ANL/EVS/AGEM/TR-06-01

Plan for Proposed Aquifer Hydraulic Testing and Groundwater Sampling at Everest, Kansas, in January–February 2006

prepared by
Environmental Science Division
Argonne National Laboratory

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by
Applied Geosciences and Environmental Management Section
Environmental Science Division, Argonne National Laboratory

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Notation

CAS	Corrective Action Study
CCC	Commodity Credit Corporation
CPT	cone penetrometer
ft	foot (feet)
gal	gallon(s)
gpm	gallon(s) per minute
hr	hour(s)
in.	inch(es)
KDHE	Kansas Department of Health and Environment
µg/L	microgram(s) per liter
min	minute(s)
PVC	polyvinyl chloride
USDA	U.S. Department of Agriculture
VOC	volatile organic compound

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1 Introduction

On September 8-9, 2005, representatives of the Kansas Department of Health and Environment (KDHE), the Commodity Credit Corporation of the U.S. Department of Agriculture (CCC/USDA), and Argonne National Laboratory met at the KDHE's offices in Topeka to review the status of the CCC/USDA's environmental activities in Kansas. A key CCC/USDA goal for this meeting was to obtain KDHE input on the selection of possible remedial approaches to be examined as part of the Corrective Action Study (CAS) for this site.

As a result of the September meeting, the KDHE recommended several additional activities for the Everest site, to further assist in selecting and evaluating remedial alternatives for the CAS. The requested actions included the following:

- Construction of several additional interpretive cross sections to improve the depiction of the hydrogeologic characteristics affecting groundwater and contaminant movement along the apparent main plume migration pathway to the north-northwest of the former CCC/USDA facility, and in the vicinity of the Nigh property.

- Identification of potential locations for several additional monitoring wells, to better constrain the apparent western and northwestern margins of the existing groundwater plume.

- Development of technical recommendations for a stepwise pumping study of the Everest aquifer unit in the area near and to the north of the Nigh property.

On October 21, 2005, Argonne issued a brief *Cross Section Analysis* (Argonne 2006a) addressing these concerns, on behalf of the CCC/USDA. This report includes the following:

- Preliminary recommendations for the siting of three new monitoring wells, at locations identified by the KDHE. Argonne also suggested, however, that the installation and sampling of these wells be deferred until after completion of the CAS evaluation.

- A proposed strategy for testing of the Everest aquifer unit near the Nigh property, involving initial test pumping of the former Nigh domestic well and subsequent testing of a new well to be installed north-northeast of the Nigh well.

On November 28, 2005, the KDHE provided written comments on the *Cross Section Analysis* and the recommendations outlined above. In response to the KDHE's comments, the CCC/USDA agreed (Roe 2005) to discontinue plans to test the Nigh well. The CCC/USDA agreed to proceed instead with the design and installation of a new pumping well and associated observation points to be used for pump testing of the Everest aquifer along the apparent contaminant migration pathway north-northeast of the Nigh property. In conjunction with this test, the CCC/USDA also proposed groundwater sampling with the cone penetrometer (CPT) at the possible monitoring well locations requested by the KDHE in lieu of installing permanent monitoring points.

The CCC/USDA and Argonne have attempted two previous aquifer pumping tests at locations along the apparent contaminant migration pathway at Everest, with limited success. The critical observations gained from these tests have significant bearing on the design of the currently proposed pumping test and ultimately on the potential for an effective pumping remedy. *Critical observations* are as follows:

- During Phase III of the CCC/USDA's investigations at Everest, Argonne installed monitoring wells MW1 and MW2 at locations specifically selected by the KDHE (Porter). These wells were chosen for pump testing with the KDHE's approval.

- Well MW1 was installed at the site of the maximum carbon tetrachloride concentration identified in a single sample of groundwater at the former CCC/USDA facility (727 μg/L, at CPT sampling location SB11; see

Figure 2.2 of the *Cross Section Analysis*). Subsequent sampling of MW1 after purging has failed to reproduce this result; a maximum carbon tetrachloride concentration of 28 µg/L has been detected at MW1.

- MW2 was installed along the apparent contaminant migration pathway marked by elevated concentrations of carbon tetrachloride (> 100 µg/L) in groundwater sampled at SB41, SB39, SB40, SB02/05, and SB52 (see Figure 2.1 of the *Cross Section Analysis*). At each of these locations, samples for analyses for volatile organic compounds (VOCs) were collected from discrete intervals by using the CPT. Sampling performed by the KDHE in 1997 detected carbon tetrachloride concentrations of 114–121 µg/L at the Nigh well, suggesting that this well also intersects the apparent plume migration pathway. Argonne's sampling of the Nigh well in 2000, after purging of 300 gal, detected a carbon tetrachloride concentration of 54 µg/L.

- Both MW1 and MW2 are screened across the full thickness of the aquifer unit. Argonne's investigations indicate that MW1 penetrates one of the thickest sections of sands and gravels identified within the aquifer unit. The available geologic control near MW2 suggests that the section penetrated by this well is comparable to the lithologies present in the other nearby borings, all of which have shown significant levels of carbon tetrachloride in selected intervals. The CCC/USDA and Argonne therefore expected that pump testing of wells MW1 and MW2 would provide data relevant to the assessment of the Everest aquifer unit characteristics within the areal limits of identified contaminant migration. The results of these tests (Argonne 2006b), however, demonstrated low sustainable pumping rates of < 1.5 gpm from both wells and minimal drawdown generated within the aquifer unit by continuous pumping (maximum < 0.3 ft after 24 hr, at a distance of 141 ft from MW1). These results were qualitatively consistent with slug test data also acquired by Argonne at multiple locations at Everest (Argonne 2006b), which indicate low net hydraulic conductivity of the aquifer unit northwest of the former CCC/USDA facility, and particularly near the Nigh property (< 2 ft/day).

- The CCC/USDA concludes that the combined weight of evidence regarding the Everest aquifer unit consistently supports the interpretation that the

migration of groundwater and carbon tetrachloride contamination occurs primarily via a complex network of thin and heterogeneously distributed, sandy to gravelly till horizons within a generally less permeable till matrix. The CCC/USDA's experience thus far suggests that the potential for use of pumping wells to achieve effective hydraulic control or extraction of the contaminated groundwater in this setting is questionable.

In light of these factors, this document presents a proposed work plan for (1) limited additional groundwater sampling and (2) stepwise testing of the aquifer response to pumping at Everest. The *specific technical objectives* of the proposed investigations at Everest are as follows:

- Directly observe the aquifer's response to pumping and thus generate information to support an evaluation of groundwater extraction as a remedial process for the aquifer along the apparent migration pathway.

- Determine, *in situ*, the quantitative hydraulic characteristics of the aquifer unit along the apparent groundwater and contaminant migration pathway near and to the north of the Nigh property.

- Use the CPT to sample groundwater for VOCs analyses and to install three permanent monitoring points at locations recommended by the KDHE (Argonne 2006a; Section 3 of this document [SB78, SB79, and SB80]), to confirm the lateral extent of the plume along its apparent margins.

The CCC/USDA is undertaking the proposed investigation to address remaining KDHE concerns about the optimal location for a definitive pumping test at Everest. The CCC/USDA and the KDHE have agreed to accept the data from this investigation as a conclusive indication of whether a pump-and-treat system is a viable remedy for evaluation in the CAS. To maximize the CCC/USDA's investment, the investigation is divided into *three segments*, as follows:

- Segment 1:

    - Install water level monitoring devices in existing observation points MW2, MW3, SB60, and the large-diameter Nigh well.

- Collect groundwater samples for VOCs analyses from MW2, MW3, SB60, and the Nigh well.

- Test the suitability of the proposed pumping well location north-northeast of the Nigh well through electronic logging with the CPT and groundwater sampling at one or more intervals to be selected in the field.

- If the location proves to be appropriate, install and develop the pumping well.

- Use the CPT to conduct electronic logging and groundwater sampling at one observation point 15 ft north of the pumping well, and then install a temporary piezometer at this location.

- Use the CPT to conduct electronic logging and groundwater sampling at one observation point 50 ft north of the pumping well and at another observation point 170 ft south of the pumping well. Then install permanent piezometers (SB81 and SB82) at these locations.

- Install three KDHE-recommended permanent monitoring points (SB78, SB79, SB80; Section 3). Collect groundwater samples for VOCs analyses.

• Segment 2 (to be conducted if development of the pumping well is successful):

- Perform a step-drawdown test with the newly installed pumping well.

• Segment 3 (to be conducted if an acceptable production rate can be established):

- Install additional observation points as determined by the CCC/USDA and KDHE project managers on the basis of data acquired in the field, pending access agreements with local landowners.

- Conduct an extended aquifer pumping test.

After each segment, the CCC/USDA and KDHE will have the opportunity to evaluate whether the results merit progression to the next segment of the investigation. The CCC/USDA and KDHE project managers will be kept informed about all results and will participate in all decisions.

2 Proposed Aquifer Testing Program

2.1 Target Location and Hydrogeology

A proposed location for the installation of a new production well to be used for pump testing of the Everest aquifer unit is shown in Figure 2.1. This location was selected on the basis of technical discussions with the KDHE on September 8–9, 2005, and January 5, 2006, and was approved by the KDHE. The suggested location is approximately 225 ft north of existing monitoring well MW2 and 225 ft northeast of the Nigh well. Installation of the pumping well in a relatively wide shoulder area along the east side of Prairie Road is recommended, to minimize disruption of the private farm properties adjacent to the road. Preliminary inquiries regarding access to this location and the private property immediately east of Prairie Road suggest that the installation of the well as proposed will be logistically possible, and that the location would be suitable for the potential long-term siting of a monitoring or extraction well.

The relationship of the proposed well location to the identified distribution of carbon tetrachloride in groundwater is shown in Figure 2.2. The proposed location lies near, and generally downgradient of, previous groundwater sampling points SB40, SB42, and SB48. This area was identified by the KDHE at the September meeting as the potential target area for testing, on the basis of the elevated carbon tetrachloride levels (159–230 μg/L) detected at these points and at downgradient sampling point SB02 (on the Nigh property; Figure 2.2).

The expected hydrogeologic setting at the proposed well location is illustrated in cross sections D–D' and E–E' (locations shown in Figure 2.2), presented as Figures 2.2 and 2.3 of the *Cross Section Analysis* (Argonne 2006a). Information on the character of the geologic section in the targeted pumping area was obtained from CPT electronic logs for nearby borings SB02, SB40, SB42, SB48, and SB66 and from core data for borings SB02, SB05, and SB66. The logs for these borings are in Appendix A.

The available control data suggest that the variably sandy to clayey till sequence that hosts the Everest aquifer unit is approximately 17–20 ft thick at the proposed well location. The sequence consists of a generally sandier upper clay till section overlying deeper clayey tills with some silt and sand. The sequence is expected to be locally heterogeneous, and it may contain multiple thin sandy to gravelly horizons within the till matrix. These coarser-grained intervals might offer preferred pathways for groundwater and contaminant migration; however, their

distribution and continuity cannot be predicted readily from lithologic logs for the adjacent borings.

2.2 Installation of the New Production Well

An estimated construction diagram for the proposed pumping well at Everest is shown in Figure 2.3. The final construction details of the well will be adjusted, if necessary, based on conditions identified in the field at the time of installation. The CCC/USDA and Argonne will consult with the KDHE on any changes that may be required in the proposed design of the well, and will obtain approval from the KDHE before the construction is completed.

It is expected that the top of the Everest aquifer unit will be encountered at a depth of approximately 60 ft below ground level at the proposed drilling site, and that the unit will be about 20 ft thick. Argonne will use the CPT to acquire electronic logs to verify the predicted geologic section at the proposed well location prior to the initiation of drilling (see proposed implementation schedule, Section 4). Groundwater sampling for VOCs analyses will also be performed from one or more selected intervals (to be determined in the field), to verify that the proposed location lies within the contaminant migration pathway. The log and VOCs analysis data will be provided to the CCC/USDA and the KDHE for review and approval of the well location prior to drilling.

If the targeted well location proves unacceptable to the CCC/USDA or the KDHE, one additional, nearby location (to be selected by the CCC/USDA and the KDHE, subject to property access) will also be investigated by using the CPT, and the data will be submitted to the agencies for review.

Upon approval of a well location by the CCC/USDA and the KDHE, drilling will be performed by the auger method. A 12-in.-diameter boring is proposed, in which a 6-in.-diameter, schedule-80 polyvinyl chloride (PVC) casing and stainless steel wire-wrapped screen will be installed. The full thickness of the aquifer unit will be screened, to ensure that groundwater flow from all permeable intervals penetrated by the well is intercepted. Use of screen with a 0.010-in. slot size is anticipated to maximize well production while limiting silt and clay infiltration into the casing. The 12-in. boring will be advanced approximately 5 ft beyond the base of the aquifer unit to permit the installation of a PVC sump below the screen.

A small-diameter (estimated 1-in.) PVC casing and fully penetrating screen will also be installed in the gravel pack surrounding the main well casing and screen to facilitate the measurement of water levels at the well while it is pumping. A flush-mount surface completion is proposed, subject to the approval of the KDHE, to permit future use of this boring as a monitoring or possible extraction well.

2.3 Well Development and Determination of Pumping Capacity

2.3.1 Development of the New Pumping Well

The production well will be developed through multiple cycles of mechanical surging across the screened interval, bailing, and pumping with a submersible pump. The cycles will continue until the groundwater discharged from the well is clear and visibly free of sediment, and the measured pH, conductivity, and turbidity of the produced water have stabilized. Development of the well will then continue until no significant improvement in the rate of flow from the well can be achieved, over an additional 4-hr period of surging, bailing, and pumping.

Per the request of the KDHE, a minimum of five casing volumes of water will be purged from the well during development if possible. If the initial production from the well is obviously insufficient to achieve this volume in one day, the CCC/USDA and Argonne will consult with the KDHE regarding possible alternate development strategies.

A groundwater sample for VOCs analyses will be collected from the production well upon completion of the well development activities, to permit comparison to the results obtained for samples previously collected at this location (Section 2.2) with the CPT.

The CPT will be used to install a 1-in.-diameter temporary piezometer, with a fully penetrating screen, at a distance of 15 ft from the pumping well. This piezometer will be used to monitor for possible direct evidence of drawdown occurring in the aquifer as a result of the step-drawdown testing. Groundwater sample(s) for VOCs analyses will be collected in one or more selected intervals, to be determined in the field, during installation of this piezometer.

The CPT will further be used to install permanent 1-in.-diameter piezometers (sand point wells) at locations SB81 and SB82 (Figure 2.1). These permanent piezometers will be constructed with screens that fully penetrate the aquifer unit.

Development of the pumping well (plus the installation of permanent piezometers SB78-SB82 [described immediately above and in Section 3]) marks the end of the first segment of the work described in this document. At this point the CCC/USDA and KDHE project managers will decide whether to continue with the other segments of the investigation.

2.3.2 Estimation of Sustainable Pumping Rates through Step-Drawdown Testing

The CCC/USDA and Argonne's experience at Everest (Argonne 2006b) suggests that the potential sustainable flow rate and radius of influence of the proposed new well cannot be reliably predicted, but they may be low. An initial step-drawdown test of the well is therefore recommended to estimate the well's long-term production capacity. The step-drawdown test will follow development of the well, when the water level in the well has recovered to the ambient static level. This testing will be in keeping with procedures in the *Master Work Plan* (Argonne 2002), as well as with the KDHE's standard operating procedure for step-drawdown tests (KDHE 2000a).

Pumping at an initial low rate (to be determined in the field) will be performed for an estimated 60 min, or until the observed water level stabilizes at this rate. At intervals, the water level in the well, immediately outside the casing, and in the temporary piezometer 15 ft from the pumping well will be measured manually. The water levels will also be recorded continuously by using pressure transducers connected to automatic data loggers. The pumping rate will then be increased progressively in a series of at least two additional similar time steps, and the resulting changes in water levels will be recorded. The exact number of pumping steps to be performed, the length of the steps, and the incremental increase in flow rate to be used for each step will be determined in the field on the basis of the observed responses of the well. At the end of the last time step, the pumping will be terminated, and the recovery of water levels will be monitored to estimate the approximate rate of groundwater recharge to the well bore. The results of the step-drawdown test will be interpreted through use of standard procedures (Kruseman and deRidder 1991) to estimate the specific capacity of the well and hence a suitable flow rate for possible extended pumping.

If the water level in the new well does not stabilize at the initial pumping rate but instead appears to fall continuously, pumping will be maintained at this rate, and monitoring will continue until the water level reaches the minimum depth acceptable for operation of the pump. The pump will then be stopped, and the recovery of water levels will be monitored to estimate the approximate rate of groundwater recharge to the well bore.

Completion of the step-drawdown test marks the end of the second segment of the work described in this document. At this point the CCC/USDA and KDHE project managers will decide whether to continue with the third segment of the investigation.

Before constant-rate testing of the new well, Argonne will request CCC/USDA and KDHE approval of a target flow rate to be used for continuous pumping of the well over a recommended 24-hr period.

2.4 Conditions of the Extended Aquifer Pumping Test

2.4.1 Distribution of Water Level Observation Points

Proposed water level observation points to be used for the monitoring of a 24-hr, constant-rate pumping test of the new well are shown in Figure 2.1. The locations illustrated are recommended to (1) permit determination of the radius of influence of the test well pumping across the apparent path of contaminant migration identified by groundwater sampling and analysis and (2) generate data useful for the quantitative estimation of the bulk hydraulic properties of the aquifer unit in the targeted pumping area, with minimal disruption of the adjacent private farm properties along Prairie Road.

Figure 2.1 shows the temporary observation point 15 ft from the pumping well (Section 2.3.1), plus an additional proposed temporary observation point 75 ft from the pumping well. Both are to be installed with the CPT as a 1-in.-diameter temporary piezometers. Water level measurements at these temporary observation points will augment measurements at existing permanent monitoring points SB60, MW2, MW3, and the Nigh well, as well as at new permanent observation points SB78, SB79, SB80, SB81, and SB82. A CPT electronic log will be obtained to verify the depth and thickness of the aquifer unit at each proposed temporary observation location. Each temporary piezometer will be constructed with a screen that fully

penetrates the aquifer unit. Both temporary piezometers will be fitted with water-tight surface completions and will be abandoned in accord with KDHE requirements at the end of the well testing program.

The locations of the temporary piezometers shown in Figure 2.1 are tentatively recommended to document the response of the aquifer to pumping, over distances that may be practical for the future consideration of groundwater extraction as a potential remedial alternative for this site. The installation of the temporary piezometer 75 ft from the pumping well will be part of the third segment of the investigation, which will be undertaken only with the approval of the CCC/USDA and the KDHE. The exact location for that temporary piezometer might depend on access limitations. The location will be determined in consultation with the CCC/USDA and KDHE project managers on the basis of data to be acquired in the field, after the second segment of the investigation ends.

2.4.2 Performance and Monitoring of the Aquifer Test

Pumping of the new production well will occur for a maximum period of 24 hr, at a constant target flow rate to be determined as described in Section 2.3. The aquifer testing will be performed in keeping with the procedures documented for this activity in the *Master Work Plan* (Argonne 2002), as well as with the KDHE's standard operating procedure for constant-rate tests (KDHE 2000b).

Changes in water levels at the pumping well and the observation points will be measured by using transducers connected to individual or multichannel automatic data loggers. Drawdown will be monitored at each location during the pumping, and water level recoveries will be recorded for an equivalent period after pumping ends.

Barometric pressure readings will be recorded on-site during the water level measurements, to facilitate corrections to the water level data for atmospheric pressure variations that might occur during the pumping and recovery periods. Barometric efficiencies required for these corrections will be calculated on the basis of atmospheric pressure data and water level measurements recorded automatically (every 2 hr) in the pumping well and at each observation point for approximately one week following the testing period. Water levels will be monitored continuously, both before and after the testing period, at monitoring wells MW2 and MW3 and

at all available nearby piezometers, as well as after the testing period at the production well. This will permit both immediate monitoring of the aquifer test and the observation of any extended rising or falling trends in water levels across the test area that might affect the drawdown and recovery results.

A sample of groundwater for VOCs analyses will be collected from the production well at the end of the pumping period to facilitate comparison to the results obtained for samples previously collected at this location (Sections 2.2 and 2.3.1).

2.4.3 Disposal of Produced Water

Groundwater withdrawn during the field work will be retained temporarily in one or more storage tanks. The stored water will be treated and disposed of (tentatively at the Atchison, Kansas, waste treatment plant, pending the approval of the KDHE). Drill cuttings will be placed in drums and held for disposal as approved by the KDHE.

2.5 Interpretation of the Pumping Test Results

The Everest aquifer unit is expected to respond as a confined, or possibly a leaky-confined, aquifer (Argonne 2006b). Under the proposed test conditions, boundary effects associated with the lateral physical limits of the aquifer unit are not expected to be detected within the radius of pumping influence. The proposed production well and all of the observation points (except the Nigh well) will effectively fully penetrate the aquifer unit, so that corrections to the observed drawdown responses for partial penetration will not be required.

Under these conditions, Argonne anticipates that the drawdown data from the constant-rate test will be interpreted using standard analysis methods that may include those developed by Theis (1935), Jacob (1950), and Cooper and Jacob (1946) for confined aquifers, and Hantush (1956, 1960) and Hantush and Jacob (1954, 1955) for leaky-confined conditions. The final selection of the appropriate interpretation technique(s) must be based on the observed characteristics of the drawdown profiles recorded, and the analysis of pre-test groundwater level trends. Recovery data will be analyzed using the method of Theis (1935) if the water level responses indicate that such an analysis is appropriate for this aquifer. The theoretical

assumptions and equations governing these solution techniques are fully documented in the respective references cited.

For each of these methodologies, the interpretive fitting of theoretical curves or straight-lines to the test data required for the analyses will be performed manually, by using the forms of these solutions implemented in the commercial well-test software analysis packages Aqtesolv for Windows and AquiferTest for Windows, singly or in combination, as appropriate.

2.6 Summary of Groundwater Sampling for Analyses for Volatile Organic Compounds

Groundwater samples will be collected for VOCs analyses during the proposed work, as follows:

- A single sample at each of three existing locations: MW2, MW3, SB60, and the large-diameter Nigh well.
- Sample(s) in one or more selected intervals, collected during the CPT investigation of the proposed pumping well location.
- Samples in a vertical profile at intervals of 5–8 ft across the entire aquifer unit, collected during the installation of permanent piezometers SB78, SB79, SB80, SB81, and SB82.
- Sample(s) in one or more selected intervals, collected during the installation of temporary observation points at locations to be determined during the field event.
- A sample from the production well, collected upon completion of development.
- A sample from the production well, collected at the end of the pumping period.

All samples will be collected and analyzed by using the detailed procedures and methods documented in the *Master Work Plan* (Argonne 2002).

FIGURE 2.1 Proposed locations for a new pumping well and water level observation points (to be installed with the cone penetrometer) for proposed aquifer testing along the plume migration pathway northeast of the Nigh property at Everest.

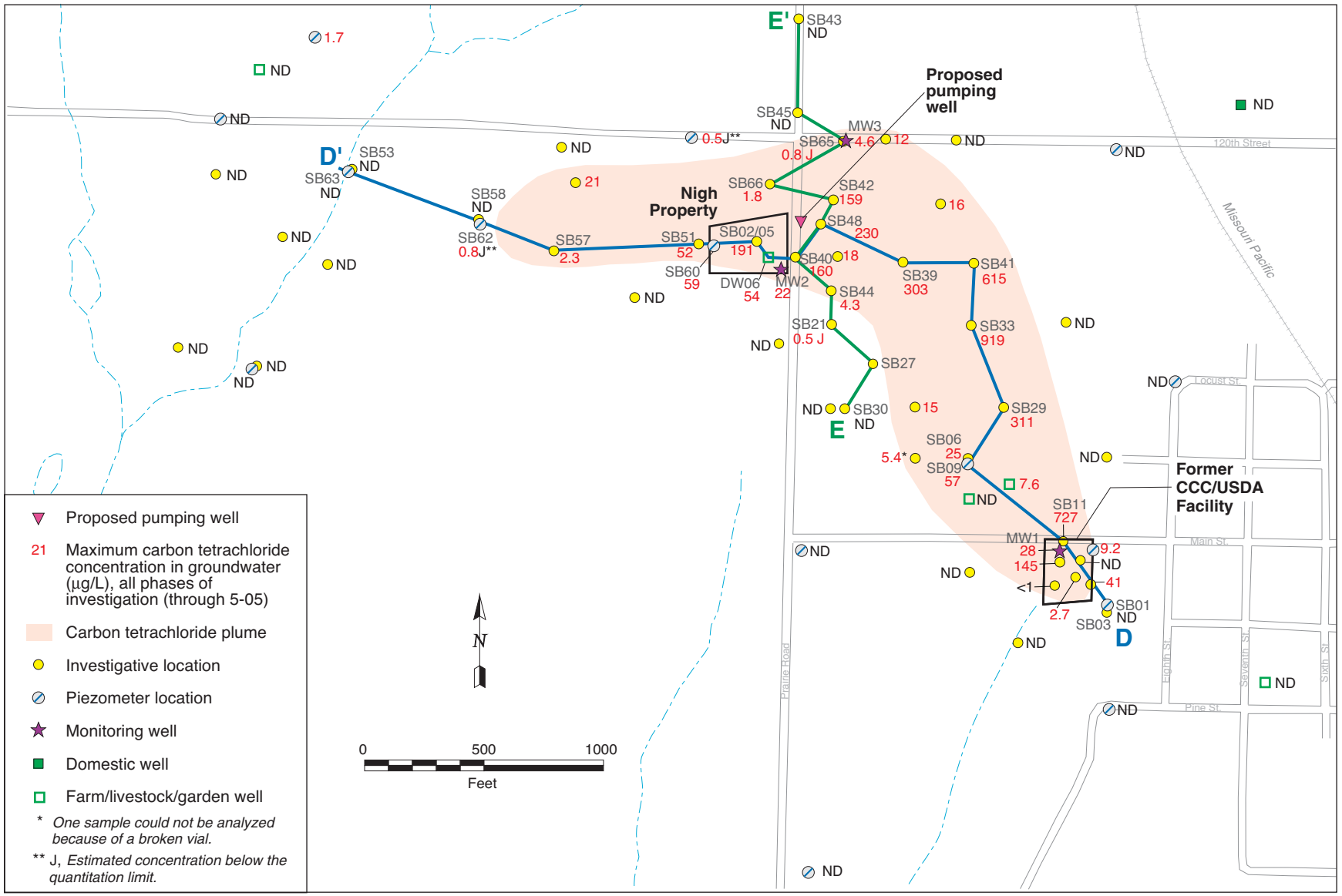

FIGURE 2.2 Proposed location of the new pumping well, shown in relation to the locations of interpretive hydrogeologic cross sections D–D' and E–E' at Everest (cross sections reported previously [Argonne 2006a]).

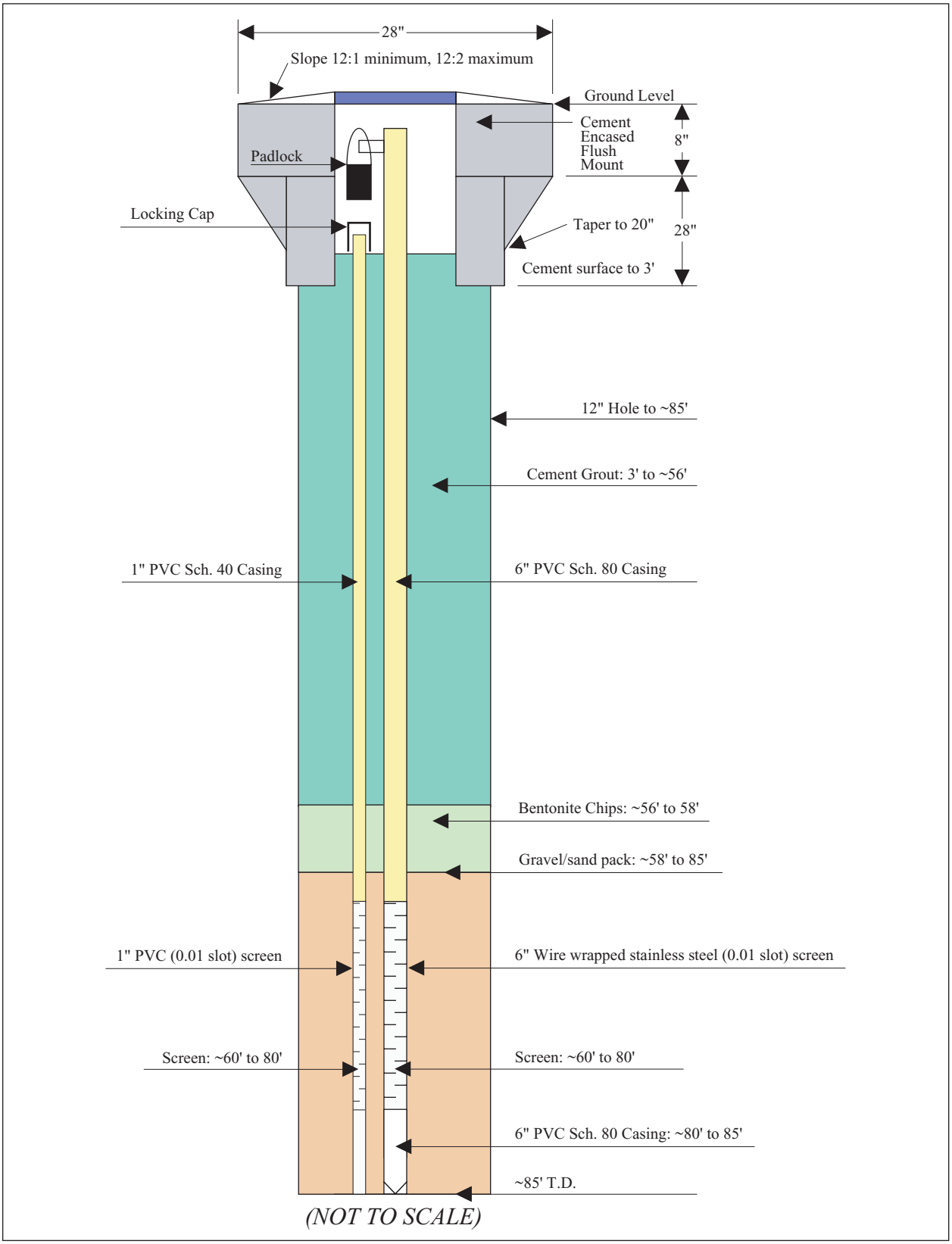

FIGURE 2.3 Proposed construction features for the new pumping well at Everest.

3 Proposed Groundwater Sampling and Piezometer Installation Requested by the KDHE at Locations near the Apparent Margins of the Plume

The CPT will be used to conduct groundwater sampling for VOCs analyses at the locations identified as SB78, SB79, and SB80 in Figure 2.1. Sampling at these locations was requested by the KDHE to investigate the extent of the carbon tetrachloride plume near its apparent margins.

Prior to sampling, a CPT electronic log will be acquired to be used in the identification of the aquifer unit at each location. The groundwater sampling will be conducted to provide a vertical profile of the contaminant distribution, through the collection of samples over successive depth intervals of 5–8 ft across the entire aquifer unit. All samples will be collected and analyzed by using the detailed procedures and methods documented in the *Master Work Plan* (Argonne 2002).

At the request of the KDHE, permanent 1-in.-diameter piezometers (sand point wells) will be installed at these locations by using the CPT. The piezometers will be constructed with screens that fully penetrate the aquifer unit.

4 Proposed Schedule and Reporting

The work described here is scheduled to begin during the last week in January 2006. The results will be documented in a letter report.

5 Health and Safety Information for Everest, Kansas

The general health and safety plan for the Everest site is in Section 3 of the *Master Work Plan* (Argonne 2002). The general plan addresses all anticipated safety issues for the investigation. Specific emergency information for use at the site is given below.

Everest has emergency 911 service. All emergency calls, including police, fire, and ambulance calls, will be directed for an appropriate response from this number. No emergency medical facilities exist at Everest. The nearest hospital with emergency medical facilities is in Horton, Kansas. Driving directions to the hospital and the map showing the route are in Figure 5.1. Additional emergency information is in Table 5.1. The Argonne project personnel responsible for activities at the site are listed in Table 5.2.

Directions from Everest to Horton Community Hospital in Horton, Kansas (240 West 18th Street)

- From Everest, proceed about 0.7 mi south on Kansas Highway 20 to its junction with U.S. Highway 73.
- Turn right onto Kansas Highway 20-U.S. Highway 73, and proceed west. After approximately 5.4 mi, the road becomes U.S. Highways 73 and 159.
- Continue on U.S. Highways 73 and 159 by turning right. Proceed north 0.3 mi to West 18th Street in Horton, Kansas.
- Turn left onto West 18th Street. Proceed one block west to the Horton Community Hospital at 240 West 18th Street. The emergency room is on the northwest corner of the building.

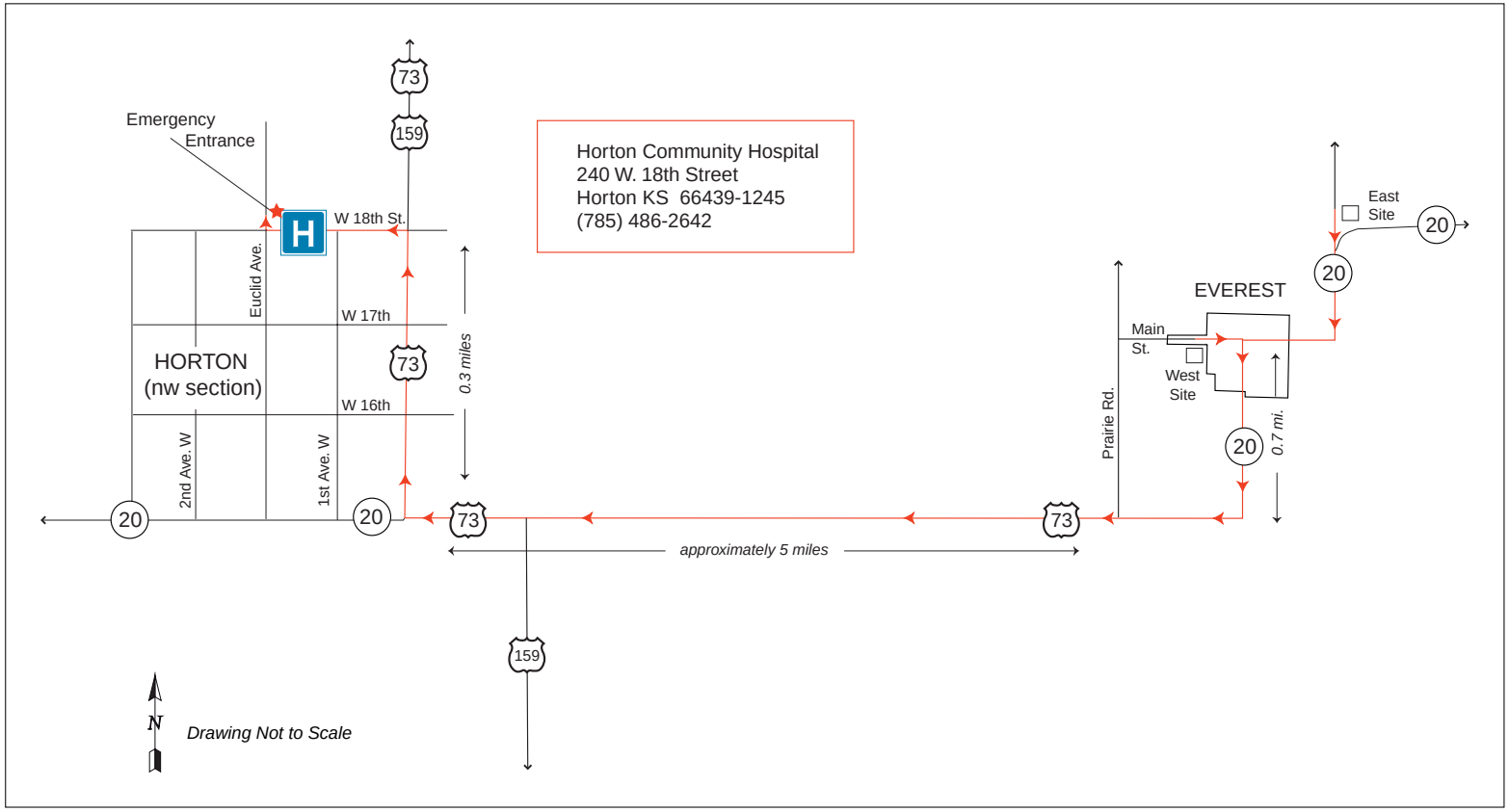

FIGURE 5.1 The emergency route from Everest to Horton Community Hospital, Horton, Kansas.

TABLE 5.1 Emergency information for the Everest, Kansas, investigation.[a]

Resource	Telephone	Name
All emergencies	911	-
Medical care	785-486-2642	Horton Community Hospital[b] 240 West 18th Street Horton, Kansas
Fire protection (nonemergency)	785-486-2345	Horton Fire Department
Police (nonemergency)	785-486-2694 785-742-7125	Horton Police Department Brown County Sheriff
Industrial hygiene	630-252-3310	Argonne — Industrial Hygiene
Safety	630-252-2885 630-252-3294	EVS Division[c] Field Safety Coordinator (Monte Brandner) EVS Division[c] Environment, Safety, and Health Coordinator (Dave Peterson)
Security	630-252-5737	Argonne — Operations Security General Information
Poison control	800-222-1222 or 913-588-6633	Mid-America Poison Control Center, University of Kansas Medical Center
Utilities survey	800-344-7233 800-DIG-SAFE	Kansas One Call, Wichita, Kansas

[a] Post this table in the field operations base.

[b] The route from Everest to the Horton Community Hospital is shown in Figure 5.1.

[c] Environmental Science Division at Argonne.

TABLE 5.2 Information for the investigation team at Everest, Kansas.

Position	Name	Office Phone	Cell Phone
Program manager	L. LaFreniere	630-252-7969	630-319-9635
Project manager	R. Sedivy	402-465-9021	402-429-5144
	E. Yan	630-252-6322	630-319-9240
Community relations coordinator	J. Hansen	630-252-4938 202-488-2453	
Health and safety coordinators	B. Nashold	630-252-7698	630-319-6820
	J. Taylor	630-252-5237	630-319-5543
Team members	J. Alvarado	630-252-5267	
	C. Dennis	630-252-5999	
	L. LaFreniere	630-252-7969	
	B. Nashold	630-252-7698	
	C. Rose	630-252-3499	
	C. Rosignolo	630-252-8589	
	R. Sedivy	630-252-1897	
	J. Taylor	630-252-5237	
	E. Yan	630-252-6322	
Subcontractors	Boart Longyear, Indianapoois, Indiana	317-784-1838	
	TCW Construction, Inc., Lincoln, Nebraska	402-475-5030	

6 References

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Appendix A:

Lithologic and Electronic Logs

SB68 (near MW2)
MW3
SB02
SB05
SB40
SB42
SB48
SB66

ARGONNE NATIONAL LABORATORY

Boring ID: SB68

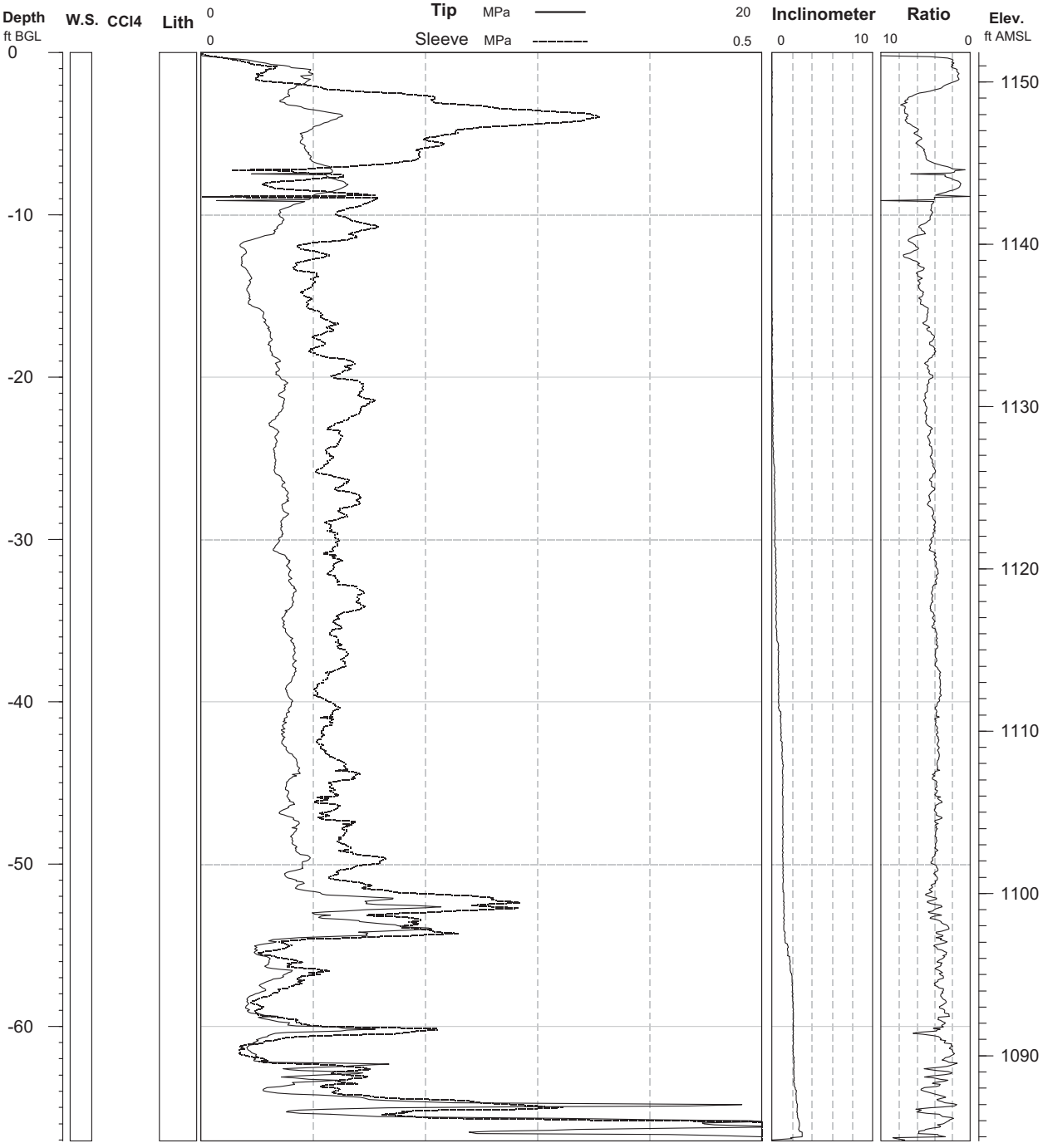
Project: Everest Targeted Investigation

Elevation: 1151.81 ft.
Depth: 67.06 ft.

Log Date: 11/14/2003
Plot Date: 11/14/2003

Rig: CPT-Crawler
Driller: Travis
Company: Argonne

Geologist: Lorraine LaFreniere



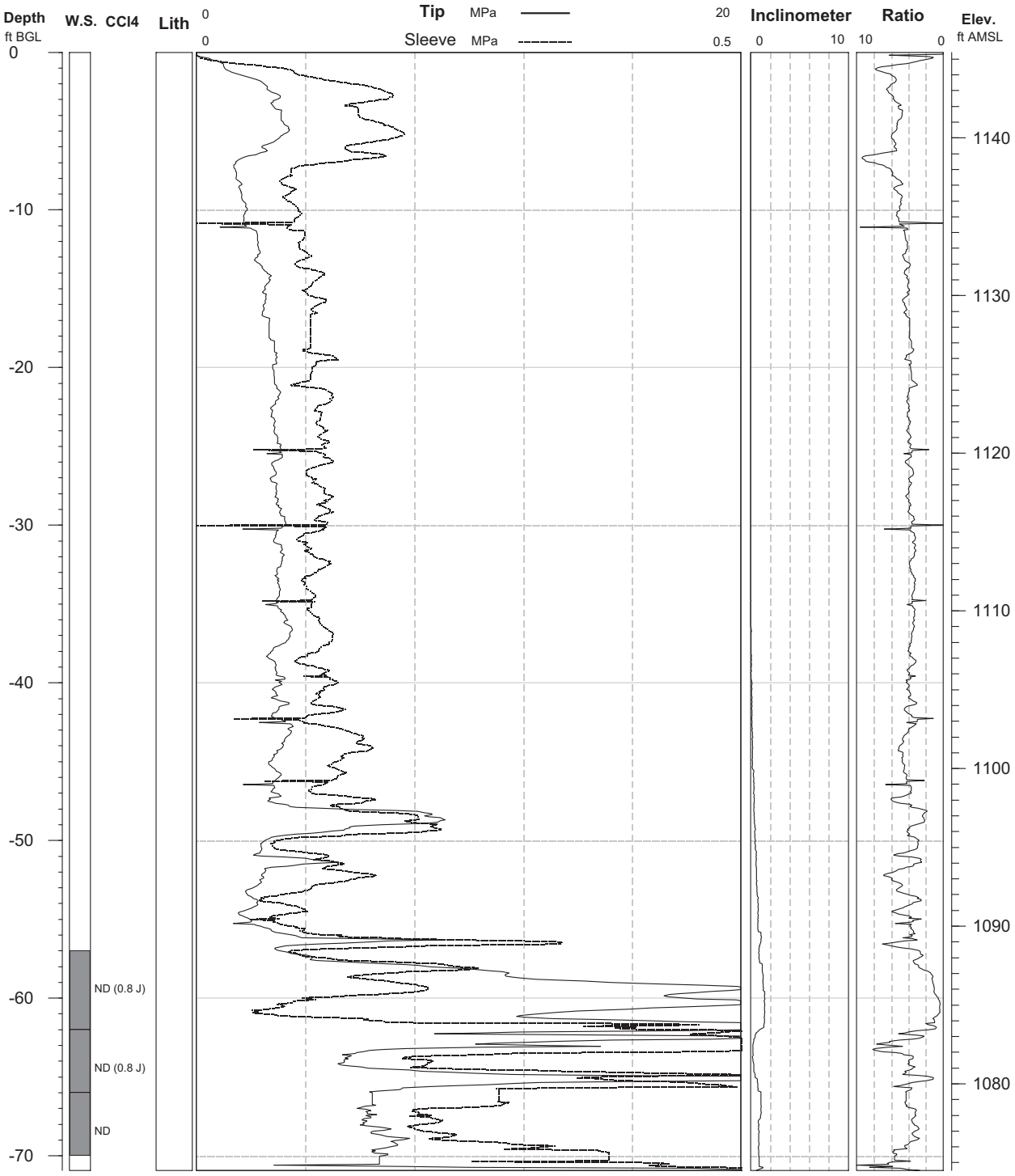
ARGONNE NATIONAL LABORATORY

Boring ID: SB65/MW3

Project: Everest Targeted Investigation

Elevation: 1145.44 ft
Depth: 70.93 ft
Log Date: 11/10/2003
Plot Date: 11/11/2003
Rig: CPT-Crawler
Driller: Travis
Company: Argonne

Geologist: Lorraine LaFreniere



Carbon tetrachloride in water sample = µg/L

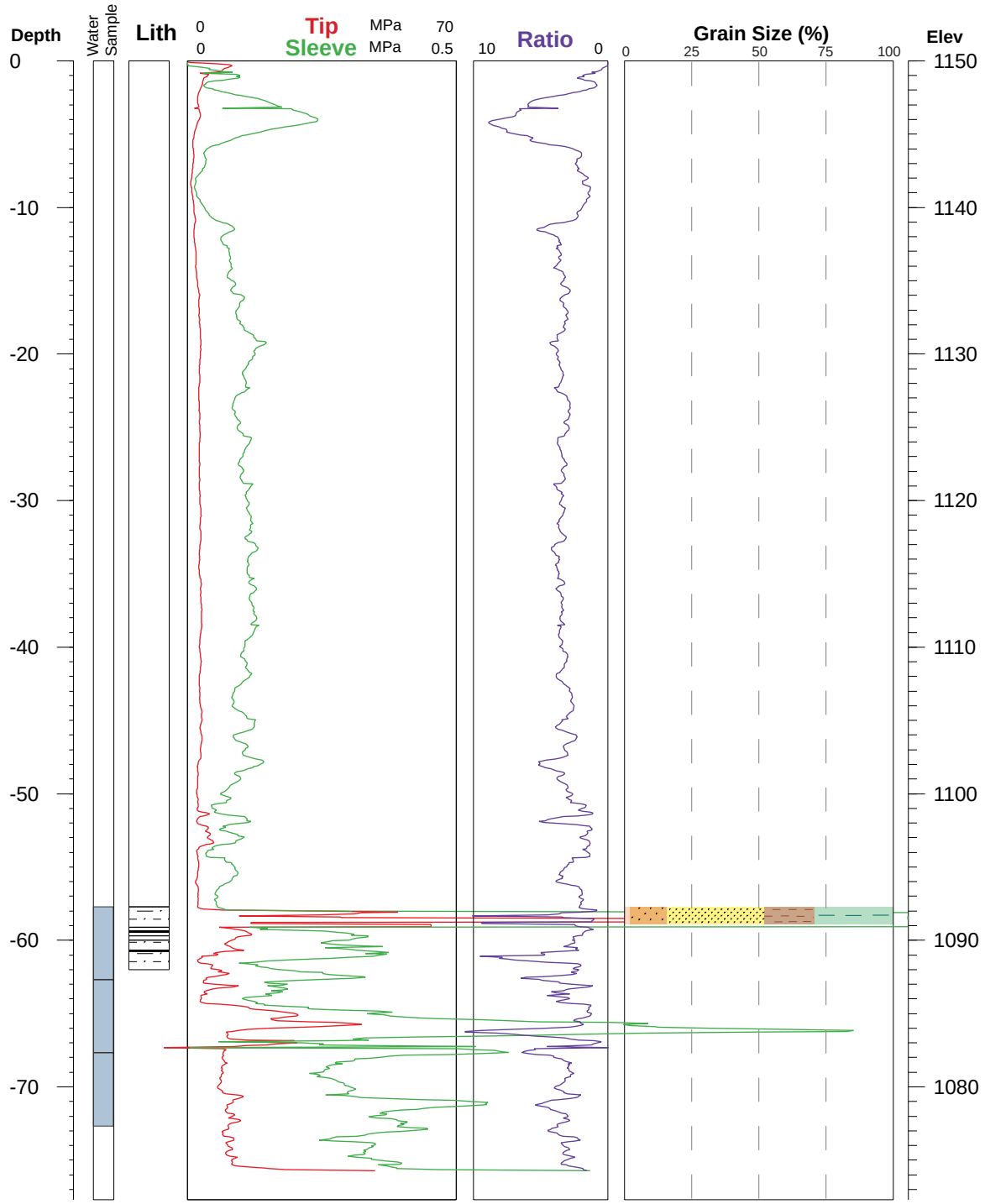
Argonne National Laboratory

Project: Everest, KS
Boring ID: SB02

Elevation: 1150.3 ft
Depth: 77.7 ft
Geologist: L. LaFreniere
Location: Nigh (Gale) home

Log Date: 5/16/00
Plot Date: 8/8/00

Rig: CPT
Driller: K. Spokas
Company: Argonne



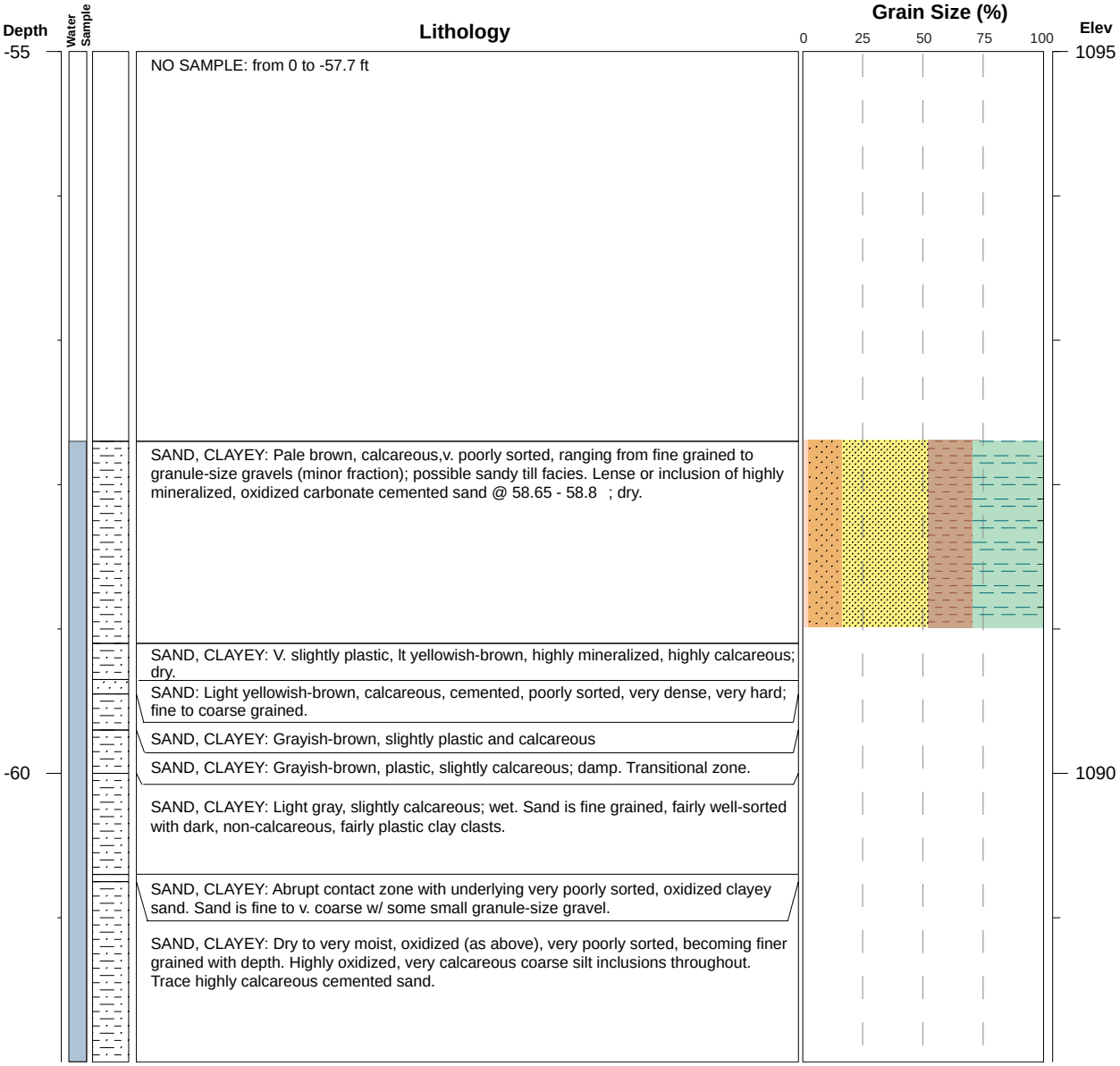
Argonne National Laboratory

Project: Everest, KS **Boring ID: SB02** **Detailed Litholoogy from -55' to -62'**

Elevation: 1150.3 ft
Depth: 77.7 ft
Geologist: L. LaFreniere
Location: Nigh (Gale) home
W. of Prairie Rd, S of 120th

Log Date: 5/16/00
Plot Date: 8/8/00

Rig: CPT
Driller: K. Spokas
Company: Argonne



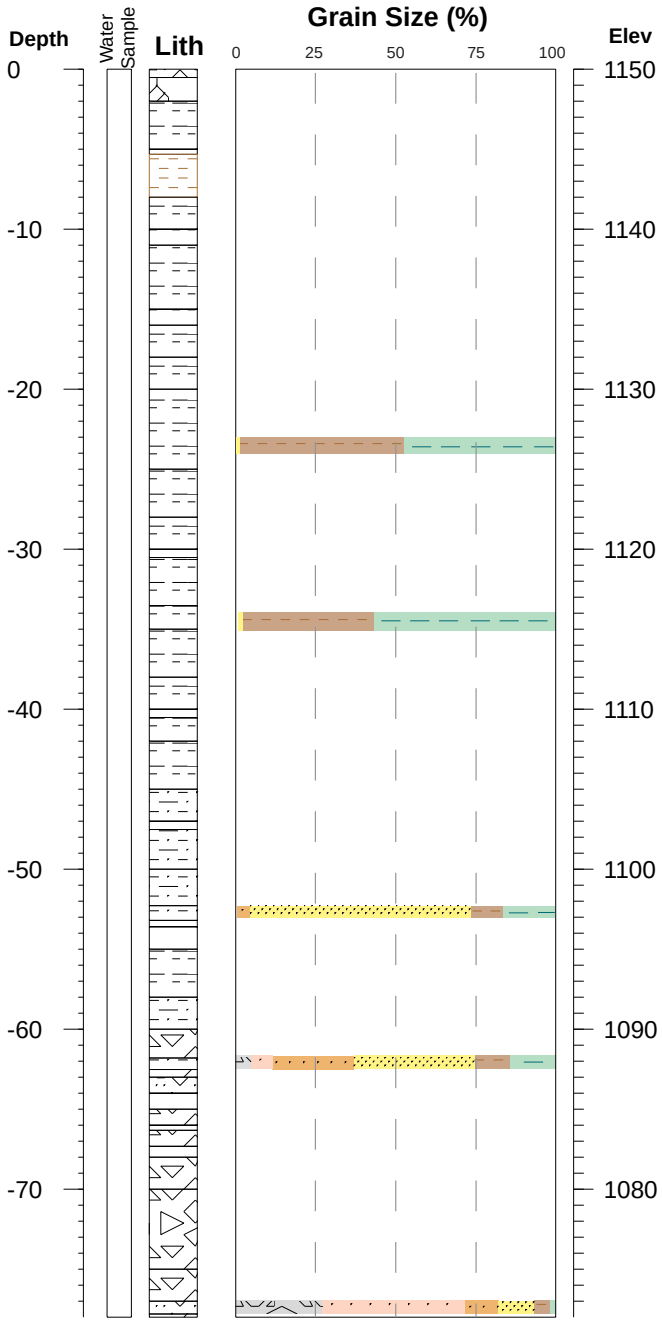
Argonne National Laboratory

Project: Everest, KS **Boring ID: SB05**

Elevation: 1150.3 ft
Depth: 78 ft
Geologist: Yan/ Meyer
Location: Nigh home (yard) W of Prairie Rd, S of 120th

Log Date: 5/19/00
Plot Date: 6/30/00

Rig: Auger
Driller: L.Porter
Company: Argonne



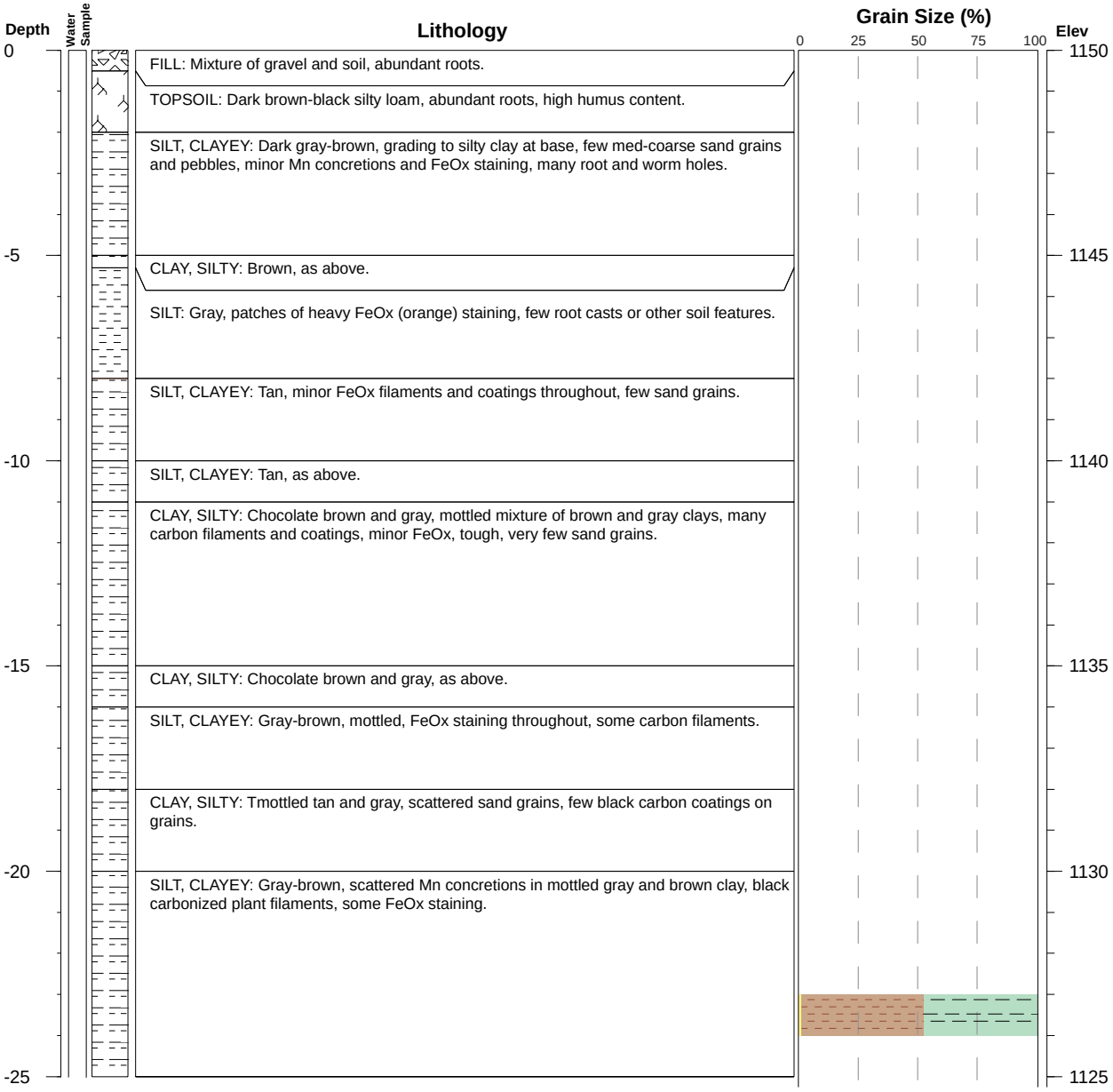
Argonne National Laboratory

Project: Everest, KS **Boring ID: SB05** **Detailed Litholoogy from 0 to -78'**

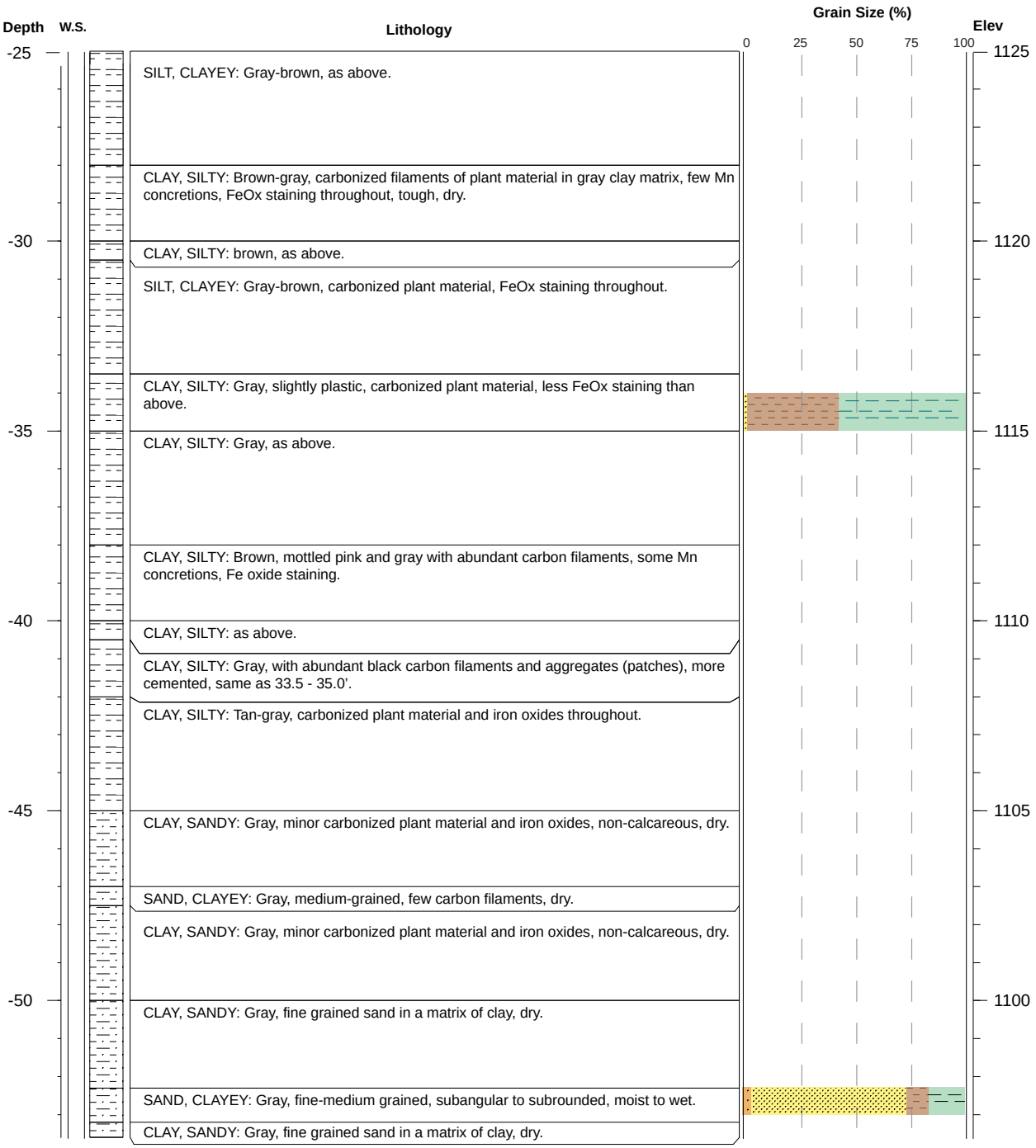
Elevation: 1150.3 ft
Depth: 78 ft
Geologist: Yan/ Meyer
Location: Nigh home (yard), W of Prairie, S of 120th

Log Date: 5/19/00
Plot Date: 6/30/00

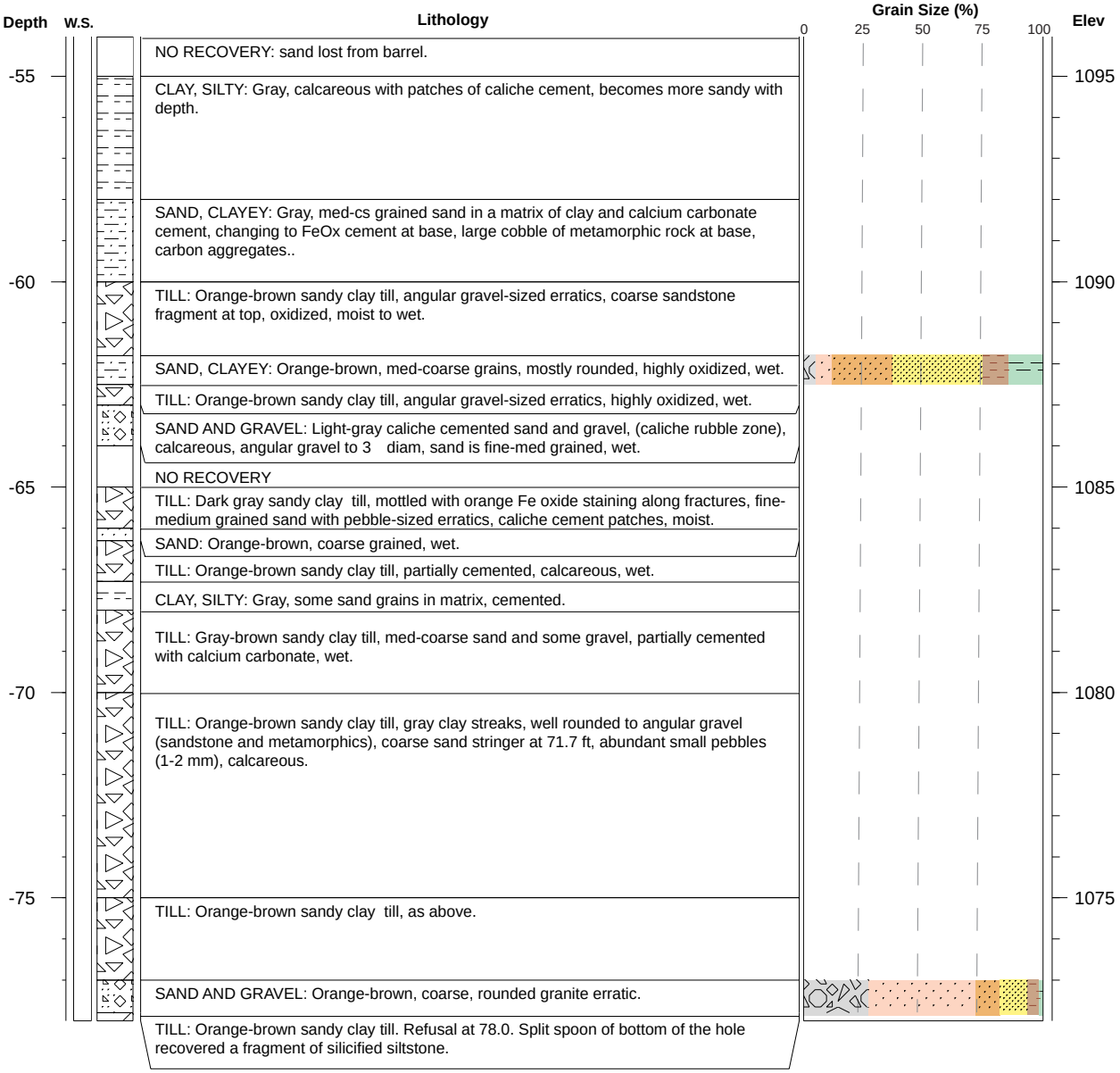
Rig: Auger
Driller: L.Porter
Company: Argonne



SB05 p.2


Depth
W.S.
Lithology
Grain Size (%)
0
25
50
75
100
Elev
-25
-30
-35
-40
-45
-50
1125
1120
1115
1110
1105
1100
SILT, CLAYEY: Gray-brown, as above.
CLAY, SILTY: Brown-gray, carbonized filaments of plant material in gray clay matrix, few Mn concretions, FeOx staining throughout, tough, dry.
CLAY, SILTY: brown, as above.
SILT, CLAYEY: Gray-brown, carbonized plant material, FeOx staining throughout.
CLAY, SILTY: Gray, slightly plastic, carbonized plant material, less FeOx staining than above.
CLAY, SILTY: Gray, as above.
CLAY, SILTY: Brown, mottled pink and gray with abundant carbon filaments, some Mn concretions, Fe oxide staining.
CLAY, SILTY: as above.
CLAY, SILTY: Gray, with abundant black carbon filaments and aggregates (patches), more cemented, same as 33.5 - 35.0'.
CLAY, SILTY: Tan-gray, carbonized plant material and iron oxides throughout.
CLAY, SANDY: Gray, minor carbonized plant material and iron oxides, non-calcareous, dry.
SAND, CLAYEY: Gray, medium-grained, few carbon filaments, dry.
CLAY, SANDY: Gray, minor carbonized plant material and iron oxides, non-calcareous, dry.
CLAY, SANDY: Gray, fine grained sand in a matrix of clay, dry.
SAND, CLAYEY: Gray, fine-medium grained, subangular to subrounded, moist to wet.
CLAY, SANDY: Gray, fine grained sand in a matrix of clay, dry.

SB05 p.3

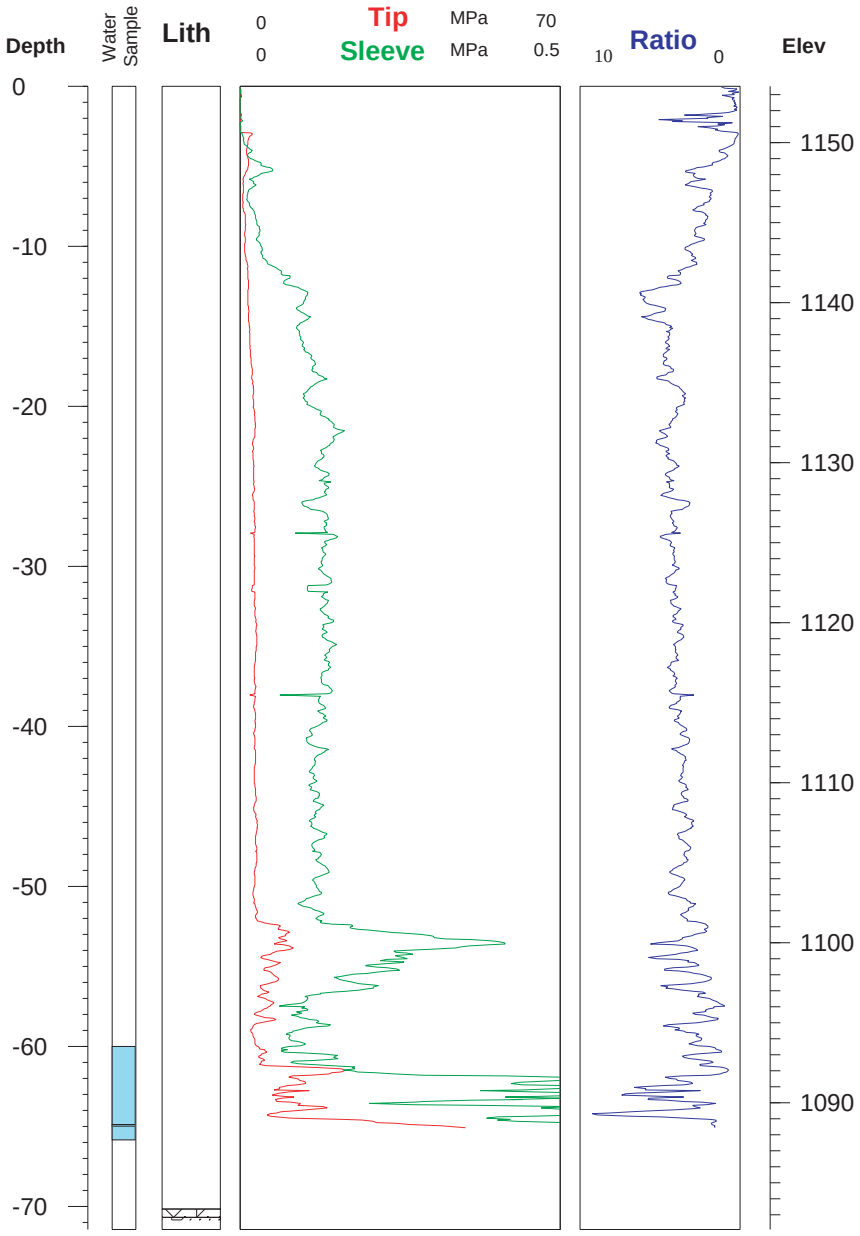

Depth
W.S.
Lithology
Grain Size (%)
0
25
50
75
100
Elev
-55
-60
-65
-70
-75
1095
1090
1085
1080
1075
NO RECOVERY: sand lost from barrel.
CLAY, SILTY: Gray, calcareous with patches of caliche cement, becomes more sandy with depth.
SAND, CLAYEY: Gray, med-cs grained sand in a matrix of clay and calcium carbonate cement, changing to FeOx cement at base, large cobble of metamorphic rock at base, carbon aggregates..
TILL: Orange-brown sandy clay till, angular gravel-sized erratics, coarse sandstone fragment at top, oxidized, moist to wet.
SAND, CLAYEY: Orange-brown, med-coarse grains, mostly rounded, highly oxidized, wet.
TILL: Orange-brown sandy clay till, angular gravel-sized erratics, highly oxidized, wet.
SAND AND GRAVEL: Light-gray caliche cemented sand and gravel, (caliche rubble zone), calcareous, angular gravel to 3 diam, sand is fine-med grained, wet.
NO RECOVERY
TILL: Dark gray sandy clay till, mottled with orange Fe oxide staining along fractures, fine-medium grained sand with pebble-sized erratics, caliche cement patches, moist.
SAND: Orange-brown, coarse grained, wet.
TILL: Orange-brown sandy clay till, partially cemented, calcareous, wet.
CLAY, SILTY: Gray, some sand grains in matrix, cemented.
TILL: Gray-brown sandy clay till, med-coarse sand and some gravel, partially cemented with calcium carbonate, wet.
TILL: Orange-brown sandy clay till, gray clay streaks, well rounded to angular gravel (sandstone and metamorphics), coarse sand stringer at 71.7 ft, abundant small pebbles (1-2 mm), calcareous.
TILL: Orange-brown sandy clay till, as above.
SAND AND GRAVEL: Orange-brown, coarse, rounded granite erratic.
TILL: Orange-brown sandy clay till. Refusal at 78.0. Split spoon of bottom of the hole recovered a fragment of silicified siltstone.

Argonne National Laboratory

Project: Everest, KS
Elevation: 1153.54 ft
Depth: 71.46 ft
Geologist: LaFreniere/Barrett
Location: 2034484.05, 500904.76

Boring ID: SB40
Log Date: 4/02/01
Plot Date: 4/27/01

Rig: CPT
Driller: K. Spokas
Company: Argonne



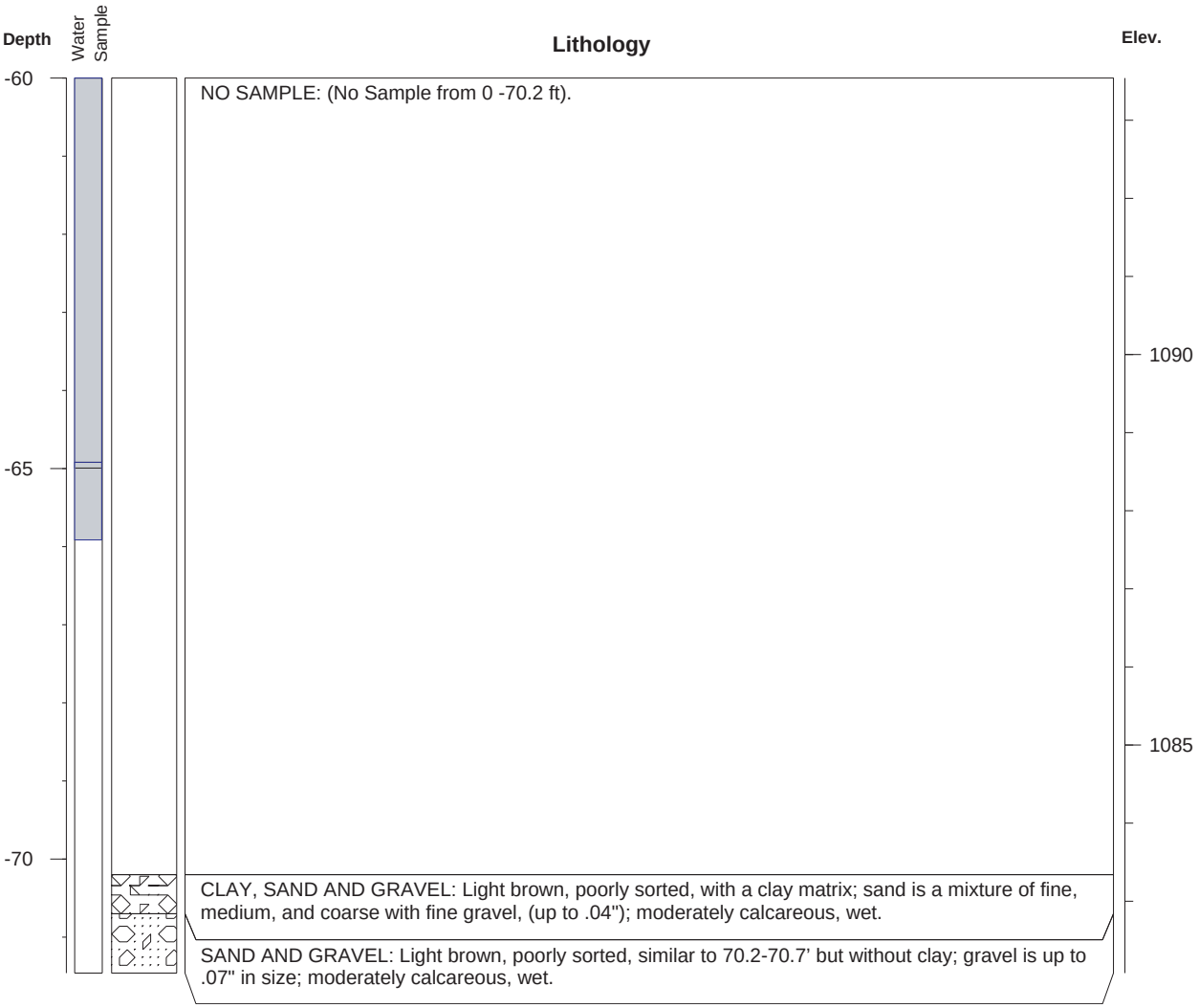
Argonne National Laboratory

Project: Everest, KS **Boring ID:** SB40

Elevation: 1153.54 ft
Depth: 71.46 ft
Geologist: LaFreniere/Barrett
Location: 2034484.05, 500904.76

Log Date: 4/02/01
Plot Date: 4/27/01

Rig: CPT
Driller: K. Spokas
Company: Argonne

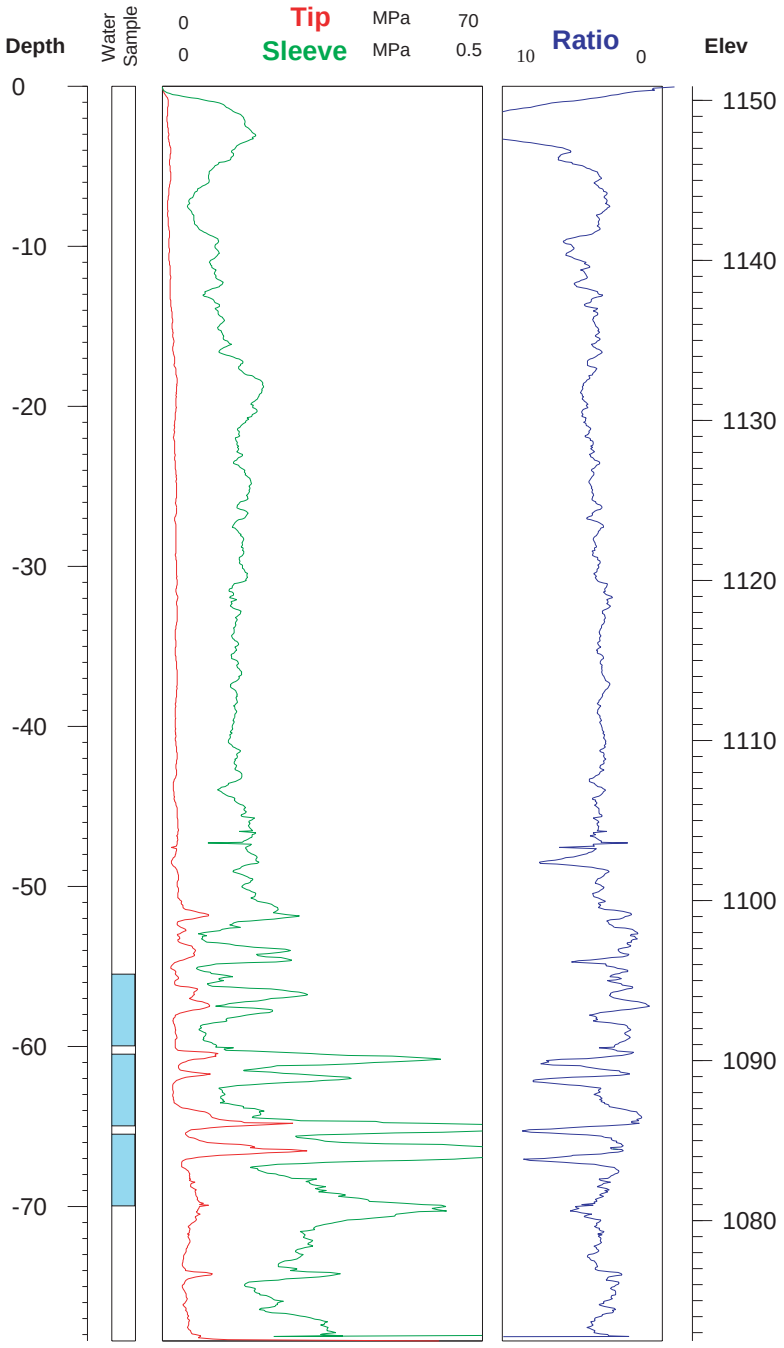


Argonne National Laboratory

Project: Everest, KS
Elevation: 1150.91 ft
Depth: 78.41 ft
Geologist: N/A
Location: 2034632.57, 501156.6

Boring ID: SB42
Log Date:
Plot Date: 9/17/01

Rig: CPT
Driller: K. Spokas
Company: Argonne



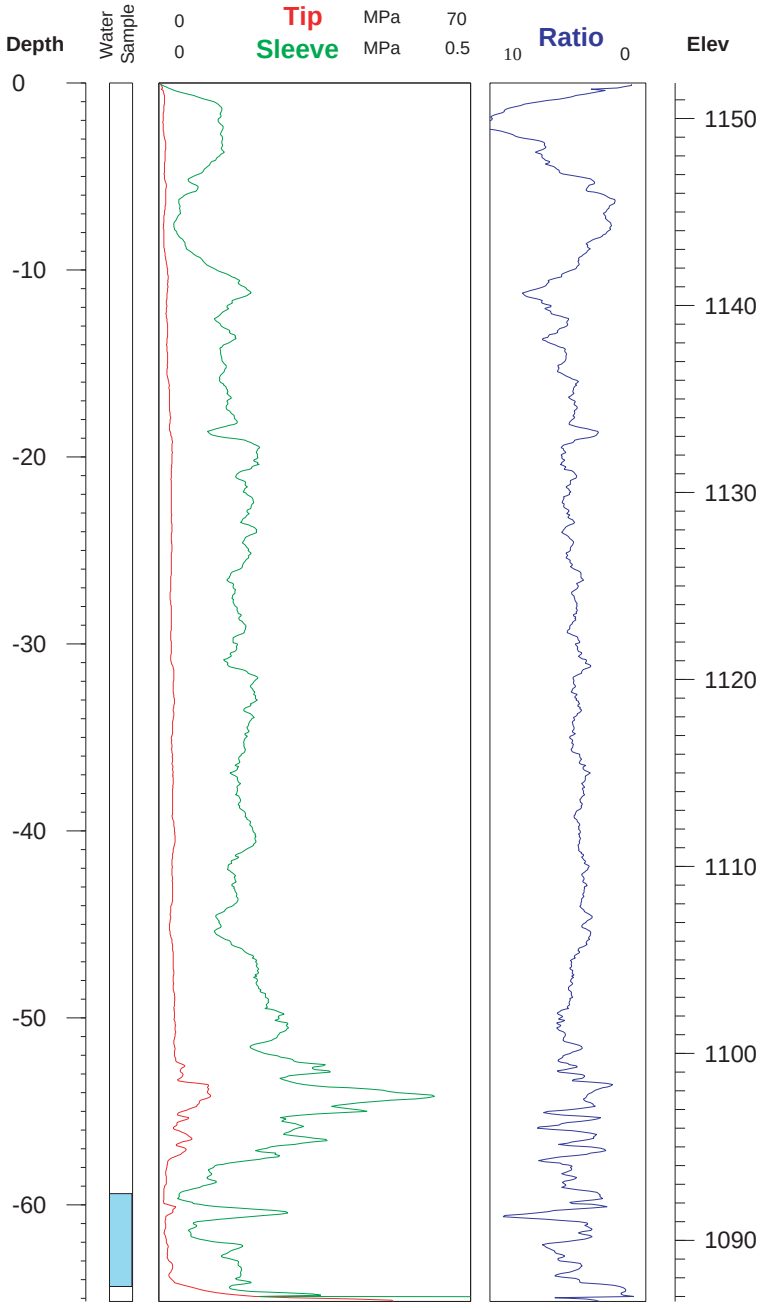
Argonne National Laboratory

Project: Everest, KS
Elevation: 1151.88 ft
Depth: 65.16 ft
Geologist: N/A
Location: 2034584.56, 501050.57

Boring ID: SB48

Log Date: N/A
Plot Date: 9/17/01

Rig: CPT
Driller: K. Spokas
Company: Argonne



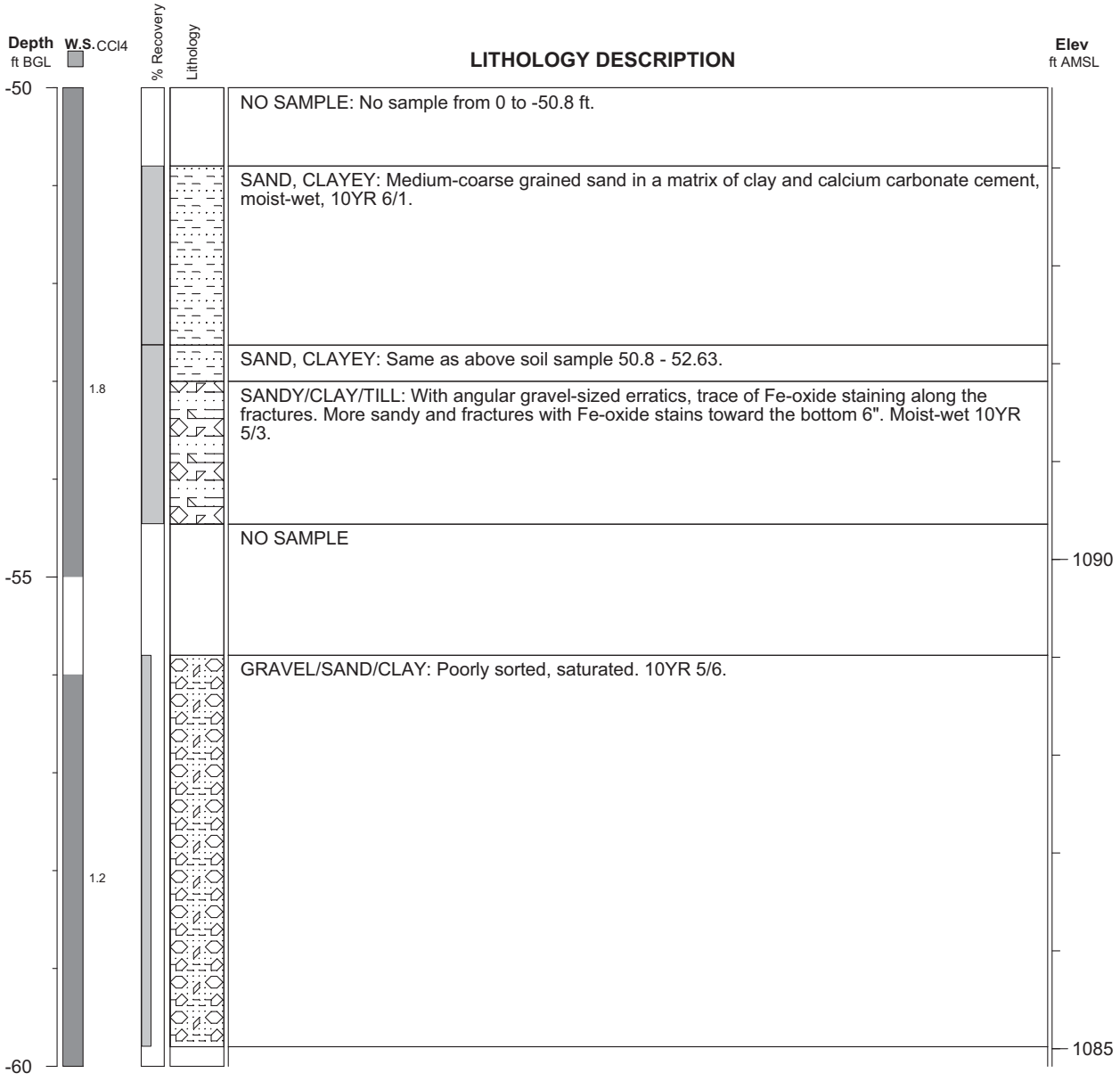
Argonne National Laboratory

Well ID: SB66

Project: Everest Targeted Investigation **Elevation:** 1144.82 ft **Log Date:** 11/11/2003 **Rig:** CPT-Crawler

Geologist: Lorraine LaFreniere **Depth:** 60.17 ft **Driller:** Travis **Drilling Company:** Argonne

Cored Interval: -50.8 to -59.8



Carbon tetrachloride in water sample = µg/L

ARGONNE NATIONAL LABORATORY

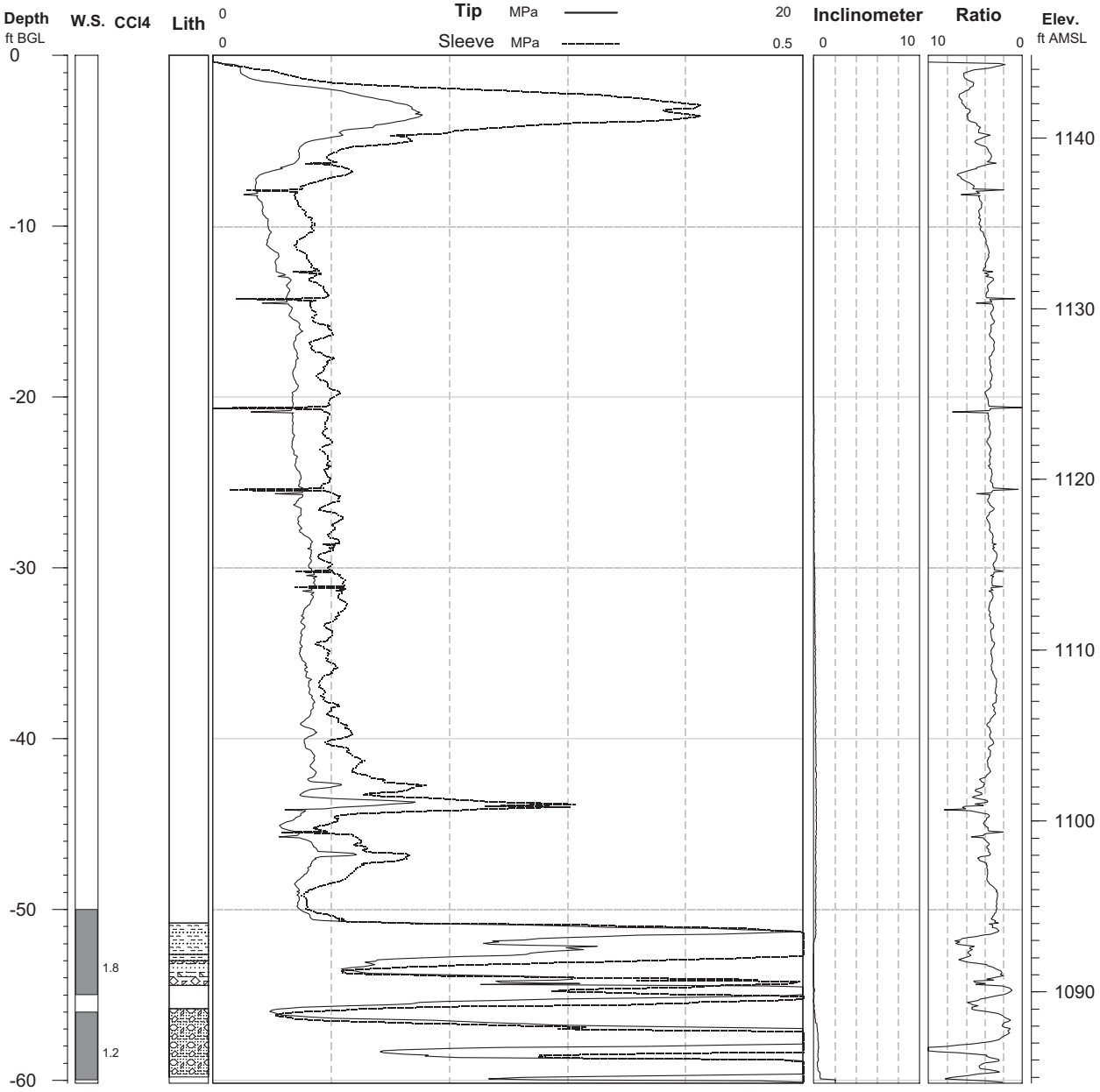
Boring ID: SB66

Project: Everest Targeted Investigation

Elevation: 1144.82 ft **Log Date:** 11/11/2003 **Rig:** CPT-Crawler

Depth: 60.17 ft **Plot Date:** 11/12/2003 **Driller:** Travis

Geologist: Lorraine LaFreniere **Company:** Argonne



Carbon tetrachloride in water sample = µg/L