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Town of Ramapo

Department of Public Works 18 Pioneer Avenue Tallman, New York 10982 (845) 357-0591 Fax: (845) 357-0895

CHRISTOPHER P. ST. LAWRENCE Supervisor

EDWARD P. DZURINKO Director of Public Works

March 7, 2006

George Jacob, P.E. Project Manager USEPA Emergency & Remedial Response Division New York Remediation Branch 290 Broadway, 20th Floor New York, NY 10007-1866

Subject: Ramapo Landfill

Dear Mr. Jacob,

In a conference held with USEPA & NYSDEC on August 22, 2005 we reviewed the EPA recommendation to install additional monitoring wells to allow for a determination of a groundwater capture zone and to serve as an early warning regarding potential contamination of down-gradient drinking water supplies. I respectfully request that the EPA reconsider requiring the installation of the additional monitoring wells based on the findings and recommendations in the attached report by Sterling Environmental Engineering P.C., the Town's groundwater monitoring consultant.

The March 6, 2006 STERLING report addresses the groundwater capture zone; the rate of groundwater movement in the shallow sand aquifer; the history of the Town's groundwater monitoring program; UWNY's independent sampling of its production wells; the proximity of the existing monitoring wells to private wells PW-1 & PW-2 and UWNY wells SVWC-93, SVWC-94, SVWC-95 & SVWC-96; and the Town's contingency plan to connect the private residences on Torne Brook Road to an alternate potable water supply. The conclusion of the report is that the installation of additional monitoring wells for determination of a groundwater capture zone and to give early warning regarding potential contaminant migration to down-gradient drinking water wells is not a necessary action.

It is important to note that the findings show that, due to the rapid groundwater movement in the shallow sand aquifer west of Torne Valley Road, additional monitoring wells would not likely provide adequate warning time for the closest down-gradient drinking water well (PW-1) in the event of a catastrophic release of contamination from the landfill. The Town of Ramapo requests that groundwater monitoring at the Landfill monitoring wells, PW-1, PW-2 and the United Water Company wells for Part 360 Baseline Parameters continue on its current schedule and that water quality data collected by the RCHD and United Water Company for the off-site drinking water supply wells be reviewed by the regulating agencies on a monthly basis. In the event that regulating agencies determine that drinking water standards are being contravened, the Town of Ramapo is committed to the immediate implement its Contingency Plan to provide an alternative water supply to the residents located on Torne Brook Road. This will include providing residents with bottled water and/or an acceptable point-of-use treatment system until an extension of the water line from Torne Valley Road can be constructed.

Please call me at (845) 357-091 if you have any questions or comments.

Very Truly Yours,

Edward P. Dzufinko Director of Public Works

Encl.

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cc: Gerald J. Rider, P.E. – NYSDEC (Albany)
 Saiban Mahamooth, P.E. – NYSDEC (New Paltz)
 James Schreyer, P.E. – NYSDEC (New Paltz)
 Supervisor St. Lawrence & Town Board
 Michael Klein
 Ed Moran
 Elizabeth M. Davis – Sterling Environmental



March 6, 2006

Mr. Edward P. Dzurinko Director Department of Public Works Town of Ramapo 18 Pioneer Avenue Tallman, New York 10982-0446

Subject: Response Letter to USEPA Five-Year Review Report (December 2004) Town of Ramapo Landfill STERLING File #20010/Task 400

Dear Mr. Dzurinko,

This letter report is prepared for the Town of Ramapo by Sterling Environmental Engineering, P.C. (STERLING) and is a summary of STERLING's review of the United States Environmental Protection Agency (USEPA) Region 2 Five-Year Review Report (December 2004) for the Town of Ramapo Landfill.

Specifically, the USEPA Review summary indicates, "the current monitoring network does not allow for a determination of a groundwater capture zone nor give early warning regarding potential contaminant migration to downgradient drinking water wells". Part of the proposed USEPA Recommendation and Follow-Up Action for this issue is to install and sample additional monitoring wells.

The purpose of this review is to determine if the proposed USEPA recommendation to install additional monitoring wells is a necessary action considering the existing landfill monitoring well and extraction well network, local aquifer characteristics and the established contingency plan for an alternative water supply for two (2) downgradient residences.

A list of documents reviewed by STERLING is provided in Table 1.

I. Description of Off-Site Water Supply Wells Downgradient of Ramapo Landfill

Two (2) privately owned water supply wells are located to the southwest of the Landfill on Torne Brook Road. The closest well is located approximately 425 feet from the southwest corner of the Landfill waste boundary and is identified as PW-1. This well serves the Torne Brook Farm. The second well is approximately 1,020 feet from the southwest corner of the Landfill waste boundary and is identified as PW-2. This well serves a two-unit apartment residence. PW-1 is classified as a Community Water Supply (CSW) well because it serves more than twenty-five (25) people on a year-round basis. The Rockland County Health Department (RCHD) file for PW-1 indicates the well is shallow, however no well log was available for review. It is assumed that the groundwater source for PW-1 is an overburden aquifer. Groundwater quality data reviewed for PW-1 in the RCHD file is discussed in Section IV of this letter report and presented in Table 3. Information for PW-2 with regards to the water supply aquifer type and water quality data was not located by STERLING's review of the RCHD files.

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Five (5) municipal water supply wells operated by United Water Company and identified as RVWF-1, SVWC-93, SVWC-94, SVWC-95 and SVWC-96 are located on the opposite side of the Ramapo River from the Landfill and are located at the following estimated distances from the southwest corner of the Landfill waste boundary:

| RVWF-1 | 1,070 feet |
|---------|------------|
| SVWC-93 | 1,400 feet |
| SVWC-94 | 1,210 feet |
| SVWC-95 | 770 feet |
| SVWC-96 | 1,280 feet |
| | |

The SVWC wells are 14-inch diameter wells continuously screened in sand and gravel deposits to an average depth of 93 feet below ground surface. Wells SVWC-94 and SVWC-95 are mostly gravel wells with cobble layers at varying depths. The well logs for the SVWC wells are provided in Appendix 1. Antimony water quality data for these four (4) municipal supply water wells is provided in Table 3.

II. Local Overburden Aquifer Characteristics and Potential Influences on Shallow Groundwater Flow Patterns

The aquifer of concern is an overburden sand and gravel aquifer that has an unconfined groundwater table that is part of the Ramapo River Basin Aquifer System. Groundwater level elevations measured in the shallow monitoring wells located at the Landfill during the October 2003 sampling event indicate groundwater flow in the shallow aquifer is to the southwest towards the Ramapo River. Torne Brook, a tributary to the Ramapo River, flows from north to south and lies between the Town Landfill and the two private water supply wells identified as PW-1 and PW-2 on Torne Brook Road. Based on results of aquifer pump tests conducted in December 1992 on monitoring wells located on the Landfill property, it was determined that Torne Brook is hydraulically connected to the shallow aquifer groundwater table. Stream elevation data was not located during STERLING's review, and it is unknown whether the stream acts as a discharge or recharge point for the shallow aquifer. Calculations from data recorded during the pump test in 1992 indicate the overburden sand aquifer west of Torne Valley Road show a hydraulic conductivity range value of 1.1×10^{-2} cm/s to 2.3×10^{-2} cm/s. This indicates that groundwater can flow through the overburden aquifer in this area at a rate equivalent to 31 to 65 feet per 24-hour day.

III. Ramapo Landfill Groundwater Capture Zone

According to a USEPA presentation titled "Capture Zone Analysis for Pump and Treat Systems", June 16, 2004, the term "Capture Zone" refers to the three-dimensional region that contributes the groundwater extracted by one or more wells or drains. For successful hydraulic containment, contaminants moving with groundwater in the containment zone must follow path lines that are captured by the Pump and Treat System (Methods for Monitoring Pump-and-Treat Performance, EPA/600/R-94/123, June 1994). For the Ramapo Landfill site, the Capture Zone is created by the pumping of extraction wells W-1 through W-7.

The extraction well collection system parallels a deeper leachate interception gravity system that starts on the northeast side of the Landfill and terminates along with the extraction well discharge line at Manhole A-5. Leachate is removed by a pump station located on the Landfill property to the Rockland County Sewer District (RCSD) #1 Facility in Orangeburg, New York where it is treated and discharged to the

Hudson River. The interception gravity system that parallels the leachate extraction well system is comprised of varying diameter, one-sided slotted PVC pipes that are located approximately 5-10 feet below ground surface, with some sections being part of the deep collector system at depths up to 20 feet below ground surface. The PVC pipes connect with lift pump stations that convey intercepted leachate to the RCSD #1 facility. The leachate interceptor system starts at the northeast corner of the landfill and runs along the northeast side of Torne Valley Road and terminates at the southern boundary of the landfill.

The extraction wells are located on the western side of the Landfill along Torne Valley Road between monitoring well clusters MW-3 and MW-8. The layout of the extraction well system is approximately 700 feet in length. Three (3) extraction wells, W-5, W-6, and W-7, are approximately 20 feet deep and are screened in dense sand and partially (~2.0 feet) into bedrock. The remaining extraction wells, W-1 through W-4, are deeper, ranging from 38 to 51 feet in depth and are screened in dense sand and partially (up to 10 feet) into bedrock. Drilling logs for the extraction wells are provided in Appendix 2.

According to the Town of Ramapo Department of Public Works, extraction wells W-5 and W-6 have not operated frequently due to lower groundwater levels and some others have at times been out of service due to clogging of the impellers and electrical power related issues. No records are available to show time periods when any of the extraction wells were operating or not. The Town noted it is currently preparing specifications for redeveloping some of the extraction wells in 2006.

There are no records of the volume of leachate pumped from individual extraction wells. Monthly totals for the volume of leachate pumped to the RCSD #1 are recorded, however, and a summary of the yearly volume of wastewater collected by extraction wells for the period from 1994 to September 2005 is presented in Table 2. The highest discharge volumes occurred between 1995 to 1998, with an estimated peak volume of 22,888,055 gallons of leachate discharged each year in 1997 and 1998. From 1999 to 2005, discharge volumes range from approximately 16 to 18 million gallons per year.

IV. Existing Town of Ramapo Landfill Monitoring Program

The current monitoring program for the Town landfill consists of sampling the landfill monitoring wells, private residence wells PW-1 and PW-2 and United Water New York municipal water supply wells SVWC-93, 94, 95 and 96 on an annual basis, every 5th quarter for NYCRR Part 360 Baseline parameters and site related Volatile Organic Compounds (VOCs). A variance was approved by the New York State Department of Environmental Conservation (NYSDEC) on October 27, 2003 to reduce the sampling frequency and number of monitoring wells based on the sampling results of thirty-six (36) rounds of sampling events conducted prior to 2003. Since October 2003, three (3) sampling events have occurred in October 2003, March 2004 and June 2005.

Analytical results for these three (3) events indicate consistent standard exceedances of iron and manganese and sporadic standard exceedances of chromium, antimony (one event), nickel, sodium, and thallium in samples from monitoring wells. One sample from 5-0S in March 2004 shows results with arsenic and beryllium standard exceedances.

Results for the private and municipal water supply wells sampled during these three (3) sampling events indicate a parameter exceedance of antimony in all wells in October 2003 (please see Section VI for a discussion on this event). PW-1 and PW-2 showed no parameter exceedances for the 2004 and 2005

events, while the four (4) municipal water supply wells reported only a sodium standard exceedance in 2004 and 2005.

V. United Water New York Monitoring Program

United Water New York (UWNY) wells SVWC-93, 94, 95 and 96 are sampled by UWNY on a quarterly basis for trace metals. UWNY sampling results for 2004 indicate no exceedances for the trace metals analyzed, including antimony.

VI. Groundwater Contamination Trends for Antimony

Antimony levels recorded from April 1996 to September 2005 for the Landfill monitoring wells, private water supply wells PW-1 and PW-2 and municipal water supply wells SVWC-93, -94, -95, and -96 are presented in Table 3. For Antimony, The Part 703.5 groundwater standard is 3 ug/l, the Primary Drinking water standard is 6 ug/l and the USEPA Region 9 Preliminary Remediation Goal (non-cancer) is 15 ug/l.

Antimony levels that consistently exceed the groundwater standard are evident in monitoring well 3-OS from May 2000 to October 2003. The only other well to show Antimony levels exceeding the groundwater standard during this time period is monitoring well 1-OS in May 2000. In October 2003, all of the monitoring wells, except 9-I, and all of the private and municipal water supply wells reported Antimony exceeding the groundwater standard. All of these levels were reported with a 'B' qualifier, meaning the concentration is less than the Contract Required Detection Limit (CRDL), but greater than the Instrument Detection Limit (IDL).

Since October 2003, results for two sampling events conducted in March 2004 and June 2005 indicate Antimony levels are below the groundwater standard for all the monitoring wells and off-site water supply wells, except for the sample collected at PW-2 in March 2004, where Antimony is reported at 5 ug/l. Water testing results for municipal water supply wells SVWC-93, -94, -95, and -96 in June-August 2004 report Antimony at non-detectable levels and PW-1 water test results obtained from the RCHD for December 2004 and September 2005 report Antimony at non-detectable levels.

VII. Contingency Plan for Alternative Water Supply

A Contingency Plan for an alternative water supply is outlined in general terms in the USEPA Superfund Record of Decision (ROD) for the Ramapo Landfill, 1992, and specifically in the Design Analysis Report, June 1994.

The Contingency Plan indicates that an alternate water supply may be deemed necessary if groundwater monitoring data indicates that drinking water standards are being contravened in residential wells or in other same-aquifer wells indicating that residential wells will be affected, and if detected concentrations are confirmed by subsequent sampling, then residents would immediately be provided with bottled water and/or an acceptable point-of-use treatment system until an alternate water supply can be constructed.

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Three options are available for extending existing water lines to the PW-1 and PW-2 properties on Torne Brook Road:

- 1. Extend a municipal water line from the Village of Hillburn that terminates approximately 500 feet from Route 59 along Torne Valley Road. Supplying water to PW-1 and PW-2 will require this municipal water line to be extended by approximately two (2) miles.
- 2. The Pothat Water Company, currently owned by United Water of New York, provides water to individual properties on Lake Street. The distance from the easternmost extent of the Pothat water line to PW-1 and PW-2 is 1,500 feet.
- 3. Since 1994, a water line owned by the Rockland County Solid Waste Management Authority was installed on Torne Valley Road. When the water line was placed along Torne Valley Road, a connector "spur" was installed at the intersection of Torne Valley Road and Torne Brook Road, in anticipation that a water main extension to PW-1 and PW-2 may be deemed necessary based on future water quality data.

The Town of Ramapo Town Board has indicated its commitment to installing an alternate water supply source if required.

VIII. Findings and Recommendations

- Calculations based on a 1992 pump test indicate that groundwater movement in the shallow sand aquifer west of Torne Valley Road is fairly rapid, with estimated hydraulic conductivity values of 31 to 65 feet per day. Samples from additional monitoring wells screened in this aquifer would not likely provide adequate warning time for the closest downgradient drinking water well (PW-1) if contamination migration occurred in the shallow aquifer.
- Since October 2003, results for two monitoring events conducted in March 2004 and June 2005 indicate Antimony levels are below the groundwater standard of 3 ug/l for all the monitoring wells and off-site water supply wells (except for the sample collected at PW-2 in March 2004, where Antimony is reported at 5 ug/l.) Water testing results for municipal water supply wells SVWC-93, -94, -95, and -96 in June-August 2004 report Antimony at non-detectable levels and PW-1 water test results obtained from the RCHD for December 2004 and September 2005 report Antimony at non-detectable levels. The March 2004 and June 2005 monitoring events report no parameter standard exceedances for PW-1 and PW-2 and only a sodium parameter exceedance for the four (4) municipal water supply wells.
- The Landfill leachate extraction system reportedly is functioning at less than full capacity during the USEPA 5-year review period of 1999-2004 and leachate discharge volumes have declined since 1998. Plans are underway by the Town to redevelop some of the wells in 2006 in order to improve the extraction process. It is anticipated that improvements to the leachate extraction system will aid in improving groundwater quality in the overburden aquifer.
- A municipal supply water line is located on Torne Valley Road that is equipped with an extension spur at the intersection of Torne Valley Road and Torne Brook Road for the purpose of

extending the water line to the two properties on Torne Brook Road if deemed necessary by the regulating agencies.

Based on the above listed findings, it is STERLING's opinion that the recommendation proposed in the USEPA Region 2 Five-Year Report (December 2004) to install additional monitoring wells for determination of a groundwater capture zone and to give early warning regarding potential contaminant migration to downgradient drinking water wells is not a necessary action.

STERLING recommends that monitoring of the Landfill monitoring wells, PW-1, PW-2 and the United Water Company wells for Part 360 Baseline Parameters continue on an annual basis and that water quality data collected by the RCHD and United Water Company for the off-site drinking water supply wells be reviewed by the regulating agencies on a monthly basis. If it is determined by the regulating agencies that drinking water standards are being contravened and subsequent sampling confirms a contamination trend, it is recommended the Town of Ramapo immediately implement its Contingency Plan to provide an alternative water supply to the residents located on Torne Brook Road. This will include providing residents with bottled water and/or an acceptable point-of-use treatment system until an extension of the water line from Torne Valley Road can be constructed.

STERLING appreciates this opportunity to provide this Review Report to the Town of Ramapo. Please call me at 518/456-4900 should you have any questions or comments.

Very truly yours,

STERLING ENVIRONMENTAL ENGINEERING, P.C.

Elizabeth M. Davis

Elizabeth M. Davis Hydrogeologist <u>liz@sterlingenvironmental.com</u>

EMD/bc Facsimile/First Class Mail Attachments

20010\EPA 5-Year Report Review/Dzurinko Response to EPA5-year Report.doc



TABLE 1

REVIEWED DOCUMENTS

| TITLE | AGENCY | DATE(S) | | |
|--|--|---------------|--|--|
| Five-Year Review Report Ramapo Landfill Superfund Site Rockland County, New York | USEPA Region 2 | December 2004 | | |
| Town of Ramapo Leachate Pumping History | Town of Ramapo | 1994 - 2005 | | |
| (Portions of) Design Analysis Report for the Ramapo Landfill Vol. 1 of 3 | URS Consultants, Inc. | June 1994 | | |
| Operation and Maintenance Manual Ramapo Landfill Remediation NYSDEC Site No. 3-44-004 | URS Greiner, Inc. | December 1998 | | |
| Landfill Leachate Extraction Well Logs | James C. Anderson Assoc., Inc./ Town of Ramapo | 1995 | | |
| Spring Valley Water Company Well Logs for Wells SVWC-93,-94,-95,-96 | Leggette Brashears & Graham/ United Water of New York | 1978 | | |
| Groundwater Quality Data for SVWC Municipal Water Supply Wells | United Water of New York | 1996 2004 | | |
| Construction Monitoring Report Ramapo Landfill Remediation | URS Greiner, Inc. | December 1998 | | |
| Landfill Monitoring Well Data | Sterling Environmental Engineering, P.C. | 1999 – 2005 | | |
| Five-Year Review Report | USEPA | 1999 | | |
| Water Quality Data for PW-1 | Rockland County Department of Health | 1996 – 2005 | | |
| Methods for Monitoring Pump-and-Treat Performance (EPA/600/R-94/123) | USEPA | June 1994 | | |
| EPA Superfund Record of Decision: Ramapo Landfill EPA ID: NYD0005/1493 OU 01 Ramapo, NY 3/31/1992 | USEPA | March 1992 | | |

20010/Table 1_Reviewed Documents.doc

TABLE 2

TOWN OF RAMAPO LANDFILL/LEACHATE PUMPING HISTORY FOR EXTRACTION WELLS AND GRAVITY INTERCEPTION SYSTEMS (1994-2005)

| Year | Annual Total Gallons of Leachate Discharged |
|--------------|--|
| 1994 | 3,690,500 |
| 1995 | 20,553,200 |
| 1996 | 21,851,062 |
| 1997 (1) | 22,888,055 |
| 1998 (1) | 22,888,055 |
| 1999 | 16,072,895 |
| 2000 | 17,234,622 |
| 2001 | 12,382,217 |
| 2002 | 13,576,560 |
| 2003 | 18,415,267 |
| 2004 | 13,827,647 |
| 2005 | 18,285,355 |
| (up to 9/05) | |

⁽¹⁾ Several months in 1997 and 1998 have estimated leachate pumping volumes due to an inactive flow-meter.

20010/Table 2_Pumping History.doc

TABLE 3

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TOWN OF RAMAPO LANDFILL POST-CLOSURE GROUNDWATER MONITORING DATA COMPOUND: ANTIMONY

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| Sample ID | SAMPLE DATE (ug/l) | | | | | | | | | | | | | | | | | | | | |
|-----------|--------------------|--------|--------|--------|--------|--------|------------------|---------|--------|--------|--------|------------|------------------|--------|--------|--------|--------|------------|--------|--------|----------|
| | Apr-96 | Jun-99 | Sep-99 | Nov-99 | May-00 | Sep-00 | Dec-00 | Mar-01 | Jul-01 | Oct-01 | Mar-02 | Jul/Aug-02 | Oct-02 | Apr-03 | Jul-03 | Oct-03 | Mar-04 | Jun/Aug-04 | Dec-04 | Jun-05 | Sep-05 |
| 1-OS | | NA | ND | | 29.1 B | NA | <u><</u> 5.5N | <4.7 | NA | <4.7 | 12.7B | NA | 15 B,N | NA | NA | NA | NA | | | 0.12 U | |
| 1-R | | NA | ND | | <3.4 | NA | <5.5N | <4.7 | NA | <4.7 | 10.5 B | NA | 5.6 B, N | 5 U | NA | 25.1 B | NA | | | NA | |
| 2-OS | | NA | ND | | <3.4 | NA | <5.5N | <4.7 | NA | <4.7 | 14 B | NA | 33 B,N | 5 U | NA | 24.6 B | 7.1 U | | | 0.12 U | |
| 2-R | | NA | ND | | <3.4 | NA | <5.5N | <4.7 | NA | <4.7 | 13.8 B | NA | 5.3 U, N | 5 U | NA | 28.7 B | NA | | | NA | |
| 3-OS/I | | NA | ND | | 4.8 B | NA | 8.2 B,N | 9.5 B,N | NA | 9.4 B | 15.1 B | NA | 25.4 B, N | 77.6 | NA | 155.0 | 5.8 U | | | 0.12 U | |
| 3-R | | NA | ND | | <3.4 | NA | <5.5N | <4.7 | NA | <4.7 | 11.9 B | NA | 5.5 B, N | 5 U | NA | 26.4 B | NA | | | NA | |
| 4-OS | | NA | ND | | <3.4 | NA | <5.5N | <4.7 | NA | <4.7 | 7.4 U | NA | 5.3 U, N | 5 U | NA | 23.4 B | 7.1 U | | | 0.12 U | |
| 4-R | | NA | ND | | <3.4 | NA | <5.5N | <4.7 | NA | <4.7 | 9.7 B | NA | 5.3 U, N | 5 U | NA | 23.7 B | NA | | | NA | |
| 5-OS | | NA | NA | | <3.4 | NA | <5.5N | <4.7 | NA | NA | NA | NA | NA | NA | NA | NA | 7.1 U | | | NA | <u> </u> |
| 5-I | | NA | ND | | NA | NA | NA | NA | NA | <4.7 | 7.4 U | NA | 5.3 U, N | 5 U | NA | 9.4 B | NA | | | 0.12 U | — |
| 5-R | | NA | NĎ | | <3.4 | NA | <5.5N | <4.7 | NA | <4.7 | 7.4 U | NA | 5.3 U, N | 5 U | NA | 9.7 B | NA | | | NA | |
| 7-OS | | NA | ND | | <3.4 | NA | <5.5N | <4.7 | NA | <4.7 | 13.2 B | NA | 5.3 U, N | 5 U | NA | 23.6 B | 5.8 U | | | 0.12 U | |
| 7-R | | NA | ND | | <3.4 | NA | <5.5N | <4.7 | NA | <4.7 | 13 B | NA | NA | NA | NA | NA | NA | | | NA | |
| 8-OS | | ND | ND | | <3.4 | <11.0 | <5.5N | <4.7 | <4.7 | <4.7 | 7.4 U | 5.3 U | 5.3 U, N | 5 U | 5.5 U | 10.5 B | 5.8 U | | | 0.13 B | |
| 8-I | | ND | ND | | <3.4 | <5.5 | <5.5N | <4.7 | <4.7 | <4.7 | 10.9 | 5.3 U | 5.3 U, N | 5 U | 7.5 B | 20.7 B | 5.8 U | | | 0.12 U | |
| 8-R | | ND | ND | | <3.4 | <5.5 | <5.5N | <4.7 | <4.7 | <4.7 | 12 B | 5.3 U | 6.3 B,N | 5 U | 8 B | 22.7 B | 5.8 U | | | 0.12 U | |
| 9-OS | | ND | ND | | <3.4 | <5.5 | <4.7 | <4.7 | <4.7 | <4.7 | 7.4 U | 5.3 U | 5.3 U, N | 5 U | 5.5 U | 7.5 B | 5.8 U | | | 0.15 B | |
| 9-I | | ND | ND | | <3.4 | <5.5 | <4.7 | <4.7 | <4.7 | <4.7 | 7.4 U | 5.3 U | 5.3 U, N | 5 U | 5.5 U | 5.5 U | 5.8 U | | | 0.12 U | |
| 9-R | | ND | ND | | <3.4 | <5.5 | <4.7 | <4.7 | <4.7 | <4.7 | 7.4 U | 5.3 U | 5.3 <u>U</u> , N | 5 U | 9.7 B | 10.2 B | 5.8 U | | | 0.12 U | |
| PW-1 | 2.0 | ND | ND | 6.0 | <3.4 | <5.5 | <4.7 | <4.7 | <4.7 | <4.7 | 7.4 U | 5.3 U | 5.3 U, N | 5 U | 5.5 U | 9.5 B | 5.8 U | | 0.1 | 0.12 U | 0.1 |
| PW-2 | | ND | ND | | <3.4 | <5.5 | <5.5N | <4.7 | <4.7 | <4.7 | 9.3 B | 5.3 U | 5.3 U, N | 9.3 B | 10.1 B | 19.4 B | 5.0 | | | 0.12 U | |
| SVWC-93 | | ND | NA | | <3.4 | <5.5 | <5.5N | <4.7 | <4.7 | NA | 8 B | 8.1 B | 17.2 B,N | 5 U | 5.5 U | 8.6 B | 5.8 U | 10 | | 0.14 B | |
| SVWC-94 | | ND | NA | **** | <3.4 | <5.5 | <5.5N | <4.7 | <4.7 | NA | 11.4 B | 5.3 U | 5.5 B,N | 5 U | 5.5 U | 7.1 B | 5.8 U | 1U | | 0.12 U | |
| SVWC-95 | | ND | NA | | <3.4 | <5.5 | <5.5N | <4.7 | <4.7 | NA | 7.4 U | 5.3 U | 5.3 U, N | 5 U | 5.5 U | 13.6 B | 5.8 U | 1U | | 0.12 U | |
| SVWC-96 | | ND | NA | | <3.4 | <5.5 | <5.5N | <4.7 | <4.7 | NA | 7.4 U | 5.3 U | 5.3 U, N | 5 U | 7.1 B | 11.1 B | 5.8 U | 1U | | 0.12 U | |

NOTES:

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Concentrations reported in mg/L (ppb).

ND = Not Detected

NA = Not Analyzed

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Values in BOLD indicate an exceedance of groundwater quality standard for Antimony, 3.0 mg/L.

B = The reported value is less than the Contract Required Detection Limit (CRDL), but greater than the instrument detection limit. N = Spiked sample recovery not within control limits

Antimony Data

Sterling Environmental Engineering, P.C.

E20010\T-Ramapo GWM Data.xls

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APPENDIX I

WELL LOG

LEGGETTE, BRASHEARS & GRAHAM, INC.

CONSULTING GROUND-WATER GEOLOGISTS 55 WEST STATE STREET

Page 1 of 3

| WESTPORT, C | ONNEC | TICUT | Ramapo Valley Well Field |
|--|--------------------------|-----------------|--|
| DESCRIPTION | THIOK- NERS (FEET) | depth (peet) | OWNER Spring Valley Water C |
| | | | Ramapo Land Company |
| Silt, grayish-brown; some gravel, fine | 3 | | Parcel 1 Location, Town of Ramapo, NY |
| and sand, coarse | 9 | 9 | WELL NO. PW-A 93 |
| Sand, medium to very coarse, greenish- | | | Completed July 28, 1978 |
| brown; little gravel, fine | 5 | 14 | DRILLING Rinbrand Well Drilli |
| Sand, medium to very coarse, with litt | le | | Co, Inc. DRILLING Cable-tool |
| fine, greenish-brown; and gravel, fir | e | | SAMPLINGBailer |
| with_few_medium, dark grav | 5 | 19 | BAMPLESI EXAMINED BYG. S. Sikora |
| Sand, medium with some coarse and few | | | REFERENCE Original Land Surfa |
| fine, greenish-brown with a little | | | ELEVATION ±306 feet |
| black; little gravel, fine to medium | d | | 58.3 feet of 20-incl 58.3 feet of 14-incl |
| dark grav | 5. | 24 | Scrack Continuous slot Staj |
| Gravel, fine (angular) to medium, dark | | | less steel DIAM, 14-inch SLOT NO. 12! |
| gray; much sand, coarse to very | | | SETTING 5812-89 feet - |
| coarse with some medium, green to | | | Pumering Tasti-September 5-8, 1 |
| white | <u>no</u> | 34 | DURATION 72 hours |
| Sand, medium to coarse with some fine, | | | STATIC WATER 14.74 feet C/ |
| light green; some gravel, fine dark | _ | | PUMPING WATER 53.6 feet C/ |
| grav | 5 | 39 | 1400 gpm |
| Sand, fine with much medium and some | . | | |
| coarse, greenish-brown with a little | <u>.</u> | | - Drilling started June 2 |
| multicolor: some gravel, fine to | <u> </u> | | 1978 - a/ Including 1.8 and 2. |
| medium, subangular, dark gray | 5 | <u>44</u> | feet above existing grade respectively |
| Sand, medium to fine with some coarse; | | <u> </u> | b/ Below present grade - C/ Below top of ½-inch |
| some gravel, fine, dark gray; little | <u>.</u> | · . | stainless pipe |
| silt brown | 5 | uа | |

(CONTINUED)

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WELL LOG LEGGETTE, BRASHEARS & GRAHAM, INC.

CONSULTING GROUND-WATER GEOLOGISTS

55 WEST STATE STREET WESTPORT, CONNECTICUT Page 2 of 3 THICK-DISCALTION DEPTH NEBB (FEET) (# X KŤ) OWNERSDring Valley Water C. Ramapo Land Company Parcel 1 LOCATION: TOWN OF Ramapo, NY Gravel, fine with some medium, dark WELL NO. PW-A (Contd.) 93 gray; little sand, coarse; trace of Completer, July 28, 1978 5 54 silt, brown Company Kinbrand Well Drilli Sand, fine with some medium, greenish-Co, Inc. DRILLING Cable-tool 5 brown; some gravel, fine dark gray 59 SAMPLING Bailer Gravel, fine to medium, subangular, METHOD: dark gray; some sand, very coarse SAMPLESI Examined By:to medium, greenish-brown; few REFERENCE POINT 5 64 ELEVATION OF R. P.: ... small cobbles, rounded Sand, medium to coarse with some fine, CARING light green; some gravel, fine with SCREEN 5 69 some medium, dark gray SLOT NO_ DIAN.L Gravel, fine to medium with some SETTING:. coarse, subangular, dark gray; some PUMPING TESTH DATE:. sand, very coarse to medium, angular DURATION. 5 74 light green STATIC WATER LEVEL Gravel, fine, dark gray, some sand, PUMPING WATER IWVEL very coarse to medium, light green 5 79 YIELD. Sand, medium to fine with little REMARKE: coarse, greenish-brown; some gravel 5 84 fine, dark gray Sand, medium to fine with some coarse some gravel, fine, subangular, dark gray; trace of silt, grayish-brown . 90 6 (Continued)

WELL LOG LEGGETTE, BRASHEARS & GRAHAM, INC.

CONSULTING GROUND-WATER GEOLOGISTS

| 55 WEST ST | ATE S | | Page 3 of 3 |
|--|--------------------------|---------------------------------------|------------------------------|
| WESTPORT, C | Ramapo Valley Well Field | | |
| DEECRHTICH | THIOK- NESS (FEET) | DEPTH (FERT) | OWNER:Spring Valley Water (|
| | | ····· | Ramapo Land Company |
| Sand, medium to fine with some coarse | | · · · · · · · · · · · · · · · · · · · | LOCATION: TOWN OF RAMADO, NY |
| subangular; some gravel, fine, sub- | | | WELL NO., PW-A (contd.) 93 |
| angular, dark gray; little silt, | | | DATE COMPLETED |
| greenish-brown | 432 | 94 3 2 | DRILLING COMPANY: |
| | | == | DRILLING |
| | | | SAMPLING METHOD: |
| | | | SAMPLESI Examined Byi |
| ······································ | | | REFERENCE POINTI |
| · | | | OF R. P.: |
| | | | CABING: |
| | | | |
| | | | DIAM. |
| | | | PUMPING TESTI |
| | · | | |
| | | | STATIC WATER |
| | | | |
| | | | |
| | <u> </u> | | |
| | | | |
| | | | |
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| · · · · · · · · · · · · · · · · · · · | <u> </u> | <u> </u> | - |
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WELL PUMP SETTING

WELL PW "A" 93



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WELL LDG LEGGETTE, BRASHEARS & GRAHAM, INC.

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CONSULTING GROUND-WATER GEOLOGISTS

55 WEST STATE STREET WESTPORT, CONNECTICUT Ramapo Valley Well Page 1 of 2 Field

| | | | Page 1 of 2 |
|--|-------------------------|---|---|
| DESCRIPTION | THICK- NESS IFETT | DEPTH (PEET) | OWNER Spring Valley Water (|
| | | | Ramapo Land Company |
| Sand, coarse, brown; some sand and | | | Parcel 1 Location:Town of Ramapo, NY |
| gravel, fine to coarse; little sand, | ļ | | WELL NO. PW-AB 94 |
| fine and silt | · 9 | 9 | Completed, December 8, 1978 |
| Gravel, fine to medium, gray-brown; | | · _ · · · · · · · · · · · · · · · · · · | BRILLING Rinbrand Well Drill |
| little gravel, coarse and sand, | ŀ | • | DRILLING Cable-tool |
| coarse | 5 | 14 | SAMPING Bailer Mathod: |
| Sand, coarse, brown; some sand, medium | 1 | | SAMPLES, Lee N. Grubman |
| trace to little silt and sand, fine | 5 | 19 | BEFERENCE Original Land Sur- |
| Gravel, medium, gray-brown; some grave | <u>,</u> | | ELEVATION ±304 feet above MS |
| coarse; trace sand, coarse | 5 | 24 | 61.3 feet of 20-inch casing.62.2 feet of 14-inch |
| Sand, coarse to medium, brown; little | | | SCREEN-Continuous Slot Stai |
| medium to fine gravel; and sand, | | | DIAN. 14-inch SLOY No 125 |
| fine and silt | 5 | 29 | SETTING: 622-99 feet D/ |
| Gravel, fine to medium, gray-brown; | | | PUMPING TEST- January 15-18, |
| little gravel, coarse and sand, | _ | | DURATION, 72.5 hours |
| coarse | 5 | 34 | STATIC WATER 9.84 feet- |
| Gravel, medium, gray-brown; some gra- | : | · | PUMPING WATER 63.1 feet - |
| vel, coarse; little sand, coarse | 5 | 39 | |
| Gravel, fine, brown; some sand, coarse | 2 | | |
| and gravel, medium; trace gravel, | _ | | |
| coarse and sand, medium to fine and | | · | feet above existing |
| silt | 5 | 44 | — b/ Below present grade |
| Gravel, coarse to medium, brown; litt] | 1. | <u> </u> | c/ Below top of ½-inch stainless steel pipe |
| gravel, fine and sand, coarse; trace | 3 | · · | |
| (Continued) | | | |

| WELL | L | | |
|---|-----------------|------------|-------------------------------|
| CONSULTING GROUND | -WATE | R GEOL | DGISTS Page 2 of 2 |
| 55 WEST ST Westport C | ATE ST | TREET | |
| | THIOK. | DEPTH | Ramapo Valley Well Field |
| | NEBB (FRET) | 4F##T) | OWNER Spring Valley Water C |
| · · · · · · · · · · · · · · · · · · · | | | Ramapo Land Company |
| sand. medium to fine and silt | 5 | 49 | LOCATION, TOWN OF Ramapo, NY |
| Gravel, medium to fine, gray-brown; | | | WELL NO. PW-AB (Continued) 94 |
| little gravel; coarse and sand, | | | DATE COMPLETEDI |
| coarse: with a few small cobbles | 5 | 54 | DRILLING |
| Gravel medium grav-brown: some | | | DRILLING |
| Gravel, medium, gray-brown, some | | 5.0 | METHODI |
| graver, coarse; trace said, coarse | 5 | 59 | METHOD: |
| Gravel, coarse, gray; some small cobble | 5 | | |
| little gravel, medium to fine | 5 | 64 | |
| Gravel, medium, gray-brown; some gra- | | | ELEVATION OF R. P.I. |
| vel, coarse; trace sand, coarse | 5 | 69 | CABING: |
| Gravel, medium, mottled gray; some | | | SCRIEN- |
| gravel, fine and coarse and sand, | | | DIAM |
| coarse | 5 | 74 | SETTING: |
| Gravel, fine, brown; some gravel, medi | l | | |
| um and sand, coarse; little sand, | | | DURATION |
| medium to fine and silt | 15 | 89 | STATIC WATER |
| Gravel, medium, mottled gray; some | | | |
| gravel, fine and coarse and sand, | | | |
| coarse; little sand, medium to fine | | | YigLD: |
| and silt | 5 | 94 | REMARK u ; |
| Sand, coarse; some rock fragments, | | | |
| crystalline | 51 ₂ | 993 | |
| | | | |
| | | | |
| | | 1 | |
| | 1 | 1 | |
| | | - <u>-</u> | |

WELL PUMP SETTING

WELL PW "AB" 94



WELL LOG LEGGETTE, BRASHEARS & GRAHAM, INC.

CONSULTING GROUND-WATER GEOLOGISTS

Page 1 of 3

| 55 WEST STA WESTPORT, C | ATE ST | | Ramapo Valley Well Field |
|---|--------------------------|---------------------------------------|---|
| DESCRIPTION | THIOK. NESS (FEET) | DEPTH IFEET) | OWNER Spring Valley Water Co |
| · | | · · · · · · · · · · · · · · · · · · · | Ramapo Land Company |
| Gravel, fine with some medium, | | | LOCATION TOWN OF RAMAPO, NY |
| subangular; some sand, medium to | | <u></u> | WELL NO .: PW-B 95- |
| fine and silt, brown; few small | · | | Completen: April 10, 1978 |
| cobbles | 8 ¹ ⁄2 | 815 | Company Rinbrand Well Drillin |
| Gravel, fine, subangular; some sand | | · | Co, Inc. DRILLING Cable-tool |
| very coarse to medium, little | | | SAMPLING Bailer |
| silt, brown. | 10 | 181/2 | G. S. SIKOra SAMPLES: 1/ Robert Lamonica |
| Gravel, fine, angular. Many cobbles, | | · · · · · · · · · · · · · · · · · · · | REFERENCE Original land surfac |
| small rounded; some sand, very | | | ELEVATION ±302 feet above MSL |
| <u>coarse to medium; trace of silt,</u> | | | casha: 59.3 feet of 14-inch |
| brown. | 5 | 2312 | SCREEN Continuous slot, SS |
| Gravel, fine, subangular; sand, | | | DIAM. 14-inch SLOT NO. 125 |
| medium to very coarse; some silt | 5 | 28 ¹ 2 | SETTING: 59 - 89 feet b/ |
| Gravel, fine to medium, subangular; | · · · · | | PUMPING TEST: May 22-24, 1978 |
| sand, medium to very coarse; with | | | DURATION: 50.25 hours |
| silt and very fine sand | 5 | 331/2 | STATIC WATER 12.11 feet C/ |
| Sand, medium to coarse; some very | _ | | - Pumping WATER 56.2 feet C/ |
| coarse sand and fine gravel; | | | 880 gpm |
| some_silt | 5 | 383 | Bewere Drilling stanted |
| Sand, medium to very coarse; with | | | March 22, 1978. |
| <u>considerable gravel, medium to</u> | <u> </u> | | feet above existing |
| coarse, and some silt and stones | 5 | 43½ | b/ Below present grade |
| Gravel, fine to medium, angular to | | | SS pipe |
| subangular; cobbles, subrounded; | <u> </u> | | _ |
| sand, medium to very coarse; some | | | _ |

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silt and very fine sand

WELL LOG

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LEGGETTE, BRASHEARS & GRAHAM, INC.

Page 2 of 3

CONSULTING GROUND-WATER GEOLOGISTS 55 WEST STATE STREET WESTPORT, CONNECTICUT

| WESTPORT, C | ONNECT | TICUT | Ramapo Valley Well Field |
|---------------------------------------|----------------------------|---------------------------------------|------------------------------|
| DESCRIPTION | T HIOK. NEBB (F 667) | DEPTH (PSET) | owner Spring Valley Water (|
| | ļ | | Ramapo Land Company |
| Gravel, fine to coarse; sand, | | | LOCATION, TOWN OF RAMAPO, NY |
| medium to very coarse; some silt | · · · · · · | | WELL NO PW-B (Contd.) 95 |
| and very fine sand | 5 | 53½ | Computito: (continued) |
| Gravel, fine to very coarse; sand, | | | DRILLING COMPANY: |
| medium to very coarse; less silt | _5 | 581/2 | DRILLING METHOD: |
| Sand, medium to very coarse; grave | | | SAMPLING METHOD: |
| fine; silt and very fine sand | 5 | .633 | SAMPLEN: \ EXAMINED BY: |
| Sand, medium to very coarse; | · · · | | ACFERENCE POINT: |
| gravel fine, some medium; | | | ELEVATION OF R. P.: |
| considerable silt and clay | 5 | 68½ | CASING |
| <u>Gravel</u> , fine to coarse; sand, | | | SCREEN:- TYPE: |
| medium to very coarse; silt and | | | DIAM |
| very fine sand; cobbles | 5 | 73 ¹ 2 | SETTING: |
| Sand, medium to very coarse; | | | PUMPING TEST:- DATE: |
| gravel, fine; some stones; less | | | DURATION: |
| | 5 | 783 | STATIC WATER |
| Sand, medium to very coarse; some | . | · · · · · · · · · · · · · · · · · · · | - PUMPING WATER |
| gravel, fine; considerable silt | | | |
| and clay | 5 | 83½ · | YisLD: |
| Sand, medium to very coarse; grave | <u>_</u> , | | REMARKD: . |
| fine; some silt and fine sand | | | |
| (less than at 85') | 5 | 883 | |
| Sand, fine to very coarse; some | <u> </u> | | _ |
| fine gravel; some silt | 41/2 | .93 | |
| Washed sample: sand, medium to | | · | |
| (continued) | | l | |

WELL LOG LEGGETTE, BRASHEARS & GRAHAM, INC.

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Page 3 of 3

| CONSULTING GROUND 55 WEST STA WESTPORT, C | WATE | R GEOLI REET | DGISTS Ramapo Valley Well Field |
|---|--------------------------|-----------------|---|
| DESCRIPTION | THIOK- NESS IFEETI | DEPTH IFERT | OWNER Spring Valley Water |
| | | | Ramapo Land Company |
| very coarse, some fine gravel; | | | Parcel Location Town of Ramapo, NY |
| <u>pieces of granitic gneiss bedroc</u> | k | | Well No. PW-B YS |
| (fresh) | <u>4½</u> : | 93 | Completed: |
| Sand, fine to very coarse; some | | | DRILLING COMPANY: |
| fine_gravel; silt. Pieces_of | | | DRILLING |
| granitic gneiss; bedrock | | | SAMPLING Method: |
| Washed sample: Sand, fine to very | | | SAMPLES: 1 EXAMINED BY: |
| coarse; some fine gravel; small | | | REFERENCE |
| chips of bedrock | 32 | 931/2 | ELEVATION OF R. P.: |
| Large chunk of granitic gneiss | | | CA3ING: |
| (gneissic granite) | 3 | 93¥ | SCREEN:- |
| · · · · | | | DIAM |
| | | | SETTING: |
| | | | PUMPING TEST:- |
| | | | |
| | | | STATIC WATER |
| · · · · | | | |
| | | | _ PUMPING WATER LEVEL: |
| ······································ | 1 | | YIELD: |
| | † | | REMARKS: |
| <u>,</u> | 1 | | - |
| | | <u> </u> | - |
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WELL PUMP SETTING

WELL PW "B" 95-



WELL LOG LEGGETTE, BRASHEARS & GRAHAM, INC. Page 1 of 2

CONSULTING GROUND-WATER GEOLOGISTS

55 WEST STATE STREET

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WESTPORT, CONNECTICUT Ramano Valley Well Field

| DEBCRITIÓN | THIOK- NESS | BEPTH IFEKTI | OWNER: Spring Valley Water |
|--|----------------|---------------------------------------|--|
| | | 1 | Co. |
| Gravel, fine to medium, subangular, | | | Parcel 1 Location: Town of Ramapo, NY |
| black; much sand, fine with some | | | WELL NO. PW-C 96 |
| medium to coarse, brown; little silt | | | Completender 6, 1978 |
| brown | 9 | 9 | BRILLING Rinbrand Well Dril |
| Sand, medium to coarse with some fine, | | | Ing Co. Dailling Cable-Tool |
| light green; some gravel, fine with | | | SAMPLING Bailer |
| little medium, subangular, black wit | n | | SAMPLESI G. S. Sikora |
| some white | 5 | 14 | BEFERENCE Original Land Sur |
| Sand, fine, green; little gravel, fine | | | face ELEVATION ±299 feet above MS |
| with trace of medium, black | 5 | 19 | 59 feet of 20-inch a cashe 59.3 feet of 14-inch |
| Sand, fine, greenish-brown | 5 | 24 | SCREEN- Continuous slot- |
| Sand, fine with few medium; greenish- | | - | DIAM, 14-inch SLOT No 125 |
| brown; little gravel, fine with | | | SETTING 553-84 feet - |
| trace of medium, black | 15 | 39 | PUMPING TEST-October 11-14, PATE: |
| Sand, fine with some medium, greenish- | | | 1978 DURATION 72 hours |
| brown; few gravels, fine | 10 | 49 | STATIC WATER 12.40 feet - |
| Gravel, fine to medium, black with | | | PUMMING WATER 44.9 feet ^{C/} |
| little white, much sand, fine to | ļ | • | 700 gpm |
| coarse, green with some white | 5 | 54 | |
| Sand, fine with some medium and coarse | ļ | | Drilling started August |
| greenish-brown; little gravel, fine, | | | 1978 |
| subangular, black | 5 | 59 | feet above existing |
| Sand, fine with few medium, greenish- | <u> </u> | · · · · · · · · · · · · · · · · · · · | b/Below present grade |
| brown; little gravel, fine, black | 5 | 64 | casing |
| (Continued) | | | |
| | 1 | 1 | |

WELL LOG

LEGGETTE, BRASHEARS & GRAHAM, INC.

CONSULTING GROUND-WATER GEOLOGISTS Page 2 of 2 55 WEST STATE STREET

WERTDORT CONNECTIONT

| WESTPORT, C | UNNEC | Ram | apo Valley Well Field |
|---------------------------------------|--------------------------|-----------------|------------------------------|
| DESCRIPTION | THIOK- NEBS (PRET) | DEPTN (PBET) | OWNER:Spring Valley Water Co |
| | | | Ramapo Land Company |
| Sand, fine with some medium and few | | - | LOCATION, TOWN OF RAMAPO, NY |
| coarse, pale green; some gravel, | | | WILL NO. PW-C (continued) 96 |
| fine, subangular, black with little | | | DATE COMPLETEDIA |
| white | 5 | 69 | DRILLING Companyi |
| Sand, medium to fine with some coarse | | | DRILLING METNODI- |
| pale green with few white, some | | | SAMPLING METHOD: |
| gravel, fine with few medium, black | | | SAMPLES: Examined By: |
| with little white | 10 | . 79 | REFERENCE POINT: |
| Sand, medium to fine with few coarse, | | | ELEVATION OF R. P. |
| pale green with few white; some | | | CABING: |
| gravel, fine to medium with few | | | SCREENH TYPE: |
| coarse, black with little white | 5 | 84 | DIAM.: |
| Sand, medium to fine with some coarse | | | \$ ETTING: |
| pale green with some white; little | ļ | | PUMPING TESTH |
| gravel, fine black with few white | 2 | 86 | DURATION |
| | <u> </u> | | STATIC WATER |
| | _ | | PUMPING WATER |
| | . | | YislDi- |
| · | _ | | REMARKS; |
| | | | _ |
| | <u></u> | | - |
| · · · · · · · · · · · · · · · · · · · | ┨ | | 4 |
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APPENDIX 2

DRILLING LOCS FOR EXTRACTION WELLS

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JAMES C. ANDERSON ASSOCIATES, INC. Drilling Contractor

| | 907 F | leas | an <u>t V</u> a | illey | Aven | ue | <u>Mount</u> | Laure | el, New Jersey 08054 | | (609)-72 | 22-6700 |
|---------|----------|----------------|-----------------|------------|----------|----------|--------------|-------|-------------------------|------------------|-----------------|----------|
| PROJECT | | | Rama | po La | ndfill | Remedi | ation Site | _ | | | Sheet 1 | of 2 |
| CLIENT | | | <u>GE0-</u> | CON | Inc, | | | | · | | Job No. | D94DRE-4 |
| | | | GRO | UND | WAT | <u> </u> | | D | RILLING METHOD | DEPTH | Borehole No. | W-1 |
| Da | ate | | | Tin | <u>e</u> | | Depth | | 12" Air Rotary | <u>0' To 44'</u> | Date Started : | 2/14/95 |
| 2/10 | 3/95 | | | | | | 17.86 ft | | | • | Date Finished : | 2/16/95 |
| | | | | | | | | | | | Driller : | UNI-TECH |
| w | ELL (| CONS | STRUC | | 4 | co | ORDINATE NO. | s | TATE PERMIT NO. | SPOON SIZE | Elevation TOC: | 321.88 |
| | | | | | | | | | | 2' X 3" | Inspector : | URS |
| | | , | | | | | SAMPLE | | | | | 0110 |
| л [| | [| Г | grade 1 | B No. | Depth | Blows | N | | CLASSIFICAT | | |
| | | | _ | - | 1 | D-2 | 12-18-18-23 | 36 | brown fine to med SA | ND | | |
| | | } | | - | | | | | some Silt, trace fine G | iravel | | |
| | | | _ | 4 | | | | | | | | |
| | | l | 1_ | ļ | 2 | 3-5 | 10-12-14-17 | 26 | S.A.A. | | | |
| 1 | | | _ | | | | | | | | | |
| | | | | 6 | 3 | 5-7 | 5-6-9-3 | 15 | dark brown fine to me | d SAND | | |
| | | | - H | | | | | | trace Silt | | | |
| | | | - N | 4 | | | · · · | | | · | | |
| | | | | | 4 | 8-10 | 0-3-2-6 | 5 | dark brown fine to me | d Clayey SAND | | |
| a di ka | | 1 | 6 | 10.3 | | | | | trace fine Gravel | | | |
| | | | | | 5 | 10-12 | 7-18-14-15 | 32 | green, gray fine to coa | arse SAND | | |
| | | | | 12.3 | | | | | some fine Gravel | | | |
| | | | | | | | | | | | | |
| | | | | 14.3 | 6 | 13-15 | 5-9-10-100/2 | 19 | S.A.A. | | | WE |
| | | | | | | | | | wet at 13 ft | | | |
| | | | |] | 7 | 15-17 | | | no sample | | | |
| | | | | 7 | | | | • | | | | |
| | | | | 1 | | | | _ | | | | |
| | | 11214 11214 | | 1 | 8 | 18-20 | 13-15-18-20 | 33 | green, gray fine to coa | arse SAND | | W |
| | | | | 1. | | | · | | some fine Gravel, trad | e Clay | | |
| | | | | 1 | 9 | 20-22 | 9-11-15-18 | 26 | S.A.A. | | | W |
| | | T. | - | 1 | | | | | | 2' | | _ |
| | <u></u> | | | 1 | | | | | | | | |
| | | | | 1 | 10 | 23-25 | 12-12-14-14 | 26 | S.A.A. | | | W |
| | | | - | 1 | | | | | | | | |
| | | | - | 1 | 11 | 25-27 | 11-10-15-16 | 25 | S.A.A. | | | w |
| | | | | 1 | | | | | | | | |
| | | | | | | | | • | | | | <u>-</u> |
| | | | | | 12 | 28-30 | 8-9-8-15 | 17 | S.A.A. | | | W |
| | | | | | | | | | | | | |
| | | | | | 13 | 30-32 | 4-10-11-9 | 21 | green, gray fine to co | arse Clayey SAND | | W |
| | | | |] | | | | | some med Gravel | | | |
| | | | | | | | | | 1 | | | |
| | <u> </u> | | | | 14 | 33-35 | 8-9-8-14 | 17 | S.A.A. | | | W |
| | _ | | | | | | | | | | | |
| | _ | | | | 15 | 35-37 | 56-100/2 | | green fine to coarse | Clayey SAND | | w |
| | | | | 7 | | | | | some fine to med Gra | avel | | |

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Т.,



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JAMES C. ANDERSON ASSOCIATES, INC. Drilling Contractor

| | 907 P | leasa | int Va | ailey A | venu | ie | Mount | Laure | I, New Jersey 08054 | | (609)-72 | 22-6700 |
|------------|--------|--|------------|------------|----------|--|--------------|----------|---------------------------|----------------|-----------------|------------|
| PROJECT | r | ŀ | Rama | ipo Lar | ndfill H | Remedia | tion Site | | | | Sheet 1 | of 2 |
| CLIENT | | | GEO- | CON | nc. | | | | | | Job No. | D94DRE-463 |
| | | | GRC | | VATE | R | | D | | DEPTH | Borehole No. | W-2 |
| D | ate | | | Time | • | | Depth | | 12" Air Rotary | 0' To 43' | Date Started : | 8/6/95 |
| 6/1 | 3/95 | | | | | | 20.38 ft | | | | Date Finished : | 6/13/95 |
| | | | | | | | | | | | Driller : | UNI-TECH |
| v | VELL C | :ONS | TRU | CTION | | coc | ORDINATE NO. | ST | TATE PERMIT NO. | SPOON SIZE | Elevation TOC: | 323,64 |
| | | | | | | | | | | 2' X 3" | Inspector : | URS |
| | | | | | | | SAMPLE | | | | CATION | |
| h | | ļ | L L | grade I | No. | Depth | Blows | <u>N</u> | · · · · · · · | CLASSIFI | | |
| | | 1 | - | - | 1 | 0-2 | 7-12-12-11 | 24 | dark brown, brown find | e to med SAND | | |
| | | } | - | - | \vdash | | ┝───┤ | | some med Gravel | | | |
| []] | | | - | - | | | | | | | | |
| | | l | - | - | | | | | | | | |
| | | | - | - | - | | 7000 | | brown fraction of a state | | | |
| | | | - I | - 6- | 2 | 5-7 | 7-6-3-2 | а | some small Group | | | |
| | | | 8 - | | - | <u>├</u> ─── | ····· | | some small Gravel | | | |
| a celara a | l | <u></u> | <u>.</u> | - 8.5 | | | | | | | | |
| | | | - | | [| | | | | | | |
| | 1 | | - - | 10.5 | 1- | 10.12 | 5.2.2.2 | 4 | brown fine SAND | | | moist |
| | 1 | | - 10 | | 1 | 10-12 | J-2-2-2 | * | trace Site | | | |
| | ├ | | - | 12.5 | | ├── | ├───┤ | | 14 aug OH | | | |
| | | | - | | | [| | 1 | | | | |
| | | | - | | 1 | | | ļ | | | | |
| | | | - | | + | 10 47 | 11 14 10 10 | 20 | brown fine SAND | | | wet |
| | | | - | \neg | 4 | 15-1/ | 11-14-10-16 | 30 | trace Sitt | | | |
| | | | - | | \vdash | <u> </u> | <u>├───</u> | ├ | | | | |
| | | | W - | | - | 10.00 | 36.52 40.24 | 07 | black arey fine to con | | | wet |
| | | | Hij- | - | 5 | 18-20 | 50-52-40-21 | 32 | and med GRAV/FI | | | |
| | | | | | - | + | † | + | | | | |
| | | | - | - | | | | | | 3 | | |
| | | | · | | | | | 1 | 1 | | | |
| | | | | - | F | 23-25 | 7-18-50/4 | | gray, brown fine to co | arse SAND | | wet |
| | | | | -1 | ູ້ | | | | with small Gravel | | | |
| | | | ЩŤ. | -1 | <u> </u> | <u>† </u> | 1 | | | | | |
| | | | | 1 | | | | | | | | |
| | | | | 4 | | | | . | | | | |
| | | | | -1 | 7 | 27-29 | 27-29 | ť | gray, brown fine to co | parse SAND | | wet |
| | | | | 7 | | | | | with med Gravel | | | |
| | | | | Τ | | <u> </u> | | Γ | | | | |
| | | | | ٦ | | | | | | | | |
| | | | | _1 | | | | | | | | |
| | | | | | 8 | 33-35 | 5-5-25-30 | 30 | light green, gray fine | to coarse SAND | | wet |
| | | and the state of t | | | | | | | with med Gravel | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

| ID NUMBER W-2 | | | | | | <u>Sheet 2 of 2</u> |
|--|------------|----|---------|----------------------|-----------|--|
| | | | | SAMPLE | | |
| | | 9 | 37-39 | 15-22-25-25 | 47 | black, gray fine to med SAND |
| | - | 10 | 20.40 | 1500 | | |
| | - | | 39-40 | 150/2 | L | Ignelss fragment (quariz, leidspar, and serpentine visible) |
| | | 5 | | | | |
| A DAMAN MENTAL AND A DAMA DAMA DAMA DAMA DAMA DAMA DAM | <u>.e:</u> | | | | | |
| Well Depth | - | ļ | LEGEN | D | | |
| 42ft 6inches | | | | | | |
| | | | | Cement/Bento | onite G | rout |
| | | | | | | |
| | | | | Bentonite Pen | et Seal | |
| | | | _ | | | |
| | | | | Gravel Pack | • | |
| | | | | _ | | |
| | | } | | 8" SCH 40 Ty | pe 304 | Flush Joint Threaded Stainless Steel Casing |
| | | | | - | | |
| | | | | 8" Type 304 0 | .035 S | lot Stainless Steel Screen |
| | | | | | | |
| | | | < > | Stainless Stee | el Cent | alizer |
| | _ | | | | | |
| 1 | | | | | | |
| | | | Notes: | | | |
| | _ | | 1. | Bore hole diam | eler wa | s 12 inches. |
| | | | 2. | Bore hole was | flushed | with air and water before casing and screen was set. Bore hole flushing |
| 1 | 4 | | | was accomplisi | ned by i | ntroducing air and water through the drilling rods. |
| | _ | | З. | Filter pack was | poured | around the well casing from the bottom of the bore hole up. |
| | | | 4. | Depth to top of | filter pa | ck was determined using a weighted measuring tape. |
| • | | | 5. | Bentonite pelle | ts were | slowly poured around the well casing and allowed to settle. |
| | | | 6. | Bentonite seal | hydrate | d for 14 hours. |
| | _ | | 7. - | Annular grout y | vas plad | ed via tremie method. |
| | | | 8. | Coment/bentor | nte groi | IT MIX - DIDS DENTONNE, 54105 CEMENT, and 6 gallons water. |
| | | | 9. | Gravel pack - F | cicci Bre | S. Sand Lo., Inc., #1 yyell Gravel, of Tould Dags used. |
| | | | 10. | Bentonite pelle | ts - Roo | inest, inc., renonne (vyoming benunne sexing Agens), i solo bucket used. |
| | 4 | Í | 11. | Bentonite - Bar | old Dril | ing riuids, inc., 1 aala bag used. |
| | | | 12. | Well Casing | Conk Sr | men Technology, Inc., 1x10ft and 1x5ft section used. |
| | 1 | | 14 | Well Screen - 0 | Cook Sr | reen Technology, Inc., 3x10ft sections used. |
| | | | 15 | Well was devel | oped 2 | 4 hours after grouting. |
| | 4 | | 16. | Well was deve | loped fr | r 1 hour at 10 gpm. |
| | - | i | 17. | Well was deve | loped u | sing a submersible pump. |
| | -1 | | 18. | Development v | vater w | as cloudy at first, then it cleared up after 30 minutes of pumping. |
| | | | 19. | Elevation of to | p-of-cas | ing is 323.64. |
| | | | 20 | The interval b | etweer | annular grout and surface grade was left open. |
| i | | | 21. | A void was er | counte | red during the placement of well gravel. The void required additional |
| | | | | bags of well g | ravel t | o fii. |
| [*] | 1 | | | | | |

5 F



JAMES C. ANDERSON ASSOCIATES, INC. Drilling Contractor

| 9 <u>07 P</u> lea | asant V | alley A | venu | e | Mount | Laure | , New Jersey 08054 | | (609)-72 | 22-6700 |
|-------------------|-------------|---------|------------------|--------------|-------------|----------|-------------------------|----------------------------|-----------------|------------|
| PROJECT | Rama | ipo Lar | ndfill F | Remedia | tion Site | | | | Sheet 1 | of 2 |
| | GEO- | CON II | nc. | | | | | | Job No. | D94DRE-463 |
| | GRO | DUNDV | VATE | R | | DF | | DEPTH | Borehole No. | W-3 |
| Date | | Time | , | | Depth | | 12' Air Rotary | 0 <u>' To</u> 30' | Date Started : | 6/2/95 |
| 6/5/95 | | | | _ | 22.98 ft | | | | Date Finlshed : | 6/5/95 |
| | | | _ | | | | | | Driller: | UNI-TECH |
| WELL CO | NSTRU | CTION | | cod | RDINATE NO. | SI | ATE PERMIT NO. | SPOON SIZE | Elevation TOC: | 328.26 |
| 1 | | • | | | | | | 2' X 3" | Inspector : | URS |
| | | | | | SAMPLE | | | | | |
| | | grade | No. | Depth | Blows | <u>N</u> | | CLASSIFICAT | | |
| | - | _ | 1 | 0-2 | 4-5-5-6 | 10 | brown, orange topsoil | over | | |
| | - | _ | | | | | light brown fine SAND |), trace Silt | | |
| |]. | _ | | | | | | | | |
| |]. | | 2 | 3-5 | 9-10-9-8 | 19 | light brown fine to me | d SAND | | |
| | . | _ | | | | | trace Silt and fine Gra | ivel | | |
| | | 6 | 3 | 5-7 | 2-4-10-13 | 14 | brown fine SAND | | | |
| | | _ | | | | | some Clay | | | |
| | | _ | | | | | | | | |
| | | _ | 4 | 8-10 | 2-2-3-4 | 5 | brown Clayey fine to | med SAND | | |
| arabid a | | 10.3 | | | | | | | | |
| | | | 5 | 10-12 | 0-1-1-2 | 2 | green SILT | | | |
| | Santh binds | 12.3 | · | | | | some fine Sand and | fine Gravel | | |
| | | _ | | | | | | | | |
| | | 14.3 | 6 | 13-15 | 0-0-0-5 | 0 | green, brown Silty Cl | <u>A</u> Y | | moist |
| | | _ | | | | | some fine Gravel | | | |
| | | _ | 7 | 15-17 | 8-24-25-40 | 49 | green fine to coarse | SAND | | wet |
| | | | | | | | some med Gravel, w | vet at 17 ft | | |
| | | _ | | | | | | | | |
| | | _ | 8 | 18-20 | 17-24-30-24 | 54 | S.A.A. | | | Wet |
| | | _ | \vdash | | | | · · · | | | wet |
| | | _ | 9 | 20-22 | 16-13-16-26 | 29 | S.A.A. | ל' | | |
| | | _ | | | | | | • | | |
| | | - | | 22.25 | 50 42 24 24 | 76 | green fine to coarse | SAND | | wet |
| | | \neg | 10 | 23-25 | 30-42-34-21 | ' | some med Gravel fr | ace Silt | | |
| | | - | 4.4 | 25.27 | 25-38-100/5 | | green fine to coarse | Clavey SAND | | wet |
| | | - | 1 | 23-21 | | | some fine Gravel | | | |
| | | | - | 27.5 | 100/7 | | Auger Refusal at 27. | 5 ft - gneiss fragments in | tip of spoon | - |
| | | | , - | | | | | | | |
| | | | - | 27.5 | | 1 | Air Hammered throu | igh rock | | |
| Well Depth | h | - | | 31.5 | | | stopped at 31.5 ft | | | |
| 29th Ainche | | - | | | | | | | | |
| , zon quiche | | - | | | | | | | | |
| | | - | | | | | | | | 8 |
| | | - | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

| | SAMPLE | | |
|-----|-------------------|---------------|--|
| | No Depth Blows | N | |
| | No. Deptin | N | CLASSIFICATION |
| - | | | |
| - | | | |
| - | | | |
| - | | | |
| | Cement/Be | ntonite Gr | out |
| - | | | |
| - | Bentonite F | ellet Seal | |
| - | | | |
| - | Gravel Pac | k | |
| - | | | |
| - | 8" SCH 40 | Туре 304 | Flush Joint Threaded Stainless Steel Casing |
| - | | | |
| - | 8" Type 30 | 4 0.035 Sk | ot Stainless Steel Screen |
| _ | | | |
| | Stainless S | teel Centra | alizer |
| - | | | |
| - | | | |
| - | Notes: | | |
| - | 1. Bore hole di | ameter was | 12 inches. |
| . – | 2 Bore hole w | as fluched v | with air and water before casing and screen was set. Bore hole flushing |
| - | | lichad by in | straducing air and water through the drilling rade |
| - | | ashed by it | and the well area for the believe of the bere belows. |
| - | J. Filler pack w | as poured | around the well casing from the bottom of the bote hole up. |
| - | 4. Depth to top | ornnerpac | k was determined using a weighted measuring tape. |
| - | 5, Bentonite pe | liets were s | slowly poured around the well casing and allowed to settle. |
| - | 6. Bentonite se | al hydrated | for 14 hours. |
| - | 7. Annular grou | it was place | ed via tremie method. |
| - | 8. Cement/ben | tonite grout | mix - 5ibs bentonite, 94ibs cement, and 8 gallons water. |
| - | 9. Gravel pack | - Ricci Bros | s. Sand Co., Inc., #1 Well Gravel, 19 100lb bags used. |
| - | 10. Bentonite pr | lets - Rock | test, Inc., Peltonite (Wyoming Bentonite Sealing Agent), 1 50lb bucket used. |
| _ | 11. Bentonite - I | Baroid Drilli | ng Fluids, Inc., 1/2 551b bag used. |
| _ | 12. Cement - Al | entown Ce | ment Company, Inc., 5 94lb bags used. |
| _ | 13. Well Casing | - Cook Scr | een Technology, Inc., 1x10ft and 1x5ft section used. |
| _ | 14. Well Screen | - Cook Scr | een Technology, inc., 1x10t and 1x5t section used. |
| - | 15. Well was de | veloped 24 | hours after grouting. |
| - | 16. Well was de | veloped for | 1 hour at 10 gpm. |
| _ | 17. Well was de | veloped us | Ing a submersible pump. |
| - | 18. Developmen | it water wa: | s cloudy at first, then cleared up after 25 minutes of pumping. |
| | 19. Elevation of | top-of-casi | ng is 328.26. |
| | 20. The interva | Ibetween | annular grout and surface grade was left open. |
| | | | |
| - | | | |
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JAMES C. ANDERSON ASSOCIATES, INC. Drilling Contractor

| , | 907 Plea | sant | Va | iley A | venu | le | Mount | Laure | el, New Jersey 08054 | | (609)-72 | 2-6700 |
|---------------|-----------|------|-----|-------------------|----------------|--------|----------------|-------|-----------------------|--------------------------|-----------------|------------|
| PROJEC | r | Rar | тар | o Lai | ndfill I | Remedi | ation Site | | | | Sheet 1 | of 2 |
| CLIENT | | GE | 0-0 | ONI | nc. | | | _ | | | Job No. | D94DRE-463 |
| | | G | ROI | UNDV | | R | | D | RILLING METHOD | DEPTH | Borehole No. | W-4 |
| D | ate | T | | Time | • | Depth | | | 12" Air Rotary | 0' To 34' | Date Started : | 5/25/95 |
| 6/ | 1/95 | 1 | _ | _ | | | 22.71 <u>π</u> | | | | Date Finished : | 6/1/95 |
| | | + | | | | | | | · | | Driller : | UNLITECH |
| | | | | TION | | | | - | | | Elevetien TOO | 210.00 |
| | | 1311 | | | | | ORDINATE NO. | 3 | TATE PERMIT NO. | SFOON SIZE | Elevation TOC: | 330.09 |
| | | 1 | _ | | | | SAMPLE | { | | 2 X 3 | inspector: | URS |
| | | | gr | ade_ | No. | Depth | Blows | N | l | CLASSIFICATI | ON | |
| | | | | | 1 | 0-2 | 4-6-6-8 | 12 | light brown fine SAND | | | |
| | | | | | | | | | trace Silt | | | |
| | | | | | | | | | | | | |
| 11 8 | { | (| | | 2 | 3-5 | 7-7-6-6 | 13 | S.A.A. | | | |
|] | | | | 1 | | | ļ } | | some fine to med Gra | veì | | |
| | 1 | | [| 6 | 3 | 5-7 | 3-3-4-4 | 7 | brown fine to med SA | ND | | |
| | | | - | - | | | | | some Clay and fine G | ravel | | |
| | | | - | 1 | | | | | | | | |
| | | | - | 1 | | 8-10 | 2-2-3-2 | 5 | brown med to coarse | Clavey SAND | | |
| | | | - | { | | 0-10 | 2-2-0-2 | 5 | | | | |
| | | | | i | 5 | 10.12 | 4222 | | S A A | | | |
| | 4 | | - | ł |) ³ | 10-12 | #2-2-2 | - | S.A.A. | | | |
| | 1 | | - | 1 | \vdash | | ╀ | | | | | |
| | | ÷. | | { | 6 | 12 15 | 2122 | | brown Sil T | | | damo |
| | | | - | 45 | | 13-13 | 2-1-2-2 | 5 | come fine Gravel and | tine Sand | | P |
| - 1. 1. fabri | | | - | 15 | - | 45 47 | 22116 | | some fine to come (| | | terr |
| | | | | 1.7 | { ' | 113-17 | 2-2-1-10 | 3 | trace fine Gravel we | | | |
| | VA | | - | + | | | | | uacenne Graver, we | | | |
| | | | - | 1.0 | | 10.00 | 24 10 10 0 | 20 | | | | wet |
| | | | - | 1,3 | ° | 10-20 | 24-10-10-3 | 20 | 3. | | | |
| | | | | { | | 20.22 | 7 10 14 20 | 24 | C A A | | | wet |
| | | | I — | { | 9 | 20-22 | 7-10-14-20 | 24 | 5.A.A. | 2 | | |
| | | | | | <u> </u> | | <u> </u> | | + | | | |
| | | | | { | 40 | 22.25 | 45 20 19 20 | 28 | <u> </u> | | | |
| | | | | 1 | 10 | 23-25 | 15-20-18-20 | 30 | S.A.A. | | | |
| | | | | ł | - | 05.07 | 0 00 10 45 | 20 | | | | wet |
| | | | | 1 | 11 | 25-27 | 6-20-16-40 | 30 | 5.A.A. | | | |
| | | | Ì | 4 | ┢ | 07.5 | 400/4 | | Auron Defund at 27.5 | A applies fragments in t | in of spoon | |
| | | | - | 1 | \vdash | 27.5 | 100/1 | | Auger Relusar at Zr.J | n - gneiss nagments in t | | |
| | | | | 1 | | 075 | | | Air Usemarad throug | h rock | | |
| | | | - | 1 | | 21.5 | | | stopped at 31 5 # | ni jour | | |
| | | | - | 1 | | 1 31.5 | 1 | | propped at 51.5 h | | | |
| | | | 1 - | $\left\{ \right.$ | 1 | | | | | | | |
| | | | - | | | | | | | | | |
| | | | - | 34 | + | | | | | | | |
| | | | - | - | | | | | | | | |
| Wel | Depth 34 | n | | $\left\{ \right.$ | | | | | | | | |
| 1 | | | | 5 | _ | _ | | | | | | |

| ID NUMBER W-4 | ····· | | | Sheet 2 of 2 |
|---------------|--------------|-----------------|-------------|--|
| | | SAMPLE | · | |
| | No. Depth | Blows | N | CLASSIFICATION |
| |] | | | |
| |] | | | |
| | LEGEN | 2 | | |
| | 1 | | | |
| - | | Cement/Bent | onite Gr | out |
| - | | | | : |
| | | Bentonite Pel | let Seal | |
| | | | | |
| | | Gravel Pack | | |
| | | n | | |
| | | 8" SCH 40 T | 'pe 304 | Flush Joint Threaded Stainless Steel Casino |
| - | ا د ا | J = 11 TU 1 } | | · · · · |
| - | | 8" Type 304 (|).035 er | ot Stainless Steel Screen |
| | | . , puu uu (l | ii | |
| i | <> | Stainless Ste | el Centr | alizer |
| −┤ | | | rill | |
| | · · | | | |
| | } N=+= | | | |
| | 10(es; | Sore hole -" | leter | x 12 Inches |
| - | | Bore hole | Runh - 1 | |
| I – 1 | Z, ' | WOR | here | Traducing air and water through the differences |
| - | · · | was accomplis | med by i | around the wall engine from the bollow of the born both and |
| I - I | 3. | Filler pack was | - poured | eround use went casing from the bottom of the botto hole up. |
| | 4. | vepin to top of | uiter pa | er was goterninger using a weignieu measuring tape. |
| I – I | 5, | pentonite pelle | NG WEIG | alowing pourou around the well casing and allowed to settle. |
| | 6. | pentonite seal | nydrate | |
| | 7. | Annular grout i | was plac | ee via remie metrod. |
| I. – | 8. | Cement/bentor | nite grou | π mux - sips pentonne, 94lbs cement, and 8 gallons water. |
| - | 9. | Gravel pack - F | racel Bro | is, sang co., mc., #1 Well Gravel, 16 100b bags used. |
| i – 1 | 10, | pentonite pelle | nas - Roci | ктер, inc., метолле (vvyoming Bentonne Sealing Agent), 1 501b bucket used. |
| | 11. | Bentonite - Bai | roid Drilli | ing Fluids, Inc., 1/2 SSIb bag used. |
| Ⅰ | 12. | Cement - Allen | 10WN Ce | ament company, Inc., 5 94lb bags Used. |
| _ | 13. | well Casing - (| Cook Sci | |
| _ , | 14. | well Screen - (| Cook Sc | reen technology, Inc., 1x1UR and 1x5R section used. |
| _ | 15. | well was deve | noped 26 | |
| | 16. | Well was deve | noped fo | |
| I – | 17. | vvell was deve | noped us | sing a submersible pump. |
| - | 18. | Development \ | water Wa | as devey as most, more it develop up after 55 minutes of pumping. |
| . – | 19. | mievation of to | p-of-cas | annular arout and surface arade was fee open |
| - | 20, | i ne interval b | etween | annular grout ann sonace graue was leit opert. |
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JAMES C. ANDERSON ASSOCIATES, INC. Drilling Contractor

| | 907 | Pleas | ant Va | alley / | ven | 16 | Mount | Laur | el, New Jersey 08054 | | (609)-72 | 22-6700 |
|--------------|----------|------------------|------------|----------|----------|---------------|--------------|---------|-------------------------|-----------------|----------------|------------|
| PROJEC | T | | Rama | po La | ndfill | <u>Remedi</u> | ation Site | | | | Sheet 1 | of 2 |
| CLIENT | | | GEO- | CONI | nc. | | | | | | Job No. | D94DRE-463 |
| 1 | | - | GRC | UND | VATE | R | | D | RILLING METHOD | DEPTH | Borehole No. | W-5 |
| | ate | | | Tim | 3 | | Depth | 1 | 12" Air Rotary | 0' To 20' | Date Started : | 5/24/95 |
| 5/2 | 24/95 | | | | | drv | | | | | Data Elpished | 6/24/05 |
| | - | | | | | | | | | | Daller . | 3/24/35 |
| <u>├──</u> , | A/E11 | | | | | | | | | | | UNI-TECH |
| ` | YELL | CONS | | JIUN | | | ORDINATE NO. | 1 3 | TATE PERMIT NO. | SPOON SIZE | Elevation TOC: | 345.82 |
| <u> </u> | - | | | | | | SANDIE | <u></u> | | <u>2'X 3"</u> _ | Inspector : | URS |
| i i | | 1 | g | rade | No. | Depth | Blows | N | - | CLASSIFICAT | ON | |
| h | | ł | | \Box | 1 | 0-2 | 5-2-5-5 | 7 | brown med to coarse \$ | SAND | | |
| 11 | | | - | 1 | ĺ | | | | trace med Gravel | | | |
| | | | - | 1 | | | <u>∤ </u> ↓ | | | | <u> </u> | |
| | • | | | 1 | 2 | 3.5 | 5-100/1 | | SAA 10358 | | | |
| | | | - | ┥ | | | 3-10011 | | boulder at 3.5.8 | | | |
| | | | - | | - | £ 7 | | | boulder at 3.5 ft | - <u></u> | | |
| | | | | <u> </u> | 3 | 3-7 | { { | | | × | | |
| | | | - | + | | | ┼───┤ | | <u> </u> | | | |
| | | S 111 | | 8 | F- | | | | | | | |
| Ê. | | \mathbf{x}_{i} | - 12 | - | 4 | 8-10 | 18-76-17-11 | 93 | gray, green fine to coa | rse SAND | | |
| | | | - 11 | 10 | <u> </u> | | <u> </u> | | with med Gravel | | | |
| | | | . . | 4 | 5 | 10-12 | 10-8-5-6 | 13 | S.A.A. | | | |
| | | | <u> </u> | 1 | | | | | | | | |
| | | | - 1 | 1 | Ĺ | | | | | | | |
| | <u> </u> | | | | 6 | 13-15 | 16-18-100/2 | | gray, green Clayey SA | ND to 14.5 ft | | moist |
| | | | |] | | | | | gneiss at 14.5 ft | | | |
| | | | | Ĺ | } | | ļ | | | | | |
| | | | | | | 14.5 to | | | Air Hammered through | rock | | |
| | | | | | | 18.5 | | | stopped at 18.5 | | | |
| | | | - N | 7 | [| | | | | | | |
| | | | - | 20 | ļ | | | | | | | |
| | | 11.29.01.0 | <u></u> | 1 | | | | | • | | | |
| Weil | Depth | 20ft | | 1 | | | | | | | | |
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| | SAMPLE | |
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| | No. Depth Blows N CLASSIFICATION | |
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| | | |
| | LEGEND | |
| | | |
| | Bentonite Pellet Seal | |
| - | | |
| 7 | Gravel Pack | |
| - | | |
| | 8" SCH 40 Type 304 Flush Joint Threaded Stainless Steel Casing | |
| -] . | | |
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| | o type 304 0.033 Stot Stamless Steel Screen | |
| · | | |
| | Stainless Steel Centralizer | |
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| 4 | Notes: | |
| | 1. Bore hole diameter was 12 inches. | |
| | 2. Bore hole was flushed with air and water before casing and screen was set. Bore hole | flushing |
| | was accomplished by Introducing air and water through the drilling rods. | |
| | 3. Filter pack was poured around the well casing from the bottom of the bore hole up. | |
| | 4. Depth to top of filter pack was determined using a weighted measuring tape. | |
| 7 | 5. Bentonite pellets were slowly poured around the well casing and allowed to settle. | |
| | 6. Bentonite seal hydrated for 14 hours. | |
| · | 7. Gravel pack - Ricci Bros, Sand Co., Inc., #1 Well Gravel, 20 100lb baos used | |
| -1 | 8. Bentonite pellets - Rocktest, Inc., Peltonite (Wyoming Bentonite Sealing Agent). 1 50lb b | oucket used. |
| - | 9. Well Casing - Cook Screen Technology. Inc., 1x10ft section used | |
| | 10. Well Screen - Cook Screen Technology Inc., 1x10ft section used | |
| - | 11 Well was developed 26 bours after hertonite seal bydration | |
| , | 12 Mell was developed by bailing till day at 15 minute intender for 1 hour | • |
| | $12. \qquad \text{We have developed using an ary at 10 minute intervals for 1 mount.}$ | |
| - | is, with was developed using a name particle. | |
| | 14. Development water cloudy at mist, upon created up after 50 minutes of balling. | |
| | To. Elevation of top-of-casing is 345,82. | |
| — — | 16. The annular space interval between the bentonike seal and surface grade was left | open. |
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JAMES C. ANDERSON ASSOCIATES, INC. Drilling Contractor

| 907 | Pleasant | Valle | ey A | venue | e . | Mount | Laure | al, New Jersey 08054 | | | (609)-72 | 2-6700 |
|-----------------|------------------|-------------|-------|-----------|---------|--------------|----------|-------------------------|------------------------|----------|-----------------|----------|
| ROJECT | Ra | таро | Lan | dfill R | emedia | tion Site | | | | | Sheet 1 | of 2 |
| | GE | 0-00 | ON In | nc | | | | | | | Job No. | D94DRE-4 |
| | G | ROU | NDW | | २ | | D | RILLING METHOD | DEPTH | | Borehole No. | W-6 |
| Date | | 1 | Time | | | Depth | | 12" Air Rotary | 0' To 19 | <u>r</u> | Date Started : | 7/24/95 |
| 7/24/95 | | | | | | dry | | | | | Date Finished : | 7/24/95 |
| | | | | | | | | | | | Driller: | UNI-TECH |
| WELL | CONSTR | NUCT | ION | | coc | ORDINATE NO. | 5 | TATE PERMIT NO. | SPOON SIZE | E | Elevation TOC: | 350.40 |
| | | | | | | | | | 2' X 3" | | Inspector : | URS |
| | | _ | | | | SAMPLE | | | | | | |
| | | gra | de | No. | Depth | .Blows | <u>N</u> | | CLASSI | -ICATI | ON | |
| | | | | 1 | 0-2 | 4-5-5-6 | 10 | brown, orange topsoil | over | | | |
| | | | | | | | | light brown fine SAND | , trace Silt | | | |
| | | | | | | | | | | | | |
| | | 4 | .5 | 2 | 3-5 | 9-10-9-8 | 19 | light brown fine to me | SAND | | | |
| | | _ | | ┝ | | | | trace Silt and fine Gra | vel | | | _ |
| SANDINA ALESSEN | Sector A Sul Par | ,f | 6.5 | 3 | 5-7 | 2-4-10-13 | 14 | brown fine SAND | | | | |
| N. | \mathbf{x} | | | ┝─┤ | | | | some Clay | · | _ | | |
| | | <u> </u> _ε | 8.5 | | | ` | | | | | | |
| | | _ | | 4 | 8-10 | 2-2-3-4 | 5 | brown Clayey fine to r | ned SAND | | | |
| | - | | | ┝─┥ | | | | | | | | |
| | - | | | | | | | | | | | |
| | - | 1_ | | | 10-13 |) | | Air Hammered throug | h boulder 10.8 to 1 | 3 π | | m |
| | - | | | - | | | | 13 to 13.2 - green, gra | ay fine to coarse S | AND | | |
| | - 201 | | | \square | 13.2 | | | auger refusal at 13.2 | t - gneiss in tip of s | spoon | | |
| | - | | | | | | | | | | | |
| | - | _ | | | 13.2 to | | | Air Hammered throug | h rock | | | |
| | - | | | | 17.2 | | | stopped at 17.2 ft | | | | |
| | - | 1 | 18.5 | | | | | | | | | |
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| Well Dep | th 18ft | _ | | | | | | | 4 | | | |
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| DINUMBER | W-6 Sheet 2 of 2 |
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| | SAMPLE |
| | No. Depth Blows N CLASSIFICATION |
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| | |
| | LEGEND |
| | |
| | Bentonite Pellet Seal |
| | |
| | Gravel Pack |
| | |
| | 8" SCH 40 Type 304 Flush Joint Threaded Staipless Steel Casing |
| | |
| | - 8" Type 304 0 035 Slot Stainless Steel Screen |
| | |
| | Stainlass Steel Centralizer |
| | |
| | - |
| | |
| | - Notes: |
| | Bore hole diameter was 12 inches. |
| | 2. Bore hole was flushed with air and water before casing and screen was set. Bore hole flushing |
| | was accomplished by introducing air and water through the drilling rods. |
| | 4. Filter pack was poured around the well casing from the bottom of the |
| | 5. Depth to top of hter pack was determined using a weighted measuring tape. |
| | Bentonite pellets were slowly poured around the well casing and allowed to settle, |
| | |
| | Gravel pack - Ricci pros. Sano Co., Inc., # Well Gravel, 12 Your bags used. |
| | Mell Caster, Cask Server Technice (wyoning Benchine Gearing Agency, 1 one bucket and . |
| | |
| | TO, Weil Screen - Cook Screen Technology, Inc., Tk foil securit used. |
| | 11. Weil was developed 26 hours after benchnite seal hydrauon. |
| | 12. Well was developed by bailing bil dry at 15 minute intervals for 1 hour. |
| | - 13. Weil was developed using a nand baller. |
| | 14. Uevelopment water cloudy at mist, then cleared up after 30 minutes or pailing. |
| | (C) Elevation or top-or-casing is JSU. |
| | To. The annuar space interval between the periodite seal and surface grave was left open, |
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JAMES C. ANDERSON ASSOCIATES, INC. Drilling Contractor

| PROJECT Rampo Landill Remediation Site Sheet 1 of 1 OLENT GEO-FON Inc. Job No. Date 0 Depth 12 Ar Rolary 0' To 20' Date Finished: 91/0965 GEO-FON Inc. ITP In 1 ITP In 1 ITP In 20' Date Finished: 91/0965 Date Finished: 91/0965 GEO-FON Inc. ITP In 1 ITP In 20' Date Finished: 91/0965 Date Finished: 91/0965 GEO-FON Inc. ITP In 1 ItP Int 20' Date Finished: 91/0965 Date Finished: 91/0965 GEO-FON Inc. ITP In 1 ItP Int 20' Date Finished: 91/0965 UNITECH WELL CONSTRUCTION COORDINATE NO. STATE PERMIT NO. SPOON SIZE Elevation TOC: 343.47 organization ItP Int 10' NOTE ItP Int 10' ItP Int 10' ItP Int 10' ItP Int 10' ItP Int 10' ItP Int 10' ItP Int 10' ItP Int 10' ItP Int 10' ItP Int 10' ItP Int 10' ItP Int 10' ItP Int 10' ItP Int 10' ItP Int 10' ItP Int 10' ItP Int 10' ItP Int 10' ItP Int 10' ItP Int 10' | 907 | Pieas | ant V | alley A | Venu | le | Mount | Laure | el, New Jersey 08054 | | (609)-7: | 22-6700 |
|--|----------|------------|-----------------|----------------|----------|--------|-------------|----------|---------------------------------------|---------------|-----------------|-------------|
| CLIENT GEO-COX Inc. Ubb No. Op ADRE-463 GROUNDWATER Date Time Depth 12 Air Rolary 0 'F o 20' Date Started: 67(905) GROUNDWATER Image: Construction of the started: 67(905) Construction of the started: 67(905) WELL CONSTRUCTION COORDINATE NO. STATE PERMIT NO. SPCON SIZE Elevation TOC: 342.47 Under the started: N CLASSIFICATION 2'X 3'' Inspector; URS Under the started: N CCORDINATE NO. STATE PERMIT NO. SPCON SIZE Elevation TOC: 342.47 Under the started: N CCORDINATE NO. STATE PERMIT NO. SPCON SIZE Elevation TOC: 342.47 Under the started: N CLASSIFICATION 2'X 3'' Inspector; URS Under the started: N CLASSIFICATION SPCON SIZE Elevation TOC: 342.47 Total 1 0.2 4.412.12.16.18 28 dark brown fine to med SAND Total - - - - - | PROJECT | | Rama | apo La | ndfill . | Remedi | ation Site | | | | Sheet 1 | of <u>1</u> |
| GROUNDWATE DRILLING METHOD DEFTH. Boebole No. W/7 Data Time Daty 12 Ar Rotary 0' To 20' Date Finished: entropsed 6/1995 - - - - Other Finished: entropsed WELL CONSTRUCTION COORDINATE NO. STATE PERMIT NO. SPOON SIZE Elevation TOC: 343.47 | CLIENT | | GEO- | - <u>con</u> I | пс. | | | | | | Job No. | D94DRE-463 |
| Date Time Depth 12* Ar Retay 0* to Date Started : 6/1995 0/1905 | | | _GRC | NDNDC | VATE | R | | D | RILLING METHOD | DEPTH | Borehole No. | W-7 |
| 6/1995 Image: Part of the second | Date | | | Time | e | | Depth | | 12" Air Rotary | 0' To 20' | Date Started : | 6/19/95 |
| Vell CONSTRUCTION CORDINATE No. STATE PERMIT NO. SPOON SIZE (2 % 3") Driller : (2 % 3") UNI-TECH Elevation TOC: 343.47 9r46 No. Depth Boo CLASSIFICATION UR3 9r46 No. Depth State PERMIT NO. SPOON SIZE Elevation TOC: 343.47 9r46 No. Depth Boo CLASSIFICATION UR3 9r46 1 D-2 6.1417.16 31 brown fine to cearse SAND Secons small Gravel Secons small Gravel Secons small Gravel Secons small Gravel, trace SR Secons small Gravel, trace SR Secons small Gravel, trace SR Secons small Gravel | 6/19/95 | | | _ | | | 17.91 ft | | | | Date Finished : | 6/19/95 |
| WELL CONSTRUCTION COORDINATE NO. STATE PERMIT NO. SPOON SIZE Elevation TOC: 34.47 Image: construction SAMPLE CLASSIFICATION Image: construction Image: construction Image: construction 6 1 0-2 6-14-17-16 31 brown fine to coarse SAND Image: construction 6 2 4-6 12-12-16-18 28 dark brown, brown fine to med SAND Image: construction 7.2 9.2 4-6 12-12-16-18 28 dark brown, brown fine to med SAND Image: construction 9.2 4-6 12-12-16-18 28 dark brown, brown fine to med SAND Image: construction 9.2 9.2 4-6 12-12-16-18 28 dark brown fine to med SAND Image: construction 9.2 < | | | | | | | | | | | Driller : | UNI-TECH |
| SAMPLE 2 X 3" Inspector ; URS grade No. Depth Blows N CLASSIFICATION i 1 0-2 6-14-17-16 31 brown fine to coarse SAND some small Gravel | WELL | | STRU | CTION | | co | | s | TATE PERMIT NO. | SPOON SIZE | Elevation TOC: | 343 47 |
| Prode No. Depth Biows N CLASSIFICATION 1 0-2 6-14-17-16 31 brown fine to coarse SAND 5 2 4-6 12-12-16-18 28 dark brown, fine to med SAND 5 2 4-6 12-12-16-18 28 dark brown fine to med SAND 5 2 4-6 12-12-16-18 28 dark brown fine to med SAND 5 2 4-6 12-12-16-18 28 dark brown fine to med SAND 5 3 11-13 100/4.5 dark brown fine to med SAND 5 3 11-13 100/4.5 borne small Gravel 4 14-16 9-15-100/5 weathered gnetss (brittle) motal | | | | • | | | | – | | 2' ¥ 3" | Inspector : | |
| Veli Depth Iso Depth Blove N CLASSIFICATION 1 0-2 6-14-17-16 31 brown fine to coarse SAND some small Gravel 5 2 4-6 12-12-16-18 28 dark brown fine to med SAND 9 7.2 - - - - - 1 3.2 - - - - - 1 - - - - - - 1 - - - - - - 1 - - - - - - 1 - - - - - - 1 - - - - - - 1 - - - - - - 1 10/4 10/4 - - - - 1 10/2 - - - - - | | | _ | _ | | | SAMPLE | | | | | |
| Vel Depth 1 0-2 6-14-17-16 31 brown fine to carse SAND some small Grave! 1 0 2 4-6 12-12-16-18 28 dark brown, brown fine to med SAND some small Grave!, trace Silt 9.2 9.2 9.2 11-13 100/4.5 dark brown fine to med SAND some small Grave! 9.2 9.2 11-13 100/4.5 dark brown fine to med SAND some small to med Grave! 9.2 9.2 11-13 100/4.5 dark brown fine to med SAND some small to med Grave! 9.2 9.2 11-13 100/4.5 dark brown fine to med SAND some small to med Grave! 9.1 11-13 100/4.5 weathered gnelss (brittle) molet | | | | grade | No. | Depth | Blows | N | | CLASSIFICA | | |
| Well Depth 19.2 46 12-12-16-18 28 dark brown, brown fine to med SAND 9.2 46 12-12-16-18 28 dark brown, brown fine to med SAND 9.2 9.2 9.2 4 4 14-18 9.2 11-13 100/4.5 dark brown fine to med SAND 9.2 11-13 100/4.5 dark brown fine to med SAND 9.2 11-13 100/4.5 dark brown fine to med SAND 9.1 11-13 100/4.5 dark brown fine to med SAND 9.2 11-13 100/4.5 dark brown fine to med SAND 9.1 11-13 100/4.5 dark brown fine to med SAND 9.1 11-13 100/4.5 weathered gneiss (brittle) molst | | | | | 1 | 0-2 | 6-14-17-16 | 31 | brown fine to coarse \$ | BAND | | |
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| Weil Depth Ill Ill Ill Ill Some small Gravel, trace Silt Weil Depth 19.2 11.13 100/4.5 dark brown fine to med SAND some small to med Gravel Image: | | | | 5 | 2 | 4-6 | 12-12-16-18 | 28 | dark brown, brown fin | e to med SAND | | |
| 7.2 9.2 9.2 9.2 9.2 9.2 3 11-13 100/4.5 4 14-16 9-15-100/5 weathered gneiss (bittle) 19h 2inches 19.2 19.2 | | | | | | _ | | | some small Gravel, t | race Silt | | |
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| 9.2 9.2 3 11-13 100/4.5 dark brown fine to med SAND some small to med Gravel 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 100/4.5 dark brown fine to med SAND 1 1 1 | | 2 | | | | | | | | | | |
| Image: Second | | | | 9.2 | | | | | | | | |
| Well Depth 19.2 Well Depth 19.4 | | - 14 | | | Į | | | | | | | |
| 3 11-13 100/4.5 dark brown fine to med SAND some small to med Gravel 4 14-16 9-15-100/5 weathered gnelss (brittle) moist 19.2 19.2 | | - | | 1 | | ļ | | | | | | |
| Well Depth - | | - | _ | | 3 | 11-13 | 100/4.5 | | dark brown fine to me | d SAND | | |
| Image: Second | | - | - | 7 | | 1 | | | some small to med G | ravel | | |
| 4 14-16 9-15-100/5 weathered gneiss (brittle) moist 19.2 19.2 19.2 ************************************ | | | - | - | | | | | | | | |
| | | | - | 1 | 4 | 14-16 | 9-15-100/5 | | weathered oneiss (b) | rittle) | | moist |
| Image: state stat | | | - | - | | | | | , , , , , , , , , , , , , , , , , , , | | | |
| Image: Second | | | - | 1 | | L | , · | | | | <u> </u> | |
| 19.2 Well Depth 19ft Zinches | | | | | | | | | | | | |
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| Well Depth 19ft 2inches | | F3043 848- | <u>9900,874</u> | - | | | | | | | | |
| 19ft 2inches | Well D | eath | - | 1 | | | | | • | | | |
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| ID NUMBER W-1 | | Sheet 2 of 2 |
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| | | SAMPLE |
| | | No. Depth Blows N CLASSIFICATION |
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| | | LEGEND |
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| | | Bentonite Pellet Seal |
| | | |
| | | Gravel Pack |
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| | - | 8" SCH 40 Type 304 Flush Joint Threaded Stainless Steel Casing |
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| | | 6" SCH 40 Type 304 0.035 Slot Stainless Steel Screen |
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| | | Stainless Steel Centralizer |
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| | 7 | |
| | - | Notes: |
| | | 1 Bara hale une Aushed hafere paring and careen was set |
| | - | 1. Dole noie was indiced before casing and scient was set. |
| | | 2. Finer pack was poured around the well casing from the bottom of the bore hole up. |
| | _ | 3. Depth to top of filter pack was determined using a weighted measuring tape. |
| | | Bentonite pellets were slowly poured around the well casing and allowed to settle. |
| | | 5. Bentonite seal hydrated for 14 hours. |
| | | 6. Gravel pack - Ricci Bros. Sand Co., Inc., #1 Well Gravel, 12 100lb bags used. |
| | 7 | 7. Bentonite pellets - Rocktest, Inc., Peltonite (Wyoming Bentonite Sealing Agent), 1 50lb bucket used. |
| | - | 8 Well Casing - Cook Screen Technology, Inc., 1x10ft section used. |
| | | 9 Well Screen - Cook Screen Technology Inc. 1x10ft section used |
| | | 5. Yell Scient 2 Cook Scient realingly, inc., in for sealon about |
| | | 10. Vyeli was developed 26 nours after bentonne sear hydration. |
| | | 11. Well was developed by pumping till dry at 15 minute intervals for 1 hour. |
| | | 12. Well was developed using a submersible pump. |
| | | 13. Development water cloudy at first, then cleared up after 30 minutes of pumping. |
| | | 14. Elevation of top-of-casing is 343.47. |
| | | 15. The annular space interval between the bentonite seal and surface grade was left open. |
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