 approved for NPDES. The pH of a sample is determined by an automatic meter. The pH is a naturally occurring constituent of groundwater. The action level on pH, for drinking water, is generally less than 6.5 or greater than 8.5.

Selenium was determined in accordance with Method 270.3, approved for NPDES and SDWA. The method utilizes atomic absorption and gaseous hydride and is applicable to inorganic selenium. Sample preparation includes the conversion of organic forms to inorganic forms, as well as the oxidation of organic matter. Selenium in the sample is first reduced from the +6 oxidation state to the +4 oxidation state by the addition of $SnCl_2$. Zinc is added to the acidified sample, producing hydrogen and converting the selenium to the hydride form, $SeH_2$. The gaseous selenium hydride is swept into the argon-hydrogen flame of an atomic absorption spectrophotometer. Selenium may be a naturally occurring constituent of groundwater.

The determination of sulfate was made using method 375.2-approval pending for NPDES. The sample is first passed through a sodium form cation-exchange column to remove multivalent metal ions. The sample containing sulfate is then reacted with an alcohol solution of barium chloride and methylthymol blue (MTB) at a pH of 2.5-3.0 to form barium sulfate. The combined solution is raised to a pH of 12.5-13.0 so that excess barium reacts with MTB. The uncomplexed MTB color is gray and is equal to the sulfate present. Sulfate may be a naturally occurring constituent of groundwater.

The determination of sulfides was made in accordance with Method 427c of Standard Methods of Water and Wastewater. This method is known as the methylene blue method. Sulfides may be a naturally occurring groundwater constituent or may be a decomposition product from landfills.

Surfactants were tested in accordance with Method 425.1. Surfactants are defined as methylene blue active substances (MBAS). In the test method, methylene blue dye in aqeous solution reacts with anionic type surface active materials to form a blue colored salt. The salt is extractable with chloroform and the intensity of the color produced is proportional to the concentration of MBAS. Surfactants are not typically naturally occurring constituents of groundwater.

Total dissolved solids were determined in accordance with Method 160.2, approved for NPDES. A well-mixed sample is filtered through a glass fiber filter and the residue retained on the filter is dried to constant weight at 103 to 105 degrees C. TDS is a naturally occurring constituent of groundwater. The recommended standard for TDS is 500 milligrams per liter (ppm), with a 1000 level for long term maximum and 1500 for short term maximum.

Barium, cadmium, calcium, chromium, iron, lead, magnesium, manganese, nickel, silver, sodium, and zinc were analyzed in accordance with EPA method 200.7. This method uses an inductively coupled plasma technique in conjunction with atomic emission spectrophotometry. The samples are prepared by the technician and the analysis is performed by a computer controlled Perkin-Elmer ICP unit. A measured sample is injected in the high energy argon plasma, where the energy levels are sufficient to reduce matter to the atomic state. The emission spectra is analyzed for the characteristic spectra of the element desired. The metals may all be naturally occurring constituents of groundwater.

Chemical tests on water samples for purgeable halocarbons have been conducted in accordance with EPA test method 601. An inert gas is bubbled through a 5-mL water sample contained in a specially designed purging chamber at ambient temperature. The halocarbons are efficiently transferred from the aqueous phase to the vapor phase. The vapor is swept through a sorbent trap where the halocarbons are trapped. After purging is completed, the trap is heated and backflushed with the inert gas to desorb the halocarbons onto a gas chromatographic column. The gas chromatograph is temperature programmed to separate the halocarbons which are then detected with a halide specific detector. The compounds tested by this method are similar to the EPA 624 series.

The basic 601 scan includes 29 consitituents, although more may be included. The constituents measured by the 601 method are typically not naturally occurring groundwater constituents. Eight of the 29 basic constituents have state action levels for drinking water, which vary from 0.1 ppb to 200 ppb.

TABLE IV: TEST METHOD EPA 601

| Constituent | Action Level | Detection Level |
|---|---|---|
| Chloromethane | NA | 0.5 ug/l |
| Bromomethane | NA | 0.5 ug/l |
| Vinyl Chloride | 2 | 0.5 ug/l |
| Chloroethane | NA | 0.5 ug/l |
| Methylene Chloride | 40 | 0.5 ug/l |
| Trichlorofluoromethane | NA | 0.5 ug/l |
| 1,1-Dichloroethene | 6 | 0.5 ug/l |
| 1,1-Dichloroethane | NA | 0.5 ug/l |
| trans-1,2-Dichloroethene | NA | 0.5 ug/l |
| Chloroform | 100 | 0.5 ug/l |
| 1,2-Dichloroethane | 1 | 0.5 ug/l |
| 1,1,1-Trichloroethane | 200 | 0.5 ug/l |
| Carbon Tetrachloride | 5 | 0.5 ug/l |
| Bromodichloromethane | 100 | 0.5 ug/l |
| 1,2-Dichloropropane | 10 | 0.5 ug/l |
| trans-1,3-Dichloropropene | NA | 0.5 ug/l |
| Trichloroethene | 5 | 0.5 ug/l |
| Dibromochloromethane | 100 | 0.5 ug/l |
| 1,1,2-Trichloroethane | NA | 0.5 ug/l |
| cis-1,3-Dichloropropene | NA | 0.5 ug/l |
| 2-Chlorovinyl Ether | NA | 0.5 ug/l |
| Bromoform | 100 | 0.5 ug/l |
| 1,1,2,2-Tetrachloroethane | NA | 0.5 ug/l |
| Tetrachloroethylene | 4 | 0.5 ug/l |
| Chlorobenzene | NA | 0.5 ug/l |
| 1,3-Dichlorobenzene | 130 | 0.5 ug/l |
| 1,2-Dichlorobenzene | 130 | 0.5 ug/l |
| 1,4-Dichlorobenzene | 130 | 0.5 ug/l |
| Dichlorodifluoromethane | NA | 0.5 ug/l |

Chemical tests on water samples for purgeable aromatics have been conducted in accordance with EPA test method 602. An inert gas is bubbled through a 5-mL water sample contained in a specially designed purging chamber at ambient temperarure. The aromatics are efficiently transferred from the aqueous phase to the vapor phase. The vapor is swept through a sorbent trap where the aromatics are trapped. After purging is completed, the trap is heated and backflushed with the inert gas to desorb the aromatics onto a gas chromatographic column. The gas chromatograph is temperature programmed to separate the aromatics which are then detected with a photoionization detector.

The basic 602 scan includes 7 constituents, although more may be included. The constituents measured by the 602 method are typically not naturally occurring groundwater constituents. Five of the seven basic constituents have state action levels for drinking water, which vary from 0.7 ppb to 620 ppb.

TABLE V: TEST METHOD EPA 602

| Constituent | Water Action Level | Water Detection Level |
|---|---|---|
| Chlorobenzene | NA | 0.5 ug/l |
| Benzene | 0.7 | 0.5 ug/l |
| 1,2 -Dichlorobenzene | 130 | 0.5 ug/l |
| 1,3 -Dichlorobenzene | 130 | 0.5 ug/l |
| 1,4 -Dichlorobenzene | 130 | 0.5 ug/l |
| Ethylbenzene | 680 | 0.5 ug/l |
| Toluene | 100 | 0.5 ug/l |

The Title 22 Organics are comprised of Endrin, Lindane, Methoxychlor, Toxaphene, 2,4-D and 2,4,5-TP (Silvex). The determination was made in accordance with method 509a, Standard Methods for Water and Wastewater. In this method, the pesticides are extracted with a mixed solvent, concentrated by evaporation, and separated by a gas chromotagraph column. The concentrations are measured on an electron capture detector. The items measured in the Title 22 Organics scan are not naturally occurring cpmounds.

# QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTS

BSK
& Associates

# FIELD DOCUMENTATION AND CHAIN OF CUSTODY

Information pertinent to field activities must be recorded in the following forms to provide proper documentation:

Log Books
Sample Tags or Gummed Label
Photographs
Chain-of-Custody Records

The staff must keep detailed records of field activities. Records must be permanent, and written in waterproof ink. A Document Coordinator must be appointed for each project. The coordinator has the responsibility and custody of all records for the project.

## Log Book

The field log book must consist of a bound book with consecutively numbered pages. The book must be used to enter information pertinent to field activities and must include the following:

Date and time of entry and sample collection.
Nature of work and purpose of sampling.
Name of individual providing sampling.
Name of waste generator.
Type of waste and description of sample.
Waste components, if known.
Number, type and size of samples.
Description of sampling point.
Sample identification number.
Field measurement data (pH, Conductivity, Temperature, etc.).
Miscellaneous field observations and records of photographs.

Log book entries must be initialled and dated by the individual.

## Photographs

Photographs must be numbered and individually documented in the log book. Documentation should include the following:

Date and time when photograph was taken.
Photographer's signature of log book.
Entry, if other than individual preparing the documentation and sampling.
General direction faced in taking photograph and description of subject.
Site location and description.
Photograph sequence and roll designation numbers.

Photographs must preferably be taken with lenses capable of duplicating naked-eye perspective. High telephoto and wide-angle distortion should be avoided.

Sample Tags and Labels

Sample tags and labels must be filled out with waterproof ink. Labels must be affixed to the sample container. If tags are used, the tag string must be secured to the sample container with a tape seal. The label must include the following information:

Date and time of collection.
Sample number or identification.
Label sequence number.
Place of collection.
Preservatives used, if any,

CHAIN-OF-CUSTODY

A chain of possession and custody of samples collected, transferred, stored, analyzed or destroyed must be maintained. The primary objective of the procedure is to create an accurate written record which traces the possession and handling of samples from sampling to its introduction as evidence in the event of litigation. A sample is in someone's custody if one of the following conditions are met:

The sample is in the person's physical possession.
The sample is in the person's view after being in his physical possession.
The sample is in the person's physical possession and then locked-up so that it cannot be tampered with, or the sample is in a secured area, restricted to authorized personnel.

Sample Collection, Handling and Identification

The number of individuals involved in the collection, handling and documentation of samples should be kept to a minimum. Accordingly, the document coordinator should also be the Field Custodian who is charged with the responsibility of collecting, documenting and transporting samples to the point of shipment or to the laboratory.

Sample Transfer

The samples must be placed in transportation cases along with the Chain-of-Custody Record Forms, pertinent field records and analyses requests. The transportation case must be sealed or locked. Individual samples should be sealed at the cap in a way that provides detection of tampering.

When samples are composited over a time period, unsealed samples can be transferred from one crew to the next. The transferring crew lists the samples and a member of the receiving crew signs the list. The receiving crew either transfers the samples to another crew or delivers them to a laboratory person, who signs for the samples.

Transfer of Custody and Shipment

The person transferring the samples must sign and date the Chain-of-Custody Form (See attachment). Custody transfer must account for each sample or group of samples. Every person in the chain of possession must similarly follow the same documentation procedures. Receipts for mailed packages sent by common carrier must be retained as a part of the permanent chain-of-custody documentation.

ATTACHMENT 1

# CHAIN OF CUSTODY RECORD

| PROJECT | SAMPLERS (signature) |
|---|---|
| | |

| Station Number | Sample Designation | Date | Time | Sample Type | | | | No. of Containers | Analysis Required |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Water | | Soil | | | |
| | | | | Comp. | Grab. | Comp. | Grab | | |
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| Relinquished by: (Signature) | Received by: (Signature) | Date/Time |
|---|---|---|
| | | |
| Relinquished by: (Signature) | Received by: (Signature) | Date/Time |
| | | |
| Relinquished by: (Signature) | Received by: (Signature) | Date/Time |
| | | |
| Dispatched by: (Signature) | Date/Time / Received for Laboratory by: | Date/Time |
| | | |
| Method of Shipment: | | |

Distribution: Orig. - Accompany Shipment

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BSK

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GEOTECHNICAL ENGINEERS CHEMICAL LABORATORIES
1414 Stanislaus • Fresno, California 93706
(209) 485-8310

| Client | Date |
|---|---|
| Lab. No. | Sample ID |
| Initials | Time |

Analyze for _____

Perservative: None $CuSO_4/H_3PO_4$

$H_2SO_4$ $HNO_3$ NaOH $ZnAc_2$

## ATTACHMENT 2

## SAMPLE LABEL AND TAGS

# LABORATORY QUALITY ASSURANCE AND CHAIN OF CUSTODY

## I INTRODUCTION

This document outlines the quality assurance program that underlies the values reported for analytical work performed by BSK Laboratories.

### Quality Responsibility

1. Lab Supervisor/Director
2. Chemist Analysts
3. Sample & Record Coordinator & Custodian

### Laboratory Department

1. Inorganic Chemistry
   -Metals (AA-ICP)

   -Nutrients/Anions (Auto Analyzer)
2. Microbiology
3. Organic Chemistry
   -Gas Chromatography

## II QUALITY ASSURANCE ORGANIZATION

### Lab Director/Supervisor

1. The Laboratory Director/Supervisor establishes quality standards.
2. The Laboratory Director/Supervisor is responsible for ensuring that all personnel working in the laboratory follow established standard operational and safety procedures.
3. Checks procedures and ensures good housekeeping practices.
4. Acquaints new personnel with the rules and regulations of the laboratory.
5. Prepares, schedules, assigns, and checks quality assurance samples. Randomly introduces blind control samples to the work performed by the analysts.
6. Insures that samples are properly taken, shipped, preserved, stored and analyzed.

7. Insures that sample log-in and traceability are done correctly.

8. Maintains the quality assurance policy.

Chemist Analysts - Level II

1. Performs analyses and quality control procedures.

2. Documents the quality programs.

3. Assigns responsibilities to and supervise Level I Chemists/Analysts.

4. Reports to Laboratory Director/Supervisor.

Chemist Analysts - Level I

1. Performs analyses and quality programs as specified and supervised by Level II Chemists/Analysts.

2. Documents assigned quality control activities.

3. Performs support functions as specified by Level II Chemist/Analyst or Lab Supervisor/Director.

## III SAMPLE CONTROL

### Sample Receipt

Upon arrival the sample control clerk will inspect each sample for broken or leaking containers and notify the section head to decide if resampling or other appropriate action is required. Information required is client name, job or purchase order number, person requesting the analysis, when samples were collected and received, who collected the samples, sample identification and parameters to be tested. After log in, the samples are stored in general conformance with the guidelines in the Federal Register, Volume 44, No. 244, December 18, 1979.

### Chain of Custody

The purpose of chain of custody procedures is to provide evidence that a sample has not been tampered with. This is achieved by creating an accurate written record tracing the possession of the sample from collection through its final analysis and possible introduction as court evidence. Custody indicates that a sample is either in actual physical possession or locked up to prevent unauthorized access.

## Sample Collection

- Obtain samples using appropriate documented sampling techniques.

- Transfer custody of the samples as little as possible.

- Attach a chain of custody record bottle label to the sample container at the time of sample collection. The label contains information on sample number, date, time, source, analyses required, name of person sampling, and witnesses. The label is signed and dated (including the time) by the sample collector. The sample container is sealed so that the bottle cannot be opened without breaking the seal.

- Field measurements are recorded with ink in a bound field notebook or log. A separate set of field notebooks are maintained and stored in a safe place where they can be accounted for at all times. Entries are signed by the person taking the sample and errors crossed out with one line and initialed.

- The person taking the sample is responsible for the care and custody of the sample and must assure that each container is in his physical possession or view at all times or is stored such that it cannot be tampered with.

When transferring custody the transferee must sign and record the date and time on the chain of custody record tag. The field custodian is responsible for properly packaging and dispatching samples to the laboratory for analysis.

All samples are accompanied by a sample transmittal form which includes information identifying the contents. For further information see "Field Documentation and Chain of Custody".

## Laboratory Procedures for Custody Samples

The lab has a designated locked refrigerator for holding chain of custody samples. A log book is maintained which contains a record of all chain of custody samples received. The information on the chain of custody sample tag is transferred to this log and the person receiving the samples must sign the log book with the date and time of laboratory receipt. Lab analysts are responsible for the care and custody of the sample once it is handed over to them for analysis. The analyst records in his notebook the name of the person from whom the sample was received, whether it is sealed, identifying information, procedures performed, and test results. Analysts must sign and date their notes as a permanent lab record. Once the sample testing is completed, the used portion of the sample along with any identifying tags and seals are returned to a designated locked storage area until they can be discarded.

# IV RECORDS

## Worksheets

Printed worksheets are provided for use by analysts to standardize the format of certain routine analyses.

## Laboratory Notebooks

Each analyst maintains his or her own laboratory notebook which is used to record data and perform calculations for those analyses where worksheets are not provided. The laboratory notebook is also used to document peripherial information not directly required on a worksheet.

## Graphs and Charts

Each analyst is responsible for plotting and filing analytical standard curves. Graphs and charts which are produced as part of a final report are filed with the report. Chemists/Analysts are responsible for maintaining and updating quality control forms for their assigned analyses. These control forms are reviewed and then filed in a central location.

## Inventory Control Logs

Records are maintained on the purchase of laboratory supplies, detailing the vendor, purchase order number, date of order, and date of receipt. Consumable supply forms are also maintained for most analyses to ensure adequate stock inventory and uniformity of supplies. Bottles of reagents are dated as soon as they are received so that the shelf life can be monitored.

## Stock Standard Logs

A log entry is maintained for each analytical stock standard. Each entry contains the date of fresh stock preparation and the results of the comparison between the old and new stocks as outlined in Section VII of this Quality Assurance Document.

## Reagent Standardization Logs

Log entries are maintained for standardized reagents which are not prepared fresh for each run but are instead periodically restandardized. Restandardization is customarily performed once a month and the new standardization factor recorded in the log along with the date and the analyst's initials. More frequent standardization may be required for certain reagents if a consistent quality control problem occurs.

## Media Log and Prepared Media Log

A media log is kept separately from the general inventory log. Upon receipt of new media, the date, the type of media, source of media, and initials of the individual receiving the media are logged into the Media Log. Media supplies are dated not only upon receipt but also when initially opened. A written record of quality control of media, materials, and equipment is logged into the Media Log book. The record includes the results of the check, the initials of the individual performing the check, and the date.

Media prepared in the lab is logged into the Prepared Media Log by the laboratory laboratory analyst. These records include media lot number, date, sterilization time and temperature, final pH, and the analyst's initials.

## Instrument Logs

The operating temperatures of incubators, waterbaths, hot air ovens, and refrigerators are checked daily and logged in the maintenance log book. Adjustments are made when necessary. Autoclave temperatures and pressures are logged in the maintenance log book for each cycle of use. A separate log book is maintained for each analytical instrument. This log contains a record of daily instrument checks which are performed to verify proper functioning of instrument mechanics and to check performance on standards and reagent blanks. The log also contains a record of the dates when routine instrument maintenance is performed, a description of any problems found, and the analyst's initials. If the instrument is not performing according to specifications, the appropriate instrumentation specialist must be called in to perform the necessary repairs.

# V GLASSWARE

Selection of the appropriate glassware cleaning procedure is dependent on the particular analysis a piece of glassware is to be used for.

## Preliminary Cleaning

All glassware is initially washed in a laboratory washer with distilled rinse capability. This glassware should be acceptable for use in analysis of most inorganic constituents in the mg/L concentration range. The surface of adequately cleaned glassware will drain in a uniform thin film. The formation of droplets upon drying is an indication that the glassware is not clean and must be rewashed. Most calibrated glassware such as pipets and graduates should be completely dry and cooled to room temperature before they are put away. Volumetrics are triple rinsed and then filled with deionized water before being put away to maintain the glass in a leached condition.

### Low Level Phosphorous

Glassware to be used for low level phosphorous determinations is soaked in 6N HCL to remove any phosphate detergent residue and rinsed several times with distilled water. A separate stock of glassware is maintained which is not washed with the regular glassware.

### Organic Constituents

Glassware to be used for determination of organic constituents must be baked at 350°C for at least 8 hours in order to remove any remaining organic residue.

### Trace Metals

Glassware to be used for trace metal analyses must be soaked overnight in 4N $HNO_3$ followed by 4-5 deionized water rinses. This glassware is stored separately from the regular glassware and should only be handed with polyethylene gloves.

### Grease

Glassware to be used of determination of oil and grease or any glassware contaminated with grease is soaked in acetone or warm sodium hydroxide followed by an acid rinse and then washed in the usual manner.

### Bacteriological

Glassware to be used in bacteriological analysis is rinsed at lease three times with distilled water which has not come in contact with copper tubing or other toxic material (pvc or stainless steel plumbing is acceptable). All bacteriological glassware must be sterilized with some type of sterilization indicator prior to use. Analyses for toxic or inhibitory residues are performed on a routine basis.

## VI GENERAL ANALYTICAL QC

### Use of Documented Procedures

Routine procedures are documented in our analytical procedures writeups. These procedures were prepared from several approved souces: the 15th edition of Standard Methods for the Examination of Water and Wastewater, the 1979 edition of EPA Methods for the Examination of Water and Wastes, the 1979 edition of the Federal Register, SW 846 (2nd ed.), and California Assessment Manual (1980). If an analyst must deviate slightly from the established procedure because of an unusual matrix problem, these deviations are to be carefully described in the analyst's notebook.

Raw Data and Calculations Clearly Documented for Review

Raw data and calculations are legibly inscribed in the analyst's bench sheet or lab notebook to enable subsequent review by the analyst or his supervisor if an unexpected result or discrepancy arises.

Performance of Daily Instrument Checks and Routine Maintenance

Instrument performance is evaluated before analysis of samples by checking the calibration and evaluating instrument response on a series of standards and a reagent blank. Routine instrument maintenance is also performed periodically.

Verification of Standards

Stock standards have specified holding periods. When a new stock standard is prepared, it must be cross-checked against the old one before it can be used. The old stock standard and a new stock standard of the same concentration are analyzed in triplicate. If the difference between the means of these triplicates is greater than 5 percent, another stock standard is prepared and these three standards are compared. If the old stock standard is suspect, the freshly prepared standard is compared against a known quality assurance sample such as those provided free of charge by EPA. Standards are labeled with the date, concentration, and preparer's initials. Preservatives or special storage procedures which are required to maintain the integrity of a standard are specified in the lab writeup for that procedure.

## VII STOCK STANDARD AND REAGENT HOLDING TIMES

The maximum allowable holding periods for stock standards, working standards and reagents for each analytical procedure are specified in the writeups for those procedures. General guidelines for holding periods for stock standards are listed below:

1) Metal Stocks

>10 ppm - 6 months
1-10 ppm - 60 days
<1.0 ppm - fresh

2) Anions, Nutrients, Cyanide, Phenol, COD Stocks

<100 ppm - 60 days until longer holding times are demonstrated
>100 ppm - fresh

3) Organics

Stock standards are made up 4 times per year and stored in a freezer in the dark.

## Blanks

At least one reagent blank is performed with each set of samples analyzed. For manual non-instrumental analyses such as gravimetry and titrimetry, one reagent blank per set of samples is sufficient unless the sample load is greater than 50. For manual and automated instrumental analyses, a reagent blank should be run after every 10 samples.

## Duplicates

The precision of an analytical method is determined by running 10 percent of the samples in duplicate. Duplicate results are recorded on the quality control form for each analytical run. Duplicate agreeement must fall within the range specified in the method writeup or +/-10 percent if a range is not specified. Samples which are between two unacceptable duplicates must be reanalyzed.

## Spikes

The accuracy of an analytical method is determined by running 10 percent of the samples with a standard spike addition. Spike recoveries are recorded on the quality control form for each analytical run. Spike calculation worksheets are available which take into account the volume dilution effect of the spike and calculate the actual recovery of the spike rather than the recovery of the spike + sample value which could lead to misleading recovery results if the spike value was less than 50 percent of the sample value. All samples falling on either side of an unacceptable spike must be reanalyzed.

## Outside Reference Samples

A known reference sample, such as those available from NBS and EPA, is run with each set of analyses for metals, inorganics, and organics and the true value and measured result are both recorded on the quality control form.

# VIII METHOD SPECIFIC QC

## Gravimetry

Desiccators of sufficient size and limited number of samples are placed in them so that the samples will be at room temperature at the end of the specified drying period.

The temperature of the drying ovens is maintained within the specified limits of the required drying temperature.

A regular maintenance program for the analytical balance is maintained by checking with Class S weights to make sure it is property calibrated.

If the working range of the method is exceeded, the procedure is repeated because the amount of residue will be so great that it is likely that water will be entrapped and not completely driven off during the drying period.

## Titrimetry

The basic equipment employed in a titrimetric procedure is a buret. This piece of glassware is properly cleaned and maintained to insure that the titrant drains out of the buret without leaving drops. If the buret is dirty, cleaning is provided by soaking in a Nochromix solution until it drains properly.

Care is taken to titrate every sample to the sample endpoint. This is usually best achieved by comparing the color of the sample currently being titrated with the color of the previously titrated sample. Some titrations have fading endpoints. In such instances, completion of titration is carried out as rapidly as possible.

Include a primary standard solution with each set of samples or at (weekly) intervals, whichever is less frequent, to ensure that the titrant has not changed strength.

A standard is analyzed along with every set of samples to verify the accuracy of the end-point determination.

## Colorimetric Spectrophotometry

A minimum of four standards, equally spaced over the concentration range is used to calibrate a spectrophotometer in the absorbance mode.

A record is maintained of the absorbance readings for each set of standards run. Subsequent standard absorbance values must be within 10 percent of the previous documented values. If they are not, a problem exists whether with the performance of the spectrophotometer or the accuracy of the standard solutions. Determination of the source of error and corrective action is taken before samples are analyzed. A gradual decrease in absorbance values from week to week is probably indicative of a deteriorating standard or the initial stage of lamp failure.

The rate of color development and color stability of spectrophotometric procedures varies considerably. The allowable time interval for reading the absorbance of the sample is specified in the procedure and is adhered to in order to obtain accurate results.

The stability of the spectrophotometer is checked by measuring a blank and a calibration standard after every tenth sample. If baseline drift has occurred or the standard absorbance value has changed by more than 2 percent, recalibration of the instrument and reanalysis of samples analyzed since the last acceptable calibration check is performed. If the color complex is unstable, sufficient standards are prepared in the order in which they will be read so that a standard can be inserted after every tenth sample.

Some water samples have a natural color or turbidity which absorbs appreciably at the wavelength used in the analysis. If the sensitivity of a procedure is sufficiently high, it is usually possible to minimize this interference by diluting the sample. If the sensitivity is not adequate to permit sample dilution, the turbidity or color interference is corrected for by reading the absorbance of the sample carried through the procedure with the exception of the addition of the indicator reagent. This absorbance reading is then subtracted as a blank from the absorbance reading of the sample.

Atomic Absorption/Inductively Coupled Emission Spectrophotometry

A record of the sensitivity of each element for a particular instrument is kept in order to detect deficiencies in the instrument or operating conditions.

Each time the instrument is calibrated, the absorbance/emission readings are recorded. If subsequent standard readings differ by more than 10 percent from the previous readings, a problem exists either with the operations settings, the performance of the instrument, or the accuracy of the standard solution. Corrective action is taken before analyzing the samples. A gradual change in the standard absorbance readings from day to day is usually indicative of an instrument malfunction.

Reagent blanks followed by a calibration standard are run for each metal determined with a frequency of 10 percent and the sample values are corrected for baseline drift. If there is a difference of over 2 percent from the initial standard reading, the instrument is recalibrated and all samples that were analyzed after the last acceptable calibration check are reanalyzed.

If the recovery of a spiked sample is not within +/-10 percent of the expected value, the sample is analyzed by the method of standard addition. When using the method of standard additions, a linear curve over the entire range of addition is necessary for the results to be considered valid.

At least one known reference sample is analyzed with every run to verify the accuracy of the results. The value of the reference material should fall within 1.5 standard deviation of the theoretical value. If it does not, corrective action is taken and samples analyzed since the last acceptable reference value are reanalyzed.

Sample matrices must be evaluated to insure that the emission wavelength is free from spectral interferences. Background correction is programmed for wavelengths displaying matrix interference.

Gas Chromatography

For all analyses, a laboratory water blank is analyzed to check for artifacts from the GC system and for the presence of impurities in the water blank making it unsuitable for standard preparation.

A field blank should be analyzed for each set of field samples taken. With each set of travel blanks sent out, a stationary travel blank is kept in the laboratory to demonstrate that the water sent out was free of contamination.

A standard curve is run once a week. These curves are used for comparison with the daily calibrations. A record of each standard curve is kept in the GC Instrument Log.

Standards are analyzed daily for each routine analysis. Standards are extracted along with the samples to ensure adequate recovery. Proper instrument sensitivity and stability are determined by comparison of performance with earlier weekly calibration curves. Significant deviations from previous quantitation curves not directly attributable to instrument adjustment requires running a complete new set.

Duplicates and spikes for assessing precision and accuracy are determined by carrying the duplicates and spikes through the extraction procedure as well as the instrumental analysis.

A record of the average internal area count for each analysis set utilizing an internal standard is kept in the GC Instrument Log.

### Odor Analysis

Odor is one of the most important measurements for the consumer since it is most readily noticed.

1. All glassware for odor analysis is acid washed, baked and rinsed two times before daily use.

2. Glassware used for a sample is not used more than once without acid washing and baking if a TON of 40 or greater is measured.

3. Odor-free water is prepared fresh each day and an odor analysis is run.

4. Between samples glassware is rinsed with odor-free water prepared by passing deionized water through carbon.

5. An odor-free water blank is carried through with each set of samples analyzed.

6. At the beginning of a series of odor analyses, four randomly chosen flasks are carried through the procedure as blanks. If any of these have a noticeable odor, the entire lot is checked and the rejected flasks rewashed.

7. At least one sample per day is analyzed in duplicate on two different runs.

## IX QUALITY ASSURANCE EVALUATION

### Quality Control Forms

Quality control procedures are available for most routine analyses. Each analyst is provided with procedures covering his or her area of responsibility. Forms are available for metals, titrations, and inorganic analyses.

The information required on the QC forms are the results of duplicates, spikes, external QC, blanks, dates of stock and working standards, statistical evaluation of the calibration curve (linear regression), and specific data on instrument settings and parameters. Every analyst is required to complete a QC form with each analytical run and submit the complete form for review. Approved forms are then filed in a central location to provide a permanent record of quality control.

The acceptable limits for the duplicates, spikes, and blanks recorded on these forms are specified in most of the method writeups. If specific limits are not specified, the following default values are used:

80 - 120 percent spike recovery

10 percent agreement on duplicated

blank values <10 percent of sample values

external QC within the acceptance range provided with the standard (usually 2 standard deviations)

Evaluation of Linear Regression Data

1. The absolute value of the intercept must be 10 percent of the lowest sample value.

2. The range of standard concentrations must cover the range of the samples.

3. Any sample value above the top standard must be diluted and rerun.

4. The correlation coefficient must be at least 0.996.

5. The concentration of the external QC standard must be within the range of sample concentrations.

Evaluation of Sample Preparation Error

1. The accuracy of sample preparation or dilution is checked by running at least one standard through the identical procedure.

2. If a run contains a large number of dilutions, duplicates are run on separate dilutions.

Evaluations of In-house Blind Check Samples

Check samples are purchased from outside laboratories and submitted as blind samples to the analysts. All results from these check samples are kept in a central quality control file maintained by the Laboratory Director. Unacceptable performances are investigated and the cause of the problem solved before any additional samples can be analyzed.

## Consistency Check of Sample Analytical Parameters

Wherever a sample is analyzed for enough analytical parameters to allow for internal consistency checks of these parameters, the checks are to be made (e.g.) are the values for total constituents greater than dissolved constituents; is the TKN value greater than the $NH_3$ value, etc). If these internal consistency checks are not met, the sample is reanalyzed until consistency is achieved.

## Cation-Anion Balance

Whenever a sample is analyzed for enough parameters to perform a cation-anion balance (Ca, Mg, Na, K, Cl, $SO_4$, $NO_3$, F, Alkalinity), the balance is checked to insure that it falls within a range of ±2 percent. The percent error is calculated in accordance with the guidelines developed in Standard Methods. Five percent is the balance criteria used for samples with milliequivalent sums greater than 15. Should the balance exceed these limits, a series of remedial measures are undertaken. The first measure is to recheck the original data sheets to be sure that the poor balance is not due to clerical or arithmetic errors. If not, the conductivity and cation-anion results are compared in order to determine the most likely erroneous test results. The original test run is then rechecked and the sample reanalyzed for that parameter. If this does not solve the balance discrepancy, all the parameters are reanalyzed and the individual tests check by different analytical methods where possible.

BSK & ASSOCIATES

# SAFETY PROGRAM MANUAL

# FIELD AND LABORATORY STUDIES IN HAZARDOUS ENVIRONMENTS



BSK & Associates

## INTRODUCTION

Understanding and following the safety program detailed in this manual is required of all BSK & Associates personnel. This manual is to be used by all personnel associated with hazardous environments. A registration card at the back of the manual is to be filled out by each individual and filed with the Office Manager.

## POTENTIAL HAZARDS

Investigation of hazardous environments typically require rigorous precautions including wearing special protective clothing and breathing apparatus. Some of the hazards which personnel may encounter at the work site include:

- Toxic substances
- Explosive materials
- Corrosive materials
- Heat stress
- Oxygen deficient air
- Carcinogens
- Flammable substances
- Noise
- Biologically active materials such as fungi, bacteria, and viruses
- Radioactive materials

The type of hazard to your person depends on the type of substance and length and degree of exposure with potential for:

- Asphyxiation
- Cancer
- Damage to internal organs
- Skin disease
- Loss of sight
- Poisoning
- Infertility
- Loss of limbs
- Loss of hearing

## GENERAL SAFETY

In addition to the dictates of common sense, all the lab field personnel should be aware of the following while on-site:

- Any weather changes. For example, when it gets hot or the air is calm, chemical concentrations in the air can increase. This may require additional protection.

- Wind direction. For example, avoid dust and vapors by working upwind if possible.

- Odors that may indicate the presence of chemicals.

- The location of someone who can help if an emergency arises.

- Laboratory decontamination procedures, including cleaning and storing or disposing of contaminated equipment and clothing. Personnel can expose family or friends to toxic substances by carrying contaminants on clothing, shoes, tools, etc.

- Washing hands BEFORE eating, drinking, smoking, or using the restroom.

- Showering (when required) and changing into clean clothes and depositing work clothes in the proper area before leaving the work site.

- Keeping food, drinks, smoking materials, and personal care items in clean areas only.

- Heavy equipment operating near personnel.

- The proper handling of drums and other equipment so as to prevent personal injury.

- The need for proper personal protection equipment and its limitations.

- Emergency procedures and the evacuation signal.

## PERSONAL PROTECTIVE EQUIPMENT

The type of protective equipment required will depend on the substances to be handled, the existing conditions, and the particular situation. Personal protective equipment includes a variety of protective clothing, hard hats, goggles, face shields, aprons, boots, gloves, respirators. Each is designed to protect personnel from certain hazards. Knowledge of the ADVANTAGES AND LIMITATIONS of all the equipment required is important.

### Protective Clothing

Protective clothing is used to shield personnel from toxic chemicals, and/or corrosive materials. Such clothing is usually disposable and includes splash suits, fully encapsulating suits, and chemical-resistant clothing. Some clothing is designed to allow personnel to work in hazardous environments by completely enclosing the body, while other clothing is designed only to protect specific portions of the body. Proper rest and cool-down periods, with replacement of body fluids and salts, should be provided when protective clothing is worn during summer or in hot conditions.

### Splash Protection and Associated Clothing

Splash suits and associated protective clothing are worn to keep hazardous materials from contacting the body. Such clothing may include: gloves, boots, aprons, goggles, hoods, and coveralls made chemically resistant materials. Different combinations of protective clothing can provide the level of protection necessary for each situation. Follow instructions of the

supervisor regarding protection. Know where the emergency eye wash and showers are located and how to use them. If eye wash and showers are not available, then a source of running potable water must be provided. IMMEDIATELY GET DECONTAMINATED IF HAZARDOUS MATERIALS SPILL OR SPLASH ON YOU.

## Fully Encapsulating Suits

Fully encapsulating suits are usually worn to protect the body against exposure to airborne concentrations of highly toxic or corrosive chemicals. (Atmosphere-supplying respirators MUST BE WORN WITH THESE SUITS.) Different suits will be required for different situations because no suit is resistant to all chemicals. Due to the specialized nature of this equipment, its use requires special training and experience, including plans for rescue and escape from the suits themselves, should this become necessary.

## Respirators

Respirators protect personnel from breathing hazardous airborne contaminants. They must be properly selected, filled, and maintained. Most important, personnel must know their proper uses and limitations. Exposure to high concentrations of toxic substance, even for a short time, can cause serious injury or death. Exposure to low concentrations of certain toxic substances can cause permanent damage to the lungs, liver, kidneys, or other organs. Work environments can be fatal if the oxygen content of the air is too low. There are two basic categories of respirators: Air-purifying respirators and atmosphere-supplying respirators.

## Air-Purifying Respirators

Air purifying respirators are designed to remove specific contaminants from the air before inhalation. Some contaminants cannot be removed by air-purifying respirators. Air-purifying respirators are NOT to be used in situations which are immediately dangerous to life or health or when the contaminants are unknown. Proper selection of an air-purifying respirator depends on:

- The contaminant to be removed from the air.
- The concentration of that contaminant.
- The efficiency of the respirator against that contaminant.

There are two types of air-purifying respirators:

- Filtering purifiers to remove dust, mists, and fumes.
- Sorbent purifiers to remove gases and vapors.

The contaminants and their expected concentrations must be known before a decision can be made as to the type of facepiece to use and which cartridge is required.

The cartridge should be replaced at least once per day to prevent saturation of the filter or sorbent materials. Air-purifying respirators should only be used against contaminants with "warning properties" (odor, irritation, etc.). If personnel becomes aware of these, they should immediately go to a clean area to check the respirator and replace the cartridge, if necessary.

## Atmosphere-Supplying Respirators

Atmosphere-supplying respirators supply air to the facepiece from a uncontaminated (clean) air source. Respirators come in two basic types:

- Air-line respirator, which provides clean air to the face mask through a connecting hose from a large tank of compressed air or an air compressor located in a clean area.

- Self-contained breathing apparatus (SCBA), which provides clean air to your facepiece from an air cylinder carried on your back. These respirators are used in the positive-pressure mode during situations which are immediately dangerous to life or health or in unknown atmospheres. Additional special training is required for their proper use and maintenance. Since this air supply is portable, it has only limited capacity, depending upon particular breathing requirements. When approximately 5 minutes of air remain stop work and leave the contaminated area immediately. Proceed to a clean area to obtain a full cylinder.

## Respirator Guidelines

A qualified person should be available at the work site to identify safety and health hazards, establish the proper level of respiratory protection, and assist in the selection and filling of respirators.

Beards and certain facial hair are not permitted because they may affect the acceptable seating and sealing of the respirator, allowing contaminated air to seep in. Be sure to have the respirator properly fitted.

Safety glasses or regular glasses with goggles can be used with facepieces. Contact lenses are not permitted with any type of full-face respirator. Daily care and maintenance of the respirator, including proper storage in a clean area, should be a regular part of the operation.

# RESPIRATORY PROTECTION PROGRAM

Laboratory personnel exposed to airborne contaminants will be fitted with a half-face respirator using qualitative isoamyl acetate tests as evaluation criteria. A selection of such masks is made available, and a written record of results of the fitting tests and the equipment issued is kept. Personnel are allowed to select from half-face respirators with which they can meet the seal criteria.

Personnel are informed of the respirator's capabilities and limitations and are made responsible for the cartridge and filter replacement at prescribed intervals (when indicated by odor penetration or change in inhalation effort). A record of all replacement parts is kept.

Non-disposable respirators are cleaned after each use. Respirators are employee specific. Upon removal, they are placed in a plastic bag lined container. Respirators are washed in a dishwasher and air dried.

## STANDARD OPERATING PROCEDURE
## RESPIRATOR FIT TESTING USING ISOAMYL ACETATE

1. Facepieces equipped with organic vapor cartridges will be used for this test.
2. The test shall be performed in an area where no noticeable air movement is observed.
3. An open bottle of isoamyl acetate is used as the test substance.
4. Prior to testing, the test subject will be exposed to a very light concentration of the isoamyl acetate to assure that he can detect the odor.
5. The test subject will don the respirator, and a visual inspection of the facepiece to face seal will be made by the tester. An obvious leak in the facepiece to face seal shall be reason to abort the test and record that mask as unsatisfactory. Expression of discomfort created by the mask shall also be reason to abort the test.
6. The bottle of isoamyl acetate will be moved slowly around the entire sealing surface of the respirator worn by the test subject. The mouth of the bottle should be no closer than 3" nor farther than 6" from the sealing surface. The test shall be performed first with the test subject sedentary, then with the subject performing head and face movements (i.e., talking, moving head side to side and up and down). Leakage at any time shall be cause to terminate the test.

Any indication of detection of the odor by the test subject during fitting indicates a failure of that respirator. If leakage is detected, the subject shall be removed from the test atmosphere and the facepiece to face seal visually inspected for obvious leakage. If any doubt about the condition of the respirator or the cartridges exists, another like respirator shall be tested to assure that the leakage was due to facepiece to face seal.

## MECHANICAL EQUIPMENT SAFETY

When drilling on site, handling containers, or removing contaminated soils, etc., a variety of types and sizes of mechanical equipment may be used. It is important to be continually aware of this equipment. Operators may be unable to see personnel working near their equipment. When working around heavy equipment:

- Never walk under suspended loads.
- Never walk in front or back of moving heavy equipment.
- Always be aware of heavy equipment location.
- Always wear a hard hat and proper foot protection.
- Be aware that equipment can be a source of ignition for flammable or explosive materials.

Heavy equipment is not the only potential hazard during material handling. Numerous smaller items such as pumps, compressors, generators, portable lights, drums, trucks, and hand tools are very common at hazardous waste sites. If not properly operated, these items can pose as serious a hazard as larger equipment. Some points to remember:

- Be sure all machine guards are in place.
- Always keep loose clothing away from moving parts.
- Never pump flammable material with gasoline or electric pumps, use only hand or air-powered diaphragm pumps and be sure to ground your equipment and bond the containers.
- Use only nonsparking tools and be sure to ground equipment and containers when working in a flammable atmosphere or transferring flammable liquids.
- Be aware of the types of fittings on pumps and hoses. For example, acid and caustic will rapidly corrode aluminum.
- Check fluid levels (oil, fuel) periodically. Never add fuel to equipment while it is running.

## HEAT STRESS

The stress of working in a hot environment can cause a variety of strains on the body, including heat exhaustion or heat stroke; the latter can be fatal.

Personal protective equipment can significantly increase heat stress. Personnel should learn to recognize the symptoms of heat stress and take necessary actions when they occur. To reduce or prevent heat stress, frequent rest cycles to cool down and replace body fluids and salts lost through perspiration may be necessary. Some of the symptoms which indicate heat exhaustion are:

- Clammy skin
- Light-headedness
- Slurred speech
- Rapid pulse
- Weakness, fatigue
- Confusion
- Fainting
- Nausea (vomiting)

If these conditions are noted, take the following actions in the order given:

- Take the victim to a cooler and uncontaminated area.
- Remove protective clothing.
- Give water to drink, if conscious.
- Allow to rest.

Symptoms that indicate heat stroke include:

- Staggering gait
- Hot skin, temperature rise (yet may feel chilled)
- Incoherent, delirious
- Mental confusion
- Convulsions

If heat stroke conditions are noted, take the following actions in the order given:

- Take victim to a cooler and uncontaminated area.
- Remove protective clothing.
- Give water to drink, if conscious.
- Cool the victim with water, cold compresses, and/or rapid fanning.
- Transport the victim to a medical facility for further cooling and monitoring of body functions. HEAT STROKE IS A MEDICAL EMERGENCY.

## CONTAMINATION/DECONTAMINATION

When working with hazardous wastes, it is important to establish and maintain "clean" areas at the site. Materials found in contaminated areas should be confined to specific "hot" zones whenever possible. Special decontamination zones and procedures should be used to help control the movement of hazardous materials from the "hot" zone.

Personnel should be familiar with all decontamination procedures at the work site and follow them carefully. After removing contaminated clothing, personnel should change into clean clothing in an uncontaminated area. Contaminated clothing or equipment should not be taken home because they could expose others to hazardous materials. Clothing, tools, and equipment should be decontaminated and stored or disposed.

If spills or splashes occur while personnel are in a contaminated area, proceed immediately to the decontamination area and correct the problem. Personnel may have to obtain clean protective clothing before returning to the contaminated area to continue work.

## EMERGENCY GUIDELINES

It is important that a telephone be available, along with the necessary phone numbers for medical and other emergency services (for example, paramedics, fire, and police departments). Emergency first aid equipment and medical personnel, or someone who knows how to provide emergency first aid, should always be present and readily available at the work site. Instructions for the fastest route to the nearest hospital or medical facility should be available, along with necessary transportation.

If a team member has been contaminated with a hazardous substance, TELL THE SUPERVISOR. Personnel should know the general symptoms of over-exposure to toxic substances. These include:

- Irritation of skin, eyes, nose, throat, or respiratory tract.
- Changes in complexion or skin discoloration.
- Headaches.
- Difficulty in breathing.
- Nausea.
- Dizziness or light-headedness.
- Excessive salivation (drooling).
- Lack of coordination.
- Blurred vision.
- Cramps and/or diarrhea.
- Changes in behavior patterns.

You should always know the location of emergency eyewash and shower facilities when available.

Before personnel enter, and periodically while they are working in confined spaces such as tanks or ditches, the air in the space should be tested for oxygen content, explosive levels of gases, and contamination.

When personnel are wearing a respirator (SCBA) in an atmosphere which is immediately dangerous to life or health, at least one additional person MUST be present with a similar respirator to help in case of an emergency. Visual or verbal contact from a safe area must be maintained with those individuals at all times.

Understand the site emergency rescue procedures and know the location of rescue equipment before the need arises. If you must rescue someone, use caution and the proper protective equipment. DO NOT BECOME A CASUALTY YOURSELF.

Move the affected person from the hazardous exposure if possible. Get help if needed and follow emergency rescue procedures.

## MEDICAL SURVEILLANCE PROGRAM

Medical surveillance defines the requirements and responsibilities to insure that all field personnel on hazardous waste sites obtain appropriate medical monitoring. The program will allow the doctor to:

- Determine a base-line picture of health against which future changes can be measured.
- Identify any underlying illnesses or conditions which might be aggravated by certain exposures or job activities.
- Recognize any abnormalities, toxic reactions, or other changes in health at the earliest opportunity - so that corrective measures can be taken.

# MEDICAL SURVEILLANCE FOR LABORATORY PERSONNEL PARTICIPATING IN HAZARDOUS WASTE SITE VISITS

The purpose of this program is to define those requirements and responsibilities to insure that all team members visiting hazardous waste sites obtain appropriate medical surveillance. This program applies to all personnel who may be exposed to hazardous substances while making visits to hazardous waste sites.

## BASELINE HEALTH ASSESSMENT

Personnel who may be required to work at or visit a hazardous waste site shall be provided a baseline health assessment. This assessment will investigate existing conditions which would predispose personnel to illness due to exposure to hazardous substances, or to the physical demands of using personal protective equipment. This assessment should include but not be limited to the following items:

- Work history
- Family history
- Laboratory analyses
- Medical history
- Physical examination
- Pulmonary function tests

## PERIODIC HEALTH ASSESSMENTS

The Laboratory Director shall insure that all personnel whose work involves visits to hazardous waste sites are provided periodic health assessments. The frequency, content, and documentation of these assessments shall be determined by the Laboratory Director. A medical examination shall be provided for any personnel who has had a change in his/her health status, e.g., heart ailment. The purpose of these periodic assessments is to screen personnel for signs of occupational exposure to toxic agents and to determine the suitability of the personnel for subsequent work assignments. Information from these assessments is to be correlated with all on-site monitoring data which may have been collected. The periodic assessment is not intended to provide a routine comprehensive medical evaluation of the employee's overall health. The periodic health assessment shall contain at least the following items:

- Names or chemical categories of hazardous substances to which the employee may have been exposed. This information must trigger specific evaluations for fertile or pregnant females.
- Estimates of probability, frequency, extent, and concentrations of exposures;
- Physical examination;
- Laboratory analyses of body fluids;
- Evaluation of pertinent functional systems of the body; and
- Annual pulmonary function testing.

# CRITERIA FOR THE BASELINE HEALTH ASSESSMENT

Medical monitoring shall include occupational, medical, and family histories, a screening physical examination, basic blood and urine laboratory tests, pulmonary function tests, and a physician's evaluation. The medical examination should be supplemented by procedures and special tests only as warranted by exposure to specific significant hazards or stresses.

Following the examination, the employee shall be advised of findings and urged to seek medical attention if indicated. Provisions should be made for repeating tests when necessary.

Each individual shall receive a basic panel of blood counts and chemistries to evaluate blood-forming, kidney, liver, endocrine, and metabolic functions. The following blood tests are considered to minimum desirable:

- White blood cell count, differential cell count, and platelet estimate
- Hemoglobin and/or hematocrit
- Albumin, globulin, and total protein
- Total bilirubin
- Serum glutamic oxalacetic transaminase (SGOT)
- Lactic dehydrogenase (LDH)
- Inorganic phosphate
- Alkaline phosphatase
- Calcium
- Phosphorus
- Uric acid
- Creatinine
- Urea nitrogen
- Cholesterol
- Glucose

Each employee shall have a routine urinanalysis which includes:

- Specific gravity
- Microscopic examination
- Acetone
- Albumin
- pH
- Protein
- Glucose

Pulmonary function testing is a requirement of the baseline medical examination. Annual pulmonary function retesting is mandatory for those employees working at hazardous waste sites. At a minimum, the tests shall include lung ventilation evaluations of forced expiratory volume in one second (FEV1) and forced vital capacity (FVC).

Periodic chest x-rays shall not be performed as a routine measure. They should be obtained only when clinically indicated by other testing procedures, e.g., pulmonary function testing. A baseline chest x-ray should be a standard 14 x 17 inch P-A (posterior-anterior) exposure. However, no baseline chest x-ray shall be obtained if the employee has had one within the past three years. That record shall be obtained from the former examining physician, radiologist, or hospital. All films shall be read or reviewed by a board-certified radiologist or other competent medical specialist.

Employees who visit hazardous waste sites with known contaminants may need special tests in addition to those outlined above. Special tests may be advised for employees who risk significant exposure to the chemical or physical agents which follow:

| SUBSTANCE | RECOMMENDED SPECIAL TESTS |
|---|---|
| Acrylonitrile | Chest X-ray, fecal occult blood, proctosigmoidoscopy |
| Inorganic arsenic | Chest X-ray, sputum cytology |
| Asbestos | Chest X-ray, pulmonary function |
| Benzene | Reticulocyte count |
| Coke oven emissions | Chest X-ray, pulmonary function, sputum cytology, urinary sediment cytology |
| Cotton dust | Pulmonary function |
| Dichlorobromopropane | Sperm count (male, serum follicle simulating hormone, serum luteinizing hormone, serum total estrogen (female) |
| Inorganic lead | Blood lead, peripheral blood smear morphology, blood zinc protoporphyrin |
| Noise (above 85 dB) | Audiometry |
| Organophosphate pesticides | Blood cholinesterase |

The physician should determine the need for special tests after reviewing an employee's form and consulting with health and safety coordinators.

Employees should be advised that medical monitoring examinations are not substitutes for general check-ups or other periodic examinations which monitor overall health. Medical monitoring is designed to screen for evidence of health problems which may be aggravated by or occur as a result of exposure to hazardous substances. The examinations do not necessarily provide a comprehensive health evaluation; neither do they provide significant screening for all common non-occupational disorders.

## SUMMARIZED ELEMENTS FOR A SAFE WORK PLAN

1. A proper identification and quantification of the materials to be handled.

2. A constant surveillance of the work environment (for example, a knowledge of weather conditions, contaminant levels, and fire/explosion potential).

3. The necessary protective equipment available and properly maintained (that is, both the personal protective equipment and the engineering equipment to provide protection from and/or isolation of the hazard).

4. An appropriate medical surveillance program, including a record of pre-employment conditions and work-related exposures.

5. A fire and spill emergency control plan.

6. A proper decontamination program (that is, a method of preventing unnecessary worker exposure and eliminating migration of contaminants from the site).

7. A comprehensive site work plan.

8. A communication/safety program which keeps track of everyone on-site and provides for medical, emergency, and/or community contacts.

9. A site security plan for properly designating and controlling access to and exit from contaminated, decontaminated, and safe areas.

You CAN work safely at a hazardous waste site if you are informed of the hazards involved, receive the necessary training, follow the proper procedures and/or instructions, use the required personal protective equipment, and remain aware of the conditions or situations around you at all times.

## ITEM 7. FINDINGS

### Results

The groundwater monitoring wells were set out to distinguish three separate areas: shallow background water quality (UW-1 at 50', UW-2 at 50', W-6), deep background groundwater quality (UW-1 at 100', UW-1 at 150', UW-2 at 100', and UW-2 at 150'), the effect of the landfill on shallow groundwater quality (Wells 1, 2, 3, 4, 5, DW-1 at 50', DW-2 at 50') and the effect of the landfill on deep downgradient wells (DW-1 at 100', DW-1 at 150', DW-2 at 100', DW-2 at 150' and 1653 W Jensen). The following table gives the range of general constituents found in each of the three areas.

TABLE VI: COMPARISON OF UPGRADIENT AND DOWNGRADIENT GROUNDWATER QUALITY

| Constituent (Standard) | Shallow Background | Deep Background | Shallow Downgradient | Deep Downgradient |
|---|---|---|---|---|
| Alkalinity ppm | 90-2523 | 91-387 | 525-1000 | 161-488 |
| Arsenic (0.050) ppm | ND-0.002 | 0.002-0.007 | 0.001-0.013 | 0.001-0.002 |
| Barium (1.0) ppm | 0.06-9.44 | 0.06-0.14 | ND-0.95 | 0.09-0.20 |
| Bicarbonate ppm | ND-490 | 62-472 | 640-1220 | 197-595 |
| Cadmium (0.010) ppm | ND | ND | ND-0.010 | ND |
| Calcium ppm | 22-611 | 20-91 | 120-210 | 33-96 |
| Chemical Oxygen Demand ppm | ND | | ND-16 | 8.9 |
| Chloride ppm | 1-62 | 7-69 | 21-74 | 20-31 |
| Chromium (0.05) ppm | ND | ND-0.02 | ND-0.06 | ND |
| Conductivity ppm (900/1600/2200) | 212-13,370 | 229-1164 | 1079-1974 | 453-1118 |

TABLE VI(cont): COMPARISON OF UPGRADIENT AND DOWNGRADIENT GROUNDWATER QUALITY

| Constituent (Standard) | Shallow Background | Deep Background | Shallow Downgradient | Deep Downgradient |
|---|---|---|---|---|
| Fluoride (1.4-2.4) ppm | ND | | ND | |
| Hardness (180) ppm | 93-1525 | 64-419 | 478-914 | 155-430 |
| Iron (0.03) ppm | 0.06-0.18 | 0.09-0.75 | 0.06-1.15 | ND-0.86 |
| Lead (0.05) ppm | ND-0.02 | ND-0.007 | ND-0.02 | ND |
| Magnesium ppm | ND-10 | 3.3-47 | ND-95 | 16-46 |
| Manganese (0.05) ppm | 0.03 | | ND-1.97 | |
| Mercury (0.02) ppb | ND-0.03 | ND-0.2 | ND | ND-0.02 |
| Nitrate (45) ppm | 5-24 | 1-112 | ND-74 | 13-26 |
| Organic Nitrogen ppm | ND | | ND | |
| Ammonia Nitrogen ppm | ND | | ND | |
| pH (6.5 to 8.5) | 7.5-12.5 | 6.9-8.4 | 6.6-7.8 | 7.6-7.9 |
| TDS (500/1000/1500) ppm | 164-3340 | 142-698 | 686-1258 | 330-648 |
| Selenium (0.010) ppm | ND-0.004 | ND | ND-0.004 | ND |
| Silver (0.050) ppm | ND | ND-0.03 | ND | ND |
| Sodium ppm | 8-459 | 9-94 | 24-167 | 25-68 |
| Sulfate (500) ppm | 5-54 | 8-30 | 7-240 | 6-18 |
| Sulfides ppm | ND | | ND | ND |
| Surfactants (0.5) ppm | ND | | ND | |
| Zinc (5) ppm | ND-0.02 | ND-0.04 | ND-0.07 | ND-0.02 |

TABLE VI(cont): COMPARISON OF UPGRADIENT AND DOWNGRADIENT GROUNDWATRER QUALITY

| Constituent (Standard) | Shallow Background | Deep Background | Shallow Downgradient | Deep Downgradient |
|---|---|---|---|---|
| Bromodichloromethane | ND | ND | ND | ND |
| Bromoform | ND | ND | ND | ND |
| Bromomethane | ND | ND | ND | ND |
| Carbon Tetrachloride | ND | ND | ND | ND |
| Chlorobenzene | ND | ND | ND | ND |
| Chloroethane | ND | ND | ND | ND |
| 2-Chloroethylvinyl ether | ND | ND | ND | ND |
| Chloroform (100) | ND | ND | ND-5.0 | ND |
| Chloromethane | ND | ND | ND | ND |
| Dibromochloromethane | ND | ND | ND | ND |
| 1,2-Dichlorobenzene (130) | ND | ND | ND | ND |
| 1,3-Dichlorobenzene (130) | ND | ND | ND | ND |
| 1,4-Dichlorobenzene (130) | ND | ND | ND-7.3 | ND-0.5 |
| 1,1-Dichloroethane | ND | ND | ND-36.0 | ND-2.4 |
| 1,2-Dichloroethane (1) | ND | ND | ND-6.8 | ND |
| 1,1-Dichloroethene (6) | ND | ND | ND-6.5 | ND |
| trans-1,2-Dichloroethene | ND | ND | ND-200 | ND-1.6 |
| 1,2-Dichloropropane (10) | ND | ND | ND-14 | ND |
| cis-1,3-Dichloropropene | ND | ND | ND | ND |
| trans-1,3-Dichloropropene | ND | ND | ND | ND |
| Ethylbenzene | ND | ND | ND | ND |
| Methylene chloride (40) | ND-3.8 | ND | ND-9610 | ND-5.3 |
| 1,1,2,2-Tetrachloroethane | ND | ND | ND | ND |
| Tetrachloroethene (4) | ND-2.8 | ND | ND-138 | ND-26 |
| 1,1,1-Trichloroethane (200) | ND | ND | ND-13.0 | ND |
| 1,1,2-Trichloroethane | ND | ND | ND | ND |
| Trichloroethene (5) | ND-1.1 | ND | ND-223 | ND-10.2 |
| Trichlorofluoromethane | ND | ND | ND-1.5 | ND-2.2 |
| Vinyl chloride | ND | ND | ND | ND |
| Endrin (2) | ND | | ND | |
| Lindane (0.7) | ND | | ND | |
| Methoxychlor (100) | ND | | ND | |
| Toxaphene (5) | ND | | ND | |
| 2,4-D (100) | ND | | ND | |
| 2,4,5-TP Silvex (10) | ND | | ND | |

Based upon the previously presented test information, we conclude that the following items are potential contaminants which indicate a general increase from background to downgradient, as well as a downgradient concentration above the suggested action level.

Chromium is a trace metal which is found both naturally and as the result of contamination. The State action level is 0.05 ppm; the maximum downgradient concentration was 0.06 ppm.

Hardness, expressed in units of calcium carbonate, refers to the tendency of water to form scale in underground piping. Hardness is principally reflected by the presence of divalent cations. A hardness in excess of 180 is considered very hard and undesirable for purposes of underground piping. Whereas the background concentration occasionally exceeded the hardness criteria, the downgradient concentration consistently exceeded the hardness criteria.

Iron is a common element. It is used in many industrial applications and as an end product. The drinking water action level is 0.3 ppm. Both the background and downgradient concentrations exceeded the State action levels; the downgradient concentrations tended to be higher with one exception.

Manganese is a trace metal in water. It is considered toxic, flammable or reactive in high concentrations, depending on the specific slats. In low concentrations, it is considered potentially toxic. The drinking water standard is 0.05 ppm. The maximum downgradient concentration was measured at 1.97 ppm.

Methylene chloride is also known as dichloromethane, methylene dichloride, and methylene bichloride. It is a colorless liquid, nonflammable and non-explosive in air. It is soluble in 50 parts water and miscible with alchohol, ether and dimethylformamide. It is used as a solvent, degreaser and cleaning fluid. It is a common laboratory reagent and used in the test procedure for EPA 625. The state action level is 40 parts per billion; a maximum concentration of 9600 ppb was found at one location downgradient. The second highest downgradient concentration was 115 ppb. It is the most unreliable item to be measured by the tests used on this report.

Tetrachloroethylene (PCE) is also known as perchloroethylene, ethylene tetrachloride, tetrachloethene, Nema, Tetracap, Tetropil, Perclene, Ankilostin, Didakene. It is a colorless, non-flammable liquid with an ethereal odor. It is soluble in water. PCE is used in the dry cleaning industry, for degreasing metals, and as a general solvent. It is commonly found in landfill environments. The state action level is 4 parts per billion; the maximum downgradient concentration was 138 ppb.

Trichloroethylene (TCE) is also known as trichloroethene, ethinyl trichloride, Tr-Clene, Trielene, Trichloran, Trichloren, Algylen, Trimar, Triline, Trethylene, Westrosol, Chlorylen, and Gemalgene. It is a non-flammable, mobile liquid. The characteristic odor resembles chloroform. It is practically insoluble in water. TCE is used for medicinal purposes and may contain some

thymol or ammonium carbonate as a stabilizer. TCE is used as a solvent for fats, waxes, resins, oils, rubber, paints and varnishes. It is used as a solvent for cellulose esters and ethers. It is used for solvent extraction in many industries, such as degreasing and dry cleaning. It is used in the manufacture of organic chemicals and pharmaceuticals. It is commonly found in landfill environments. The State action level is 5 parts per billion; the maximum downgradient concentration was 223 ppb.

1,1-Dichloroethene is also known as vinylidene chloride and 1-1-dichloroethylene. It is used as an intermediate in the production of plastics such as Saran and Velon. The State action level is 6 parts per billion; the maximum downgradient concentration was 6.5 ppb.

1,2-Dichloropropane is also known as propylene dichloride. It is an oil and fat solvent. It is used in dry cleaning fluids and in degreasing. It is also used in insecticidal fumigant mixtures. The State action level is 10 parts per billion; the maximum downgradient concentration was 14 ppb.

Conclusions Regarding Waste Characterization

The waste may be classified as municipal refuse. Because of the nature of municipal refuse, components which are currently listed as designated wastes or higher have frequently been disposed in landfill environments. The typical wastes emanating from landfills contain a mixture of volatile organics, including methylene chloride, trichloroethylene and tetrachloroethylene. These constituents predominate in the downgradient wells at this site. Currently, these items are commonly referred to as household-hazardous waste, though some may be of commercial or industrial origin.

Other wastes of concern are represented in the general minerals and inorganics scan. These include some metals, such as iron and manganese.

Scans for pesticides and herbicides have not detected any constituents to date.

Conclusions Regarding Soil Type

The soil type is principally highly stratified clayey sands, silty sands, clay, silts and sands. The overlying layering is indicate of the alluvial fan depostion mode, which is a series of discontinuous and truncated strata.

Of particular concern is the separation distance and soil type which exists between the base of the landfill and the groundwater table. Although this may be inferred by the test holes and wells performed around the perimeter of the landfill, the most direct evidence is the Twining Laboratories report of 1971. The deepest pits in the landfill were 35 feet deep. The separation between the base of the pit and the first groundwater was about 13 feet. Three impermeable strata were identified in the report. The first was about 6 feet above the base of the excavation. The second was about three feet below the base of the groundwater table. The third was immediately at the contact with groundwater. We conclude that no impermeable stratum was established between the base of the landfill and the first groundwater table in 1971.

The current regulatory environment suggests that the separation between the base of the landfill and the top of the capillary fringe above the 100 year highest groundwater table should be a minimum of 10 feet. Over the last ten years, the highest groundwater table has been about 43 feet. Not counting the capillary fringe and the use of a 100 year high as opposed to a 10 year high, the separation distance is insufficient by today's standards.

Conclusions Regarding Clay Layers or Aquitards

Aquitards are siginificant layers of relatively impervious soils which restrict the flow of groundwater, and to a lesser extent, contaminants in a vertical direction.

The deep groundwater monitoring wells occasionally encountered significant strata of relatively impervious soils. The piezometric levels in these strata, however, did not vary substantially, indicating that significant aquitards may not be present.

The existing high capacity well at the edge of the landfill likely pumps from deep strata. Yet, there has been a notable improvement in the shallow groundwater quality in the vicinity of this well. This suggests that there are no large aquitards on the site.

The regional geohydrologic information indicates that the principal confining strata for the Central Valley (the A through E Clays) do not extend to this site.

The observed groundwater tables at the site, including first groundwater and deep groundwater, agree very well with the groundwater levels reported on the basis of deep wells. This suggests that the shallow groundwater and deep groundwater are reflecting the same piezometric levels.

The vertical migration of contamination has been observed at the deep well locations. This is particularly true at DW-1, where contamination to about 150 feet is noted. The decrease in contamination from the first groundwater to the deep groundwater is suggestive of some restriction of vertical migration, but not that afforded by a substantial aquitard.

In summary, we conclude that a substantial aquitard, separating first groundwater from deeper groundwater, is not indicated on the site.

Conclusions Regarding Groundwater Occurence

On occasion, the stabilized water level differed substantially from the point of water entry in the wells. However, the general case was for the stabilized level to be close to the water entry level.

We have previously concluded that there was no significant aquitard at the site within the depths investigated. The first groundwater levels measured reflect the levels obtained from wells in the vicinity.

In summary, we conclude that the first groundwater at the site is part of an unconfined groundwater system.

The data indicate that the background groundwater levels are highly variable. In some areas, high quality groundwater was encountered while others, marginal to extremely low quality groundwater. The testing of the domestic wells has indicated that bacteriological and nitrate pollution is present in the domestic wells around the landfill. This contamination has likely been caused by the residents themselves or the adjoining agricultural usage.

The RWQCB frequently uses a background concentration of 10,000 ppm as measured by total dissolved solids to distinguish between groundwater requiring protection and not requiring protection. In this instance, the background groundwater levels are below the cutoff requiring protection.

Conclusions Regarding Historical Groundwater Levels

The historical groundwater levels show a high groundwater table on the order of 43 feet below the existing grade. This is likely lower than the levels of 100 years ago, before groundwater withdrawal on a large scale was in operation. However, from the standpoint of long term groundwater levels, we conclude that it would be prudent to assume an additional 5 to 10 foot rise in the groundwater table as an unlikely event in the long term future, similar in concept to the 100 year groundwater table. This would put the long term unlikely groundwater level at a depth of 33 to 38 feet below the existing site grade.

Conclusions Regarding Groundwater Gradients

The groundwater gradient has been determined by site specific well measurements and by reference to regional geologic maps. In both instances, the predominant trends are westward flow, with occasional deviations slightly north or south.

The presence of groundwater contamination has moved westward to the largest extent. This further indicates predominant groundwater flow westward.

In summary, we conclude that the predominant groundwater flow is westward.

Conclusions Regarding Lateral and Vertical Extent of Contaminants in Soil

Because of the observed presence of contaminants in groundwater, there is undoubtably contamination migrating through soil, at least vertically through the base of the landfill.

We have previously provided a study of methane gas migration from the landfill. The issue of methane gas will not be rediscussed at this time. However, the extent of methane gas migration has been identified as approximately 150 feet laterally from the edge of landfill materials. Current regulatory concepts include the assumption that the methane gases may act as carrier gases for volatile organic materials, such as already identified within the groundwater regime.

It is possible that volatile organics may be carried by methane gas away from the landfill horizontally to ultimately diffuse vertically into the groundwater regime. However, at this site, the point of maximum excursion of the groundwater contamination is well in excess of the point of maximum excursion of the methane gas. The point of maximum excursion of the groundwater contamination appears more directly related to the lack of separation distance between the base of the landfill pit and the groundwater table. We conclude that the extent of soil contamination is less than the groundwater contamination and only partially the cause of the groundwater contamination.

Lateral and Vertical Extent of Groundwater Degradation

The original monitoring data indicated that groundwater contamination is occurring in the immediate vicinity of the landfill, mainly in terms of volatile organic contamination. The offsite data by others and the long term deep well monitoring by the City of Fresno indicate that the contamination was limited in extent. The Fresno County Health Department has detected volatile organics in the residential well north of the landfill but subsequent retesting has not found the organics again. At another domestic well location, the Fresno County Health Department has detected one of the constituents listed on the Title 22 scan; again retesting has not detected the constituent.

The lateral extent of degradation, as indicated on Figure 2, has been determined on the basis of the well data to date. The data is plotted based upon the first groundwater contact EPA 601 test results. It has been our experience that this type of analyses describes the maximum lateral extent of contamination for landfills in the most cost-effective fashion.

There are several important features of the groundwater contour map. First, the map indicates that there is a zone of contamination extending as far as 800 feet away from the landfill. This distance is quite far, considering the limited groundwater gradients in the vicinity of the site, and indicates that other modes of migration are involved. These modes could include drawdown effects due to irrigation pumping and dispersive movement of the contaminants at a faster rate than groundwater flow itself.

Second, the map indicates that the largest extent of contamination is associated with the more recent landfill pits. The area of largest contamination and farthest excursion of contamination is closest to the deep pit constructed in the early 1970's. In this pit, it is believed that there is less than 10 feet of separation from the landfill bottom and the groundwater table. The bottom of the landfill pit was determined to have an impermeable stratum separating the landfill from the groundwater (Twining Laboratories, July 14, 1971). We have concluded that there is not suitable separation or impermeable soils of the base of the landfill in this area.

Third, the map indicates that the maximum concentrations of contaminants are found at some distance from the landfill, instead of at the precise edge of the landfill. This indicates that the principal discharge of contaminants to the groundwater occurred at some time in the past, as opposed to an extremely recent event.

Fourth, the map indicates the beneficial effects of large scale pumping withdrawal on groundwater quality. The 300-series of wells is essentially downgradient from large scale pumping operations and the contaminant levels are dramatically reduced.

Fifth, the issue of upgradient groundwater quality is not fully resolved. Wells at substantial distance from the landfill in the upgradient direction still exhibit the presence of contaminants. This could mean either of two possibilities. First, the contamination could be moving upgradient from the landfill by dispersion; this appears unlikely as the rate of concentration changes with distance are much slower upgradient than downgradient. Second, there may be smaller sources of contamination upgradient from the landfill; this appears more likely as the concentrations of volatile organics is consistent with our experience on other sites where multiple sources of contamination are present.

Sixth, the individual contaminant concentrations (e.g. TCE, PCE) are fairly consistent in their variation laterally from the landfill. The variation in total contaminants (all EPA 601 volatile organics), however, appears to be a better index of the overall contaminant levels. The map shown in Figure 2 is based upon total concentration of volatile organics.

Seventh, isolated pockets of more concentrated contaminants may be present. One well, 400, encountered one contaminant (methylene chloride) at an extremely high concentration (9600 ppb).

The vertical extent of contamination is defined by the permanent cluster wells. The wells sample from levels of approximately 50, 100 and 150 feet from the existing site grade. Based upon the data from the cluster wells, the maximum vertical extent of contamination is between 100 and 150 feet below grade near the edge of the landfill.

Cleanup of Soil Contamination

As discussed previously, soil contamination is believed present under and around the perimeter of the landfill. The methane gas issues have been addressed in other transmittals.

Cleanup of soil contamination under the landfill, between the base of the landfill and the top of the groundwater, is virtually impossible. The long term presence of this potential source of contamination should be assumed.

Cleanup of soil contamination around the perimeter of the landfill is partially addressed by the methane gas mitigation system. It is unlikely, however, that reduction of methane gas to the regulatory levels (less than 5% by volume) would reduce trace volatile organic constituents to no impact levels. The issue of soil contamination around the perimeter is nonetheless secondary to the issue of groundwater contamination around the perimeter, as the evidence points to the groundwater contamination coming from the base of the landfill as opposed to the perimeter.

We conclude that soil cleanup is only feasible in portions of the landfill, particularly the perimeter, and should be tied to the overall gas migration issue.

Cleanup of Groundwater Contamination

The cleanup of groundwater contamination is indicated within the previously defined areas of lateral and vertical extent of contamination.

There are several different criteria for groundwater cleanup. The first is basically cleanup to background levels. However, the background levels are quite variable and indicate other point sources of contamination, limited in extent, around the landfill. These include septic contamination, nitrate contamination, and other sources of volatile organics. Because of the variability of the background levels, we conclude that cleanup to background levels would not be definable.

The second basic method for assignment of cleanup levels is to clean up until action levels are reached for the various constituents. There are a variety of action levels for the various constituents, though none for total volatile organics. One important concept, when dealing with multiple contaminants, is that effects of contaminants of similar toxicology should be added together, requiring lower action levels for individual constituents. The following table summarizes the typical maximum concentration levels versus the action levels for the compounds.

TABLE VII: CLEANUP REQUIREMENTS

| Constituent | Action Level or Background | Peak Concentration Downgradient | Reduction | Group Reduction |
|---|---|---|---|---|
| Chromium, ppm | 0.05 | 0.06 | 16% | |
| Iron, ppm | 0.5 approx. | 1.15 | 57% | |
| Manganese, ppm | 0.05 | 1.97 | 98% | |
| 1,2-Dichloroethane, ppb | 1 | 6.8 | 85% | |
| 1,1-Dichloroethene, ppb | 6 | 6.5 | 8% | |
| 1,2-Dichloropropane, ppb | 10 | 14 | 29% | |
| Methylene chloride, ppb | 40 | 9610 (one)<br>115 (typ) | 99%<br>65% | |
| Tetrachloroethene, ppb | 4 | 138 | 97% | |
| Trichloroethene, ppb | 5 | 223 | 98% | |
| Volatiles, general | | | | 99% |

The foregoing table only presents those compounds which were tested, for which an action level exists, and on which the constituent exceeded the action level downgradient. In addition, the one relatively high methylene chloride value was not used in the final calculation for group reduction for volatile organics. Therefore, the 99% reduction may underestimate the actual reduction required at some point in the future.

In addition, a total pollutant scan has not been required for the site. For instance, acid and base neutral extractable constituents (as measured by test method EPA 625) may indicate other constituents requiring reduction. The testing to date has indicated two general types of contaminants - metals and volatile organics - and this has been the primary testing performed.

A third method of determining cleanup levels would be a functional method, whereby the future usage of the site and perimeter area would be addressed and water quality objectives be set based upon those specific objectives. This has not been addressed in this report, but could consist of an assessment of the site cleanup standards to agricultural usage as opposed to drinking water standards. Economic trade-offs could be established at that time.

Under the current regulatory environment, cleanup to drinking water standards is likely to be the first option which would be assessed in detail. We conclude that the cleanup would be directed towards a minimum of 99 percent reduction in the existing levels of certain metals and volatile organics.

Cleanup is generally required at certain compliance points on the site. These compliance points are typically permanent monitoring wells, as opposed to extraction wells. This means that cleanup is complete when groundwater still within the aquifer meets the cleanup standards, not when the extracted water meets the cleanup standards.

It is technically feasible to obtain 99% reduction in constitutents removed by the extraction process. By going to deep high capacity pumps, it is possible to approach 90 percent reduction by dilution alone. Multiple treatment processes would be likely required, as the treatment for metals is different than the treatment for volatiles.

It is much more difficult to achieve 99% reduction in the aquifer system itself. The different soil types have different affinities for retention of volatile organics. Clean, quartz sands will generally flush out volatile organics, whereas fine grained silts and clays will retain the volatile within the soil matrix itself. The effect is compounded by the overall extraction process. Most of the extracted water comes from the sand strata and little from the fine grained strata.

In addition, high capacity extraction generally results in a net drawdown of the groundwater table. A frequent regulatory request is that the site be enveloped with wells which establish a cone of depression surrounding the site, functioning as a containment system. Metals and volatiles, currently concentrated in the upper reaches of the groundwater profile, frequently become separated from the main body of the groundwater due to drawdown effects. These metals and volatiles are trapped in the soils above the artificially lowered groundwater table and, at the intended close of the cleanup operation, reappear in the compliance point monitoring system because the high capacity extraction system has been shut off.

These factors all combine to make a system which is intended to reduce contaminants in the groundwater by 99% quite difficult, if not impossible, from a technical standpoint.

We therefore conclude that an extraction system, coupled with a treatment system, would be required. Because of the relatively high concentrations of contaminants in the aquifer and the likelihood of further contamination emanating from the landfill, the extraction and treatment would be a long term process.

In order to minimize the amount of treatment required for the extracted water, it would be beneficial to place the extraction system near the leading edge of the contamination. For purposes of this study, we have used the contour on Figure 2 approximating a 10 ppb total volatile organic concentration. There would likely be a beneficial effect of dilution at this point, minimizing the necessity for treatment at the surface.

Published literature on the groundwater system in this area indicates that the typical aquifer permeability is 700 gallons per day per square foot and the typical storage coefficient is 12%. Based upon these aquifer properties, we calculate that wells, spaced about 400 feet center to center and 200 feet deep could be required. The wells would pump at a rate of 400 gallons per minute each in order to establish a net one foot drawdown at the midpoint between the wells. The total system discharge would be about 18,000 gallons per minute or 26 million gallons per day. Disposal to a series of percolation ponds would be envisaged, either nearby or at a remote location.

Obviously, from the size of the system required, alternatives should be studied in the future work plan for the site.

Recommendations for Future Work

The future work should include more detailed investigation of the extraction and treatment alternative, as well as other options.

In order to further assess the extraction and treatment operation, four main areas of work are necessary. First, the additional cluster wells originally envisaged for the site should be installed near the 10 ppb total volatile organic contour. Second, these new wells and the existing wells should be tested for acid and base neutral extractables in the uppermost groundwater. Third, a pump out well should be established near one of the additional cluster wells in order to evaluate aquifer properties and potential beneficial effects of dilution on extracted water. Fourth, an economic analysis of potential beneficial uses of groundwater at the site should be performed in order to assess the most cost-effective treatment program at the site, should action levels different than drinking water standards be applicable.

## 14. Changed Conditions

The analyses and recommendations contained in this report are based upon the data obtained from the test holes and monitoring wells performed at the locations shown on the Site Plan in Figure 1.

The report does not reflect variations which may occur between wells. The nature and extent of such variations may not become evident until further studies are initiated. If variations then appear, a re-evaluation of the recommendations of this report will be necessary after performing additional analyses of any variations.

The Engineer has prepared this report for the exclusive use of the Owner. The report has been prepared in accordance with generally accepted engineering practices. No other warranties, either expressed or implied, are made as to the professional advice provided under the terms of this agreement and included in this report.

BSK & Associates

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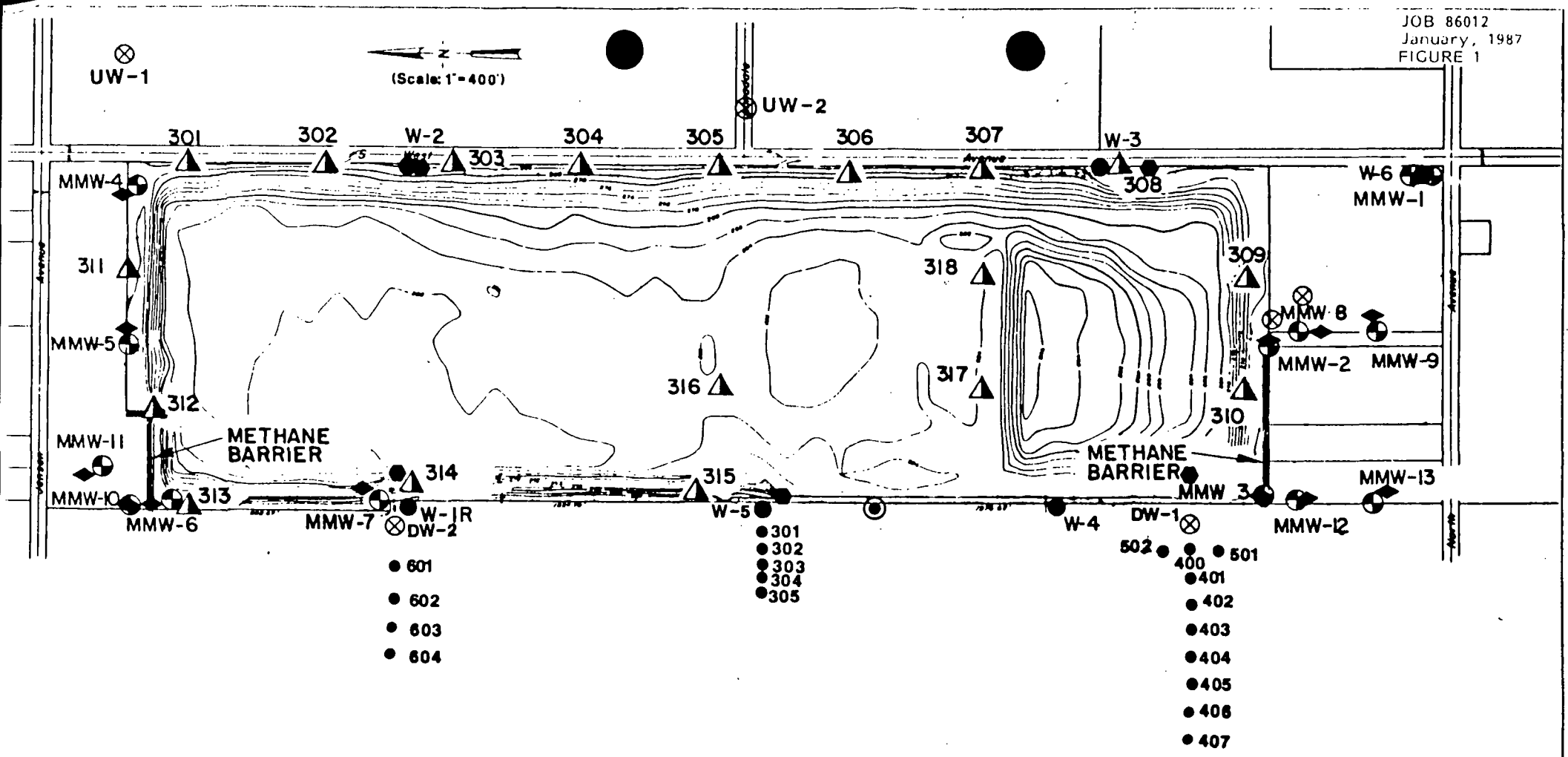
JOB 86012
January, 1987
FIGURE 1




LEGEND

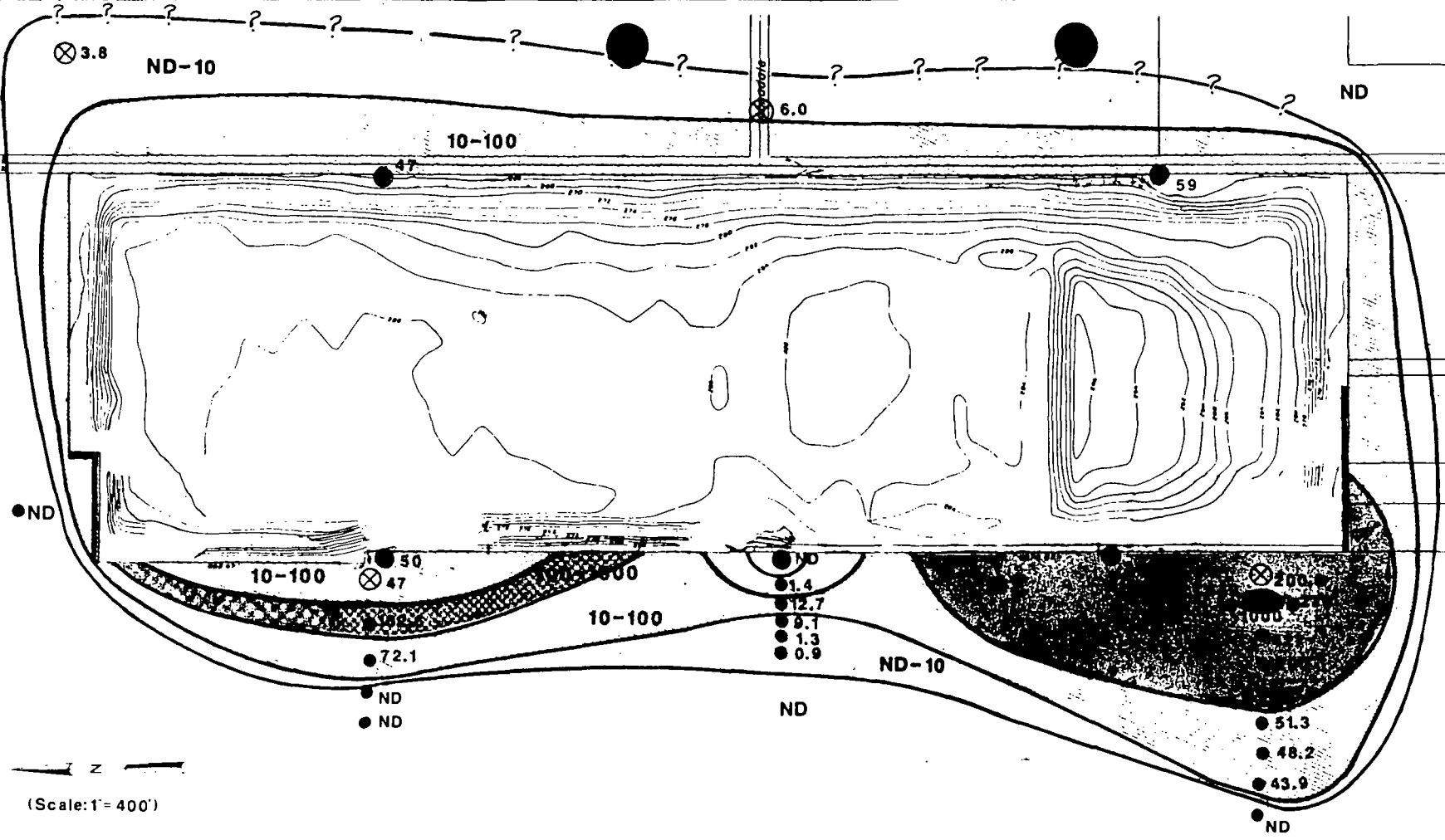
- Proposed 150' Deep Groundwater Monitoring Wells (Approx. Location)
- Existing 50' Deep Groundwater Monitoring Wells (Approx. Location)
- Existing Methane Monitoring Wells (Approx. Location)
- Test Hole Through Existing Landfill (Approx. Location)
- Groundwater Monitoring Well (Approx. Location)
- Location of Surface Water Sample

erence: "Contour and Land Use - Fresno City Sanitary Landfill Site," prepared by City of Fresno, Department of Public Works (Date: September, 1977).

**SITE PLAN**

**Landfill Closure**
**City of Fresno**
**Solid Waste Disposal Facilities**

JOB 86012
January, 1987
FIGURE 2




LEGEND

Total Volatile Hydrocarbons, mg/l, by EPA 601, First Groundwater

| | |
|---|---|
| ND | None Detected |
| ND-10 | None Detected to 10 |
| 10-100 | 10-100 |
| 100-1000 | 100-1000 |
| >1000 | Greater than 1000 |

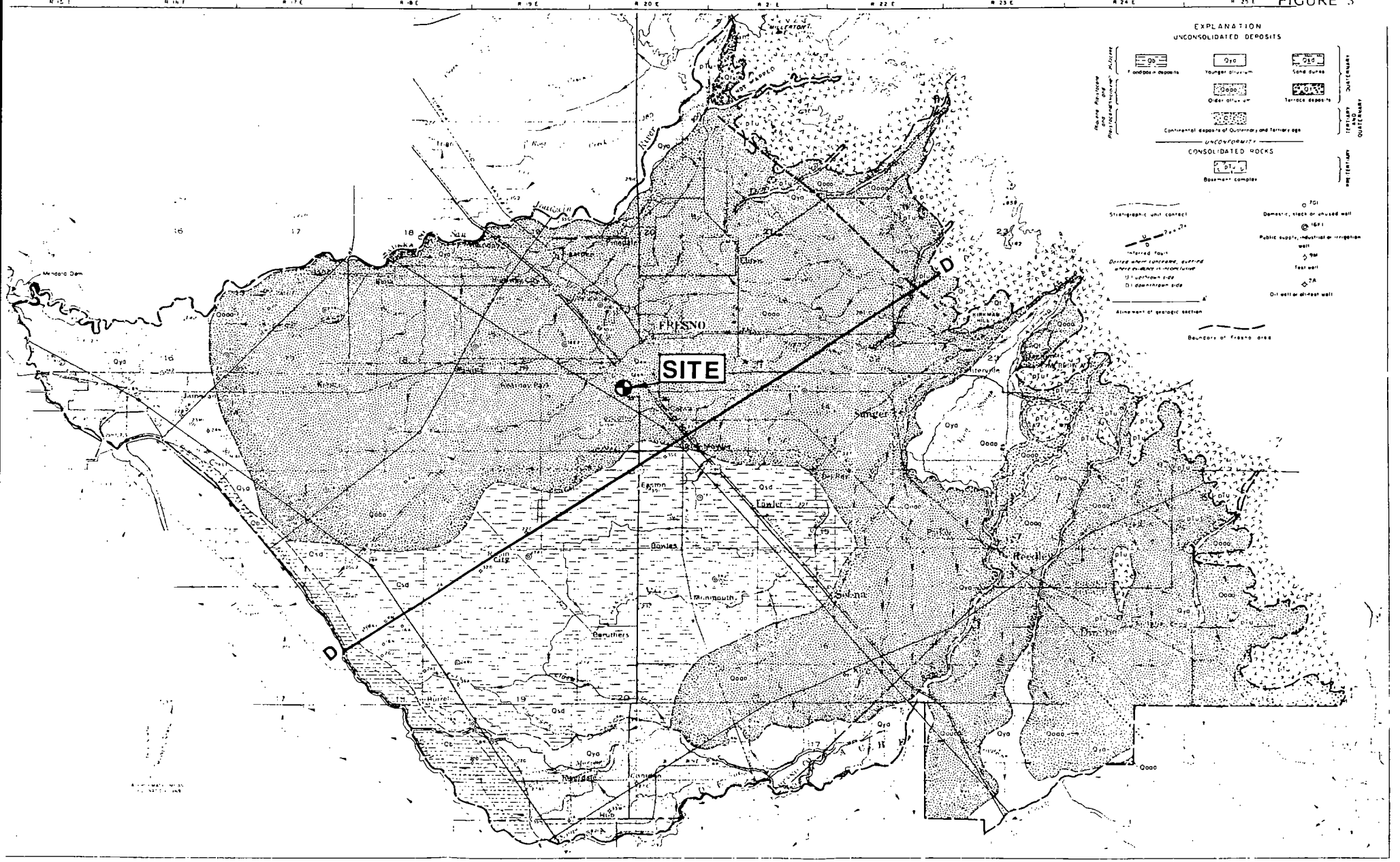
erence: "Contour and Land Use - Fresno City Sanitary Landfill Site," prepared by City of Fresno, Department of Public Works (Date: September, 1977).

# LATERAL EXTENT OF CONTAMINATION

## CITY OF FRESNO
## SOLID WASTE DISPOSAL FACILITIES

LOGICAL SURVEY

Prepared in co[illegible]ion with CALIFORNIA DEPARTMENT OF WATER [illegible]URCES

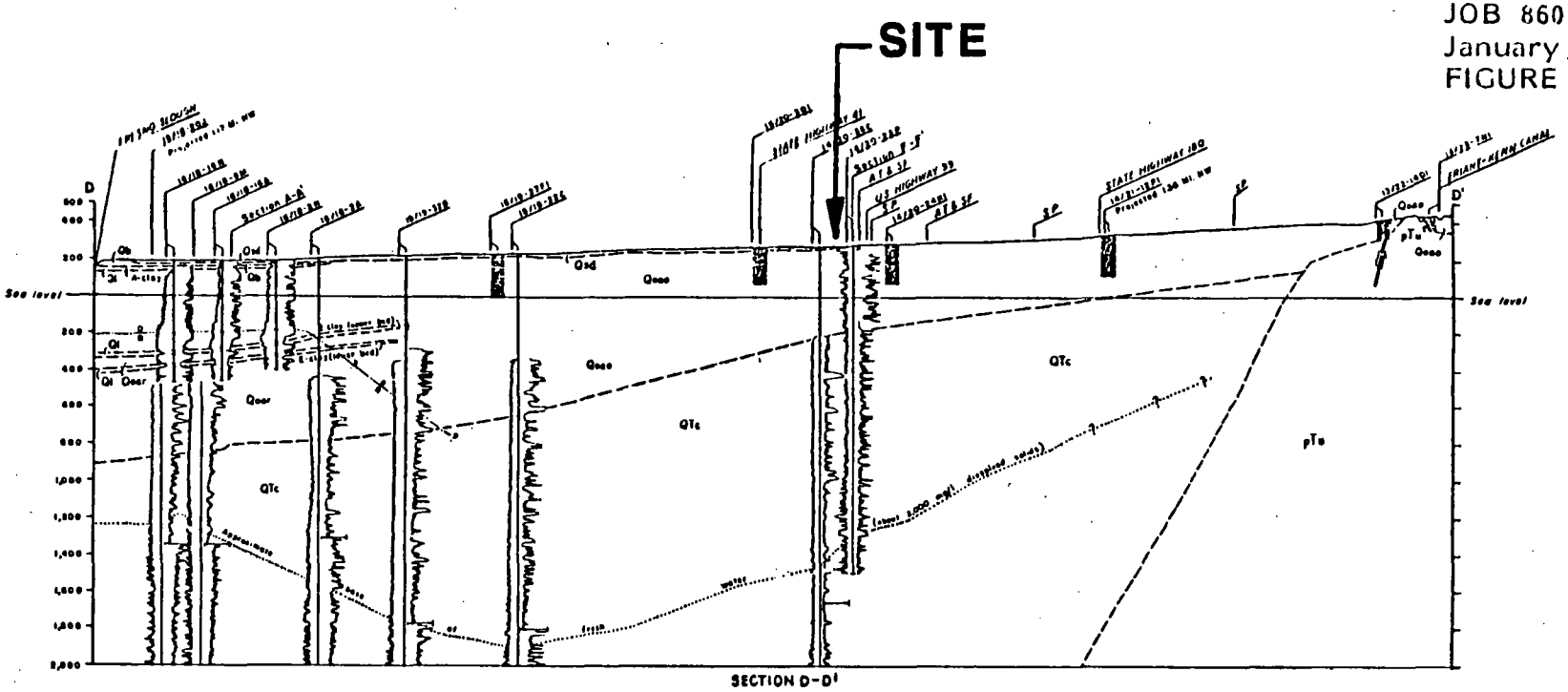


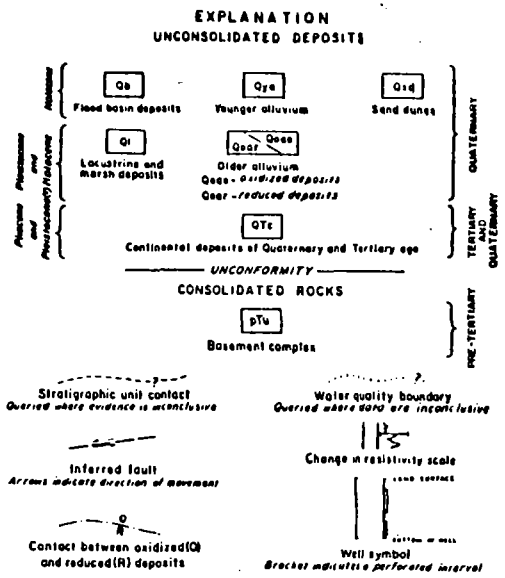

ERENCE U.S.Geological Survey Prepared in Cooperation With California Department of Water Resources

GEOLOGIC MAP OF THE FRESNO AREA, SAN JOAQUIN VALLEY, CALIFORNIA

# REGIONAL GEOLOGIC MAP
## CITY OF FRESNO LANDFILL
## JENSEN AND WEST
## FRESNO, CALIFORNIA

JOB 86012
January, 1987
FIGURE 4




# REGIONAL GEOLOGIC CROSS SECTION

## CITY OF FRESNO LANDFILL
## JENSEN AND WEST
## FRESNO, CALIFORNIA

REFERENCE: U.S.Geological Survey Prepared In Cooperation With California Department of Water Resources

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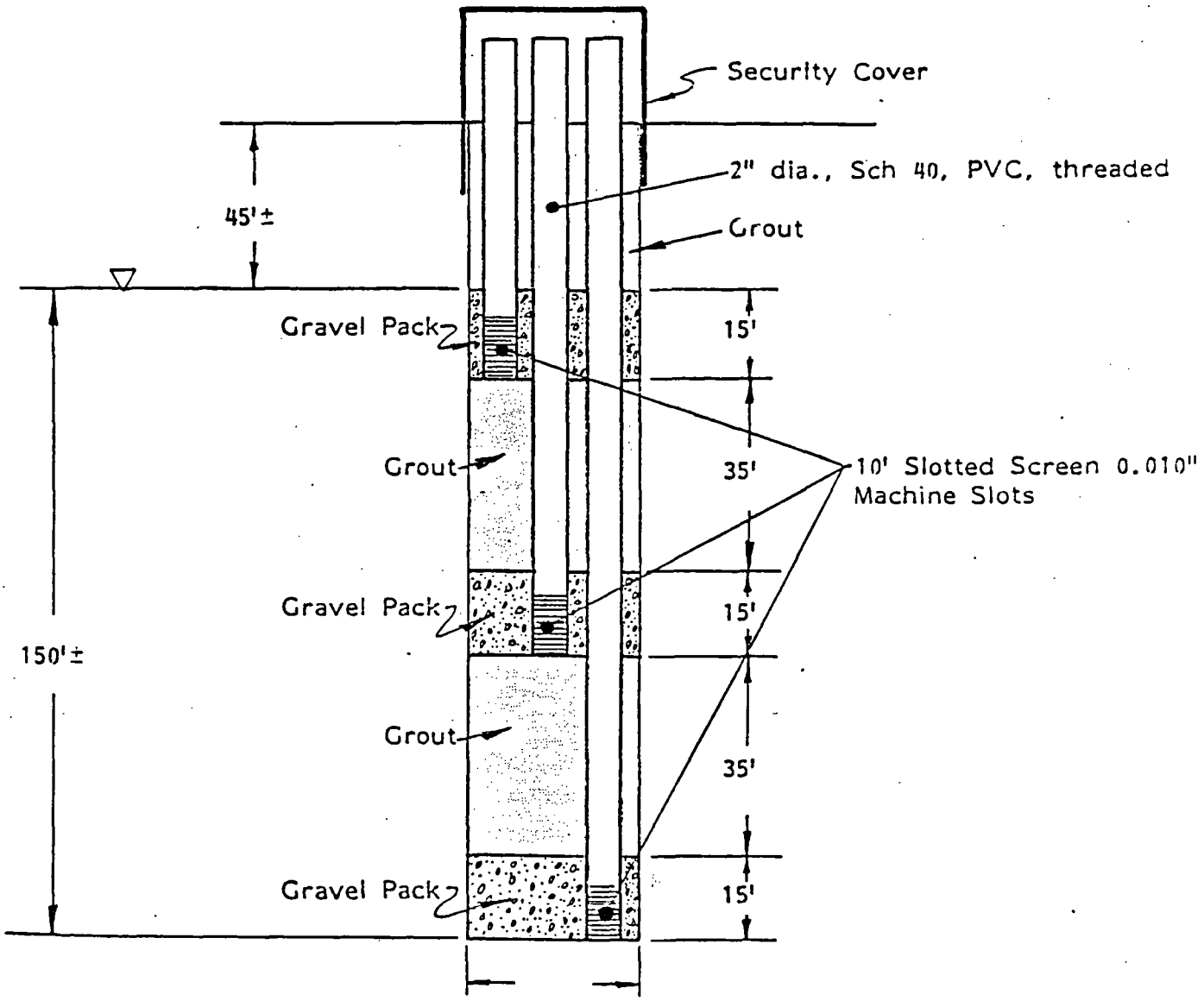
January, 1987
FIGURE 5



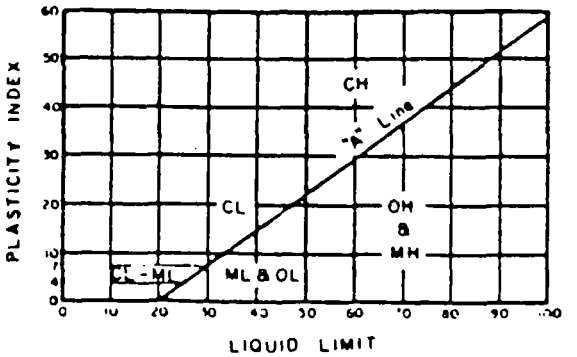

TYPICAL GROUNDWATER MONITORING WELL CLUSTER

City of Fresno Landfill
Jensen and West

# LEGEND FOR TEST HOLE LOGS

## METHOD OF SOIL CLASSIFICATION
(Unified Soil Classification System)

| MAJOR DIVISIONS | | SYMBOLS | TYPICAL NAMES |
|---|---|---|---|
| COARSE GRAINED SOILS (More than 1/2 of soil > no. 200 sieve size) | GRAVELS (More than 1/2 of coarse fraction > no. 4 sieve size) | GW | Well graded gravels or gravel-sand mixtures, little or no fines |
| | | GP | Poorly graded gravels or gravel-sand mixtures, little or no fines |
| | | GM | Silty gravels, gravel-sand-silt mixtures |
| | | GC | Clayey gravels, gravel-sand-clay mixtures |
| | SANDS (More than 1/2 of coarse fraction < no. 4 sieve size) | SW | Well graded sands or gravelly sands, little or no fines |
| | | SP | Poorly graded sands or gravelly sands, little or no fines |
| | | SM | Silty sands, sand-silt mixtures |
| | | SC | Clayey sands, sand-clay mixtures |
| FINE GRAINED SOILS (More than 1/2 of soil < no. 200 sieve size) | SILTS & CLAYS LL < 50 | ML | Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity |
| | | CL | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays |
| | | OL | Organic silts and organic silty clays of low plasticity |
| | SILTS & CLAYS LL > 50 | MH | Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts |
| | | CH | Inorganic clays of high plasticity, fat clays |
| | | OH | Organic clays of medium to high plasticity, organic silty clays, organic silts |




PLASTICITY CHART

BSK & Associates

DATE: 5-12-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION UW-1

(60' Well)

JOB: 86012
FIGURE: 7

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 5 | | | | | SM | Silty SAND: brown; slightly damp; fine to medium grained; abundant silt top 3'; minimal silt content from 3'-6'. | |
| 10 | | | | | SP | SAND: light brown; fine to medium grained. | |
| 15 | | | | | SM | Silty SAND: olive brown; fine to medium grained; slightly cemented. | |
| 20 | | | | | | Minimal silt from 17'-22'. | |
| 25 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 5-12-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION UW-1 (Cont'd)

JOB: 86012
FIGURE: 7

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | SM | Silty SAND: olive brown; fine to medium grained; slightly cemented. | |
| 30 | | | | | SP | SAND: light brown; medium to fine grained; occasionally coarse.<br><br>Becomes coarser with depth. | |
| 35 | | | | | | Coarse to fine grained at 38'. | |
| 40 | | | | | | | |
| 45 | | | | | ML | Sandy SILT: olive; fine to medium grained sand; slightly cemented. | |
| 50 | | | | | SP | SAND: pale brown; fine to coarse grained. | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 5-12-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION UW-1 (Cont'd)

JOB: 86012
FIGURE: 7

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 50 | | | | | SP | SAND: pale brown; fine to coarse grained. | 50 Feet of Solid Pipe. 10 Feet of Slotted Screen Installed. Slot Size: 0.020". Pipe: 2" Diameter SCH 40 PVC. 15 Feet of Gravel Pack. remainder of Hole Pressure Grouted. |
| | | | | | SM | Silty SAND: reddish brown; fine to coarse grained; dense. | |
| 55 | | | | | | | |
| 60 | | | | | SC/CL | Clayey SAND/Sandy CLAY: grey; fine to medium grained; occasionally coarse grained; slightly cemented; slightly to moderately plastic. | Terminated at 60' |
| 65 | | | | | | | |
| 70 | | | | | | | |
| 75 | | | | | | | |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 5-12-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION UW-1

(110' Well)

JOB: 86012
FIGURE: 8

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 5 | | | | | SM | Silty SAND: brown; slightly damp; fine to medium grained; abundant silt top 3'; minimal silt content from 3'-6'. | |
| 10 | | | | | SP | SAND: light brown; fine to medium grained. | |
| 15 | | | | | SM | Silty SAND: olive brown; fine to medium grained; slightly cemented. | |
| 20 | | | | | | Minimal silt from 17'-22'. | |
| 25 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 5-12-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION UW-1 (Cont'd)

JOB: 86012
FIGURE: 8

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | SM | Silty SAND: olive brown; fine to medium grained; slightly cemented. | |
| 30 | | | | | SP | SAND: light brown; medium to fine grained; occasionally coarse. | |
| | | | | | | Becomes coarser with depth. | |
| 35 | | | | | | Coarse to fine grained at 38'. | |
| 40 | | | | | ML | Sandy SILT: olive; fine to medium grained sand; slightly cemented. | |
| 45 | | | | | SP | SAND: pale brown; fine to coarse grained. | |
| 50 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 5-12-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION UW-1 (Cont'd)

JOB: 86012
FIGURE: 8

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 50 | | | | | SP | SAND: pale brown; fine to coarse grained. | |
| | | | | | SM | Silty SAND: reddish brown; fine to coarse grained; dense. | |
| 55 | | | | | | | |
| 60 | | | | | SC/CL | Clayey SAND/Sandy CLAY: grey; fine to medium grained; occasionally coarse grained; slightly cemented; slightly to moderately plastic. | |
| 65 | | | | | | | |
| 70 | | | | | | Fine to medium grained. Grades to Sandy Clay. Some Fe Oxide staining. | |
| 75 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 5-12-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION UW-1 (Cont'd)

JOB: 86012
FIGURE: 8

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 75 | | | | | CL | Sandy CLAY: grey; fine to medium grained; slightly cemented; slightly to moderately plastic; some Fe Oxide staining. | |
| 80 | | | | | SC | Clayey SAND: greyish brown; fine to coarse grained; slightly plastic. | |
| 85 | | | | | | | |
| 90 | | | | | | | |
| 95 | | | | | | Minimal clay content from 90' - 105'. Grades to reddish brown. | |
| 100 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 5-13-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION UW-1 (Cont'd)

JOB: 86012
FIGURE: 8

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS / FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 100 | | | | | SC | Clayey SAND: reddish brown; fine to coarse grained; trace of silt; minimal clay to 105'. | 100 Feet of Solid Pipe. 10 Feet of 2" Diameter SCH 40 PVC added. Slot Size: 0.020". 15 Feet of Gravel Pack. Hole Pressure Grouted from 60' to 95'. |
| 105 | | | | | | Slightly cemented. | |
| 110 | | | | | | | Terminated at 110' |
| 115 | | | | | | | |
| 120 | | | | | | | |
| 125 | | | | | | | |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 5-12-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION UW-1

(150' Well)

JOB: 86012
FIGURE: 9

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 5 | | | | | SM | Silty SAND: brown; slightly damp; fine to medium grained; abundant silt top 3'; minimal silt content from 3'-6'. | |
| 10 | | | | | SP | SAND: light brown; fine to medium grained. | |
| 15 | | | | | SM | Silty SAND: olive brown; fine to medium grained; slightly cemented. | |
| 20 | | | | | | Minimal silt from 17'-22'. | |
| 25 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 5-12-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION UW-1 (Cont'd)

JOB: 86012
FIGURE: 9

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | SM | Silty SAND: olive brown; fine to medium grained; slightly cemented. | |
| 30 | | | | | SP | SAND: light brown; medium to fine grained; occasionally coarse.<br><br>Becomes coarser with depth. | |
| 35 | | | | | | Coarse to fine grained at 38'. | |
| 40 | | | | | | | |
| 45 | | | | | ML | Sandy SILT: olive; fine to medium grained sand; slightly cemented. | |
| 50 | | | | | SP | SAND: pale brown; fine to coarse grained. | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 5-12-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION UW-1 (Cont'd)

JOB: 86012
FIGURE 9

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 50 | | | | | SP | SAND: pale brown; fine to coarse grained. | |
| | | | | | SM | Silty SAND: reddish brown; fine to coarse grained; dense. | |
| 55 | | | | | | | |
| 60 | | | | | SC/CL | Clayey SAND/Sandy CLAY: grey; fine to medium grained; occasionally coarse grained; slightly cemented; slightly to moderately plastic. | |
| 65 | | | | | | | |
| 70 | | | | | | Fine to medium grained. Grades to Sandy Clay. Some Fe Oxide staining. | |
| 75 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 5-12-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION UW-1 (Cont'd)

JOB: 86012
FIGURE: 9

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 75 | | | | | CL | Sandy CLAY: grey; fine to medium grained; slightly cemented; slightly to moderately plastic; some Fe Oxide staining. | |
| 80 | | | | | SC | Clayey SAND: greyish brown; fine to coarse grained; slightly plastic. | |
| 85 | | | | | | | |
| 90 | | | | | | | |
| 95 | | | | | | Minimal clay content from 90'-105'. Grades to reddish brown. | |
| 100 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER – 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 5-13-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION UW-1 (Cont'd)

JOB: 86012
FIGURE: 9

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 100 | | | | | SC | Clayey SAND: reddish brown; fine to coarse grained; trace of silt; minimal clay to 105'. | |
| 105 | | | | | | Slightly cemented. | |
| 110 | | | | | | Color grades to grey. | |
| 115 | | | | | | Slight increase in clay content below 115'. | |
| 120 | | | | | | | |
| 125 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 5-13-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION UW-1

JOB: 86012
FIGURE: 9

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 125 | | | | | SC | Clayey SAND: grey; fine to coarse grained; slight increase in clay. | 140 Feet of Solid Pipe. 10 Feet of 2" Dimeter SCH 40 PVC Installed. Slot Size: 0.020" 15 Feet of Gravel Pack added. Hole Pressure Grouted from 110' to 135'. |
| | | | | | SP | SAND: dark brown; coarse to fine grained; poorly graded. | |
| 130 | | | | | | | |
| | | | | | | Trace of clay at 132'-135'. | |
| 135 | | | | | | | |
| | | | | | | Some silt content below 140'. | |
| 140 | | | | | | | |
| 145 | | | | | | | |
| | | | | | SC | Clayey SAND: grey; fine to coarse grained; slightly cemented. | |
| 150 | | | | | | | Terminated at 150' |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 6-11-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION UW-2

(60' Well)

JOB: 86012
FIGURE: 10

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| | | | | | SC | Clayey SAND: brown; moist; fine grained plastic. | |
| 5 | | | | | CL/SC | Sandy CLAY/Clayey SAND: brownish olive; fine grained; highly plastic; firm. | |
| 10 | | | | | SM | Silty SAND: reddish brown; fine to medium grained; slightly cemented. | |
| 15 | | | | | SC | Clayey SAND: olive brown; fine grained; moderately plastic; moderately cemented. | |
| | | | | | | Abundant clay content. | |
| 20 | | | | | | | |
| | | | | | | Increase in cementation. | |
| 25 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 6-11-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION UW-2

JOB: 86012
FIGURE: 10

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | SC | Clayey SAND: olive brown; fine grained; moderately plastic; abundant clay content; cementation. | |
| 30 | | | | | SP | SAND: brownish white; fine to medium grained; occasionally coarse grained. | |
| 35 | | | | | | | |
| 40 | | | | | | | |
| 45 | | | | | SM | Silty SAND: brown to olive brown; fine to medium grained; cemented. | |
| 50 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 6-11-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION UW-2 (Cont'd)

JOB: 86012
FIGURE: 10

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 50 | | | | | SM | Silty SAND: brown to olive brown; fine to medium grained; cemented. | 50 Feet of Solid Pipe Installed. 10 Feet of Screen Installed. Slot Size: 0.020" 15 Feet of Gravel Pack added. Hole Pressure Grouted from 0' - 45'. |
| 55 | | | | | SC | Clayey SAND: reddish brown; fine to medium grained; slightly plastic. | |
| 60 | | | | | | | Terminated at 60' |
| 65 | | | | | | | |
| 70 | | | | | | | |
| 75 | | | | | | | |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 6-11-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION UW-2

(110' Well)

JOB: 86012
FIGURE: 11

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| | | | | | SC | Clayey SAND: brown; moist; fine grained; plastic. | |
| 5 | | | | | CL/SC | Sandy CLAY/Clayey SAND: brownish olive; fine grained; highly plastic; firm. | |
| 10 | | | | | SM | Silty SAND: reddish brown; fine to medium grained; slightly cemented. | |
| 15 | | | | | SC | Clayey SAND: olive brown; fine grained; moderately plastic; moderately cemented. | |
| | | | | | | Abundant clay content. | |
| 20 | | | | | | | |
| | | | | | | Increase in cementation. | |
| 25 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 6-11-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION UW-2

JOB: 86012
FIGURE: 11

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS / FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | SC | Clayey SAND: olive brown; fine grained; moderately plastic; abundant clay content; cementation. | |
| 30 | | | | | SP | SAND: brownish white; fine to medium grained; occasionally coarse grained. | |
| 35 | | | | | | | |
| 40 | | | | | | | |
| 45 | | | | | SM | Silty SAND: brown to olive brown; fine to medium grained; cemented. | |
| 50 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES

(1) SAMPLER INSIDE DIAM
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 6-11-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION UW-2 (Cont'd)

JOB: 86012
FIGURE: 11

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 50 | | | | | SM | Silty SAND: brown to olive brown; fine to medium grained; cemented. | |
| | | | | | SC | Clayey SAND: reddish brown; fine to medium grained; slightly plastic. | |
| 55 | | | | | | | |
| 60 | | | | | CL | Sandy CLAY: olive to olive brown; fine grained sand; plastic; trace of silt.<br>Occasional lens of Silty Clay.<br>Occasionally slightly cemented. | |
| 65 | | | | | | | |
| 70 | | | | | | Increased silt content. | |
| 75 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 6-12-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION UW-2 (Cont'd)

JOB: 86012
FIGURE: 11

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 75 | | | | | CL | Silty CLAY: olive to olive brown; fine to medium grained sand; slightly cemented; increased in silt content. | |
| 80 | | | | | | Becomes olive to olive grey. Firm; highly plastic. | |
| 85 | | | | | | Some Fe Oxide staining. | |
| 90 | | | | | | | |
| | | | | | SP | SAND: brown; coarse to fine grained. | |
| 95 | | | | | | | |
| 100 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 6-12-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION UW-2 (Cont'd)

JOB: 86012
FIGURE: 11

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 100 | | | | | SP | SAND: brown; coarse to fine grained. | 100 Feet of Solid Pipe Installed. 10 Feet of Screen Installed. Slot Size: 0.020" 15 Feet of Gravel Pack Hole Pressure Grouted from 60' to 95'. |
| 105 | | | | | CL | Sandy CLAY: olive; fine grained sand; plastic. | |
| 110 | | | | | | | Terminated at 110' |
| 115 | | | | | | | |
| 120 | | | | | | | |
| 125 | | | | | | | |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 6-11-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION UW-2

(150' Well)

JOB: 86012
FIGURE: 12

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| | | | | | SC | Clayey SAND: brown; moist; fine grained; plastic. | |
| 5 | | | | | CL/SC | Sandy CLAY/Clayey SAND: brownish olive; fine grained; highly plastic; firm. | |
| 10 | | | | | SM | Silty SAND: reddish brown; fine to medium grained; slightly cemented. | |
| 15 | | | | | SC | Clayey SAND: olive brown; fine grained; moderately plastic; moderately cemented. | |
| | | | | | | Abundant clay content. | |
| 20 | | | | | | | |
| | | | | | | Increase in cementation. | |
| 25 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 6-11-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION UW-2

JOB: 86012
FIGURE: 12

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | SC | Clayey SAND: olive brown; fine grained; moderately plastic; abundant clay content; cementation. | |
| 30 | | | | | SP | SAND: brownish white; fine to medium grained; occasionally coarse grained. | |
| 35 | | | | | | | |
| 40 | | | | | | | |
| 45 | | | | | SM | Silty SAND: brown to olive brown; fine to medium grained; cemented. | |
| 50 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 6-11-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION UW-2 (Cont'd)

JOB: 86012
FIGURE. 12

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 50 | | | | | SM | Silty SAND: brown to olive brown; fine to medium grained; cemented. | |
| | | | | | SC | Clayey SAND: reddish brown; fine to medium grained; slightly plastic. | |
| 55 | | | | | | | |
| 60 | | | | | CL | Sandy CLAY: olive to olive brown; fine grained sand; plastic; trace of silt.<br>Occasional lens of Silty Clay.<br>Occasionally slightly cemented. | |
| 65 | | | | | | | |
| 70 | | | | | | | |
| | | | | | | Increased silt content. | |
| 75 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 6-12-86
LOGGED BY: TCK

# LOG DESIGNATION UW-2 (Cont'd)

ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

JOB: 86012
FIGURE: 12

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 75 | | | | | CL | Silty CLAY: olive to olive brown; fine to medium grained sand; slightly cemented; increased in silt content. | |
| 80 | | | | | | Becomes olive to olive grey. Firm; highly plastic. | |
| 85 | | | | | | Some Fe Oxide staining. | |
| 90 | | | | | | | |
| | | | | | SP | SAND: brown; coarse to fine grained. | |
| 95 | | | | | | | |
| 100 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 6-12-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION UW-2 (Cont'd)

JOB 86012
FIGURE: 12

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 100 | | | | | SP | SAND: brown; coarse to fine grained. | |
| 105 | | | | | CL | Sandy CLAY: olive; fine grained sand; plastic. | |
| 110 | | | | | | | |
| 115 | | | | | | | |
| | | | | | SM | Silty SAND: olive brown to reddish brown; fine to medium grained; cemented. | |
| 120 | | | | | | | |
| 125 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 6-12-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION UW-2 (Cont'd)

JOB: 86012
FIGURE: 12

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 125 | | | | | SM | Silty SAND: olive brown to reddish brown; fine to medium grained; cemented. | 140 Feet of Solid Pipe Installed. |
| | | | | | SC/CL | Clayey SAND/Sandy CLAY: light grey; fine to medium grained; abundant clay content. | 10 Feet of Slotted Pipe Installed. Slot Size: 0.020". 15 Feet of Gravel Pack Installed. Hole Pressure Grouted from 110' to 135' |
| 130 | | | | | | | |
| | | | | | SP | SAND: brown; fine to coarse grained. | |
| 135 | | | | | | | |
| 140 | | | | | | | |
| 145 | | | | | | | |
| 150 | | | | | | | Terminated at 150' |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 5-21-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION DW-1

(50' Well)

JOB: 86012
FIGURE: 13

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| | | | | | SC | Clayey SAND: brown; damp; fine to medium grained; some silt content. | |
| | | | | | SM | Silty SAND: dark olive green; fine to medium grained. | |
| 5 | | | | | | | |
| 10 | | | | | | | |
| | | | | | SC | Clayey SAND: light grey; fine to medium grained. | |
| 15 | | | | | | Slightly cemented; moderately plastic. | |
| 20 | | | | | | Abundant clay. | |
| 25 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 5-21-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION DW-1 (Cont'd)

JOB: 86012
FIGURE: 13

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | SC | Clayey SAND: light grey; fine to medium grained; slightly cemented; moderately plastic; abundant clay. | 40 Feet of Solid Pipe Installed. |
| | | | | | SP | SAND: grey; fine to medium grained; trace of silt. | 10 Feet of Slotted Pipe Installed. Slot Size: 0.020". 15 Feet of Gravel added. Hole Pressure Grouted from 0' to 35' |
| 30 | | | | | | | |
| | | | | | SC | Clayey SAND and Gravel: grey; fine to coarse grained; cemented; minimal clay content. | |
| 35 | | | | | | | |
| | | | | | | Some silt content. | |
| 40 | | | | | | | |
| 45 | | | | | SP | SAND: light brown; fine to coarse grained; occasional gravel. | |
| 50 | | | | | | | Terminated at 50' |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 5-21-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION DW-1

(100' Well)

JOB: 86012
FIGURE 14

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| | | | | | SC | Clayey SAND: brown; damp; fine to medium grained; some silt content. | |
| | | | | | SM | Silty SAND: dark olive green; fine to medium grained. | |
| 5 | | | | | | | |
| 10 | | | | | | | |
| | | | | | SC | Clayey SAND: light grey; fine to medium grained. | |
| 15 | | | | | | Slightly cemented; moderately plastic. | |
| 20 | | | | | | Abundant clay. | |
| 25 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 5-21-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION DW-1 (Cont'd)

JOB: 86012
FIGURE: 14

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | SC | Clayey SAND: light grey; fine to medium grained; slightly cemented; moderately plastic; abundant clay. | |
| | | | | | SP | SAND: grey; fine to medium grained; trace of silt. | |
| 30 | | | | | | | |
| | | | | | SC | Clayey SAND and Gravel: grey; fine to coarse grained; cemented; minimal clay content. | |
| 35 | | | | | | | |
| 40 | | | | | | Some silt content. | |
| 45 | | | | | | | |
| | | | | | SP | SAND: light brown; fine to coarse grained; occasional gravel. | |
| 50 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES

(1) SAMPLER INSIDE DIAM
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 5-22-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION DW-1 (Cont'd)

JOB: 86012
FIGURE: 14

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C. | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 50 | | | | | SP | SAND: light brown; fine to coarse grained; occasional gravel. | |
| | | | | | CL | Sandy CLAY: olive brown to grey; fine to medium grained sand; plastic. | |
| 55 | | | | | | | |
| 60 | | | | | | Sand becomes fine at 60'. | |
| 65 | | | | | | Slightly cemented from 64'-66'. | |
| | | | | | | Small decrease in sand content below 67'. | |
| 70 | | | | | | | |
| 75 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 5-22-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION DW-1 (Cont'd)

JOB: 86012
FIGURE: 14

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 75 | | | | | CL | Sandy CLAY: olive brown to grey; minimal sand content; slightly cemented. | 90 Feet of Solid Pipe Installed. 10 Feet of Slotted Pipe Installed. Slot Size: 0.020". 15 Feet of Gravel Pack added. Hole Pressure Grouted from 50' to 85'. |
| 80 | | | | | | | |
| 85 | | | | | | Some Fe Oxide staining. Slight cementation from 85'-90'. | |
| 90 | | | | | | Slight increase in sand content. | |
| 95 | | | | | | | |
| 100 | | | | | | | Terminated at 100' |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES

(1) SAMPLER INSIDE DIAM
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 5-21-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION DW-1

(170' Well)

JOB: 86012
FIGURE: 15

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C. | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| | | | | | SC | Clayey SAND: brown; damp; fine to medium grained; some silt content. | |
| 5 | | | | | SM | Silty SAND: dark olive green; fine to medium grained. | |
| 10 | | | | | | | |
| 15 | | | | | SC | Clayey SAND: light grey; fine to medium grained.<br><br>Slightly cemented; moderately plastic. | |
| 20 | | | | | | Abundant clay. | |
| 25 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 5-21-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION DW-1 (Cont'd)

JOB: 86012
FIGURE: 15

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | SC | Clayey SAND: light grey; fine to medium grained; slightly cemented; moderately plastic; abundant clay. | |
| | | | | | SP | SAND: grey; fine to medium grained; trace of silt. | |
| 30 | | | | | | | |
| | | | | | SC-GC | Clayey SAND and GRAVEL: grey; fine to coarse grained; cemented; minimal clay content. | |
| 35 | | | | | | | |
| 40 | | | | | | Some silt content. | |
| 45 | | | | | | | |
| | | | | | SP | SAND: light brown; fine to coarse grained; occasional gravel. | |
| 50 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 5-22-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION DW-1 (Cont'd)

JOB: 86012
FIGURE: 15

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 50 | | | | | SP | SAND: light brown; fine to coarse grained; occasional gravel. | |
| | | | | | CL | Sandy CLAY: olive brown to grey; fine to medium grained sand; plastic. | |
| 55 | | | | | | | |
| 60 | | | | | | Sand becomes fine at 60'. | |
| | | | | | | Slightly cemented from 64'-66'. | |
| 65 | | | | | | Small decrease in sand content below 67'. | |
| 70 | | | | | | | |
| 75 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 5-22-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION DW-1 (Cont'd)

JOB: 86012
FIGURE: 15

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 75 | | | | | CL | Sandy CLAY: olive brown to grey; minimal sand content; slightly cemented. | |
| 80 | | | | | | | |
| 85 | | | | | | Some Fe Oxide staining. Slight cementation from 85'-90'. | |
| 90 | | | | | | Slight increase in sand content. | |
| 95 | | | | | | | |
| 100 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 5-22-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION DW-1 (Cont'd)

JOB: 86012
FIGURE: 15

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 100 | | | | | CL | Sandy CLAY: olive brown to grey; small sand content; some Fe Oxide staining; slight cementation. | |
| 105 | | | | | | | |
| 110 | | | | | | Fe Oxide staining; slightly cemented. | |
| 115 | | | | | | | |
| 120 | | | | | SC | Clayey SAND: brown; fine to medium grained; abundant clay. | |
| 125 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 5-22-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL: No Groundwater Encountered at Time of Drilling
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION DW-1 (Cont'd)

JOB: 86012
FIGURE: 15

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 125 | | | | | SC | Clayey SAND: brown; fine to medium grained; abundant clay. | |
| | | | | | CL | Sandy CLAY: grey to greenish grey; fine grained; plastic; minimal sand. | |
| 130 | | | | | | | |
| 135 | | | | | | Highly cemented below 135'. | |
| 140 | | | | | | | |
| 145 | | | | | | | |
| 150 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 5-22-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION DW-1 (Cont'd)

JOB: 86012
FIGURE: 15

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 150 | | | | | CL | Sandy CLAY: grey to greenish grey; fine grained; plastic; highly cemented. | 150 Feet of Solid Pipe Installed. 20 Feet of Screen Installed. Slot Size: 0.020". 25 Feet of Gravel Pack Installed. Hole Pressure Grouted from 100' to 145' |
| 155 | | | | | | Moderately cemented below 155'. | |
| 160 | | | | | | | |
| 165 | | | | | | | |
| 170 | | | | | | | Terminated at 170' |
| 175 | | | | | | | |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 6-02-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION DW-2
(50' Well)

JOB: 86012
FIGURE: 16

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| | | | | | SC | Clayey SAND: brown; damp; fine to medium grained; some silt. | |
| 5 | | | | | SM | Silty SAND: dark olive green; fine to medium grained. | |
| 10 | | | | | SM/ SC | Silty SAND/Clayey SAND: light grey; fine to medium grained; highly cemented. | |
| 15 | | | | | | Some Fe Oxide staining. | |
| 20 | | | | | | Increase in clay content. | |
| 25 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 6-02-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION DW-2 (Cont'd)

JOB: 86012
FIGURE: 16

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | SM/SC | Silty SAND/Clayey SAND: light grey; fine to medium grained; decreasing cementation; some Fe Oxide staining; increase in clay content. | 30 Feet of Solid Pipe Installed. 10 Feet of Slotted Pipe Installed. 15 Feet of Gravel Pack added. Hole Pressure Grouted from 0' to 35'. |
| 30 | | | | | | | |
| 35 | | | | | | Slightly cemented. | |
| | | | | | SC/CL | Clayey SAND/Sandy CLAY: olive; fine grained. | |
| 40 | | | | | | | |
| 45 | | | | | | | |
| 50 | | | | | | | Terminated at 50' |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 6-02-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION DW-2

(100' Well)

JOB: 86012
FIGURE: 17

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| | | | | | SC | Clayey SAND: brown; damp; fine to medium grained; some silt. | |
| 5 | | | | | SM | Silty SAND: dark olive green; fine to medium grained. | |
| 10 | | | | | SM/SC | Silty SAND/Clayey SAND: light grey; fine to medium grained; highly cemented. | |
| 15 | | | | | | Some Fe Oxide staining. | |
| 20 | | | | | | Increase in clay content. | |
| 25 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 6-02-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION DW-2 (Cont'd)

JOB: 86012
FIGURE: 17

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | SM/SC | Silty SAND/Clayey SAND: light grey; fine to medium grained; decreasing cementation; some Fe Oxide staining; increase in clay content. | |
| 30 | | | | | | | |
| 35 | | | | | | Slightly cemented. | |
| | | | | | SC/CL | Clayey SAND/Sandy CLAY: olive; fine grained. | |
| 40 | | | | | | | |
| 45 | | | | | | | |
| 50 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 6-03-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION DW-2 (Cont'd)

JOB: 86012
FIGURE: 17

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 50 | | | | | SC/CL | Clayey SAND/Sandy CLAY: olive; fine to medium grained. | |
| 55 | | | | | ML | Sandy SILT: light grey; fine grained; occasional medium; trace of clay; cemented. | |
| 60 | | | | | | | |
| 65 | | | | | | | |
| 70 | | | | | | | |
| 75 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 6-03-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION DW-2 (Cont'd)

JOB: 86012
FIGURE: 17

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 75 | | | | | ML | Sandy SILT: light grey; fine grained; occasional medium; trace of clay; cemented. | 90 Feet of Solid Pipe Installed. 10 Feet of Screen Installed. 15 Feet of Gravel Pack added. Hole Pressur Grouted from 50' to 85'. |
| 80 | | | | | | | |
| | | | | | SC | Clayey SAND: reddish brown; fine to coarse grained; minimal clay content. | |
| 85 | | | | | | | |
| 90 | | | | | | | |
| | | | | | CL/SC | Sandy CLAY/Clayey SAND: grey; fine to medium grained; plastic; Becomes reddish brown below 95'. | |
| 95 | | | | | | | |
| 100 | | | | | | | Terminated at 100' |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 6-02-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL.
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION DW-2

(170' Well)

JOB: 86012
FIGURE: 18

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| | | | | | SC | Clayey SAND: brown; damp; fine to medium grained; some silt. | |
| 5 | | | | | SM | Silty SAND: dark olive green; fine to medium grained. | |
| 10 | | | | | SM/SC | Silty SAND/Clayey SAND: light grey; fine to medium grained; highly cemented. | |
| 15 | | | | | | Some Fe Oxide staining. | |
| 20 | | | | | | Increase in clay content. | |
| 25 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 6-02-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION DW-2 (Cont'd)

JOB: 86012
FIGURE: 18

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | SM/SC | Silty SAND/Clayey SAND: light grey; fine to medium grained; decreasing cementation; some Fe Oxide staining; increase in clay content. | |
| 30 | | | | | | | |
| 35 | | | | | | Slightly cemented. | |
| | | | | | SC/CL | Clayey SAND/Sandy CLAY: olive; fine grained. | |
| 40 | | | | | | | |
| 45 | | | | | | | |
| 50 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 6-03-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION DW-2 (Cont'd)

JOB: 86012
FIGURE: 18

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 50 | | | | | SC/CL | Clayey SAND/Sandy CLAY: olive; fine to medium grained. | |
| 55 | | | | | ML | Sandy SILT: light grey; fine grained; occasional medium; trace of clay; cemented. | |
| 60 | | | | | | | |
| 65 | | | | | | | |
| 70 | | | | | | | |
| 75 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 6-03-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION DW-2 (Cont'd)

JOB: 86012
FIGURE: 18

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 75 | | | | | ML | Sandy SILT: light grey; fine grained; occasional medium; trace of clay; cemented. | |
| 80 | | | | | SC | Clayey SAND: reddish brown; fine to coarse grained; minimal clay content. | |
| 85 | | | | | | | |
| 90 | | | | | | | |
| 95 | | | | | CL/SC | Sandy CLAY/Clayey SAND: grey; fine to medium grained; plastic.<br>Becomes reddish brown below 95'. | |
| 100 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 6-03-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION DW-2 (Cont'd)

JOB: 86012
FIGURE: 18

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 100 | | | | | CL/SC | Sandy CLAY/Clayey SAND: grev: fine grained sand; plastic; some Fe Oxide staining. | |
| 105 | | | | | | Increase in sand content at 105'. | |
| 110 | | | | | | Decrease in sand content. Trace of silt at 114'. | |
| 115 | | | | | | Increase in silt content with depth. | |
| 120 | | | | | ML | Clayey SILT: grey; slightly plastic; trace of sand. | |
| 125 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 6-03-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION DW-2 (Cont'd)

JOB: 86012
FIGURE: 18

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 125 | | | | | ML | Clayey SILT: grey; slightly plastic; trace of sand. | |
| | | | | | CL | Silty CLAY: olive grey; moderately plastic; trace of fine grained sand. | |
| 130 | | | | | | | |
| 135 | | | | | SM | Silty SAND: brown; fine grained; abundant silt content; slightly cemented. | |
| 140 | | | | | | | |
| 145 | | | | | CL | Sandy CLAY: light olive; fine grained; moderately plastic. | |
| 150 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 6-05-86
LOGGED BY: TCK
ELEVATION:
WATER LEVEL:
EQUIPMENT: 11-1/2" Drag Bit, CME Rotary Wash with Bentonite

# LOG DESIGNATION DW-2 (Cont'd)

JOB: 86012
FIGURE: 18

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 150 | | | | | CL | Sandy CLAY: light olive; fine grained; moderately plastic. | 150 Feet of Solid Pipe added. 20 Feet of Screen Installed. Slot Size: 0.020". Gravel Pack Installed from 145' to 170' Hole Present Grouted from 100' to 145'. |
| | | | | | | Some Fe Oxide staining. | |
| 155 | | | | | | Fine grained with occasional medium grained below 155'. | |
| 160 | | | | | | Increase in sand content. | |
| 165 | | | | | | Slightly cemented below 165'; high sand content. | |
| 170 | | | | | | | Terminated at 170' |
| 175 | | | | | | | |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 9-29-86
LOGGED BY: JH
ELEVATION:
WATER LEVEL: Groundwater Encountered at 40' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME 75 Drill Rig

# LOG DESIGNATION 301

JOB: 86012
FIGURE: 19

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| | | | | | ML | Sandy SILT: yellow brown; damp; loose. | Hole Backfilled with Grout to within 7 Feet of Surface on Completion |
| 5 | | | | | ML | Clayey SILT: greyish brown; damp; some clay; loose. | |
| | | | | | SM | Silty SAND: light brown; damp; medium to fine grained; some clay; loose; some cementation. | |
| 10 | | | | | CL | Silty CLAY: greyish brown; damp; firm. | |
| 15 | | | | | | | |
| 20 | | | | | | | |
| 25 | | | | | SP | SAND: brown; damp; medium to fine grained; some clay; loose. | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 9-29-86
LOGGED BY: JH
ELEVATION:
WATER LEVEL: Groundwater Encountered at 40' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME 75 Drill Rig

# LOG DESIGNATION 301 (Cont'd)

JOB: 86012
FIGURE: 19

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | SP | SAND: brown; damp; medium to fine grained; some clay; loose. | |
| | | | | | CL | Silty CLAY: greyish brown; damp; firm. | |
| 30 | | | | | ML | Sandy SILT: brown; damp; fine to medium grained. | |
| | | | | | CL | Silty CLAY: greyish brown; damp; firm. | |
| 35 | | | | | SM | Silty SAND: brown; damp; medium to fine grained. | |
| | | | | | CL | Silty CLAY: greyish brown; damp; firm. | |
| 40 | | | | | SM | Silty SAND: yellow brown; damp; medium to fine grained. | Groundwater Encountered at 40' at Time of Drilling |
| | | | | | CL | Silty CLAY: greyish brown; firm; saturated. | |
| 45 | | | | | | | |
| 50 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 9-29-86
LOGGED BY: JH
ELEVATION:
WATER LEVEL: Groundwater Encountered at 40' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME 75 Drill Rig

# LOG DESIGNATION 301 (Cont'd)

JOB: 86012
FIGURE: 19

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 50 | | | | | CL | Silty CLAY: greyish brown; firm; saturated. | Groundwater Encountered at 40' at Time of Drilling |
| 55 | | | | | | | Terminated at 55' |
| 60 | | | | | | | |
| 65 | | | | | | | |
| 70 | | | | | | | |
| 75 | | | | | | | |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 9-29-86
LOGGED BY: JH
ELEVATION:
WATER LEVEL: Groundwater Encountered at 39' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME 75 Drill Rig

# LOG DESIGNATION 302

JOB: 86012
FIGURE: 20

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| | | | | | ML | SILT: yellow brown; damp; loose. | Hole Backfilled with Grout to within 7 Feet of Surface upon Completion |
| | | | | | ML | Clayey Sandy SILT: greyish brown; loose. | |
| 5 | | | | | SM | Silty SAND: brown; damp; some clay; loose. | |
| 10 | | | | | CL | CLAY: greyish brown; wet; firm. | |
| 15 | | | | | SM | Silty SAND: yellow brown; saturated; loose. | |
| 20 | | | | | CL | Silty CLAY: brown; damp; firm. | |
| 25 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 9-29-86
LOGGED BY: JH
ELEVATION:
WATER LEVEL: Groundwater Encountered at 39' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME 75 Drill Rig

# LOG DESIGNATION 302 (Cont'd)

JOB: 86012
FIGURE: 20

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C. | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | CL | Silty CLAY: brown; damp; firm. | |
| | | | | | SM | Silty SAND: yellow brown; damp; medium to fine grained; loose. | |
| 30 | | | | | CL | Silty CLAY: greyish brown; moist; firm. | |
| 35 | | | | | CL | CLAY: greyish brown; wet; firm. | Groundwater Encountered at 39' at Time of Drilling |
| 40 | | | | | CL | Silty CLAY: greyish brown; moist; firm. | |
| 45 | | | | | CL | Silty CLAY: brown; moist; firm. | |
| 50 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 9-29-86
LOGGED BY: JH
ELEVATION:
WATER LEVEL: Groundwater Encountered at 39' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME 75 Drill Rig

# LOG DESIGNATION 302 (Cont'd)

JOB: 86012
FIGURE: 20

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 50 | | | | | CL | Silty CLAY: brown; moist; firm. | |
| | | | | | CL | Silty CLAY: greyish brown; saturated; firm. | |
| 55 | | | | | CL | Sandy CLAY: yellow brown; stiff. | Groundwater Encountered at 39' at Time of Drilling |
| 60 | | | | | | | Terminated at 60' |
| 65 | | | | | | | |
| 70 | | | | | | | |
| 75 | | | | | | | |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 9-29-86
LOGGED BY: JH
ELEVATION:
WATER LEVEL: Groundwater Encountered at 37' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME 75 Drill Rig

# LOG DESIGNATION 303

JOB: 86012
FIGURE: 21

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| | | | | | SM | Sandy SILT: yellow brown; damp; fine to medium grained; loose. | Hole Backfilled with Grout to within 7 Feet of Surface on Completion |
| 5 | | | | | ML | Clayey SILT: greyish brown; damp; loose. | |
| | | | | | SC | Clayey SAND: reddish brown; damp; fine to medium grained; loose. | |
| 10 | | | | | CL | Silty CLAY: greyish brown; moist; firm. | |
| 15 | | | | | | | |
| 20 | | | | | SM | Silty SAND: yellow brown; damp; fine to medium grained; loose. | |
| | | | | | CL | Silty CLAY: brown; moist; firm. | |
| 25 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 9-29-86
LOGGED BY: JH
ELEVATION:
WATER LEVEL: Groundwater Encountered at 37' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME 75 Drill Rig

# LOG DESIGNATION 303 (Cont'd)

JOB: 86012
FIGURE: 21

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | CL | Silty CLAY: brown; moist; firm. | |
| | | | | | CL | Silty CLAY: greyish brown; moist; firm. | |
| 30 | | | | | CL | Silty CLAY: brown; wet; firm. | |
| | | | | | ML | Sandy SILT: light brown; damp; fine to medium and medium graded. | |
| | | | | | CL | Sandy CLAY: greyish brown; moist; firm. | |
| 35 | | | | | | | |
| | | | | | | | Groundwater Encountered at 37' at Time of Drilling |
| 40 | | | | | | | |
| 45 | | | | | | | |
| | | | | | CL | Silty CLAY: greyish brown; saturated; firm. | |
| 50 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 9-29-86
LOGGED BY: JH
ELEVATION:
WATER LEVEL: Groundwater Encountered at 37' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME 75 Drill Rig

# LOG DESIGNATION 303 (Cont'd)

JOB: 86012
FIGURE: 21

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 50 | | | | | CL | Silty CLAY: greyish brown; saturated; firm. | |
| | | | | | CL | Sandy CLAY: yellow brown; saturated; stiff. | Groundwater Encountered at 37' at Time of Drilling |
| 55 | | | | | | | |
| | | | | | | | Terminated at 58' |
| 60 | | | | | | | |
| 65 | | | | | | | |
| 70 | | | | | | | |
| 75 | | | | | | | |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 10-28-86
LOGGED BY: JH
ELEVATION:
WATER LEVEL: Groundwater Encountered at 42' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME Drill Rig

# LOG DESIGNATION 304

JOB: 86012
FIGURE: 22

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| | | | | | ML | Sandy SILT: yellow brown; damp; loose. | Hole Backfilled with Grout to within 7 Feet of Surface on Completion |
| | | | | | CL | Silty CLAY: greyish brown; damp; firm. | |
| 5 | | | | | SM | Silty SAND: light brown; damp; medium to fine grained; some clay; medium dense. | |
| 10 | | | | | | Some cementation. | |
| 15 | | | | | | | |
| 20 | | | | | CL | Silty CLAY: grey brown; damp; firm. | |
| 25 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 10-28-86
LOGGED BY: JH
ELEVATION:
WATER LEVEL: Groundwater Encountered at 42' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME Drill Rig

# LOG DESIGNATION 304 (Cont'd)

JOB: 86012
FIGURE: 22

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | CL | Silty CLAY: brown; moist; firm. | |
| 30 | | | | | ML | Sandy SILT: light brown; fine grained; medium dense. | |
| 35 | | | | | CL | Sandy CLAY: greyish brown; moist; stiff. | |
| 40 | | | | | | | Groundwater Encountered at 42' at Time of Drilling |
| 45 | | | | | CL | Sandy CLAY: greyish brown; saturated; firm. | |
| 50 | | | | | | | Terminated at 50' |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 10-28-86
LOGGED BY: JH
ELEVATION:
WATER LEVEL: Groundwater Encountered at 41' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME Drill Rig

# LOG DESIGNATION 305

JOB: 86012
FIGURE: 23

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 5 | | | | | SC | Clayey SAND: tan; moist; medium to very fine grained; loose. | Hole Backfilled with Grout to within 7 Feet on Completion |
| 10 | | | | | SM | Silty SAND: light brown; damp; medium to fine grained; some clay; loose.<br><br>Some cementation. | |
| 15 | | | | | CL | Silty CLAY: greyish brown; moist; firm. | |
| 20 | | | | | SM | Silty SAND: yellow brown; damp; fine to medium grained; medium dense. | |
| 25 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 10-28-86
LOGGED BY: JH
ELEVATION:
WATER LEVEL: Groundwater Encountered at 41' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME Drill Rig

# LOG DESIGNATION 305 (Cont'd)

JOB: 86012
FIGURE: 23

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | SM | Silty SAND: yellow brown; damp; fine to medium grained; medium dense. | |
| | | | | | CL | Silty CLAY: brown; wet; firm; slightly plastic. | |
| 30 | | | | | | | |
| 35 | | | | | | | |
| 40 | | | | | | | Groundwater Encountered at 41' at Time of Drilling |
| | | | | | SC | Clayey SAND: olive grey; saturated; fine to medium grained; medium dense. | |
| 45 | | | | | | | |
| | | | | | SP | SAND: tan; saturated; fine to medium grained; loose; poorly graded. | Terminated at 50' |
| 50 | | | | | | | |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 9-09-86
LOGGED BY: HN
ELEVATION:
WATER LEVEL: Groundwater Encountered at 51' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME Drill Rig

# LOG DESIGNATION 400

JOB: 86012
FIGURE: 24

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| | | | | | SM | Silty SAND: brown; dry; fine to medium grained; loose. | Hole Backfilled with Grout to within 7 Feet on Completion |
| 5 | | | | | SC | Clayey SAND: grey; moist; fine to medium grained; medium dense. | |
| | | | | | SW | SAND: brown; moist; fine to medium grained; loose. | |
| 10 | | | | | SC | Clayey SAND: reddish brown; moist; fine to medium grained; medium dense. | |
| 15 | | | | | SM | Silty SAND: reddish brown; moist; loose. | |
| 20 | | | | | CL | Sandy CLAY: brown; moist; firm. | |
| 25 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 9-09-86
LOGGED BY: HN
ELEVATION:
WATER LEVEL: Groundwater Encountered at 51' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME Drill Rig

# LOG DESIGNATION 400 (Cont'd)

JOB: 86012
FIGURE: 24

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | CL | Sandy CLAY: brown; moist; firm. | |
| | | | | | CL | Silty CLAY: grey brown; moist; firm; slightly plastic. | |
| 30 | | | | | | | |
| 35 | | | | | | | |
| | | | | | CL | CLAY: grey; moist to wet; firm; plastic. | |
| 40 | | | | | CL | Sandy CLAY: light brown; moist; slightly plastic. | |
| | | | | | | Becomes wet. | |
| 45 | | | | | | | |
| 50 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 9-09-86
LOGGED BY: HN
ELEVATION:
WATER LEVEL: Groundwater Encountered at 51' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME Drill Rig

# LOG DESIGNATION 400 (Cont'd)

JOB: 86012
FIGURE: 24

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 50 | | | | | CL | Sandy CLAY: light brown; wet; slightly plastic. | Groundwater Encountered at 51' at Time of Drilling |
| 55 | | | | | SP | SAND: grey; saturated; medium grained; poorly graded; loose. | |
| | | | | | CL | Sandy CLAY: brown; wet; stiff. | |
| 60 | | | | | | | Terminated at 60' |
| 65 | | | | | | | |
| 70 | | | | | | | |
| 75 | | | | | | | |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 11-14-86
LOGGED BY: LI
ELEVATION:
WATER LEVEL: Groundwater Encountered at 53'4" at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger

# LOG DESIGNATION 401

JOB: 86012
FIGURE: 25

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| | | | | | SM | Silty SAND: medium brown; dry; fine grained. | Hole Backfilled with Grout to within 7 Feet of Surface on Completion. |
| 5 | | | | | SC | SAND: with brown grey clay; moist. | |
| | | | | | SW | SAND: light brown; moist. | |
| 10 | | | | | SC | Clayey SAND: red brown; moist. | |
| 15 | | | | | CH | CLAY: grey brown; slightly plastic. | |
| 20 | | | | | SM | Silty SAND: light red brown with grey clay. | |
| | | | | | CL | Sandy CLAY: brown; moist. | |
| 25 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 11-14-86
LOGGED BY: LI
ELEVATION:
WATER LEVEL: Groundwater Encountered at 53'4" at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger

# LOG DESIGNATION 401 (Cont'd)

JOB: 86012
FIGURE: 25

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | SC | Sandy CLAY: brown; moist. | |
| 30 | | | | | CL | Silty CLAY: red brown; moist to wet. | |
| 40 | | | | | CL | Sandy CLAY: brown; moist; slightly plastic. | |
| 45 | | | | | | | |
| 50 | | | | | | Becomes wet. | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 11-14-86
LOGGED BY: LI
ELEVATION:
WATER LEVEL: Groundwater Encountered at 53'4" at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger

# LOG DESIGNATION 401 (Cont'd)

JOB: 86012
FIGURE: 25

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 50 | | | | | CL | Sandy CLAY: brown; wet; slightly plastic. | |
| 55 | | | | | | | Groundwater Encountered at 53'4" at Time of Drilling |
| 60 | | | | | | | Terminated at 60' |
| 65 | | | | | | | |
| 70 | | | | | | | |
| 75 | | | | | | | |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 11-14-86
LOGGED BY: LI
ELEVATION:
WATER LEVEL: Groundwater Encountered at 57' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger

# LOG DESIGNATION 402

JOB: 86012
FIGURE: 26

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| | | | | | CL | Silty CLAY: brown; moist. | Hole Backfilled with Grout to within 7 Feet of Surface on Completion. |
| 5 | | | | | SC | Clayey SAND: brown grey; moist. | |
| | | | | | SM | Silty SAND: brown; damp. | |
| 10 | | | | | SC | Clayey SAND: red brown; well graded. | |
| 15 | | | | | CL | Sandy CLAY: grey brown; moist. | |
| 20 | | | | | SC | Clayey SAND: red brown; moist. | |
| 25 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER – 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 11-14-86
LOGGED BY: LI
ELEVATION:
WATER LEVEL: Groundwater Encountered at 57' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger

# LOG DESIGNATION 402 (Cont'd)

JOB: 86012
FIGURE: 26

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | CL | CLAY: grey brown; moist; plastic; loose. | |
| 30 | | | | | CL | Silty CLAY: brown with hard red clay; loose. | |
| 35 | | | | | CH | CLAY: red; very moist. | |
| 40 | | | | | SW | SAND: brown; moist. | |
| 45 | | | | | | | |
| 50 | | | | | SC | Clayey SAND: red; very wet. | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 11-14-86
LOGGED BY: LI
ELEVATION:
WATER LEVEL: Groundwater Encountered at 57' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger

# LOG DESIGNATION 402 (Cont'd)

JOB: 86012
FIGURE: 26

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 50 | | | | | SC | Clayey SAND: reddish brown; moist. | |
| 55 | | | | | SC | Clayey SAND: wet to saturated; very fine grained. | Groundwater Encountered at 57' at Time of Drilling |
| 60 | | | | | | | Terminated at 60' |
| 65 | | | | | | | |
| 70 | | | | | | | |
| 75 | | | | | | | |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 11-24-86
LOGGED BY: LI
ELEVATION:

# LOG DESIGNATION 403

WATER LEVEL: Groundwater Encountered at 49.6' at Time of Drilling JOB: 86012
EQUIPMENT: 8" Hollow Stem Auger, CME 75 Drill Rig FIGURE: 27

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 5 | | | | | ML | Clayey SILT: medium brown; damp. | Hole Backfilled with Grout to within 7 Feet of Surface on Completion. |
| 10 | | | | | SC | Clayey SAND: brown with grey clay; damp. | |
| 15 | | | | | CL | Sandy CLAY: brown grey; damp. | |
| 20 | | | | | | | |
| 25 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 11-24-86
LOGGED BY: LI
ELEVATION:
WATER LEVEL: Groundwater Encountered at 49.6' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME 75 Drill Rig

# LOG DESIGNATION 403 (Cont'd)

JOB: 86012
FIGURE: 27

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | CL | Sandy CLAY: brown grey; damp. | |
| 30 | | | | | SC | Clayey SAND: medium brown; damp. | |
| 35 | | | | | | | |
| 40 | | | | | | | |
| 45 | | | | | | | Groundwater Encountered at 49.6' at Time of Drilling |
| 50 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 11-24-86
LOGGED BY: LI
ELEVATION:
WATER LEVEL: Groundwater Encountered at 49.6' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME 75 Drill Rig

# LOG DESIGNATION 403 (Cont'd)

JOB: 86012
FIGURE: 27

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 50 | | | | | SC | Clayey SAND: medium brown; damp. | |
| 55 | | | | | | | Terminated at 55' |
| 60 | | | | | | | |
| 65 | | | | | | | |
| 70 | | | | | | | |
| 75 | | | | | | | |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 11-25-86
LOGGED BY: LI
ELEVATION:
WATER LEVEL: Groundwater Encountered at 43' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME 75 Drill Rig

# LOG DESIGNATION 404

JOB: 86012
FIGURE: 28

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS / FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| | | | | | CL | Sandy CLAY: dark brown; damp. | Hole Backfilled with Grout to within 7 Feet of Surface on Completion. |
| 5 | | | | | SC | Clayey SAND: light brown; with grey clay. | |
| 10 | | | | | | | |
| | | | | | CL | CLAY: grey brown; moist with small amount of sandy fines. | |
| 15 | | | | | | | |
| 20 | | | | | SC | Clayey SAND: brown; moist. | |
| | | | | | CL | CLAY: grey brown; moist. | |
| 25 | | | | | SC | Clayey SAND: medium brown; damp. | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 11-25-86
LOGGED BY: LI
ELEVATION:
WATER LEVEL: Groundwater Encountered at 43' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME 75 Drill Rig

# LOG DESIGNATION 404 (Cont'd)

JOB: 86012
FIGURE: 28

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | SC | Clayey SAND: medium brown; damp. | |
| 30 | | | | | | | |
| 35 | | | | | | | |
| 40 | | | | | | Wetter at 40'. | Groundwater Encountered at 43' at Time of Drilling |
| 45 | | | | | | | |
| 50 | | | | | | | Terminated at 50' |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 11-26-86

LOGGED BY: LI

ELEVATION:

WATER LEVEL: Groundwater Encountered 45.5' at Time of Drilling

EQUIPMENT: 8" Hollow Stem Auger, CME 75

# LOG DESIGNATION 405

JOB: 86012

FIGURE: 29

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 5 | | | | | SC | Clayey SAND: medium brown; damp. | Hole Backfilled with Grout to within 7 Feet of Surface on Completion. |
| 10 | | | | | CL | Sandy CLAY: red brown; moist. | |
| 15 | | | | | SC | Clayey SAND: medium brown; moist. | |
| 20 | | | | | CL | Silty CLAY: medium brown; moist. | |
| 25 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.

(2) 140 lbs HAMMER - 30 INCH DROP.

(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 11-26-86
LOGGED BY: LI
ELEVATION:

# LOG DESIGNATION 405 (Cont'd)

WATER LEVEL: Groundwater Encountered at 45.5' at Time of Drilling JOB: 86012
EQUIPMENT: 8" Hollow Stem Auger, CME 75 Drill Rig FIGURE: 29

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | CL | Silty CLAY: medium brown; moist. | |
| | | | | | SC | Clayey SAND: yellow brown; damp. | |
| 30 | | | | | CL | Sandy CLAY: brown; damp. | |
| | | | | | SC | Clayey SAND: red brown; damp. | |
| 35 | | | | | | | |
| | | | | | SP | SAND: medium brown; very wet; fine to medium grained. | |
| 40 | | | | | | | |
| 45 | | | | | | | Groundwater Encountered at 45.5' at Time of Drilling |
| 50 | | | | | | | Terminated at 50' |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 1-02-87
LOGGED BY: JH
ELEVATION:
WATER LEVEL: Groundwater Encountered at 47' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, Mobile B-50 Drill Rig

# LOG DESIGNATION 406

JOB: 86012
FIGURE: 30

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| | | | | | SC | Clayey SAND: tan; moist; loose; fine to medium grained. | Hole Backfilled with Grout to within 7 Feet of Surface on Completion |
| 5 | | | | | SC | Clayey SAND: olive grey; moist; loose; medium to fine grained; poorly graded. | |
| 10 | | | | | SM | Silty SAND: tan; moist; loose; fine grained; poorly graded. | |
| 15 | | | | | SC | Clayey SAND: tan; moist; loose; fine grained; poorly graded.<br><br>Some cementation at 17'. | |
| 20 | | | | | ML | Clayey SILT: olive tan; moist; medium dense. | |
| 25 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 1-02-87
LOGGED BY: JH
ELEVATION:
WATER LEVEL: Groundwater Encountered at 47' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, Mobile B-50 Drill Rig

# LOG DESIGNATION 406 (Cont'd)

JOB: 86012
FIGURE: 30

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | ML | Clayey SILT: olive tan; moist; medium dense. | |
| 30 | | | | | CL | Silty CLAY: olive grey; moist; firm; slightly plastic. | |
| 35 | | | | | ML | Clayey SILT: tan; moist; loose. | |
| 40 | | | | | | | |
| 45 | | | | | | | Groundwater Encountered at 47' at Time of Drilling |
| 50 | | | | | | | Terminated at 50' |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 1-02-87

# LOG DESIGNATION 407

LOGGED BY: JH

ELEVATION:

WATER LEVEL: Groundwater Encountered at 46' at Time of Drilling

JOB: 86012

EQUIPMENT: 8" Hollow Stem Auger, Mobile B-50 Drill Rig

FIGURE: 31

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 5 | | | | | SC | Clayey SAND: tan; moist; loose; fine to medium grained. | Hole Backfilled with Grout to within 7 Feet of Surface on Completion. |
| | | | | | SC | Clayey SAND: olive grey; moist; loose; fine to medium grained; poorly graded. | |
| 10 | | | | | SM | Silty SAND: tan; moist; loose; fine grained; poorly graded. | |
| 15 | | | | | SC | Clayey SAND: tan; moist; fine to medium grained; medium dense. | |
| | | | | | SC | Clayey SAND: olive grey; fine grained; poorly graded; medium dense; some cementation. | |
| 20 | | | | | ML | Clayey SILT: olive grey; moist; medium dense. | |
| 25 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM

(2) 140lbs HAMMER - 30 INCH DROP.

(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 1-02-87
LOGGED BY: JH
ELEVATION:
WATER LEVEL: Groundwater Encountered at 46' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, Mobile B-50 Drill Rig

# LOG DESIGNATION 407 (Cont'd)

JOB: 86012
FIGURE: 31

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | SC | Clayey SAND: olive grey; moist; fine grained; dense. | |
| | | | | | CL | Silty CLAY: olive grey; moist; firm; slightly plastic. | |
| 30 | | | | | | | |
| 35 | | | | | | | |
| 40 | | | | | | | |
| | | | | | SC | Clayey SAND: olive grey; moist; fine to medium grained; medium dense. | |
| 45 | | | | | SP | SAND: tan; moist; fine to medium grained; loose; poorly graded. | Groundwater Encountered at 46' at Time of Drilling |
| 50 | | | | | | | Terminated at 50' |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 11-24-86
LOGGED BY: LI
ELEVATION:
WATER LEVEL: Groundwater Encountered at 47.4' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME 75 Drill Rig

# LOG DESIGNATION 501

JOB: 86012
FIGURE: 32

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 5 | | | | | CL | Silty CLAY: grey; moist. | Hole Backfilled with Grout to within 7 Feet of Surface on Completion. |
| 10 | | | | | CL | Sandy CLAY: light brown with grey clay moist. | |
| 15 | | | | | CL | CLAY: light brown; slightly plastic. | |
| 20 | | | | | CL | Sandy CLAY: light brown; grey clay damp. | |
| 25 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 11-24-86
LOGGED BY: LI
ELEVATION:
WATER LEVEL: Groundwater Encountered at 47.4' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME 75 Drill Rig

# LOG DESIGNATION 501 (Cont'd)

JOB: 86012
FIGURE: 32

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | CL | Sandy CLAY: light brown to grey; damp. | |
| 30 | | | | | CL | CLAY: grey; moist. | |
| 35 | | | | | SC/CL | Sandy CLAY to Clayey SAND: reddish brown; moist to wet. | |
| 40 | | | | | | | |
| 45 | | | | | | | |
| 50 | | | | | CL | CLAY: brown; moist. | Groundwater Encountered at 47.7' at Time of Drilling (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 11-24-86
LOGGED BY: LI
ELEVATION:
WATER LEVEL: Groundwater Encountered at 47.4' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME 75 Drill Rig

# LOG DESIGNATION 501 (Cont'd)

JOB: 86012
FIGURE: 32

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 50 | | | | | CL | CLAY: brown; moist. | |
| 55 | | | | | | | Terminated at 55' |
| 60 | | | | | | | |
| 65 | | | | | | | |
| 70 | | | | | | | |
| 75 | | | | | | | |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 11-24-86
LOGGED BY: LI
ELEVATION:
WATER LEVEL: Groundwater Encountered at 46' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME 75 Drill Rig

# LOG DESIGNATION 502

JOB: 86012
FIGURE: 33

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 5 | | | | | CL | Silty CLAY: brown grey; damp. | Hole Backfilled with Grout to within 7 Feet of Surface on Completion. |
| 10 | | | | | ML | Clayey SILT: brown; damp. | |
| | | | | | CL | Sandy CLAY: brown grey; damp. | |
| 15 | | | | | CL | CLAY: grey brown; damp. | |
| 20 | | | | | SC | Clayey SAND: brown; damp; coarser grained with depth. | |
| 25 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 11-24-86
LOGGED BY: LI
ELEVATION:
WATER LEVEL: Groundwater Encountered at 46' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME 75 Drill Rig

# LOG DESIGNATION 502 (Cont'd)

JOB:86012
FIGURE: 33

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | SC | Clayey SAND: brown; damp; coarser with depth. | |
| 30 | | | | | CL | CLAY: medium brown; damp. | |
| | | | | | SC | Clayey SAND: red brown; very fine grained. | |
| 35 | | | | | | | |
| 40 | | | | | | | Groundwater Encountered at 46' at Time of Drilling |
| 45 | | | | | | | |
| 50 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 11-24-86
LOGGED BY: LI
ELEVATION:
WATER LEVEL: Groundwater Encountered at 46' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME 75 Drill Rig

# LOG DESIGNATION 502 (Cont'd)

JOB: 86012
FIGURE: 33

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 50 | | | | | SC | Clayey SAND: red brown; very fine grained. | |
| 55 | | | | | | | Terminated at 55' |
| 60 | | | | | | | |
| 65 | | | | | | | |
| 70 | | | | | | | |
| 75 | | | | | | | |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 11-26-86
LOGGED BY: LI
ELEVATION:
WATER LEVEL: Groundwater Stabilized at 47 .8' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME 75 Drill Rig

# LOG DESIGNATION 601

JOB: 86012
FIGURE: 34

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| | | | | | CL | Silty CLAY: light brown; damp. | Hole Backfilled with Grout to within 7 Feet on Completion |
| 5 | | | | | SC | Clayey SAND: medium brown; damp. | |
| 10 | | | | | | | |
| 15 | | | | | CL | Sandy CLAY: grey brown; moist. | |
| 20 | | | | | SC | Clayey SAND: medium brown; damp. | |
| 25 | | | | | CL | CLAY: medium brown; damp. | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 11-26-86
LOGGED BY: LI
ELEVATION:
WATER LEVEL: Groundwater Stabilized at 47.8' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME 75 Drill Rig

# LOG DESIGNATION 601 (Cont'd)

JOB: 86012
FIGURE: 34

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | CL | CLAY: medium brown; damp. | |
| 30 | | | | | SC | Clayey SAND: red brown; damp. | |
| 35 | | | | | CL | Sandy CLAY: medium brown; moist. | |
| 40 | | | | | SC | Clayey SAND: red brown; damp. | |
| 45 | | | | | CL | Sandy CLAY: brown; wet. | Groundwater Stabilized at 47.8' at Time of Drilling (Continued) |
| 50 | | | | | | | |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 11-26-86
LOGGED BY: LI

# LOG DESIGNATION 601 (Cont'd)

ELEVATION:
WATER LEVEL: Groundwater Stabilized at 47.8' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME 75 Drill Rig

JOB: 86012
FIGURE: 34

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 50 | | | | | CL | Sandy CLAY: brown; wet. | |
| 55 | | | | | | | Terminated at 55' |
| 60 | | | | | | | |
| 65 | | | | | | | |
| 70 | | | | | | | |
| 75 | | | | | | | |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 11-26-86
LOGGED BY: LI
ELEVATION:
WATER LEVEL: Groundwater Encountered at 47.7' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME 75 Drill Rig

# LOG DESIGNATION 602

JOB: 86012
FIGURE: 35

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| | | | | | SC | Clayey SAND: dark brown; damp. | Hole Backfilled with Grout to within 7 Feet of Surface on Completion. |
| | | | | | SC | Clayey SAND: grey; damp. | |
| 5 | | | | | SC | Clayey SAND: medium brown; damp. | |
| 10 | | | | | | | |
| | | | | | CL | CLAY: grey brown; damp; minimal sand. | |
| 15 | | | | | | | |
| | | | | | SC | Clayey SAND: medium brown; damp. | |
| 20 | | | | | | | |
| 25 | | | | | | | (continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 11-26-86
LOGGED BY: LI
ELEVATION:
WATER LEVEL: Groundwater Encountered at 47.7' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME 75 Drill Rig

# LOG DESIGNATION 602 (Cont'd)

JOB: 86012
FIGURE: 35

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | CL | Sandy CLAY: medium brown; damp. | |
| 30 | | | | | SP | SAND: light brown; damp; fine to medium grained. | |
| 35 | | | | | SC | Clayey SAND: light brown with grey; damp. | |
| 40 | | | | | CL | Sandy CLAY: grey; damp to moist. | |
| | | | | | SP | SAND: light brown; damp; fine grained. | |
| 45 | | | | | CL | Sandy CLAY: grey; damp.<br>Becoming wet with depth. | Groundwater Encountered at 47.7' at Time of Drilling |
| 50 | | | | | | | |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES

(1) SAMPLER INSIDE DIAM.
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 11-26-86
LOGGED BY: LI

# LOG DESIGNATION 602 (Cont'd)

ELEVATION:
WATER LEVEL: Groundwater Encountered at 47.7' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, CME 75 Drill Rig

JOB: 86012
FIGURE: 35

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 50 | | | | | CL | Sandy CLAY: grey; wet with depth. | |
| 55 | | | | | | | Terminated at 55' |
| 60 | | | | | | | |
| 65 | | | | | | | |
| 70 | | | | | | | |
| 75 | | | | | | | |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 1-05-87
LOGGED BY: JA
ELEVATION:
WATER LEVEL: Groundwater Encountered at 47' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, Track Mount

# LOG DESIGNATION 603

JOB: 86012
FIGURE: 36

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| | | | | | ML | SILT: dark brown; damp; loose; trace of fine sand. | Hole Backfilled with Grout to within 7 Feet of Surface on Completion. |
| | | | | | ML | SILT: brown; damp; loose; trace of medium sand. | |
| 5 | | | | | ML | SILT: tan; damp; loose; scattered pebbles. | |
| 10 | | | | | ML | SILT: tan; damp; loose; scattered cobbles (hardpan). | |
| | | | | | ML | SILT: light tan; damp; loose; mixed with hardpan. | |
| 15 | | | | | | | |
| 20 | | | | | ML | SILT: grey; damp; loose; mixed with hardpan. | |
| | | | | | ML | SILT: grey; damp; loose; mixed with very fine sand. | |
| 25 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 1-05-87
LOGGED BY: JA

# LOG DESIGNATION 603 (Cont'd)

ELEVATION:
WATER LEVEL: Groundwater Encountered at 47' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, Track Mount

JOB: 86012
FIGURE: 36

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | ML | SILT: grey; damp; loose; mixed with very fine sand. | |
| 30 | | | | | ML | SILT: grey; samp; loose; mixed with very fine sand and pebbles. | |
| | | | | | ML | SILT: brown; damp; loose; mixed with hardpan fragments. | |
| 35 | | | | | ML | SILT: grey; damp; loose; mixed with rounded hardpan pebbles. | |
| | | | | | MH | CLAY: grey; damp; firm. | |
| 40 | | | | | | | |
| 45 | | | | | MH | CLAY: grey; damp; firm. | Groundwater Encountered at 47' at Time of Drilling |
| 50 | | | | | MH | CLAY: grey; damp; very stiff. | Terminated at 50' |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES

(1) SAMPLER INSIDE DIAM
(2) 140lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 1-06-87
LOGGED BY: JA

# LOG DESIGNATION 604

ELEVATION:
WATER LEVEL: Groundwater Encountered at 47' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, Track Mount

JOB: 86012
FIGURE: 37

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| | | | | | ML | SILT: dark brown; damp; loose. | Hole Backfilled with Grout to within 7 Feet of Surface on Completion. |
| | | | | | ML | SILT: light tan; damp; loose; trace of medium sand. | |
| 5 | | | | | ML | SILT: brown; damp; loose; mixed with round hardpan pebbles. | |
| | | | | | ML | SILT: brown; damp; loose; partially cemented into round pebble size fragments. | |
| 10 | | | | | | | |
| 15 | | | | | ML | SILT: light brown; damp; loose; partially cemented into round pebble size fragments. | |
| | | | | | ML | SILT: grey; damp; loose; partially cemented into round pebbles; mixed with trace of medium sand. | |
| 20 | | | | | | | |
| 25 | | | | | | | (Continued) |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

DATE: 1-06-87
LOGGED BY: JA
ELEVATION:
WATER LEVEL: Groundwater Encountered at 47' at Time of Drilling
EQUIPMENT: 8" Hollow Stem Auger, Track Mount

# LOG DESIGNATION 604 (Cont'd)

JOB: 86012
FIGURE: 37

| DEPTH, FEET | NOMINAL (1) DIAMETER, IN. | BLOWS/FOOT (2) | MOISTURE % | DRY DENSITY, PCF | U.S.C | SOIL OR ROCK DESCRIPTION | NOTES |
|---|---|---|---|---|---|---|---|
| 25 | | | | | ML | SILT: grey; damp; loose; partially cemented into round pebbles; mixed with trace of medium sand. | |
| | | | | | SM | Silty SAND: brown; damp; loose; fine grained; micaceous with trace of medium grains. | |
| 30 | | | | | ML | Sandy SILT: brown; damp; loose; trace of medium sand. | |
| 35 | | | | | ML | SILT: dark brown; samp; loose; partially cemented into pebble size gravel. | |
| 40 | | | | | ML | Sandy SILT: dark brown; damp; loose; partially cemented into pebble size gravel. | |
| 45 | | | | | CL | CLAY: grey; damp; soft; partially cemented into pebble size gravel. | Groundwater Encountered at 47' at Time of Drilling |
| | | | | | CL | CLAY: grey; damp; very stiff; partially cemented into pebble size gravel. | |
| 50 | | | | | CL | CLAY: grey; wet; hard. | Terminated at 50' |

THE LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED, AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

(1) SAMPLER INSIDE DIAM.
(2) 140 lbs HAMMER - 30 INCH DROP.
(P) HYDRAULICALLY PUSHED

BSK & Associates

Jensen and West
City of Fresno

JOB 86012
July, 1984

TABLE 1: Summary of Water Quality Tests
Samples obtained and tests performed by BSK and Associates

| Constituent (Standard) [Detection Level] | | Upgradient W-6 | Downgradient W-1 | W-2 | W-3 | W-4 | W-5 | 1653 W Jensen |
|---|---|---|---|---|---|---|---|---|
| Conductance micromhos/cm | (800/1600/2400) | 212 | 1134 | 1276 | 1129 | 1974 | 1079 | 453 |
| pH | (6.5 to 8.5) | 7.8 | 7.3 | 7.2 | 6.6 | 7.8 | 6.8 | 7.7 |
| Hardness as Calcium Carbonave,ppo | (Very Hard>180) | 93 | 478 | 549 | 649 | 914 | 487 | 179 |
| Calcium ppm | (See Hardness) | 22 | 120 | 130 | 175 | 210 | 125 | 39 |
| Magnesium ppm | (See Hardness) | 10 | 44 | 55 | 52 | 95 | 43 | 20 |
| Chlorides ppm | (250/500/600) | 6 | 37 | 55 | 21 | 73 | 51 | 27 |
| Sulfates ppm | (250/500/600) | 5 | 25 | 28 | 7 | 135 | 45 | 10 |
| Sodium ppm | (NA) | 8 | 79 | 94 | 24 | 135 | 45 | 25 |
| Nitrate ppm | (45) [4.4] | 12 | 75 | 21 | ND | ND | ND | 26 |
| Bicarbonate ppm | (500) | 110 | 637 | 790 | 830 | 1220 | 640 | 197 |
| Total Iron ppm | (0.3) | 0.18 | 0.08 | 0.06 | 0.06 | 0.06 | 0.08 | <0.02 |
| Organic Nitrogen ppm | (None) [0.1] | ND | ND | ND | ND | ND | ND | NA |
| Ammonia Nitrogen ppm | (None) [0.1] | ND | ND | ND | ND | ND | ND | NA |
| Total Dissolved Solids, ppm | (500/1000/1500) | 164 | 739 | 841 | 724 | 1258 | 686 | 333 |
| Chemical Oxygen Demand, ppm | (None) [2.0] | ND | 3.6 | 7.1 | ND | 16 | 8.9 | 8.9 |
| Sulfides ppm | (0.05) [0.05] | ND | ND | ND | ND | ND | ND | ND |
| Alkalinity, total | (None) | 90 | 572 | 660 | 680 | 1000 | 525 | 161 |

BSK & Associates

City of Fresno
Jensen and West

JOB 86012
July, 1984

TABLE 2: Water Quality Tests
Adjoining Residences
Samples obtained and tested by State Department of Health
General Mineral, TCE and PCE Tests

| Constituent | (Standard) [Detection Level] | 2188 W North Domestic | 2168 W North Domestic | 2142 W North Irrigation | 2100 W North Domestic |
|---|---|---|---|---|---|
| pH | (None) | 7.6 | 7.7 | 7.3 | 7.4 |
| Hardness ppm | (None) | 227 | 113 | 380 | 213 |
| Calcium ppm | (None) | 43 | 20 | 83 | 41 |
| Magnesium ppm | (None) | 29 | 20 | 42 | 26 |
| Chlorides ppm | (250) | 10 | 10 | 23 | 46 |
| Sulfates ppm | (250) | 7 | 2 | 13 | 13 |
| Sodium ppm | (None) | 38 | 23 | 53 | 25 |
| Nitrate ppm | (45) | 6 | 4 | 22 | 12 |
| Bicarbonate ppm | (None) | 294 | 144 | 464 | 174 |
| Iron ppm | (0.3) [0.05] | ND | ND | 0.05 | ND |
| Total Solids ppm | (500) | 372 | 222 | 564 | 392 |
| Alkalinity ppm | (None) | 294 | 144 | 464 | 174 |
| Carbonate ppm | (None) | 0 | 0 | 0 | 0 |
| Hydroxide ppm | (None) | 0 | 0 | 0 | 0 |
| Copper ppm | (1.0) [0.02] | ND | ND | ND | ND |
| Manganese ppm | (0.05) [0.02] | ND | ND | ND | ND |
| Zinc ppm | (5.0) [0.02] | 0.1 | 0.04 | ND | 0.06 |
| Aluminum ppm | (None) [0.5] | ND | ND | ND | ND |
| Odor | (3 T.O.N.) | None | None | Septic | None |

ND: None detected at indicated detection level

BSK & Associates

City of Fresno
Jensen and West

JOB 86012
July, 1984

TABLE 2(cont.): Water Quality Tests
Adjoining Residences
Sampled and tested by State Department of Health
General Minerals, TCE and PCE tests

| Constituent (Standard) [Detection Level] | | 2188 W North Domestic | 2168 W North Domestic | 2142 W North Irrigation | 2100 W North Domestic |
|---|---|---|---|---|---|
| Potassium ppm | (None) | 7.0 | 5.0 | 9.0 | 9.0 |
| Nickel ppm | (None) [0.01] | ND | ND | ND | ND |
| Arsenic ppm | (0.05) [0.005] | ND | ND | ND | ND |
| Barium ppm | (1.0) [0.01] | ND | ND | 0.183 | ND |
| Cadmium ppm | (0.01) [0.001] | ND | ND | ND | ND |
| Chromium ppm | (0.05) [0.005] | ND | ND | ND | ND |
| Lead ppm | (0.05) [0.01] | ND | ND | ND | ND |
| Mercury ppm | (0.002) [0.001] | ND | ND | ND | ND |
| Selenium ppm | (0.01) [0.005] | ND | ND | ND | LD |
| Silver ppm | (0.05) [0.001] | ND | ND | ND | ND |
| Flouride ppm | (1.0) | 0.1 | 0.11 | 0.09 | 0.1 |
| TCE ppb | (5.0) [1] | ND | ND | 1.5 | ND |
| PCE ppb | (4.0) [1] | ND | ND | 4.8 | ND |

BSK & Associates

City of Fresno
Jensen and West

JOB 86012
July, 1984

TABLE 3: Water Quality Tests
On-Site Monitoring Well
Sampled by RWQCB and Tested by Radian Laboratories

| Constituent (Standard) | EPA 601<br>W-1 |
|---|---|
| Chloromethane | ND |
| Bromomethane | ND |
| Vinyl Chloride | ND |
| Chloroethane (NA) | 46.7 |
| Methylene Chloride (40) | 18.3 |
| Trichloroflouromethane | 2.6 |
| 1,1-Dichloroethene | ND |
| 1,1-Dichloroethane (NA) | 0.8 |
| trans-1,2-Dichloroethene (NA) | 22.9 |
| Chloroform | ND |
| 1,2-Dichloroethane | ND |
| 1,1,1-Trichloroethane | ND |
| Carbon Tetrachloride | ND |
| Bromodichloromethane | ND |
| 1,2-Dichloropropane (10) | 1.4 |
| trans-1,3-Dichloropropene | ND |
| Trichloroethene (5) | 22.6 |
| Dibromochloromethane | ND |
| 1,1,2-Trichloroethane | ND |
| cis-1,3-Dichloropropene | ND |
| 2-Chloroethylvinyl Ether | ND |
| Bromoform | ND |
| 1,1,2,2-Tetrachloroethane plus Tetrachloroethylene (4) | 62.3 |
| Chlorobenzene | ND |
| 1,3-Dichlorobenzene | ND |
| 1,2-Dichlorobenzene | ND |
| 1,4-Dichlorobenzene | ND |
| Total All Constituents Detected | 177.6 |

ND: Not Detected at detection level of 1 part per billion

BSK & Associates

City of Fresno
Jensen and West

JOB 86012
July, 1984

TABLE 4: Water Quality Tests
On-Site Monitoring Wells
Sampled by BSK and Associates, June 21, 1984
Tested by California Analytical
EPA 601, DBCP, and PCB Test Results

| Constituent (Standard) | W-1 | W-2 | W-3 | W-4 | W-5 | W-6 | 1653 W Jensen |
|---|---|---|---|---|---|---|---|
| 1,1 Dichloroethylene (6) | ND | ND | 6.5 | ND | ND | ND | ND |
| 1,1 Dichlopoethane | ND | ND | 5.3 | ND | ND | ND | ND |
| trans-1,2-Dichloroethylene (NA) | 18 | ND | 33 | 200 | 3.5 | ND | ND |
| Chloroform | ND | ND | ND | ND | ND | ND | ND |
| 1,1,2-Trichloro-2,2,1-triflouroethane | ND | ND | ND | ND | ND | ND | ND |
| 1,2-Dichloroethane | ND | ND | ND | ND | ND | ND | ND |
| 1,1,1-Trichloroethane | ND | ND | ND | ND | ND | ND | ND |
| Carbon Tetrachloride | ND | ND | ND | ND | ND | ND | ND |
| Bromodichloromethane | ND | ND | ND | ND | ND | ND | ND |
| 1,2-Dichloropropane (10) | 1.1 | 3.4 | ND | 5.0 | ND | ND | ND |
| cis-1,3-Dichloropropylene | ND | ND | ND | ND | ND | ND | ND |
| Trichloroethylene (5) | 24 | 0.9 | 34 | 131 | ND | ND | ND |
| trans-1,3-Dichloropropylene | ND | ND | ND | ND | ND | ND | ND |
| 1,1,2-Trichloroethane | ND | ND | ND | ND | ND | ND | ND |
| Dichlorobromomethane | ND | ND | ND | ND | ND | ND | ND |
| 1,2-Dibromoethane | ND | ND | ND | ND | ND | ND | ND |
| Bromoform | ND | ND | ND | ND | ND | ND | ND |
| Tetrachloroethylene (4) | 49 | 8.8 | 38 | 32 | ND | ND | ND |
| 1,1,2,2-Tetrachloroethylene | ND | ND | ND | ND | ND | ND | ND |
| Chlorobenzene | ND | ND | ND | ND | ND | ND | ND |
| DBCP [0.01] | ND | ND | ND | ND | ND | ND | ND |
| PCB | ND | ND | ND | ND | ND | ND | ND |
| Total All Constituents Detected | 92.1 | 13.1 | 116.8 | 368 | 3.5 | ND | ND |

ND: None Detected at 0.5 parts per billion unless otherwise noted in brackets.

BSK
& Associates

City of Fresno Landfill
Jensen and West

JOB 86012
March, 1986

TABLE 5: Water Quality Tests
Groundwater Samples
On-Site Monitoring Wells
Sampled by BSK, Tested by BSK, March, 1986
EPA 601

| Constituent | W-1 | W-2 | W-3 | W-4 | W-5 | W-6 |
|---|---|---|---|---|---|---|
| | ND: None detected at 1 ug/l | | | | | |
| Bromodichloromethane | ND ug/l | ND ug/l | ND ug/l | ND ug/l | ND ug/l | ND ug/l |
| Bromoform | ND | ND | ND | ND | ND | ND |
| Bromomethane | ND | ND | ND | ND | ND | ND |
| Carbon Tetrachloride | ND | ND | ND | ND | ND | ND |
| Chlorobenzene | ND | ND | ND | ND | ND | ND |
| Chloroethane | ND | ND | ND | ND | ND | ND |
| 2-Chloroethylvinyl ether | ND | ND | ND | ND | ND | ND |
| Chloroform | ND | ND | ND | ND | ND | ND |
| Chloromethane | ND | ND | ND | ND | ND | ND |
| Dibromochloromethane | ND | ND | ND | ND | ND | ND |
| 1,2-Dichlorobenzene | ND | ND | ND | ND | ND | ND |
| 1,3-Dichlorobenzene | ND | ND | ND | ND | ND | ND |
| 1,4-Dichlorobenzene | ND | ND | ND | ND | ND | ND |
| 1,1-Dichloroethane | ND | ND | ND | ND | ND | ND |
| 1,2-Dichloroethane | ND | ND | ND | ND | ND | ND |
| 1,1-Dichloroethene (6) | 2 | ND | ND | ND | ND | ND |
| trans-1,2-Dichloroethene | ND | ND | ND | ND | ND | ND |
| 1,2-Dichloropropane | ND | ND | ND | ND | ND | ND |
| cis-1,3-Dichloropropene | ND | ND | ND | ND | ND | ND |
| trans-1,3-Dichloropropene | ND | ND | ND | ND | ND | ND |
| Ethyl benzene | ND | ND | ND | ND | ND | ND |
| Methylene chloride | ND | ND | ND | ND | ND | ND |
| 1,1,2,2-Tetrachloroethane | ND | ND | ND | ND | ND | ND |
| Tetrachloroethene (4) | 33 | 71 | 32 | 110 | ND | ND |
| 1,1,1-Trichloroethane | ND | ND | ND | ND | ND | ND |
| 1,1,2-Trichloroethane | ND | ND | ND | ND | ND | ND |
| Trichloroethene (5) | 15 | ND | 27 | 150 | ND | ND |
| Trichlorofluoromethane | ND | ND | ND | ND | ND | ND |
| Vinyl chloride | ND | ND | ND | ND | ND | ND |
| Total All Constituents | 50 | 71 | 59 | 260 | ND | ND |

ND: None Detected at 1.0 micrograms per liter

BSK & Associates

City of Fresno Landfill
Jensen and West

JOB 86012
March, 1986

TABLE 6: Water Quality Tests
Groundwater Samples
On-Site Monitoring Wells
Sampled and Tested by BSK, March, 1986
General Mineral plus Inorganics Tests

| Constituent (Standard) [Detection Level] | W-1 | W-2 | W-3 | W-4 | W-5 | W-6 |
|---|---|---|---|---|---|---|
| Arsenic (0.05) ppm | 0.001 | 0.002 | 0.001 | 0.006 | 0.013 | 0.006 |
| Barium (1.0) ppm | 0.38 | 0.17 | 0.36 | 0.95 | 0.68 | 0.06 |
| Cadmium (0.01) [0.01] ppm | ND | ND | ND | 0.01 | ND | ND |
| Chromium (0.05) [0.01] ppm | ND | ND | 0.02 | 0.05 | ND | ND |
| Fluoride (1.4-2.4) ppm [0.01] | ND | ND | ND | ND | ND | ND |
| Lead (0.05) [0.01] ppm | ND | ND | 0.02 | ND | ND | ND |
| Mercury (2) [0.1] ppb | ND | ND | ND | ND | ND | ND |
| Nitrate (45) ppm NO3 | 24 | 74 | 0.4 | 2 | 0.1 | 0.1 |
| Selenium (0.01) ppm | 0.001 | 0.004 | 0.001 | 0.001 | 0.004 | 0.004 |
| Silver (0.05) [0.01] ppm | ND | ND | ND | ND | ND | ND |

BSK & Associates

City of Fresno Landfill
Jensen and West

JOB 86012
March, 1986

TABLE 7: Water Quality Tests
Groundwater Samples
On-Site Monitoring Wells
Sampled and Tested by BSK, March, 1986
General Mineral plus Inorganics Tests

| Constituent (Standard) [Detection Level] | W-1 | W-2 | W-3 | W-4 | W-5 | W-6 |
|---|---|---|---|---|---|---|
| Carbonate (NA) [0.1] ppm | ND | ND | ND | ND | ND | ND |
| Bicarbonate (NA) ppm | 761 | 663 | 848 | 1216 | 762 | 84 |
| Alkalinity (NA) ppm | 623 | 543 | 695 | 997 | 625 | 71 |
| Calcium (NA) ppm | 122 | 116 | 197 | 206 | 153 | 18 |
| Chloride (NA) ppm | 29 | 28 | 1 | 24 | 16 | 2 |
| Conductivity micromhos/cm (900/1600/2200) | 1145 | 1110 | 1150 | 1780 | 1155 | 197 |
| Copper (NA) [0.01] ppm | ND | ND | ND | ND | ND | ND |
| Iron (0.3) ppm | 0.09 | 0.03 | 0.41 | 1.72 | 0.40 | 0.35 |
| Magnesium (NA) ppm | 55 | 52 | 47 | 90 | 63 | 9 |
| Manganese (NA) ppm [0.001] | 0.013 | ND | 0.103 | 0.381 | 1.971 | 0.029 |
| pH (6.5-8.5) | 7.0 | 7.3 | 6.6 | 6.8 | 7.7 | 7.9 |
| Sodium (NA) ppm | 71 | | | 98 | 18 | 3.2 |
| Sulfate (NA) ppm | 15.9 | 26.4 | 15.8 | 59.8 | 49.3 | 18.4 |
| Surfactants (MBAS) ppm (0.5) [0.5] | ND | ND | ND | ND | ND | ND |
| TDS (500/1000/1500) ppm | 770 | 768 | 758 | 1249 | 761 | 132 |
| Hardness (30-180) ppm | 528 | 503 | 686 | 882 | 640 | 80 |
| Zinc (5) ppm | 0.04 | 0.01 | 0.07 | 0.06 | 0.01 | 0.02 |

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TABLE 8: Water Quality Tests
Groundwater Samples
On-Site Monitoring Wells
Sampled by BSK, March, 1986
Tested by Brown and Caldwell, April 1986
Title 22 Organics

| Constituent (Standard) [Detection Level] | W-1 | W-2 | W-3 | W-4 | W-5 | W-6 |
|---|---|---|---|---|---|---|
| Endrin (2) [0.1] ppb | ND | ND | ND | ND | ND | ND |
| Lindane (0.7) [0.05] ppb | ND | ND | ND | ND | ND | ND |
| Methoxychlor (100) [0.3] ppb | ND | ND | ND | ND | ND | ND |
| Toxaphene (5) [1] ppb | ND | ND | ND | ND | ND | ND |
| 2,4-D (100) [5] ppb | ND | ND | ND | ND | ND | ND |
| 2,4,5-TP Silvex (10) [1] ppb | ND | ND | ND | ND | ND | ND |

ND: None detected at indicated detection level

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TABLE 9: Water Quality Tests
Groundwater Samples
Off-Site Monitoring Wells
Sampled by BSK, Tested by BSK, April 1986
EPA 601

| Constituent | 2100 North | | 2142 North | | 2168 North | | 2188 North | | 2429 North | |
|---|---|---|---|---|---|---|---|---|---|---|
| | ND: None Detected at 1 ppb | | | | | | | | | |
| Bromodichloromethane | ND | ppb | ND | ppb | ND | ppb | ND | ppb | ND | ppb |
| Bromoform | ND | | ND | | ND | | ND | | ND | |
| Bromomethane | ND | | ND | | ND | | ND | | ND | |
| Carbon Tetrachloride | ND | | ND | | ND | | ND | | ND | |
| Chlorobenzene | ND | | ND | | ND | | ND | | ND | |
| Chloroethane | ND | | ND | | ND | | ND | | ND | |
| 2-Chloroethylvinyl ether | ND | | ND | | ND | | ND | | ND | |
| Chloroform | ND | | ND | | ND | | ND | | ND | |
| Chloromethane | ND | | ND | | ND | | ND | | ND | |
| Dibromochloromethane | ND | | ND | | ND | | ND | | ND | |
| 1,2-Dichlorobenzene | ND | | ND | | ND | | ND | | ND | |
| 1,3-Dichlorobenzene | ND | | ND | | ND | | ND | | ND | |
| 1,4-Dichlorobenzene | ND | | ND | | ND | | ND | | ND | |
| 1,1-Dichloroethane | ND | | ND | | ND | | ND | | ND | |
| 1,2-Dichloroethane | ND | | ND | | ND | | ND | | ND | |
| 1,1-Dichloroethene | ND | | ND | | ND | | ND | | ND | |
| trans-1,2-Dichloroethene | ND | | ND | | ND | | ND | | ND | |
| 1,2-Dichloropropane | ND | | ND | | ND | | ND | | ND | |
| cis-1,3-Dichloropropene | ND | | ND | | ND | | ND | | ND | |
| trans-1,3-Dichloropropene | ND | | ND | | ND | | ND | | ND | |
| Ethyl benzene | ND | | ND | | ND | | ND | | ND | |
| Methylene chloride | ND | | ND | | ND | | ND | | ND | |
| 1,1,2,2-Tetrachloroethane | ND | | ND | | ND | | ND | | ND | |
| Tetrachloroethene | ND | | ND | | ND | | ND | | ND | |
| 1,1,1-Trichloroethane | ND | | ND | | ND | | ND | | ND | |
| 1,1,2-Trichloroethane | ND | | ND | | ND | | ND | | ND | |
| Trichloroethene | ND | | ND | | ND | | ND | | ND | |
| Trichlorofluoromevhane | ND | | ND | | ND | | ND | | ND | |
| Vinyl chloride | ND | | ND | | ND | | ND | | ND | |
| Total All Constituents | ND | | ND | | ND | | ND | | ND | |

ND: None Detected at 1.0 micrograms per liter

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TABLE 10: Water Quality Tests
Groundwater Samples
Off-Site Monitoring Wells
Sampled and Tested by BSK, March, 1986
General Mineral plus Inorganics

| Constituent | 2100 North | 2142 North | 2168 North | 2188 North | 2429 North |
|---|---|---|---|---|---|
| Arsenic (0.05) ppm | 0.001 | 0.003 | 0.003 | 0.003 | 0.001 |
| Barium (1.0) ppm | 0.09 | 0.03 | 0.04 | 0.08 | 0.17 |
| Cadmium (0.01) [0.01] ppm | ND | ND | ND | ND | ND |
| Chromium (0.05) [0.01] ppm | ND | ND | ND | ND | ND |
| Fluoride (1.4-2.4) ppm | 0.11 | 0.14 | 0.13 | 0.11 | 0.11 |
| Lead (0.05) [0.01] ppm | ND | ND | ND | ND | ND |
| Mercury (2) [2.1] ppb | ND | ND | ND | ND | ND |
| Nitrate (45) ppm NO3 | 19 | 3.8 | 4.0 | 6.2 | 41.2 |
| Selenium (0.01) [0.001] ppm | ND | ND | ND | ND | 0.002 |
| Silver (0.05) [0.01] ppm | ND | ND | ND | ND | ND |

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TABLE 11: Water Quality Tests
Groundwater Samples
Off-Site Monitoring Wenls
Sampled and Tested by BSK, March, 1986
General Mineral Plus Inorganics

| Constituent | 2100 North | 2142 North | 2168 North | 2188 North | 2429 North |
|---|---|---|---|---|---|
| Carbonate (NA) [0.1] ppm | ND | ND | ND | ND | ND |
| Bicarbonate (NA) ppm | 209 | 94 | 116 | 297 | 533 |
| Alkalinity (NA) ppm | 171 | 77 | 95 | 243 | 437 |
| Calcium (NA) ppm | 49.1 | 14.2 | 20.6 | 44.9 | 106.2 |
| Chloride (NA) ppm | 48.7 | 8.4 | 10.0 | 8.4 | 39.5 |
| Conductivity micromhos/cm (900/1600/2200) | 525 | 196 | 255 | 470 | 970 |
| Copper (NA) [0.01] ppm | ND | 0.01 | ND | ND | ND |
| Iron (0.3) [0.01] ppm | 0.10 | 0.01 | ND | ND | 0.04 |
| Magnesium (NA) ppm | 24.7 | 7.2 | 10.4 | 22.3 | 51.8 |
| Manganese (NA) [0.001] ppm | 0.005 | 0.007 | ND | ND | 0.003 |
| pH (6.5-8.5) | 7.7 | 7.7 | 7.7 | 7.7 | 7.7 |
| Sodium (NA) ppm | 22.4 | 13.1 | 19.1 | 33.2 | 45.9 |
| Sulfate (NA) ppm | 12 | 8 | 16 | 25 | 38 |
| Surfactants (MBAS) ppm (0.5) [0.5] | ND | ND | ND | ND | ND |
| TDS (500/1000/1500) ppm | 370 | 174 | 202 | 345 | 675 |
| Hardness (30-180) ppm | 224 | 65 | 94 | 289 | 477 |
| Zinc (5) ppm | 0.53 | 0.07 | 0.04 | 0.01 | 0.07 |

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TABLE 12: Water Quality Samples
Groundwater Samples
Adjoining Residences
Sampled by BSK, March, 1986
Tested by Brown and Caldwell, April 1986
Title 22 Organics

| Constituent | 2100 North | 2142 North | 2168 North | 2188 North | 2429 North |
|---|---|---|---|---|---|
| (Standard) [Detection Level] | | | | | |
| Endrin (2) [0.1] ppb | ND | ND | ND | ND | ND |
| Lindane (0.7) [0.05] ppb | ND | ND | ND | ND | ND |
| Methoxychlor (100) [0.3] ppb | ND | ND | ND | ND | ND |
| Toxaphene (5) [1] ppb | ND | ND | ND | ND | ND |
| 2,4-D (100) [5] ppb | ND | ND | ND | ND | ND |
| 2,4,5-TP Silvex (10) [1] ppb | ND | ND | ND | ND | ND |

ND: None detected at indicated detection level

TABLE 13: Water Quality Tests
Groundwater Samples
Adjoining Residences
Sampled and Tested by BSK, March, 1986
Bacteriological Tests

| Location | Number of Portions | Volume per Portion ml | Number of portions showing gas in 24 hrs | Number of portions showing gas in 48 hrs | Confirmation Test showing gas in 24 hrs | Confirmation Test showing gas in 48 hrs | Colifor: MPN per 100 ml water |
|---|---|---|---|---|---|---|---|
| 2100 North Avenue | 5 | 10 | 0 | 5 | 0 | 5 | 16+ |
| 2142 North Avenue | 5 | 10 | 0 | 1 | 0 | 0 | ND |
| 2168 North Avenue | 5 | 10 | 0 | 0 | - | - | ND |
| 2188 North Avenue | 5 | 10 | 0 | 0 | - | - | ND |
| 2429 North Avenue | 5 | 10 | 0 | 0 | - | - | ND |

ND: Less than 2.2

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TABLE 14: Water Quality Tests
Groundwater Samples
Adjoining Residences
Sampled by BSK, Tested by BSK, April 1986
EPA 601

| Constituent | 1304 Jensen | 1346 Jensen | 1642 Jensen | 1653 Jensen | 2121 Jensen |
|---|---|---|---|---|---|
| | ND: None Detected at 1 ppb | | | | |
| Bromodichloromethane | ND ppb | ND ppb | ND ppb | ND ppb | ND ppb |
| Bromoform | ND | ND | ND | ND | ND |
| Bromomethane | ND | ND | ND | ND | ND |
| Carbon Tetrachloride | ND | ND | ND | ND | ND |
| Chlorobenzene | ND | ND | ND | ND | ND |
| Chloroethane | ND | ND | ND | ND | ND |
| 2-Chloroethylvinyl ether | ND | ND | ND | ND | ND |
| Chloroform | ND | ND | ND | ND | ND |
| Chloromethane | ND | ND | ND | ND | ND |
| Dibromochloromethane | ND | ND | ND | ND | ND |
| 1,2-Dichlorobenzene | ND | ND | ND | ND | ND |
| 1,3-Dichlorobenzene | ND | ND | ND | ND | ND |
| 1,4-Dichlorobenzene | ND | ND | ND | ND | ND |
| 1,1-Dichloroethane | ND | ND | ND | ND | ND |
| 1,2-Dichloroethane | ND | ND | ND | ND | ND |
| 1,1-Dichloroethene | ND | ND | ND | ND | ND |
| trans-1,2-Dichloroethene | ND | ND | ND | ND | ND |
| 1,2-Dichloropropane | ND | ND | ND | ND | ND |
| cis-1,3-Dichloropropene | ND | ND | ND | ND | ND |
| trans-1,3-Dichloropropene | ND | ND | ND | ND | ND |
| Ethyl benzene | ND | ND | ND | ND | ND |
| Methylene chloride | ND | ND | ND | ND | ND |
| 1,1,2,2-Vetrachloroethane | ND | ND | ND | ND | ND |
| Tetrachloroethene | ND | ND | ND | ND | ND |
| 1,1,1-Trichloroethane | ND | ND | ND | ND | ND |
| 1,1,2-Trichloroethane | ND | ND | ND | ND | ND |
| Trichloroethene | ND | ND | ND | ND | ND |
| Trichlorofluoromethane | ND | ND | ND | ND | ND |
| Vinyl chloride | ND | ND | ND | ND | ND |

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TABLE 15: Water Quality Tests
Groundwater Samples
Adjoining Residences
Sampled and Tested by BSK, March, 1986
General Mineral plus Inorganics Tests

| Constituent | 1304 Jensen | 1346 Jensen | 1642 Jensen | 1653 Jensen | 2121 Jensen |
|---|---|---|---|---|---|
| Arsenic (0.05) ppm | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 |
| Barium (1.2) ppm | 0.19 | 0.11 | 0.15 | 0.21 | 0.18 |
| Cadmium (0.01) [0.01] ppm | ND | ND | ND | ND | ND |
| Chromium (0.05) [0.01] ppm | ND | ND | ND | ND | ND |
| Fluoride (1.4-2.4) [0.1] ppm | ND | ND | ND | ND | ND |
| Lead (0.05) ppm | 0.01 | 0.03 | 0.01 | 0.03 | 0.02 |
| Mercury (2) [0.1] ppb | ND | ND | ND | ND | ND |
| Nitrate (45) ppm NO3 | 48.3 | 45.3 | 39.9 | 61.5 | 75.4 |
| Selenium (2.01) [0.001] ppm | ND | ND | ND | 0.001 | ND |
| Silver (0.05) [0.01] ppm | ND | ND | ND | ND | ND |

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TABLE 16: Water Quality Tests
Groundwater Samples
Adjoining Residences
Sampled and Tested by BSK, March, 1986
General Minerals plus Inorganics

| Constituent | 1304 Jensen | 1346 Jensen | 1642 Jensen | 1653 Jensen | 2321 Jensen |
|---|---|---|---|---|---|
| Carbonate (NA) [0.1] ppm | ND | ND | ND | ND | ND |
| Bicarbonate (NA) ppm | 315 | 278 | 335 | 505 | 281 |
| Alkalinity (NA) ppm | 259 | 228 | 275 | 414 | 231 |
| Calcium (NA) ppm | 64.0 | 64.9 | 53.1 | 85.2 | 55.7 |
| Chloride (NA) ppm | 45.1 | 57.1 | 55.3 | 47.3 | 25.5 |
| Conductivity micromhos/cm (900/3600/2200) | 700 | 665 | 742 | 981 | 640 |
| Copper (NA) [0.01] ppm | ND | ND | ND | ND | ND |
| Iron (0.3) [0.01] ppm | ND | 0.03 | 0.01 | 0.06 | ND |
| Magnesium (NA) ppm | 31.6 | 32.7 | 25.9 | 39.8 | 28.7 |
| Manganese (NA) [0.001] ppm | ND | ND | ND | 0.008 | ND |
| pH (6.5-8.5) | 7.5 | 7.8 | 8.3 | 7.5 | 7.5 |
| Sodium (NA) ppm | 39.9 | 27.7 | 71.6 | 74.5 | 37.5 |
| Sulfate (NA) ppm | 26 | 9 | 14 | 15 | 2.2 |
| Surfactants (MBAS) ppm (0.5) [0.5] | ND | ND | ND | ND | ND |
| TDS (500/1000/1500) ppm | 485 | 466 | 514 | 675 | 479 |
| Hardness (30-180) ppm | 289 | 296 | 239 | 376 | 257 |
| Zinc (5) ppm | 0.01 | 0.05 | 0.08 | 1.27 | 0.05 |

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TABLE 17: Water Quality Tests
Groundwater Samples
Sampled by BSK, March, 1986
Tested by Brown and Caldwell, April 1986
Title 22 Organics

| Constituent | 1304 Jensen | 1346 Jensen | 1642 Jensen | 1653 Jensen | 2121 Jensen |
|---|---|---|---|---|---|
| (Standard) [Detection Level] | | | | | |
| Endrin (2) [0.1] ppb | ND | ND | ND | ND | ND |
| Lindane (0.7) [0.05] ppb | ND | ND | ND | ND | ND |
| Methoxychlor (100) [0.3] ppb | ND | ND | ND | ND | ND |
| Toxaphene (5) [3] ppb | ND | ND | ND | ND | ND |
| 2,4-D (100) [5] ppb | ND | ND | ND | ND | ND |
| 2,4,5-TP Silvex (10) [1] ppb | ND | ND | ND | ND | ND |

ND: None detected at indicated detection level

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TABLE 18: Water Quality Tests
Groundwater Qamples
Adjoining Residences
Sampled and Tested by BSK, March 19:6
Bacteriological Tests

| Location | Number of Portions | Volume per Portion ml | Number of portions showing gas in 24 hrs | Number of portions showing gas in 48 hrs | Confirmation Test showing gas in 24 hrs | showing gas in 48 hrs | Collifor MPN per 100 ml water |
|---|---|---|---|---|---|---|---|
| 1304 W Jensen | 5 | 10 | 5 | 5 | 3 | 3 | 9.2 |
| 1346 W Jensen | 5 | 10 | 0 | 0 | 0 | 0 | ND |
| 1642 W Jensen | 5 | 10 | 0 | 0 | - | - | ND |
| 1653 W Jensen | 5 | 10 | 0 | 0 | - | - | ND |
| 2121 W Jensen | 5 | 10 | 0 | 0 | - | - | ND |

ND: Less than 2.2

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TABLE 19: SUMMARY OF WELL DEPTH MEASUREMENTS

| Well | Depth to Groundwater, feet From Surrounding Grade |
|---|---|
| W-1 | 47 ft 10 in |
| W-2 | 47 ft 5 in |
| W-3 | 47 ft 9 in |
| W-4 | 46 ft 10 in |
| W-5 | 48 ft 3 in |
| W-6 | 46 ft 8 in |

TABLE 20: Water Quality Tests
Surface Water Sample
Adjoining Landfill Boundary
Sampled and Tested by BSK, March 1986
EPA 601

| Constituent | Detection Limit |
|---|---|
| Bromodichloromethane | ND |
| Bromoform | ND |
| Bromomethane | ND |
| Carbon Tetrachloride | ND |
| Chlorobenzene | ND |
| Chloroethane | ND |
| 2-Chloroethylvinyl ether | ND |
| Chloroform | ND |
| Chloromethane | ND |
| Dibromochloromethane | ND |
| 1,2-Dichlorobenzene | ND |
| 1,3-Dichlorobenzene | ND |
| 1,4-Dichlorobenzene | ND |
| 1,1-Dichloroethane | ND |
| 1,2-Dichloroethane | ND |
| 1,1-Dichloroethene | ND |
| trans-1,2-Dichloroethene | ND |
| 1,2-Dichloropropane | ND |
| cis-1,3-Dichloropropene | ND |
| trans-1,3-Dichloropropene | ND |
| Ethyl benzene | ND |
| Methylene chloride | ND |
| 1,1,2,2-Tetrachloroethane | ND |
| Tetrachloroethene | ND |
| 1,1,1-Trichloroethane | ND |
| 1,1,2-Trichloroethane | ND |
| Trichloroethene | ND |
| Trichlorofluoromethane | ND |
| Vinyl chloride | ND |

ND: None Detected at 50 parts per billion. Detection levels raised by foaming characteristics of sample.

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TABLE 21: Water Quality Tests
Surface Water Sample
Adjoining Landfill Boundary
Sampled and Tested by BSK, March 1986
EPA 602

| Constituent | Concentration |
|---|---|
| Benzene | ND |
| Chlorobenzene | ND |
| 1,2-Dichlorobenzene | ND |
| 1,3-Dichlorobenzene | ND |
| 1,4-Dichlorobenzene | ND |
| Ethylbenzene | ND |
| Toluene | ND |

ND: None Detected at 50 parts per billion. Detection level raised above normal by foaming characteristics of sample.

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TABLE 22: Water Quality Tests
Surface Water Samples
Adjoining Landfill Boundary
Sampled and Tested by BSK, March 1986
EPA Metals plus Conductivity and pH

| Constituent [Detection Level] | Concentration |
|---|---|
| Antimony [0.05] ppm | ND |
| Arsenic [0.005] ppm | ND |
| Barium [0.01] ppm | ND |
| Cadmium [0.01] ppm | ND |
| Chromium [0.01] ppm | ND |
| Copper [0.01] ppm | ND |
| Lead prm | 0.21 |
| Mercury [0.002] ppm | ND |
| Nickel ppm | 0.13 |
| Selenium [0.005] ppm | ND |
| Silver [0.01] ppm | ND |
| Sodium ppm | 191 |
| Thallium [0.05] ppm | ND |
| Zinc ppm | 0.20 |
| Electrical Conductivity micromhos/cm | 3400 |
| pH | 6.5 |

ND: None Detected at Indicated Detection Level

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TABLE 23: Water Quality Tests
Surface Water Sample
Adjoining Landfill Boundary
Sampled by BSK and Tested by Brown and Caldwell, March 1986
Title 22 Organics

| Constituent | [Detection Level] | Concentration |
|---|---|---|
| Endrin | [1] | ND |
| Lindane | | 14 ppb |
| Methoxychlor | [3] | ND |
| Toxaphene | [10] | ND |
| 2,4-D | [5] | ND |
| 2,4,5-TP Silvex | [1] | ND |

ND: None Detected at indicated detection level.

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TABLE 25: Water Quality Tests
Groundwater Samples from Upgradient Cluster Wells
Sampled and Tested by BSK, August 1986
General Mineral plus Inorganics

| | UW-1 | | | UW-2 | | |
|---|---|---|---|---|---|---|
| Constituent (Standard) [Detection Level] | 50' | 100' | 150' | 50' | 100' | 150' |
| Arsenic (0.05) [0.005] ppm | 0.002 | 0.004 | 0.002 | ND | 0.007 | 0.006 |
| Barium (1) [0.01] prm | | 0.13 | 0.14 | 9,44 | 0.06 | 0.17 |
| Cadmium (0.10) [0.01] ppm | | ND | ND | ND | ND | ND |
| Chromium (0.05) [0.01] ppm | | 0.01 | ND | ND | 0.02 | ND |
| Copper (NA) [0.01] ppm | ND | ND | ND | ND | ND | ND |
| Lead (0.05) [0.005] ppm | ND | ND | 0.007 | 0.02 | ND | ND |
| Mercury (2) [0.1] ppb | | 0.2 | ND | 0.3 | ND | ND |
| Nitrate (45) [4.4] ppm | | 112 | 74 | 5 | 1 | 5 |
| Selenium (0.01) [0.005] ppm | ND | ND | ND | ND | ND | ND |
| Silver (0.05) [0.01] ppm | | ND | ND | ND | 0.03 | ND |
| Zinc (5) [0.01] ppm | ND | ND | 0.01 | 0.01 | 0.04 | 0.01 |

ND: None Detected at Indicated Detection Level

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TABLE 26: Summary of Water Quality Tests
Groundwater Samples from Downgradient Cluster Wells
Samples obtained and tests performed by BSK and Associates, August 1986
Test Method General Mineral Plus Inorganics

| Constituent (Standard) [Detection Level] | | DW-1 | | | DW-2 | | |
|---|---|---|---|---|---|---|---|
| | | 50' | 100' | 150' | 50' | 100' | 150' |
| Alkalinity, total | (None) | 635 | 439 | 215 | 612 | 488 | 341 |
| ppm | | | | | | | |
| Bicarbonate | (500) | 775 | 535 | 262 | 747 | 595 | 416 |
| ppm | | | | | | | |
| Calcium | (See Hardness) | 146 | 86 | 33 | | 96 | 60 |
| ppm | | | | | | | |
| Chlorides | (250/500/600) | 74 | 31 | 23 | 54 | 30 | 20 |
| ppm | | | | | | | |
| Conductance | (800/1600/2400) | 1879 | 933 | 511 | 1303 | 1118 | 837 |
| micromhos/cm | | | | | | | |
| Hardness | (Very Hard>180) | 592 | 362 | 155 | | 430 | 264 |
| as Calcium Carbonate,ppm | | | | | | | |
| Total Iron | (0.3) [0.01] | 1.15 | ND | 0.86 | 0.49 | 0.03 | 0.54 |
| ppm | | | | | | | |
| Magnesium | (See Hardness) | 55.6 | 16.0 | 17.6 | ND | 46.4 | 27.9 |
| ppm | | | | | | | |
| pH | (6.5 to 8.7) | 7.5 | 7.7 | 7.9 | 7.3 | 7.6 | 7.7 |
| Sodium | (20) | 167 | 57 | 43 | | 51 | 68 |
| ppm | | | | | | | |
| Sulfates | (250/500/600) | 240 | 10 | 8 | 48 | 18 | 6 |
| ppm | | | | | | | |
| Total Dissolved Solids, ppm | (500/1000/1500) | 1144 | 550 | 330 | 744 | 648 | 476 |

TABLE 27: Water Quality Tests
Groundwater Samples from Downgradient Cluster Wells
Sampled and Tested by BSK, August 1986
General Minerals plus Inorganics

| | DW-1 | | | DW-2 | | |
|---|---|---|---|---|---|---|
| Constituent (Standard) [Detection Level] | 50' | 100' | 150' | 50' | 100' | 150' |
| Arsenic (0.05) [0.005] ppm | 0.008 | 0.002 | 0.002 | 0.002 | 0.001 | 0.002 |
| Barium (1) [0.01] ppm | 0.00 | 0.13 | 0.09 | | 0.20 | 0.12 |
| Cadmium (0.10) [0.01] ppm | ND | ND | ND | | ND | ND |
| Chromium (0.05) [0.01] ppm | 0.06 | ND | ND | | ND | ND |
| Copper (NA) [0.01] ppm | ND | ND | ND | ND | ND | ND |
| Lead (0.05) [0.005] ppm | 0.006 | ND | ND | ND | ND | ND |
| Mercury (2) [0.1] ppb | ND | ND | ND | | 0.2 | ND |
| Nitrate (45) [4.4] ppm | 5 | 15 | 13 | | 06 | 20 |
| Selenium (0.01) [0.005] ppm | 0.001 | ND | ND | ND | ND | ND |
| Silver (0.05) [0.01] ppm | ND | ND | ND | | ND | ND |
| Zinc (5) [0.01] ppm | 0.02 | 0.01 | 0.01 | ND | ND | 0.02 |

ND: None Detected at Indicated Detection Level

TABLE 28: Water Quality Tests
Groundwater Sample from Upgradient Cluster Wells
Sampled and Tested by BSK, August 1986
Test Method EPA 601

| Constituent (Standard) | UW-1 50' | UW-1 100' | UW-1 150' | UW-2 50' | UW-2 100' | UW-2 150' |
|---|---|---|---|---|---|---|
| Bromodichloromethane | ND | ND | ND | ND | ND | ND |
| Bromoform | ND | ND | ND | ND | ND | ND |
| Bromomethane | ND | ND | ND | ND | ND | ND |
| Carbon Tetrachloride | ND | ND | ND | ND | ND | ND |
| Chlorobenzene | ND | ND | ND | ND | ND | ND |
| Chloroethane | ND | ND | ND | ND | ND | ND |
| 2-Chloroethylvinyl ether | ND | ND | ND | ND | ND | ND |
| Chloroform | ND | ND | ND | ND | ND | ND |
| Chloromethane | ND | ND | ND | ND | ND | ND |
| Dibromochloromethane | ND | ND | ND | ND | ND | ND |
| 1,2-Dichlorobenzene (130) | ND | ND | ND | ND | ND | ND |
| 1,3-Dichlorobenzene (130) | ND | ND | ND | ND | ND | ND |
| 1,4-Dichlorobenzene (130) | ND | ND | ND | ND | ND | ND |
| Dichlorodifluoromethane | ND | ND | ND | ND | ND | ND |
| 1,1-Dichloroethane | ND | ND | ND | ND | ND | ND |
| 1,2-Dichloroethane | ND | ND | ND | ND | ND | ND |
| 1,1-Dichloroethene | ND | ND | ND | ND | ND | ND |
| trans-1,2-Dichloroethene | ND | ND | ND | ND | ND | ND |
| 1,2-Dichloropropane | ND | ND | ND | ND | ND | ND |
| cis-1,3-Dichloropropene | ND | ND | ND | ND | ND | ND |
| trans-1,3-Dichloropropene | ND | ND | ND | ND | ND | ND |
| Ethyl benzene | ND | ND | ND | ND | ND | ND |
| Methylene chloride (40) | 3.8 | ND | ND | 2.1 | ND | ND |
| 1,3,2,2-Tetrachloroethane | ND | ND | ND | ND | ND | ND |
| Tetrachloroethene (4) | ND | ND | ND | 2.8 | ND | ND |
| 1,1,1-Trichloroethane | ND | ND | ND | ND | ND | ND |
| 1,1,2-Trichloroethane | ND | ND | ND | ND | ND | ND |
| Trichloroethene (5) | ND | ND | ND | 1.1 | ND | ND |
| Trichlorofluoromethane | ND | ND | ND | ND | ND | ND |
| Vinyl chloride | ND | ND | ND | ND | ND | ND |
| Total All Constituents Detected | 3.8 | ND | ND | 6.0 | ND | ND |

ND: None Detected at 0.5 parts per billion.

TABLE 29: Water Quality Tests
Groundwater Sample from Downgradient Cluster Wells
Sampled and Tested by BSK, August 1986
Test Method EPA 601

| Constituent (Standard) | DW-1 50' | DW-1 100' | DW-1 150' | DW-2 50' | DW-2 100' | DW-2 150' |
|---|---|---|---|---|---|---|
| Bromodichloromethane | ND | ND | ND | ND | ND | ND |
| Bromoform | ND | ND | ND | ND | ND | ND |
| Bromomethane | ND | ND | ND | ND | ND | ND |
| Carbon Tetrachloride | ND | ND | ND | ND | ND | ND |
| Chlorobenzene | ND | ND | ND | ND | ND | ND |
| Chloroethane | ND | ND | ND | ND | ND | ND |
| 2-Chloroethylvinyl ether | ND | ND | ND | ND | ND | ND |
| Chloroform | ND | ND | ND | ND | ND | ND |
| Chloromethane | ND | ND | ND | ND | ND | ND |
| Dibromochloromethane | ND | ND | ND | ND | ND | ND |
| 1,2-Dichlorobenzene (130) | ND | ND | ND | ND | ND | ND |
| 1,3-Dichlorobenzene (130) | ND | ND | ND | ND | ND | ND |
| 3,4-Dichlorobenzene (130) | 2.3 | 0.5 | ND | ND | ND | ND |
| Dichlorodifluoromethane | ND | ND | ND | ND | ND | ND |
| 1,1-Dichloroethane | 21.0 | 2.4 | ND | ND | 0.5 | ND |
| 1,2-Dichloroethane (1) | 2.1 | ND | ND | ND | ND | ND |
| 1,1-Dichloroethene (6) | 0.8 | ND | ND | ND | ND | ND |
| trans-1,2-Dichloroethene (NA) | 22.0 | 1.6 | ND | ND | 0.6 | ND |
| 1,2-Dichloropropane (10) | 7.5 | ND | ND | ND | 1.6 | ND |
| cis-1,3-Dichloropropene | ND | ND | ND | ND | ND | ND |
| trans-3,3-Dichloropropene | ND | ND | ND | ND | ND | ND |
| Ethyl benzene | ND | ND | ND | ND | ND | ND |
| Methylene chloride (40) | 6.1 | 5.3 | 3.0 | 13.0 | ND | ND |
| 1,1,2,2-Tetrachloroethane | ND | ND | ND | ND | ND | ND |
| Tetrachloroethene (4) | 31.0 | 26.0 | 2.6 | 30.5 | 6.7 | ND |
| 1,1,1-Trichloroethane | ND | ND | ND | ND | ND | ND |
| 1,1,2-Trichloroethane | ND | ND | ND | ND | ND | ND |
| Trichloroethene (5) | 108 | 13.5 | 1.0 | 3.2 | 10.2 | ND |
| Trichlorofluoromethane (NA) | ND | 2.2 | ND | ND | ND | ND |
| Vinyl chloride | ND | ND | ND | ND | ND | ND |
| Total All Constituents Detected | 200.8 | 51.5 | 6.6 | 46.7 | 19.6 | ND |

ND: None Detected at 0.5 parts per billion.

City of Fresno
Jensen and West

JOB 86012
August, 1986

TABLE 30: Water Quality Tests
Groundwater Samples from Well Clusters
Sampled by BSK and Tested by Brown and Caldwell, August 1986
Title 22 Organics

| Constituent (Standard) [Detection Level] | DW-1 50' | UW-2 50' |
|---|---|---|
| Endrin (2) [0.1] | ND | ND |
| Lindane (0.7) [0.05] | ND | ND |
| Methoxychlor (100) [0.3] | ND | ND |
| Toxaphene (5) [1] | ND | ND |
| 2,4-D (100) [5] | ND | ND |
| 2,4,5-TP Silvex (10) [1] | ND | ND |

ND: None Detected at indicated detection level.

BSK & Associates

City of Fresno
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December, 1986

TABLE 32: Water Quality Tests
Groundwater Sample from Temporary Wells
Sampled and Tested by BSK, December 1986
Test Method EPA 601

| Constituent (Standard) | 501 | 502 |
|---|---|---|
| Bromodichloromethane | ND | ND |
| Bromoform | ND | ND |
| Bromomethane | ND | ND |
| Carbon Tetrachloride | ND | ND |
| Chlorobenzene | ND | ND |
| Chloroethane | ND | ND |
| 2-Chloroethylvinyl ether | ND | ND |
| Chloroform (100) | 5* | 5* |
| Chloromethane | ND | ND |
| Dibromochloromethane | ND | ND |
| 1,2-Dichlorobenzene (130) | ND | ND |
| 1,3-Dichlorobenzene (130) | ND | ND |
| 1,4-Dichlorobenzene (130) | 7.3 | 4.3 |
| Dichlorodifluoromethane | ND | ND |
| 1,1-Dichloroethane (NA) | 36 | 27 |
| 1,2-Dichloroethane (1) | 2.6 | ND |
| 1,1-Dichloroethene (6) | 1.2 | 1.3 |
| trans-1,2-Dichloroethene (NA) | 40 | 32 |
| 1,2-Dichloropropane (10) | 14 | 28 |
| cis-1,3-Dichloropropene | ND | ND |
| trans-1,3-Dichloropropene | ND | ND |
| Ethyl benzene | ND | ND |
| Methylene chloride (40) | 39 | 5.6 |
| 1,3,2,2-Tetrachloroethane | ND | ND |
| Tetrachloroethene (4) | 34 | 80 |
| 1,1,1-Trichloroethane (200) | 5* | 5* |
| 1,1,2-Trichloroethane | ND | ND |
| Trichloroethene (5) | 86 | 261 |
| Trichlorofluoromethane | ND | ND |
| Vinyl chloride | ND | ND |
| Total All Constituents Detected | 270.1 | 449.2 |

ND: None Detected at 0.5 parts per billion.
*:Identified by nearest peak.

BSK & Associates

City of Fresno
Jensen and West

JOB 86012
January, 1987

TABLE 33: Water Quality Tests
Groundwater Sample from Temporary Wells
Sampled and Tested by BSK, December 1986 and January, 1987
Test Method EPA 601

| Constituent (Standard) | 400 | 401 | 402 | 403 | 404 | 405 | 406 | 407 |
|---|---|---|---|---|---|---|---|---|
| Bromodichloromethane | ND | ND | ND | ND | ND | ND | ND | ND |
| Bromoform | ND | ND | ND | ND | ND | ND | ND | ND |
| Bromomethane | ND | ND | ND | ND | ND | ND | ND | ND |
| Carbon Tetrachloride | ND | ND | ND | ND | ND | ND | ND | ND |
| Chlorobenzene | ND | ND | ND | ND | ND | ND | ND | ND |
| Chloroethane | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-Chloroethylvinyl ether | ND | ND | ND | ND | ND | ND | ND | ND |
| Chloroform (100) | ND | 0.7 | ND | ND | ND | ND | ND | ND |
| Chloromethane | ND | ND | ND | ND | ND | ND | ND | ND |
| Dibromochloromethane | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,2-Dichlorobenzene (130) | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,3-Dichlorobenzene (130) | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,4-Dichlorobenzene (130) | ND | 1.1 | ND | ND | ND | ND | ND | ND |
| Dichlorodifluoromethane | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,1-Dichloroethane (NA) | 27 | 29 | 13 | 2.6 | ND | ND | ND | ND |
| 1,2-Dichloroethane (1) | 6.8 | ND | ND | ND | ND | ND | ND | ND |
| 1,1-Dichloroethene (6) | 2.0 | ND | ND | ND | ND | ND | ND | ND |
| trans-1,2-Dichloroethene (NA) | 5* | 25 | 12 | 3.9 | ND | ND | ND | ND |
| 1,2-Dichloropropane | ND | ND | ND | ND | ND | ND | ND | ND |
| cis-1,3-Dichloropropene | ND | ND | ND | ND | ND | ND | ND | ND |
| trans-1,3-Dichloropropene | ND | ND | ND | ND | ND | ND | ND | ND |
| Ethyl benzene | ND | ND | ND | ND | ND | ND | ND | ND |
| Methylene chloride (40) | 9610 | 115 | 16 | 6.3 | ND | ND | 0.5 | ND |
| 1,1,2,2-Tetrachloroethane | ND | ND | ND | ND | ND | ND | ND | ND |
| Tetrachloroethene (4) | 90 | 128 | 138 | 96 | 39.3 | 44.5 | 32.0 | ND |
| 1,1,1-Trichloroethane (200) | 13 | ND | ND | ND | ND | ND | ND | ND |
| 1,1,2-Trichloroethane | ND | ND | ND | ND | ND | ND | ND | ND |
| Trichloroethene (5) | 223 | 128 | 111 | 47 | 12 | 3.7 | 0.4 | ND |
| Trichlorofluoromethane (NA) | ND | ND | ND | 1.5 | ND | ND | 11.0 | ND |
| Vinyl chloride | ND | ND | ND | ND | ND | ND | ND | ND |
| Total All Constituents Detected | 9977 | 426.8 | 290 | 157.3 | 51.3 | 48.2 | 43.9 | ND |

ND: None Detected at 0.5 parts per billion.
*: Identified on basis of nearest peak.

BSK & Associates

City of Fresno
Jensen and West

JOB 86012
January, 1987

TABLE 34: Water Quality Tests
Groundwater Sample from Temporary Wells
Sampled and Tested by BSK, December 1986 and January, 1987
Test Method EPA 601

| Constituent (Standard) | 601 | 602 | 603 | 604 |
|---|---|---|---|---|
| Bromodichloromethane | ND | ND | ND | ND |
| Bromoform | ND | ND | ND | ND |
| Bromomethane | ND | ND | ND | ND |
| Carbon Tetrachloride | ND | ND | ND | ND |
| Chlorobenzene | ND | ND | ND | ND |
| Chloroethane | ND | ND | ND | ND |
| 2-Chloroethylvinyl ether | ND | ND | ND | ND |
| Chloroform | ND | ND | ND | ND |
| Chloromethane | ND | ND | ND | ND |
| Dibromochloromethane | ND | ND | ND | ND |
| 1,2-Dichlorobenzene (130) | ND | ND | ND | ND |
| 1,3-Dichlorobenzene (130) | ND | ND | ND | ND |
| 1,4-Dichlorobenzene (130) | ND | ND | ND | ND |
| Dichlorodifluoromethane | ND | ND | ND | ND |
| 1,1-Dichloroethane | ND | ND | ND | ND |
| 1,2-Dichloroethane | ND | ND | ND | ND |
| 1,1-Dichloroethene | ND | ND | ND | ND |
| trans-1,2-Dichloroethene | ND | ND | ND | ND |
| 1,2-Dichloropropane | ND | ND | ND | ND |
| cis-1,3-Dichloropropene | ND | ND | ND | ND |
| trans-1,3-Dichloropropene | ND | ND | ND | ND |
| Ethyl benzene | ND | ND | ND | ND |
| Methylene chloride (40) | ND | ND | ND | ND |
| 1,3,2,2-Tetrachloroethane | ND | ND | ND | ND |
| Tetrachloroethene (4) | 47.3 | 32.5 | ND | ND |
| 1,1,1-Trichloroethane (200) | ND | ND | ND | ND |
| 1,1,2-Trichloroethane | ND | ND | ND | ND |
| Trichloroethene (5) | 55.3 | 39.6 | ND | ND |
| Trichlorofluoromethane | ND | ND | ND | ND |
| Vinyl chloride | ND | ND | ND | ND |
| Total All Constituents Detected | 102.6 | 72.1 | ND | ND |

ND: None Detected at 0.5 parts per billion.

BSK & Associates

Well Designation UW-1 at 50'

Date Sampled 7/16/86

Sampled by TCK

Weather Sunny, Warm

Static Water Level before Sampling from Top of Well Casing 48.5'

Well Casing Stickup above Grade 0.5'

Static Water Level before Sampling from Grade 48.0'

Test Well dried on initial pumping. Unable to get a sample.

Well Designation UW-1 at 100'

Date Sampled 7/16/86

Sampled by TCK

Weather Sunny, Warm

Static Water Level before Sampling from Top of Well Casing 48.4'

Well Casing Stickup above Grade 0.5'

Static Water Level before Sampling from Grade 47.9'

| | | | | |
|---|---|---|---|---|
| Time 10:07 | Time 10:10 | Time 10:12 | Time 10:15 | Time 10:18 |
| Ec 1000 | Ec 990 | Ec 980 | Ec 1000 | Ec 1000 |
| pH 7.2 | pH 7.2 | pH 7.1 | pH 7.0 | pH 6.9 |
| Temp 20 | Temp 20 | Temp 20 | Temp 20 | Temp 20 |
| Sampled N | Sampled N | Sampled N | Sampled N | Sampled N |

| | | | | |
|---|---|---|---|---|
| Time 10:21 | Time | Time | Time | Time |
| Ec 1000 | Ec | Ec | Ec | Ec |
| pH 6.9 | pH | pH | pH | pH |
| Temp 20 | Temp | Temp | Temp | Temp |
| Sampled Y | Sampled | Sampled | Sampled | Sampled |

Well Designation UW-1 at 150'

Date Sampled 7/16/86

Sampled by TCK

Weather Sunny, Warm

Static Water Level before Sampling from Top of Well Casing 48.4'

Well Casing Stickup above Grade 0.4'

Static Water Level before Sampling from Grade 48.0'

| | | | | |
|---|---|---|---|---|
| Time 1:35 | Time 1:38 | Time 1:41 | Time 1:44 | Time |
| Ec 1100 | Ec 1050 | Ec 1050 | Ec 1100 | Ec |
| pH 7.2 | pH 7.2 | pH 7.2 | pH 7.2 | pH |
| Temp 21 | Temp 20 | Temp 20 | Temp 20 | Temp |
| Sampled N | Sampled N | Sampled N | Sampled Y | Sampled |

Well Designation UW-2 at 60'

Date Sampled 7/16/86 - 7/17/86

Sampled by TCK

Weather Sunny, Warm

Static Water Level before Sampling from Top of Well Casing 49.9'

Well Casing Stickup above Grade 1.5'

Static Water Level before Sampling from Grade 48.4'

| | | | | |
|---|---|---|---|---|
| Time 3:45 | Time 9:50 | Time | Time | Time |
| Ec 14,000 | Ec 13,000 | Ec | Ec | Ec |
| pH 12.6 | pH 12.3 | pH | pH | pH |
| Temp 23 | Temp 22 | Temp | Temp | Temp |
| Sampled N | Sampled Y | Sampled | Sampled | Sampled |

Well Designation UW-2 at 100'

Date Sampled 7/17/86

Sampled by TCK

Weather Sunny, Warm

Static Water Level before Sampling from Top of Well Casing 49.9'

Well Casing Stickup above Grade 1.3'

Static Water Level before Sampling from Grade 48.6'

| | | | | |
|---|---|---|---|---|
| Time 9:48 | Time 9:51 | Time 9:54 | Time 9:57 | Time 10:00 |
| Ec 220 | Ec 200 | Ec 200 | Ec 200 | Ec 200 |
| pH 9.5 | pH 9.2 | pH 9.1 | pH 9.1 | pH 9.1 |
| Temp 18 | Temp 18 | Temp 18 | Temp 18 | Temp 18 |
| Sampled N | Sampled N | Sampled N | Sampled N | Sampled Y |

Well Designation UW-2 at 150'

Date Sampled 7/16/86

Sampled by TCK

Weather Sunny, Warm

Static Water Level before Sampling from Top of Well Casing 50.3'

Well Casing Stickup above Grade 1.7'

Static Water Level before Sampling from Grade 48.7'

| | | | | |
|---|---|---|---|---|
| Time 2:30 | Time 2:33 | Time 2:36 | Time 2:39 | Time 2:42 |
| Ec 370 | Ec 340 | Ec 320 | Ec 300 | Ec 300 |
| pH 9.2 | pH 9.1 | pH 8.9 | pH 8.8 | pH 8.7 |
| Temp 20 | Temp 20 | Temp 20 | Temp 20 | Temp 20 |
| Sampled N | Sampled N | Sampled N | Sampled N | Sampled N |

| | | | | |
|---|---|---|---|---|
| Time 2:45 | Time 2:48 | Time 2:51 | Time 2:54 | Time 2:57 |
| Ec 300 | Ec 290 | Ec 280 | Ec 280 | Ec 280 |
| pH 8.6 | pH 8.5 | pH 8.4 | pH 8.4 | pH 8.4 |
| Temp 20 | Temp 20 | Temp 20 | Temp 20 | Temp 20 |
| Sampled N | Sampled N | Sampled N | Sampled N | Sampled Y |

Well Designation DW-1 at 60'

Date Sampled 7/17/86

Sampled by TCK

Weather Sunny, Warm

Static Water Level before Sampling from Top of Well Casing 46.7'

Well Casing Stickup above Grade 1.3'

Static Water Level before Sampling from Grade 45.4'

| | | | | |
|---|---|---|---|---|
| Time 11:05 | Time 11:12 | Time 11:15 | Time 11:18 | Time 11:21 |
| Ec 1140 | Ec 1120 | Ec 1170 | Ec 1300 | Ec 1380 |
| pH 8.6 | pH 9.9 | pH 9.1 | pH 8.5 | pH 8.3 |
| Temp 23 | Temp 23 | Temp 23 | Temp 23 | Temp 23 |
| Sampled N | Sampled N | Sampled N | Sampled N | Sampled N |

| | | | | |
|---|---|---|---|---|
| Time 11:24 | Time 11:27 | Time 11:30 | Time 11:33 | Time 11:36 |
| Ec 1420 | Ec 1500 | Ec 1600 | Ec 1680 | Ec 1650 |
| pH 8.2 | pH 7.9 | pH 7.6 | pH 7.4 | pH 7.2 |
| Temp 23 | Temp 23 | Temp 23 | Temp 23 | Temp 23 |
| Sampled N | Sampled N | Sampled N | Sampled N | Sampled N |
| Time 11:45 | Time 11:48 | Time 11:51 | Time 11:54 | Time 11:58 |
| Ec 1700 | Ec 1600 | Ec 1700 | Ec 1700 | Ec 1700 |
| pH 7.0 | pH 7.1 | pH 7.0 | pH 7.0 | pH 7.0 |
| Temp 23 | Temp 23 | Temp 23 | Temp 23 | Temp 23 |
| Sampled N | Sampled N | Sampled N | Sampled N | Sampled Y |

Well Designation DW-1 at 100'

Date Sampled 7/17/86

Sampled by TCK

Weather Sunny, Warm

Static Water Level before Sampling from Top of Well Casing 47.3'

Well Casing Stickup above Grade 1.2'

Static Water Level before Sampling from Grade 46.1'

| | | | | |
|---|---|---|---|---|
| Time 1:55 | Time 1:58 | Time 2:01 | Time _____ | Time _____ |
| Ec 900 | Ec 900 | Ec 900 | Ec _____ | Ec _____ |
| pH 7.3 | pH 7.3 | pH 7.3 | pH _____ | pH _____ |
| Temp 21 | Temp 21 | Temp 21 | Temp _____ | Temp _____ |
| Sampled N | Sampled N | Sampled Y | Sampled ___ | Sampled ___ |

Well Designation DW-1 at 150'

Date Sampled 7/17/86

Sampled by TCK

Weather Sunny, Warm

Static Water Level before Sampling from Top of Well Casing 46.1'

Well Casing Stickup above Grade 0.0'

Static Water Level before Sampling from Grade 46.1'

| | | | | |
|---|---|---|---|---|
| Time 2:48 | Time 2:51 | Time 2:54 | Time _____ | Time _____ |
| Ec 530 | Ec 520 | Ec 520 | Ec _____ | Ec _____ |
| pH 7.5 | pH 7.5 | pH 7.5 | pH _____ | pH _____ |
| Temp 22 | Temp 22 | Temp 22 | Temp _____ | Temp _____ |
| Sampled N | Sampled N | Sampled Y | Sampled ___ | Sampled ___ |

Well Designation DW-2 at 50'

Date Sampled 7/18/86

Sampled by TCK

Weather Sunny, Warm

Static Water Level before Sampling from Top of Well Casing 47.5'

Well Casing Stickup above Grade 0.0'

Static Water Level before Sampling from Grade 47.5'

Well dried up on initial pumping. Unable to obtain sample.

Well Designation DW-2 at 110'

Date Sampled 7/18/86

Sampled by TCK

Weather Sunny, Warm

Static Water Level before Sampling from Top of Well Casing 50'4"

Well Casing Stickup above Grade 0.8'

Static Water Level before Sampling from Grade 49.6'

| | | | | |
|---|---|---|---|---|
| Time 9:40 | Time 9:43 | Time 9:46 | Time _____ | Time _____ |
| Ec 1000 | Ec 1000 | Ec 1000 | Ec _____ | Ec _____ |
| pH 7.0 | pH 7.0 | pH 7.0 | pH _____ | pH _____ |
| Temp 24 | Temp 24 | Temp 24 | Temp _____ | Temp _____ |
| Sampled N | Sampled N | Sampled Y | Sampled ___ | Sampled ___ |

Well Designation DW-2 at 150'

Date Sampled 7/17/86

Sampled by TCK

Weather Sunny, Warm

Static Water Level before Sampling from Top of Well Casing 51.3'

Well Casing Stickup above Grade 1.8'

Static Water Level before Sampling from Grade 49.5'

| | | | | |
|---|---|---|---|---|
| Time 3:54 | Time 3:57 | Time 4:00 | Time _____ | Time _____ |
| Ec 800 | Ec 750 | Ec 790 | Ec _____ | Ec _____ |
| pH 7.2 | pH 7.2 | pH 7.2 | pH _____ | pH _____ |
| Temp 25 | Temp 25 | Temp 25 | Temp _____ | Temp _____ |
| Sampled N | Sampled N | Sampled Y | Sampled ___ | Sampled ___ |