GPU Nuclear, Inc.
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Tel 717-944-7621

E910-01-007
March 19, 2001

U.S. Nuclear Regulatory Agency
Attention: Document Control Desk
Washington, DC 20555

Gentlemen,

Subject: Saxton Nuclear Experimental Corporation (SNEC)
SNEC License Termination Plan (LTP), Response to NRC Request for Additional Information
Operating License No. DPR-4
Docket No. 50-146

Attached to this letter is GPU Nuclear's response to the NRC Request for Additional Information, dated January 17, 2001, concerning the License Termination Plan (LTP) for the Saxton Nuclear Experimental Corporation (SNEC) facility, License No. DPR-4, which was submitted on February 2, 2000.

If you have any questions or require additional information regarding this submittal please contact Mr. James Byrne at (717) 948-8461.

Sincerely,

G. A. Kuehn, Jr.
Director, SNEC Facility

Attachments

cc: NRC Project Manager NRC
NRC Project Scientist, Region 1

A020

Attachments: Response to NRC Request for Additional Information

Report titled "Report of Field Investigation, Saxton Nuclear Experimental Station, Saxton, Pennsylvania" by Haley & Aldrich, Inc., dated 14 March 2001

Figure 1 – Site Location Map
Figure 2 – Site Plan
Figure 3 – Typical Bedrock Well Detail
Figure 4 – Typical Overburden Well Detail
Figure 5 – Hydrogeologic Cross Section A – A'
Figure 6 – Hydrogeologic Cross Section B – B'
Figure 7 – Ground Water Elevation Contours (Potentiometric Service (SIC)) in the Overburden (Boulder Layer): January 11, 2001
Figure 8 - Ground Water Elevation Contours (Potentiometric Service (SIC)) in Bedrock: January 11, 2001
Figure 9 – Regional Groundwater Flow Cross Section
Figure 10 – Schematic of Groundwater Monitoring Well Adjacent to CV

SAXTON NUCLEAR EXPERIMENTAL CORPORATION

SAXTON NUCLEAR FACILITY

Operating License No. DPR-4
Docket No. 50-146

Response to Request for Additional Information, RE: License Termination Plan, (TAC NO. MA8076) dated January 17, 2001

COMMONWEALTH OF PENNSYLVANIA)
) SS:
COUNTY OF DAUPHIN)

This Response to Request for Additional Information, RE: License Termination Plan (TAC NO. MA8076) dated January 17, 2001 is submitted in support of Licensee's request to change Operating License No. DPR-4 for the Saxton Nuclear Experimental Corporation facility.

I, G. A. Kuehn Jr., being duly sworn, state that I am the Vice President Saxton Nuclear Experimental Corporation (SNEC) and Program Director SNEC Facility; that on behalf of SNEC, I am authorized by SNEC to sign, and file with the Nuclear Regulatory Commission, this Application to amend the facility license; that I signed this Application as Vice President of SNEC and Program Director SNEC Facility; and that statements made and the matters set forth therein are true and correct to the best of my knowledge, information and belief.

SAXTON NUCLEAR EXPERIMENTAL CORPORATION

BY: [signature]
Vice President, SNEC & Program Director, SNEC Facility

Notarial Seal
Linda C. Witter, Notary Public
Londonderry Twp., Dauphin County
My Commission Expires Sept 25, 2004
Member, Pennsylvania Association of Notaries

Sworn and Subscribed to before me
This 19th day of March, 2001

[signature]
Notary Public

My commission expires 9-25-2004

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION
GPU NUCLEAR - SAXTON NUCLEAR EXPERIMENTAL CORPORATION
DOCKET No. 50-146, LICENSE No. DPR-4

Question 1 - Question 6 from the first RAI. The NRC staff recognizes GPU Nuclear's concern for angle drilling to characterize soil/rock beneath the CV's concrete base to minimize potential damage to the CV steel liner below grade as a result of angle drilling, and to maintain the integrity of the CV liner while decommissioning activities are in progress in the CV. The NRC staff understands that GPU Nuclear: (1) intends to evaluate whether the area underneath the CV should be characterized to determine the nature and extent of potential subsurface soil/rock contamination at the time known contaminated soil adjacent to the CV is remediated; and (2) proposes to consider that if all residual radioactivity is removed by excavation before reaching the CV concrete base, then the area beneath the CV concrete base should be considered as non-impacted [defined in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) as an area without residual radioactivity from licensed activities] which requires no surveys or sampling in the final status survey.

The NRC staff believes that insufficient information has been provided to conclude that the area beneath the CV concrete base is non-impacted for two reasons. First, Section 2.2.4.2 of the LTP (and Table 2-16) indicates that subsurface soil contamination resulting from leakage of piping, tanks, and components in soil adjacent to the CV requires remediation in these areas due to residual radioactivity concentrations that exceed the proposed derived concentration guideline (DCGL) for Cs-137 in soil (efforts are underway to characterize the area surrounding the CV since it has not yet been characterized due to prevailing soil conditions and ground water near the surface of the CV). Depending on the area's initial impacted classification level (and subsequent successful remediation), the area immediately adjacent to this area would be expected to be, in the least conservative case, a Class 3 buffer zone which requires the appropriate scan coverage and number of samples. As described in MARSSIM, the buffer zone would exist surrounding a Class 1 or 2 area/survey unit. It is not clear whether the boundary of this buffer zone or similarly classified area/survey unit would overlap into the area adjacent to or underneath the CV because the extent and depth of contamination is unknown. Second, potential surface/subsurface soil contamination near the CV may reach the area underneath the CV by movement or through water infiltration of radionuclides along the exterior of the CV.

The NRC staff requests that with the limited radiological characterization and ground water information, GPU Nuclear initially classify the area beneath the CV concrete base as impacted considering the proximity and residual radioactivity concentrations of known subsurface soil contamination, or demonstrate that the mechanism described above is not likely or probable.

Based on the teleconference conducted on December 6, 2000, the NRC staff understands that GPU Nuclear proposes to install at least one bedrock monitoring well (during the spring or early summer 2001) hydraulically down gradient but adjacent to the CV. This monitoring well will be installed so that its screened interval will range from 5 feet above to 5 feet below the CV concrete base. GPU Nuclear intends to add this monitoring well to their modified schedule for sampling radionuclides and measuring water levels. Please confirm GPU Nuclear's proposed plan to add this monitoring well, as discussed on December 6, 2000, and provide this detailed plan to the NRC for review.

The NRC staff acknowledges that when the radiological characterization, remediation plan, FSS design, sampling methodology, and remediation of the CV, and soil beneath the CV is complete, the results and data will be provided by GPU Nuclear for NRC's review.

Response:

GPU Nuclear will designate the area beneath the Containment Vessel (CV) concrete base as impacted.

GPU Nuclear retained the firm of Haley & Aldrich, Inc. to determine the requirements for installation of a bedrock groundwater monitoring well as discussed with the NRC staff during a teleconference conducted on December 6, 2000. They have recommended the following installation scheme:

- Install this monitoring well approximately 15' hydraulically down gradient from the CV.
- Install monitoring well in a bedrock angle drillhole (25 degrees). The screen section should effectively extend five feet above the bottom of the CV shell and five feet below the concrete base see Figure 10 (attached).
- This installation is oriented generally perpendicular to the major, high angle fracture.
- Filter design will minimize the passage of fine soil particles from the nearby backfill.
- Removing borehole cuttings after the completion of drilling (if necessary) should be accomplished by adding water or using an airlift procedure. This procedure should serve to minimize the potential of drawing fine-grained soil to the borehole.
- Groundwater sampling should minimize stress to the immediate aquifer.
- The timing of this installation should occur after the activities associated with concrete removal in the CV are completed.

Sampling device

- A GEOMON groundwater-sampling device should be utilized since this device is currently in use on site and its smaller diameter provides more options for filter design. A general schematic of the GEOMON, showing the screen section in relation to the base of the concrete, is presented on Figure 10 (attached).

GPU Nuclear will proceed with the installation of this well, as recommended above, when remediation of the proposed installation site is complete and when such installation will not interfere with the measures necessary to stabilize the CV during concrete removal. Please refer to GPU Nuclear's letter E910-01-0001, dated January 30, 2001 for schedule information. Note that if an angled well is installed, as recommended, only sampling will be performed, as level measurements are not practical in an angled well.

Question 2 - Question 7 from the first RAI. The NRC staff acknowledges GPU Nuclear's plan to continue sample collection in concert with gamma logging, since gamma logging is considered acceptable for screening purposes. However, the following statement is unclear: "But, in areas where sampling is impossible or obviously inaccurate (i.e., rubble, gravel, or muck), gamma logging must be relied upon." The NRC staff recognizes that certain surveys or measurement techniques /methodologies (i.e., in situ gamma spectroscopy) may be impractical in inaccessible or not readily available areas. However, it is common practice that rubble, gravel, muck or other media samples are collected in areas where such surveys are not feasible. These samples are analyzed isotopically for quantitative purposes under an approved and audited quality assurance program. Please clarify this statement.

Response:

When practical, physical samples will be collected and analyzed in accordance with SNEC Facility survey and sampling procedures and the SNEC Facility Decommissioning Quality Assurance Plan. When obtaining physical samples is not practical, gamma logging may be used as a tool to determine the extent of contamination. Gamma logging at the SNEC Facility is performed by using gamma-ray spectroscopy analysis equipment tethered to an appropriate detector (NaI, etc.). With this equipment, *in-situ* spectroscopy analysis of subsurface materials is performed at vertical intervals down the bored hole (a vertical profile of the subsurface materials).

Question 3 – Question 9 from the first RAI. The types of laboratory analysis (gross and isotopic) and concentrations for transuranic (TRU) (isotopic plutonium, uranium, cerium, and Am-241) and hard-to-detect (HTD) (C-14, Fe-55, I-129, Ni-63, Tc-99) radionuclides indicates the absence of TRU radionuclides in the ground water samples analyzed. The composite ground water sample concentrations provided are within the U.S Environmental Protection Agency's maximum contaminant level (MCL) for activity concentrations for gross alpha emitters of 15 pCi/l as prescribed in 40 CFR Part 141 – National Primary Drinking Water Standard. The composite ground water samples for HTD radionuclides were reported at less than the minimum detectable concentration (MDC). The staff suggests that GPU Nuclear continue with the same regimen of sample analysis (gross alpha/beta and further isotopic analysis for TRU and HTD radionuclides) in the proposed phased onsite ground water monitoring program.

GPU Nuclear has addressed several issues pertaining to their justification that current monitoring wells are representative and appropriate for measuring potentially contaminated ground water onsite. However, the NRC staff believes that additional data still needs to be provided and that the data should address both potential onsite and offsite ground water contamination. For example, the following items should be determined and provided to the NRC: (1) current water level configuration maps representing the shallow water bearing unit (wells screened in the fill, boulder, and the upper weathered bedrock) and the bedrock water bearing unit (wells screened in the bedrock at a depth approximately equal to the base of the CV); (2) ground water flow patterns for both water units delineating discharge points; (3) ground water flow rates with and without dissolved radionuclides; (4) whether radionuclide contaminated ground water has either reached surface water discharge points or moved beyond the SNEC property; and (5) hydrogeologic cross sections delineating the lithology, and potentiometric surfaces across the site.

GPU Nuclear and NRC staff have discussed, during a site inspection meeting on November 14, 2000, and during a teleconference on December 6, 2000, the ground water issues and the need for shallow and bedrock wells located between the site and the Raystown Branch of the Juniata River (the potential ground water discharge point) and for background monitoring wells in both water units. Based on these discussions, the NRC staff understands that GPU Nuclear is proposing to develop a phased approach to resolve ground water issues. Phase I includes the installation of seven wells, three nests of a shallow and a bedrock well and one additional bedrock well. GPU Nuclear intends to monitor these new wells in addition to all existing wells at its site and provide an evaluation of the aforementioned hydrogeologic issues. Additional monitoring wells may be necessary depending upon the results of Phase I.

Please confirm GPU Nuclear's proposed plan to develop a phased ground water monitoring program, as discussed on November 14, and December 6, 2000, and provide this detailed plan and schedule to the NRC for review.

Response:

GPU Nuclear interprets that the following issues in question three require a response:

1. "The staff suggests that GPU Nuclear continue with the same regimen of sample analysis (gross alpha/beta and further isotopic analysis for TRU and HTD radionuclides) in the proposed phased onsite ground water monitoring program."

Response:

GPU Nuclear will continue the same regimen of sample analysis in the additional ground water monitoring program as has been conducted to date with the current ground water monitoring program. The current program, per the Offsite Dose Calculation Manual (ODCM), requires that quarterly well samples be analyzed for tritium (H-3) and gamma spectroscopy. In addition to these requirements, the new wells installed as part of the phase one and phase two ground water monitoring program will be initially analyzed for transuranics (TRU) and hard to detect (HTD) radionuclides. If these sample results are negative (<MDA/LLD), further TRU and HTD analysis will not be conducted unless the tritium and/or gamma spectroscopy results are positive.

2. "The following items should be determined and provided to the NRC: (1) current water level configuration maps representing the shallow water bearing unit (wells screened in the fill, boulder, and the upper weathered bedrock) and the bedrock water bearing unit (wells screened in the bedrock at a depth approximately equal to the base of the CV); (2) ground water flow patterns for both water units delineating discharge points; (3) ground water flow rates with and without dissolved radionuclides; (4) whether radionuclide contaminated ground water has either reached surface water discharge points or moved beyond the SNEC property; and (5) hydrogeologic cross sections delineating the lithology, and potentiometric surfaces across the site."

Response:

During a site inspection meeting on November 14, 2000, and during a teleconference on December 6, 2000, GPU Nuclear and NRC staff discussed, the ground water issues and the need for shallow and bedrock wells located between the site and the Raystown Branch of the Juniata River (the potential ground water discharge point) and for background monitoring wells in both water units. In response to these and other discussions with the NRC staff, GPU Nuclear retained the firm of Haley & Aldrich, Inc. Representatives of Haley & Aldrich, Inc. have been conducting studies of ground water and hydrogeology at the SNEC site periodically since 1981.

Haley & Aldrich, Inc. has completed the most recent field investigation and provided the results in a report titled "Report of Field Investigation" by Haley & Aldrich, Inc., dated March 14, 2001. That report (attached) addresses each of the questions above as follows and will be included as an Appendix to Chapter 2 of the LTP:

(1) Current water level configuration maps representing the shallow water bearing unit (wells screened in the fill, boulder, and the upper weathered bedrock) and the bedrock water bearing unit (wells screened in the bedrock at a depth approximately equal to the base of the CV): see section 3.0 "GROUND WATER FLOW" and figures 7 and 8 of the Haley & Aldrich report.

(2) Ground water flow patterns for both water units delineating discharge points: see section 3.0 "GROUND WATER FLOW" and figures 7, 8 and 9 of the Haley & Aldrich report.

(3) Ground water flow rates with and without dissolved radionuclides: see section 4.0 "TRAVEL TIME/FATE OF RADIONUCLIDES IN GROUNDWATER" and figures 7 and 8 of the Haley & Aldrich report.

(4) Whether radionuclide contaminated ground water has either reached surface water discharge points or moved beyond the SNEC property: see section 4.0 "TRAVEL TIME/FATE OF RADIONUCLIDES IN GROUNDWATER" and figures 7, 8 and 9 of the Haley & Aldrich report. This section describes the behavior of tritium in ground water. For other radionuclides, site specific data is unavailable at this time. GPU Nuclear will be developing site specific factors (K_d) for predominant site specific radionuclides and the postulated travel times will be reported when available.

(5) Hydrogeologic cross sections delineating the lithology, and potentiometric surfaces across the site: see section 3.0 "GROUND WATER FLOW" and figures 2,4, 5, 7 and 8 of the Haley & Aldrich report.

3. Please confirm GPU Nuclear's proposed plan to develop a phased ground water monitoring program, as discussed on November 14, and December 6, 2000, and provide this detailed plan and schedule to the NRC for review.

Response:

Please refer to GPU Nuclear's letter E910-01-0001, dated January 30, 2001 for schedule information relative to the phased ground water monitoring program. Phase 1 ground water monitoring wells have been installed as described in the attached report titled; "Report of Field Investigation" by GPU Nuclear's hydrogeological consultant, Haley & Aldrich, Inc., dated 14 March 2001. As recommended in section 5.0 "RECOMMENDATIONS", of this report, GPU Nuclear will implement "Phase 2" of a ground water monitoring program. This will involve the installation and monitoring of at least one additional well cluster (one overburden and one bedrock well) and two observation points. Installation of these wells and associated monitoring is scheduled to begin in the second quarter of 2001.

Question 4 – Question 15 from the first RAI. Table 5-10 "Typical Detection Sensitivities." Page 20: The column label in the table for "Instrumentation Efficiency" indicates the total efficiency for surface contamination detectors planned for use in the final status survey. The total efficiency (ε_τ) is the product of the instrument (ε_i) and source (ε_s) efficiencies. The NRC staff recommends that GPU Nuclear add a footnote to this table to illustrate that these two distinct parameter values will be evaluated as adequately addressed in Question 24 of the first RAI. The NRC staff considers a source efficiency (ε_s) value of 0.5 for beta emitters with maximum energies above 400 keV, and an ε_s value of 0.25 for alpha and beta emitters with maximum energies between 150 keV and 400 keV to be acceptable estimates (absent site-specific information) of the ε_s values for alpha/beta surface contamination detectors for an *a priori* static and scan MDCs in the final status survey design. The NRC staff acknowledges GPU Nuclear's commitment to determine an appropriate ε_s value for surface contamination detectors and calculate the actual scan and static MDCs for implementation in the final status survey. The staff suggests that the equation given to calculate the static MDC (section 5.5.2.4.4, page 5-38) include the ε_i, ε_s, and detector area parameters. The definition of K following the static MDC equation given and last sentence that reads: "the value of K may include..." would be deleted as appropriate. Please revise this table accordingly.

Response:

The following footnote will be added to Table 5-10 in the SNEC LTP, to address NRC concerns regarding the determination of the two factors (ε_i) and (ε_s).

> [d] The total efficiency (ε_τ) is the product of the instrument (ε_i) and source (ε_s) efficiencies. These values will be determined during the calibration process for the specific radionuclide mix expected in each survey area/unit (as appropriate). Actual instrument efficiencies are continuously monitored by site personnel. Any information or calculations used to establish instrument efficiencies for final status survey work, will be available at the site for NRC on-site inspection purposes.

Section 5.5.2.4.4 of the SNEC LTP will be modified (as shown below) to include (ε_i) and (ε_s). Additionally, the probe area factor will be included.

5.5.2.4.4 Static MDC For Structural Surfaces

For static measurements of surfaces, the MDC_{STATIC} may be calculated using draft Regulatory Guide DG-4006, Equation 3, (Reference 5-4) and substituting more specific values for the calibration constant K shown in the equation which would be:

(1) the area of the detector (A),
(2) the source efficiency factor (ε_s), and
(3) the instrument efficiency for the emitted radiation(s) (ε_i)

$$MDC_{static} = ((3+(4.65)\sqrt{B})/((\varepsilon_i\varepsilon_s)(A/100cm^2)(t))$$

Where:

MDC_{static}	=	minimum detectable concentration for static counting (dpm/l00 cm^2)
B	=	background counts during measurement time interval t (counts)
t	=	measurement counting time interval (minutes)
ε_i	=	instrument efficiency for emitted radiation (cpm/dpm)
ε_s	=	source efficiency for emissions/disintegration
A	=	area of detector (cm^2)

Question 5 - Question 23 from the first RAI: In Section 5.5.2.2 (page 30 of the response) the energy units for Tc-99 should be corrected. The maximum beta energy for Tc-99 is about 85 keV or 0.085 MeV. Please revise this accordingly.

<u>Response:</u>

This was a typographical error in the submittal and should have been 0.085 MeV. The value will be corrected to 0.085 MeV as requested in the proposed revision of Section 5.5.2.2 "Calibration and Maintenance".

Question 6 - As part of the staff's review of the DCGL values proposed in the LTP, please provide: (1) a brief discussion of the methodology used to determine the nature, areal extent, and depth of radiological contamination in the area of the SSGS; (2) the identified radionuclides, concentrations and estimates of standard deviation, and sample locations; (3) minimum detectable concentrations, analytical method (i.e., gamma/alpha spectroscopy, radiochemical analysis, etc.) used to quantify the identified radionuclides; (4) quality assurance practices implemented; and (5) based on the developed characterization information, the specific DCGL values and type (i.e., surface or volumetric) that will be considered in remediating radiological contamination in the former SSGS footprint.

Please note that the proposed DCGL values for remediating building surface contamination may not be appropriate in this situation if volumetric contamination exists, which is likely given the nature of the contamination. Further, the proposed DCGL values for remediating contaminated soil may not be appropriate given the difference in the contaminated medium and potential exposure pathways. Accordingly, GPU Nuclear will need to justify the DCGL values for the former SSGS remediation in terms of the nature of the contamination (i.e., surface or volumetric), contaminated medium (i.e., concrete or soil), and potential exposure routes.

Response:

The SSGS facility and Intake and Discharge Tunnel complex are being characterized in accordance with SNEC procedures and work instructions, including the SNEC Facility Decommissioning Quality Assurance Plan. Since this particular characterization activity is not complete, much of the necessary characterization information is not currently available but will be provided in accordance with the schedule provided in GPU Nuclear's letter E910-01-0001, dated January 30, 2001

Regarding DCGL values as part of our response to the second RAI, a separate set of subsurface DCGL values are being developed. These values will reflect the fact that most subsurface contaminated areas reside in the saturated zone at the SNEC site.

Question 7 - To support the staff's development of an environmental assessment, the staff needs specific information concerning the presence of any non-radiological contamination (e.g., hazardous wastes, toxic wastes, asbestos, etc.) in the former SSGS, its disposition, and GPU Nuclear's involvement with other State or Federal agencies in addressing such contamination.

Response:

During the process of the characterizing the SSGS 'footprint', sampling wells were installed to obtain data from the low points of the footprint. The most significant of these were four wells that were drilled down to approximately the bottom of the four drainage sumps in the former SSGS.

Drilling spoils from the well installation were examined and analyzed. It was determined that the material, which was predominately demolition debris used as backfill in the SSGS footprint contained greater than 2 percent asbestos fibers and that the material was friable. The primary concern at this point was that the presence of asbestos contamination in the fill area could result in an airborne asbestos hazard as characterization work proceeded. The work area was covered with a ground stabilization membrane and a layer of gravel to prevent the generation of an airborne asbestos hazard.

Excavation of the area began in order to remove the asbestos and to further characterize the area. The subsequent excavation of the filled area has been performed under the auspices of individuals licensed by the Commonwealth of Pennsylvania to supervise asbestos remediation activities.

Excavation of the SSGS footprint is now complete. About 1 million lbs. of asbestos containing debris have been removed from the SSGS footprint. This debris contains about 41,500 lbs. of asbestos. The material is packaged and when ready is shipped for disposal at an approved disposal facility.

In addition to the asbestos bearing waste, the excavation uncovered four electrical capacitors that had been buried during demolition of the SSGS. Testing revealed that they contained oil with PCB contamination. Each capacitor was packed in a drum along with the surrounding soil. One has been shipped to an approved disposal facility; the other three are in storage awaiting shipment.

Analyses of water samples from the four sumps in the SSGS footprint identified very low but detectable levels of oil and grease, mercury, and Arochlor-1254 and Arochlor-1260 (classes of PCB's). The detectable contaminants are believed to be the result of residual contamination in the sumps that was not cleaned out at the time of demolition of the SSGS. The approach to dealing with these contaminants is removal of the solid debris down to the base slab of the demolished building followed by pumping of the remaining water into a holding container so that the floor area and the sumps can be cleaned. The water will be analyzed again and processed at a licensed disposal facility if needed. It is believed that additional water that accumulates in the area following cleaning of the floor and sump will be ground water and rain water and will not require remediation. It will be initially sampled and monitored to confirm this before being disposed. Subsequent accumulations will be handled as rainwater and/or groundwater intrusions.

Throughout the SSGS remediation project, GPU Nuclear has been in communication with the Pennsylvania Department of Environmental Protection Bureau of Air Quality and the Bureau of Water Quality; South Central Regional Office located in Harrisburg, Pennsylvania.

UNDERGROUND
ENGINEERING &
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14 March 2001
File No. 74683-000

HALEY & ALDRICH

GPU Nuclear
Route 441 South
PO Box 480
Middletown, PA 17057-0480

Attention: Robert D. Holmes

Subject: Report of Field Investigation
Saxton Nuclear Experimental Station
Saxton, Pennsylvania

Dear Mr. Holmes:

This letter summarizes our supplemental field investigation to characterize the subsurface materials, groundwater movement, and potential fate of tritium in groundwater. This investigation was undertaken to respond to comments in the 17 January 2001 letter to GPU Nuclear regarding Saxton Nuclear Experimental Station from the United States Nuclear Regulatory Commission (NRC) regarding potential onsite and offsite groundwater contamination and migration. The five areas the NRC requested GPU Nuclear to address are listed below.

- Groundwater level (potentiometric surface) contour maps for both overburden and bedrock units. (see Section 3.0)
- Groundwater discharge points. (see Section 3.0)
- Groundwater flow rates with and without dissolved radionuclides (see Section 4.0)
- Fate of radionuclide contaminated groundwater and whether the contaminated groundwater has reached the discharge points or moved beyond the Saxton facility. (see Section 4.0)
- Hydrogeologic cross-sections delineating the lithology and potentiometric surfaces across the site. (see Section 3.0)

Our investigation found groundwater generally flows toward and discharges to the nearby Raystown Branch of the Juniata River. The operation period of this plant was from 1962-1972, or 39 to 29 years ago. If tritium was released during the plant operational period, it has likely reached the river in both overburden and bedrock, based on average travel time calculations. The remainder of this letter will address the five areas listed above and discuss background, field investigation and aquifer testing, groundwater flow, travel time/fate of radionuclides in groundwater and recommendations.

1.0 BACKGROUND

The Saxton Nuclear Experimental Station is located in Liberty Township, near Saxton, Pennsylvania. The facility is located on approximately 1-acre. Surrounding the property is open land that is bounded on three sides by a river and a stream (Figure 1). To the south, approximately 600 feet from the property is Shoup Run, which flows toward the west and drains into Raystown Branch of the Juniata River. To the north and west, approximately 500 to 1000 feet from the property is the Raystown Branch of the Juniata River which flows toward the northwest and drains into the Raystown Lake created by a dam located approximately 15 miles away. The facility has undergone previous subsurface investigations and low concentrations of tritium, a radiological isotope, were detected in the groundwater. These concentrations were well below USEPA's Primary Drinking Water Standards. The previous investigations focused in the immediate vicinity of the Waste Treatment Building and the Containment Vessel. This supplemental investigation extends beyond these areas to the open land between the facility and nearby river/stream.

2.0 FIELD INVESTIGATION AND AQUIFER TESTING

In December 2000, seven observation wells were installed to characterize groundwater flow in the local area. The seven wells consisted of three nests of an overburden and bedrock well (OW-3/3R, OW-4/4R, and OW-5/5R) and one additional overburden well (OW-6). The overburden wells are screened in the fill, boulders, and upper weathered bedrock. The bedrock wells extend to 50 feet below ground surface. The well installations occurred between December 11 and 21, 2000. Figure 2 shows the location of new and existing overburden wells, bedrock wells, surface water gauging stations and reference elevations of these observation points used in our assessment. Construction details of the newly installed overburden and bedrock wells are presented in Figures 3 and 4, respectively.

The field investigation confirmed the stratigraphy reported in earlier investigations. There is approximately 10 to 15 feet of overburden material overlying bedrock (a fractured siltstone). The overburden materials consist of a natural boulder layer with silt and clay filling the interstitial spaces. A thin veneer of artificial fill may be present over the boulder layer. Groundwater occurs in both the overburden materials and bedrock. Figures 5 and 6 show two hydrogeologic cross-sections across the site. Below are observations regarding the site:

- A thin layer of fill is present over the natural boulder layer throughout most of the area, although it may be thinner or absent near the surface water features.

- The elevation of the bedrock surface is generally decreasing from east to west (Figure 5). Also, Figure 6 suggests that the bedrock's elevation decreases north and south away from the area of the Containment Vessel (CV).

- A subterranean discharge tunnel, a vestige of the former coal-fired power plant, has locally altered the natural subsurface conditions. This man-made feature observed in the field during a prior field backhoe exploration is a concrete structure poured using wooden forms on an excavated slot in the bedrock (refer to Figure 2 for its location).

- A noteworthy aspect of this construction was that boulders were apparently removed and stockpiled during the excavation process. As part of construction, the boulders were used as backfill. As a result, the boulders no longer have the silt and clay in the interstitial space effectively creating a highly permeable zone. Figure 7 shows a conceptual cross-section of the tunnel area and its relationship to the overburden and groundwater.

- This tunnel apparently creates both a barrier and groundwater diversion feature. The tunnel creates a barrier based on its construction; it is concrete poured directly on bedrock. Surrounding the tunnel is a boulder backfill, which readily allows groundwater to drain through it. This feature will be addressed further in the groundwater flow analysis section

Following the well installations, aquifer testing was conducted on the new wells. Slug tests (falling head tests) were conducted on six wells to assess the ability of water to move through the subsurface. Tests were conducted on three overburden (OW-3, OW-5, and OW-6) and three bedrock wells (OW-3R, OW-4R, OW-5R). The slug test data was analyzed using the Bouwer & Rice Method to estimate the hydraulic conductivity of the subsurface material. Calculated hydraulic conductivity values ranged from 0.14 to 0.32 ft/day in overburden wells and 0.14 to 0.79 ft/day in bedrock wells.

3.0 GROUNDWATER FLOW

Water level information from existing wells, new wells and our river gauging stations, was used to create computer generated (kriging routine) groundwater (potentiometric surface) contour maps for both the overburden and the bedrock. Groundwater contour maps for January 11, 2001 provide information about the direction of flow. Groundwater contour maps for both the overburden and the bedrock are presented in Figures 7 and 8.

In the overburden, the site groundwater flow direction is toward the west, northwest. This flow direction is the general trend for the property. However, as noted earlier, the tunnel and adjacent boulder backfill likely affects localized groundwater flow, resulting in a drainage pathway to the Raystown Branch Juniata River (refer to Figure 7 presenting the groundwater flow path). The groundwater flow direction indicates a groundwater discharge area is present along the Raystown Branch of the Juniata River (Figure 7).

In the bedrock, site groundwater flow direction is toward the northwest, based on groundwater contours. Groundwater movement in the bedrock is controlled by the openings in the bedrock. Ground/Water Technology Inc. in 1981, reported the major fracture is oriented between N 50° W and N 75° W, dipping nearly vertical. The bedrock groundwater contour information supports the premise that this major structural feature controls the direction of groundwater flow in the bedrock. The groundwater flow direction and bedrock fracture orientations indicate a groundwater discharge area is present along the Raystown Branch of the Juniata River (Figure 8). Thus, if a release occurred from the containment vessel to the underlying bedrock, it would be discharged to the Raystown Branch of the Juniata River.

Water level elevations in the overburden and the bedrock wells show the Raystown Branch of the Juniata River is a discharge point for groundwater from the facility. Referring to Figure 5 (A-A'), it is apparent that water levels are higher to the east (A') and generally decrease to the west (A) and the river. Further, the water level in the overburden well OW-3 compared to its counterpart in the bedrock (OW-3R), indicate groundwater in the overburden has the potential to replenish the bedrock. On the left-hand of the drawing the water level in the rock is higher than the river, indicating that the groundwater drains to the river. Figure 5, on the right-hand side of this hydrogeologic cross-section (near B'), the overburden well is dry and groundwater flow is taking place in the bedrock (through openings in the rock), draining to the river (note the water level is higher in the bedrock well than the river). These same flow patterns are on the other side of the Raystown Branch of the Juniata River and regional groundwater flow is shown in Figure 9. The relationships described above maybe affected by seasonal water level fluctuations.

4.0 TRAVEL TIME/FATE OF RADIONUCLIDES IN GROUNDWATER

To identify when tritium would be observed in the site monitor wells or river, we used an average seepage velocity calculation. The operational period of this plant was from 1962-1972, or 39 to 29 years ago. Tritium has been the only positively identified radionuclide detected in the site groundwater and has not been detected above USEPA's Primary Drinking Water Standard of 20,000 pCi/l. Results of radionuclide testing in the monitoring wells indicate non-detect for other radioactive contaminants. Tritium is very mobile and serves as an ideal tracer in groundwater since it does not undergo soil adsorption. Most other radionuclides have the propensity for adsorption and site conditions would provide ample means for ion adsorption. Thus, we considered the travel time of tritium to be the same as groundwater and utilized the seepage velocity formula below.

$$v = Ki/\theta$$

Where v = Average seepage velocity

θ = Effective porosity of the flow medium

K = Permeability or hydraulic conductivity

i = Change in hydraulic head per unit length (gradient)

In overburden, if tritium was released during operations, based on travel time calculations it has likely reached the river. In the overburden, we calculated travel time from the former Radwaste Treatment Building to the Raystown Branch of the Juniata River. The calculation was divided into two parts, due to differing hydraulic characteristics. The first part was the distance from the buildings to the tunnel (450 feet) and the second part was the distance adjacent to the tunnel in the pervious boulder backfill (550 feet) to the river, as shown in Figure 7. We utilized minimum and maximum values for the hydraulic conductivity (K) from our slug testing and published effective porosity (θ) values in order to obtain a minimum and maximum travel time values. The calculated travel time from the site to the river ranges approximately between 13 and 30 years. An average travel time of approximately 19 years was calculated using a geometric mean of the hydraulic conductivity (K). The velocity calculations were performed using an electronic spread sheet and includes references for the utilized values. Below we summarize the values used to calculate travel time.

Table 1: Summary of Values to Calculate Overburden Travel Time

	Utilized Values		
Parameter	**High**	**Low**	**Average**
θ	10% (overburden)	20% (tunnel backfill)	--
$K_{overburden}$	0.32 ft/day*	0.14 ft/day*	0.21 ft/day **
K_{tunnel}	28.4 ft/day	2835 ft/day	283.75 **
i	0.03 (Bldg to Tunnel)	0.02 (Tunnel to River)	--

-- - Value not calculated for this parameter.
* - Values from aquifer testing at the site.
** - Geometric mean

In bedrock, if tritium was released during operations, it has likely reached the river. In bedrock, we calculated travel time from the Former Radwaste Treatment Building to Raystown Branch of the Juniata River. In bedrock, the flow direction was based on the bedrock fracture orientation. This calculation also contained two components since the hydraulic gradient varied in the bedrock groundwater elevation contours. The first part was the distance from the buildings to the tunnel (600 feet) and the second part was the distance between tunnel and the river (464 feet), as shown in Figure 8. We utilized minimum and maximum values for hydraulic conductivity (K) and effective porosity (θ) in order to obtain minimum and maximum travel time values. The calculated travel time from the site to the river ranges approximately between 1 and 60 years. An average travel time of approximately 16 years was calculated using a geometric mean of the hydraulic conductivity (K) and average effective porosity (θ) values.

Table 2: Summary of Values to Calculate Bedrock Travel Time

Parameter	Utilized Values		
	High	Low	Average
θ	0.5%	5%	2.75%
K	0.79 ft/day*	0.14 ft/day*	0.26 ft/day **
i	0.03 (Bldg to Tunnel)	0.013 (Tunnel to River)	--

-- - Value not calculated for this parameter.
* - Values from aquifer testing at the site.
** - Geometric mean.

5.0 RECOMMENDATIONS

We recommend continuing to monitor the existing well array. Our timing calculations indicate that the tritium, if released to the subsurface, has likely reached the river in both overburden and bedrock.

However, to increase your confidence that the monitoring well system will detect tritium in groundwater, if present, we recommend you install an additional well cluster and two observation points. The additional cluster would be installed near the substation side of the tunnel and would further confirm the presence or absence of tritium in groundwater. Two observation points would be installed in the boulder backfill around the tunnel. The observation points would be used to monitor the conditions in this area.

It has been a pleasure to be of service, please contact us if you have any questions.

Sincerely yours,
HALEY & ALDRICH, INC.

Nancy V.R. van Dyke, C.P.G.
Project Manager

Charles R. Butts
Vice President

Attachments:
Figures 1 through 9

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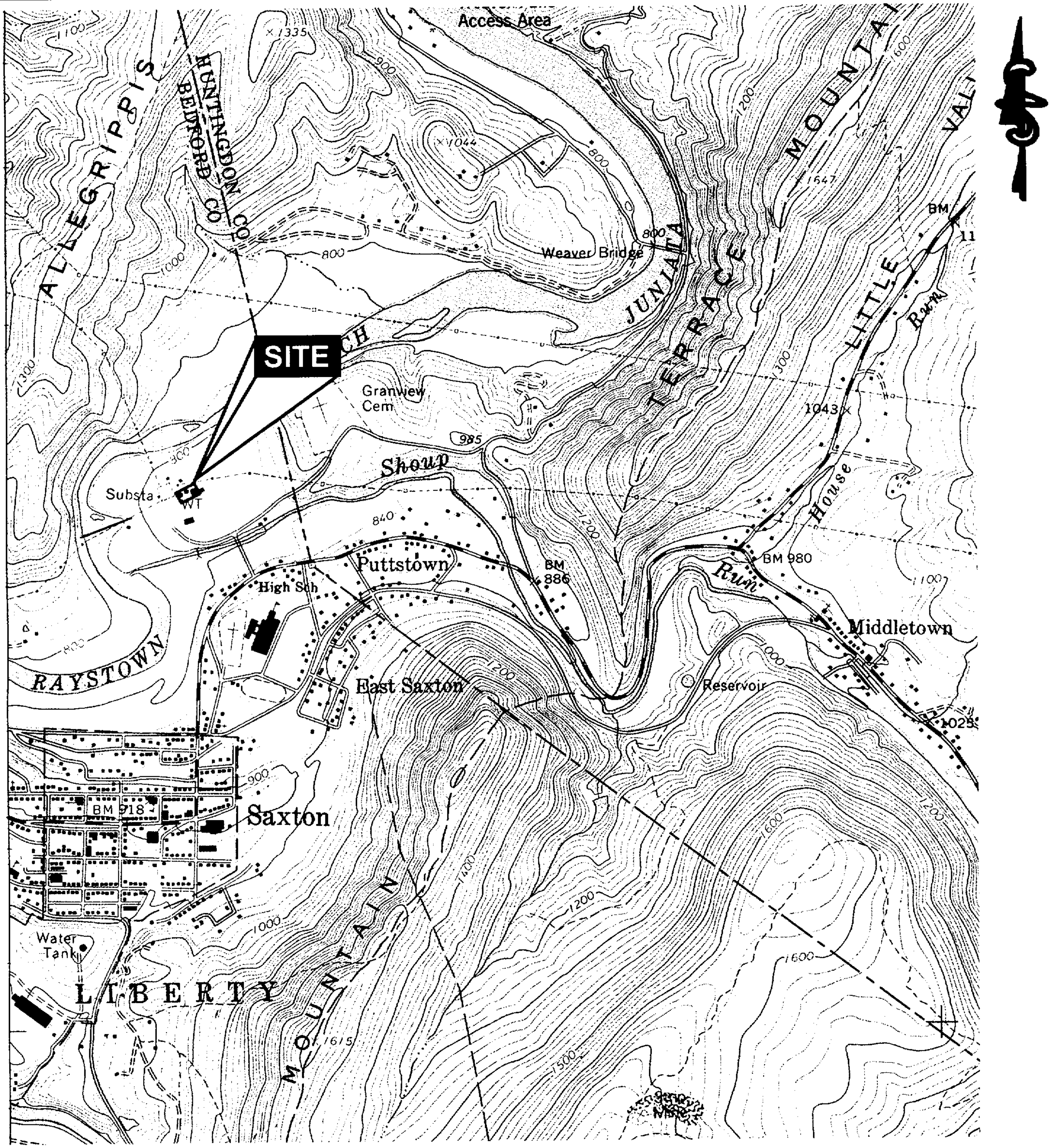

SOURCE:
SAXTON QUADRANGLE, PENNSYLVANIA,
USGS 7.5 MINUTE SERIES (TOPOGRAPHIC),
DATED 1968, PHOTOREVISED 1994.

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SITE LOCATION MAP

SCALE: 1"=2000'

MARCH 2001

FIGURE 1

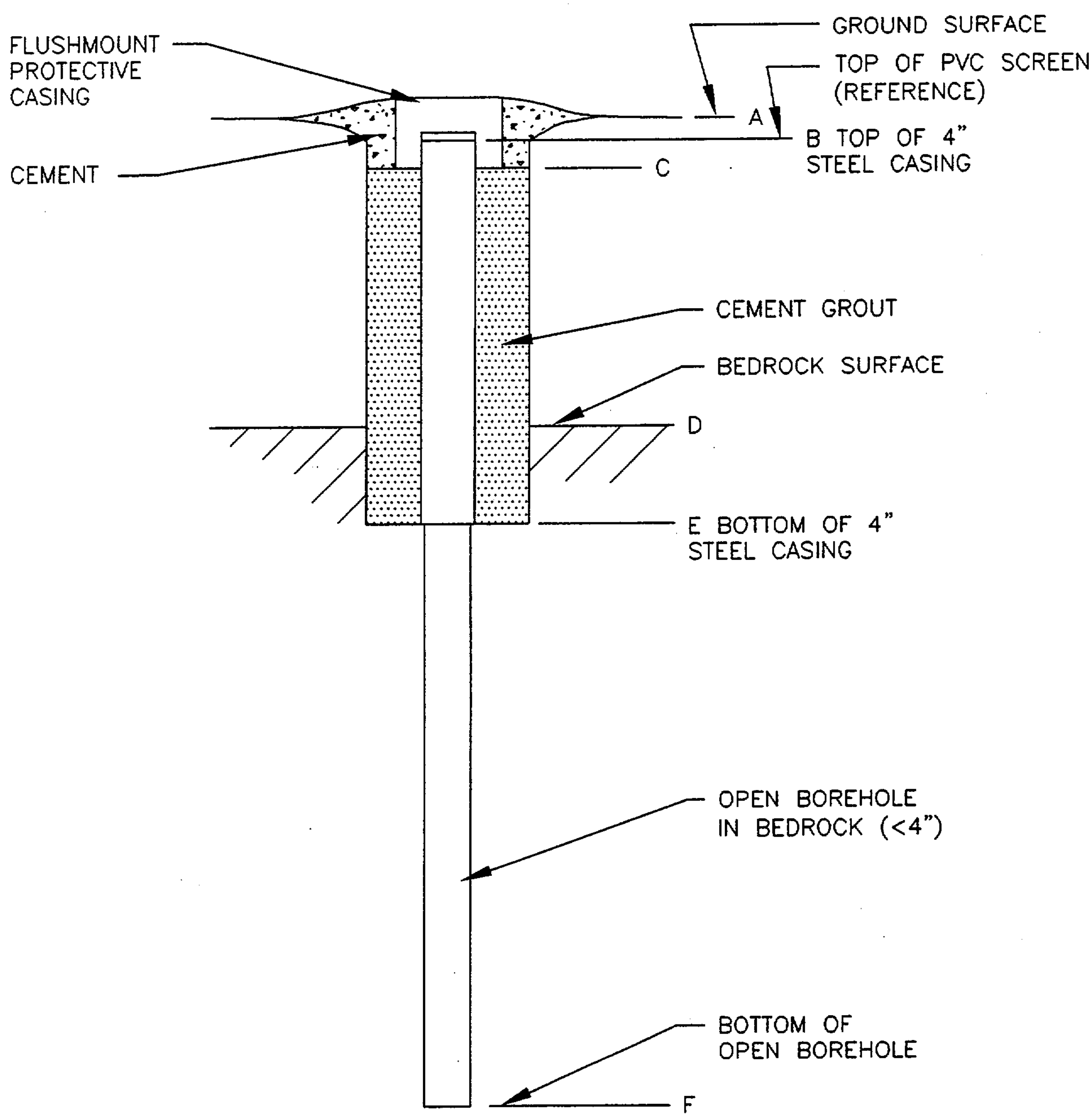
FILE: SITEMAP.PSD 74683-000

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED: FIGURE 2: SITE PLAN

WITHIN THIS PACKAGE...OR, BY SEARCHING USING THE DRAWING NUMBER: FIGURE 2

NOTE: Because of this page's large file size, it may be more convenient to copy the file to a local drive and use the Imaging (Wang) viewer, which can be accessed from the Programs/Accessories menu.



TYPICAL BEDROCK WELL DETAIL

SCALE: NOT TO SCALE

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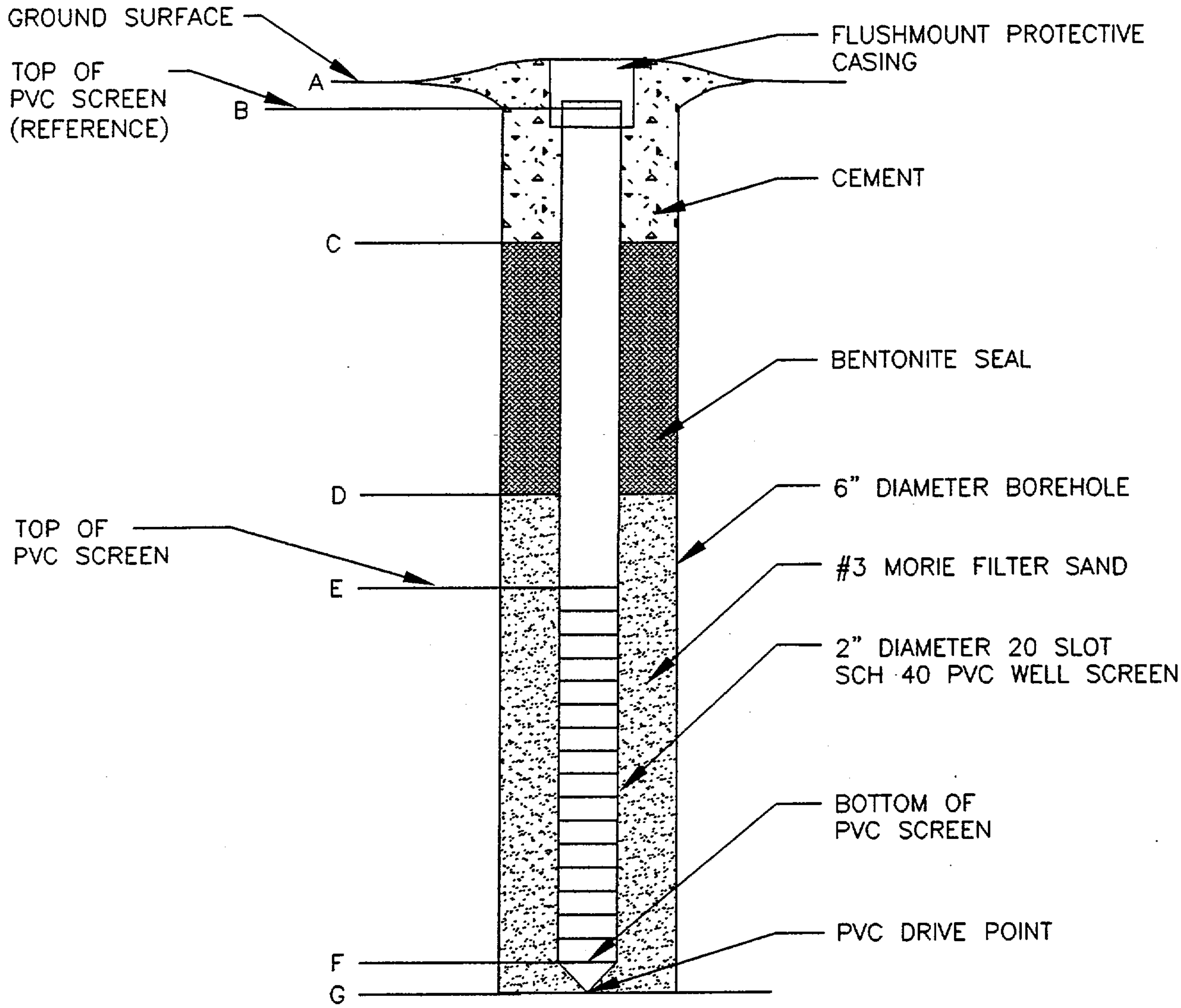
TYPICAL BEDROCK WELL DETAIL

SCALE: AS SHOWN

MARCH 2001

FILE: WELL DETAIL 74683-000

FIGURE 3



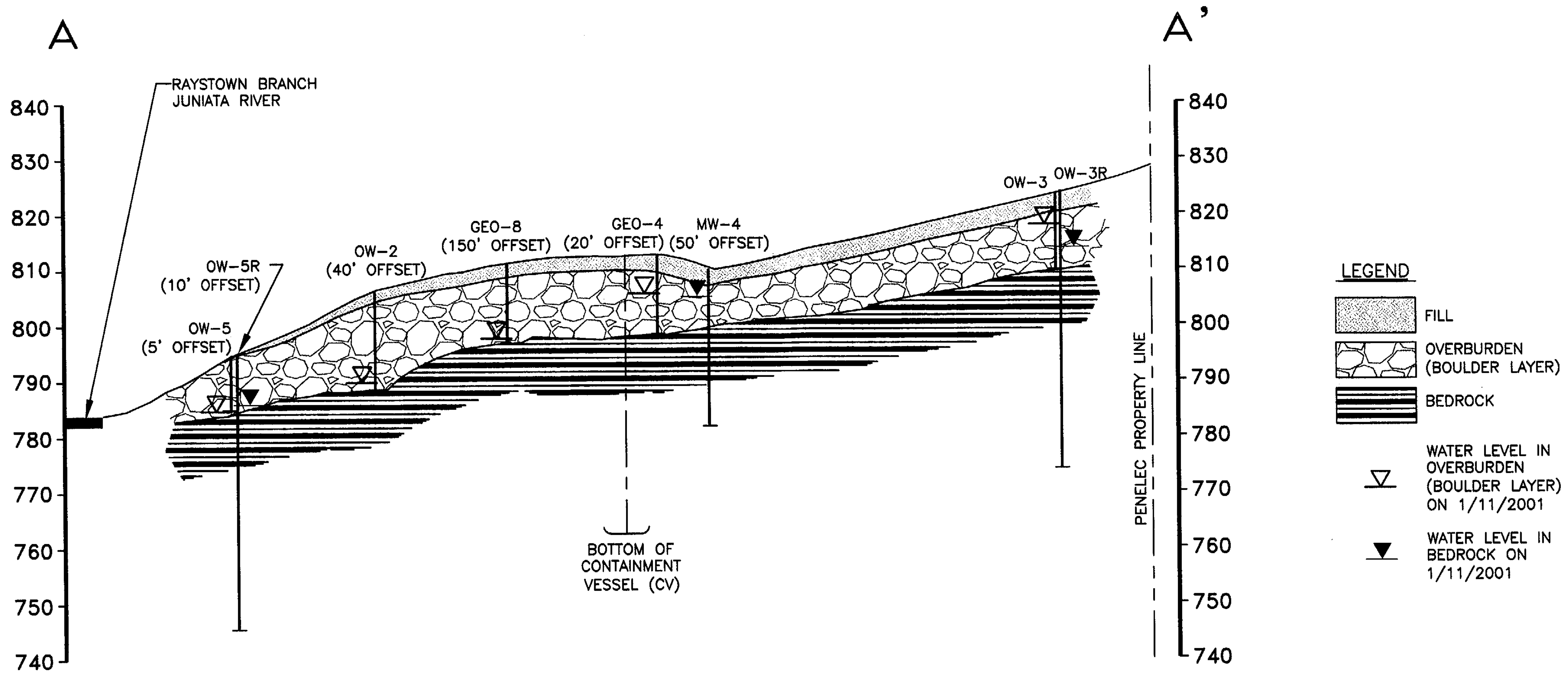
TYPICAL OVERBURDEN WELL DETAIL

SCALE: NOT TO SCALE

UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS 150 MINERAL SPRING DRIVE DOVER, NEW JERSEY 07801 TEL: 973-361-3600 FAX: 973-361-3800	SAXTON NUCLEAR EXPERIMENTAL STATION SAXTON, PENNSYLVANIA **TYPICAL OVERBURDEN WELL DETAIL** SCALE: AS SHOWN MARCH 2001

FILE: WELL DETAIL 74683-000

FIGURE 4



VIEW TO THE NORTH

HORIZONTAL SCALE: 1" = 200'
VERTICAL SCALE: 1" = 20'

NOTE:

THIS SUB-SURFACE CROSS-SECTION REPRESENTS OUR EVALUATION OF THE MOST PROBABLE CONDITIONS BASED UPON INTERPRETATION OF PRESENTLY AVAILABLE DATA. SOME VARIATIONS FROM THESE CONDITONS MUST BE EXPECTED.

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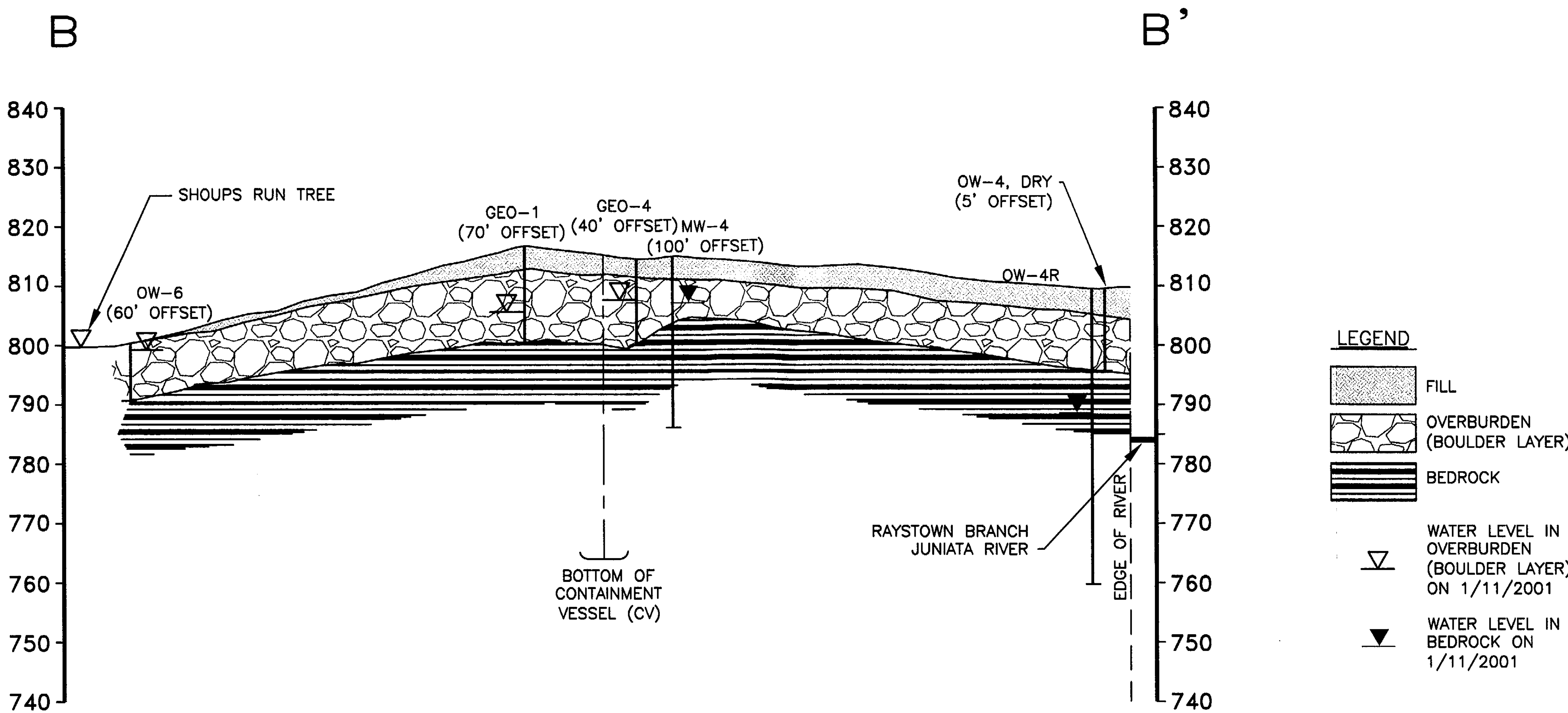
HYDROGEOLOGIC CROSS SECTION A-A'

SCALE: AS SHOWN

MARCH 2001

FILE: SECTIONAA 74683-000

FIGURE 5



VIEW TO THE WEST

HORIZONTAL SCALE: 1" = 200'
VERTICAL SCALE: 1" = 20'

NOTE:

THIS SUB-SURFACE CROSS-SECTION REPRESENTS OUR EVALUATION OF THE MOST PROBABLE CONDITIONS BASED UPON INTERPRETATION OF PRESENTLY AVAILABLE DATA. SOME VARIATIONS FROM THESE CONDITONS MUST BE EXPECTED.

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HYDROGEOLOGIC CROSS SECTION B-B'

SCALE: AS SHOWN

MARCH 2001

FILE: SECTIONBB 74683-000

FIGURE 6

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FIGURE 7: GROUNDWATER ELEVATION CONTOURS (POTENTIOMETRIC SERVICE) IN THE OVERBURDEN (BOULDER LAYER): JANUARY 11, 2001

WITHIN THIS PACKAGE...OR, BY SEARCHING USING THE DRAWING NUMBER: FIGURE 7

NOTE: Because of this page's large file size, it may be more convenient to copy the file to a local drive and use the Imaging (Wang) viewer, which can be accessed from the Programs/Accessories menu.

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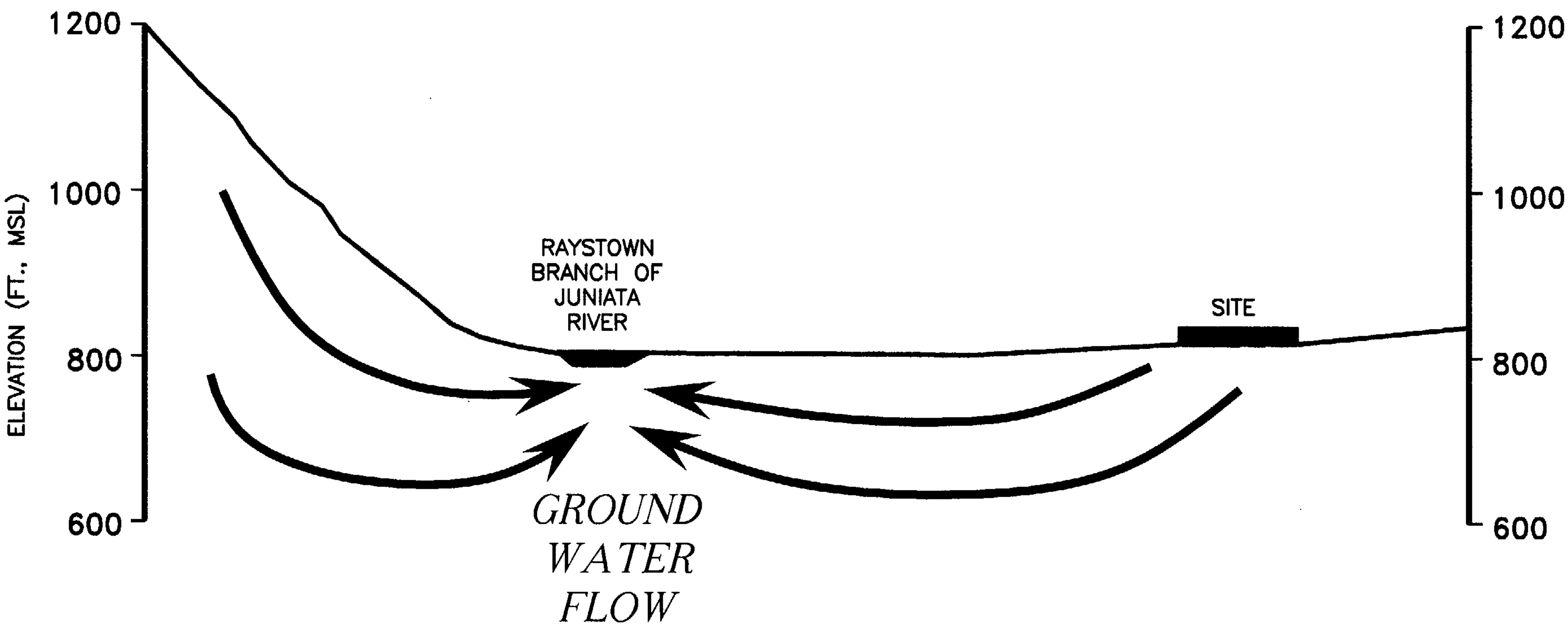
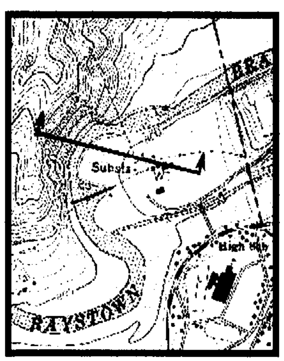
FIGURE 8: GROUNDWATER ELEVATION CONTOURS (POTENTIOMETRIC SERVICE) IN BEDROCK: JANUARY 11, 2001

WITHIN THIS PACKAGE...OR, BY SEARCHING USING THE DRAWING NUMBER: FIGURE 8

NOTE: Because of this page's large file size, it may be more convenient to copy the file to a local drive and use the Imaging (Wang) viewer, which can be accessed from the Programs/Accessories menu.



AREA OF DETAIL



N.T.S.

SCALE:

HORIZONTAL: 1"=300'
VERTICAL: 1"=200'

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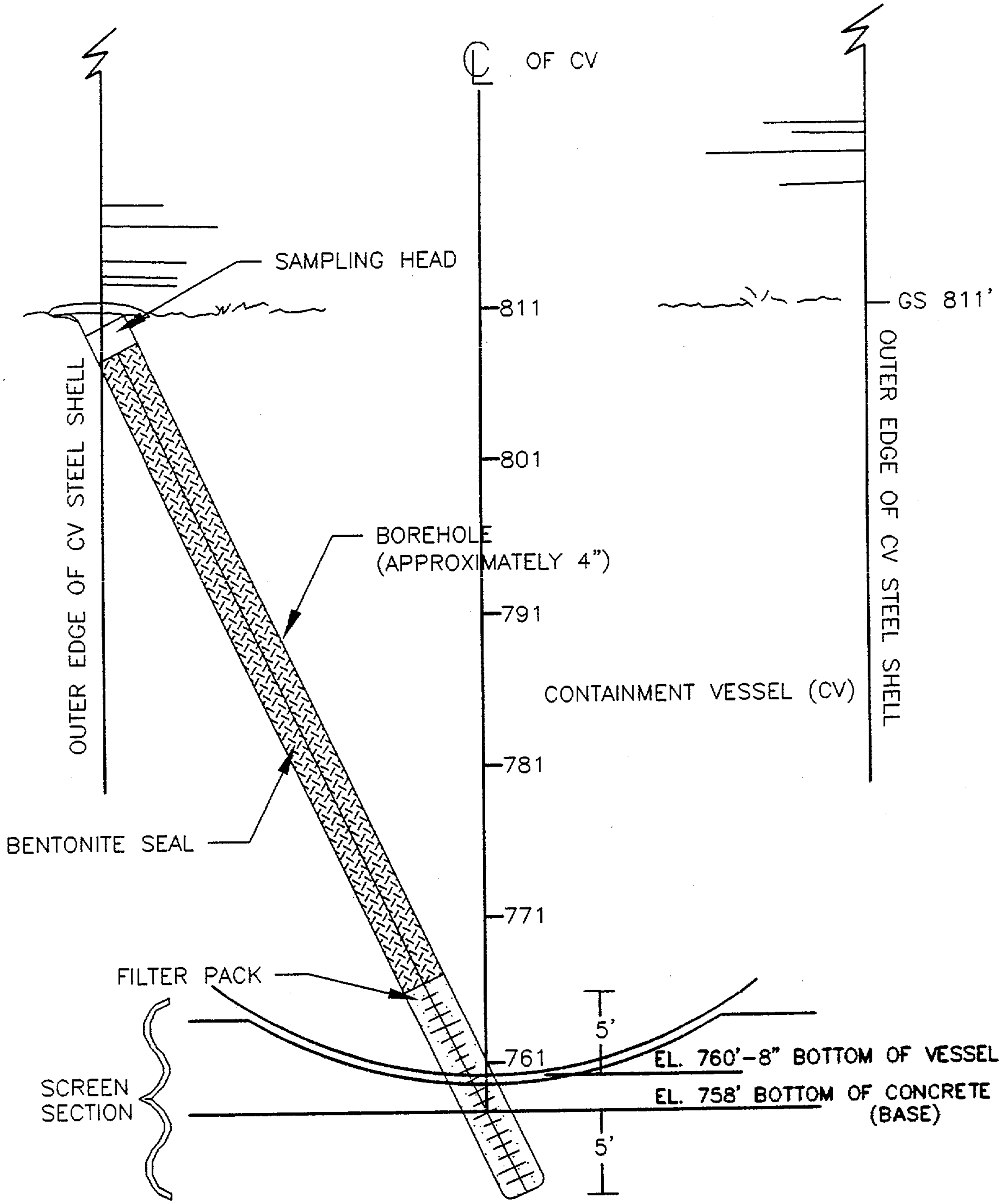
REGIONAL GROUNDWATER FLOW CROSS SECTION

SCALE: AS SHOWN

MARCH 2001

FILE: REGIONAL CROSS-SECTION 74683-000

FIGURE 9



VIEW TO SOUTHEAST

NOTE: SCHEMATIC OF GROUNDWATER MONITORING WELL (GEOMON). REFER TO ACCOMPANYING WRITTEN DESCRIPTION.

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SCHEMATIC OF GROUNDWATER MONITORING WELL ADJACENT TO CV. (SEE NOTE)

SCALE: AS SHOWN

MARCH 2001

FILE: 74683-000

FIGURE 10