

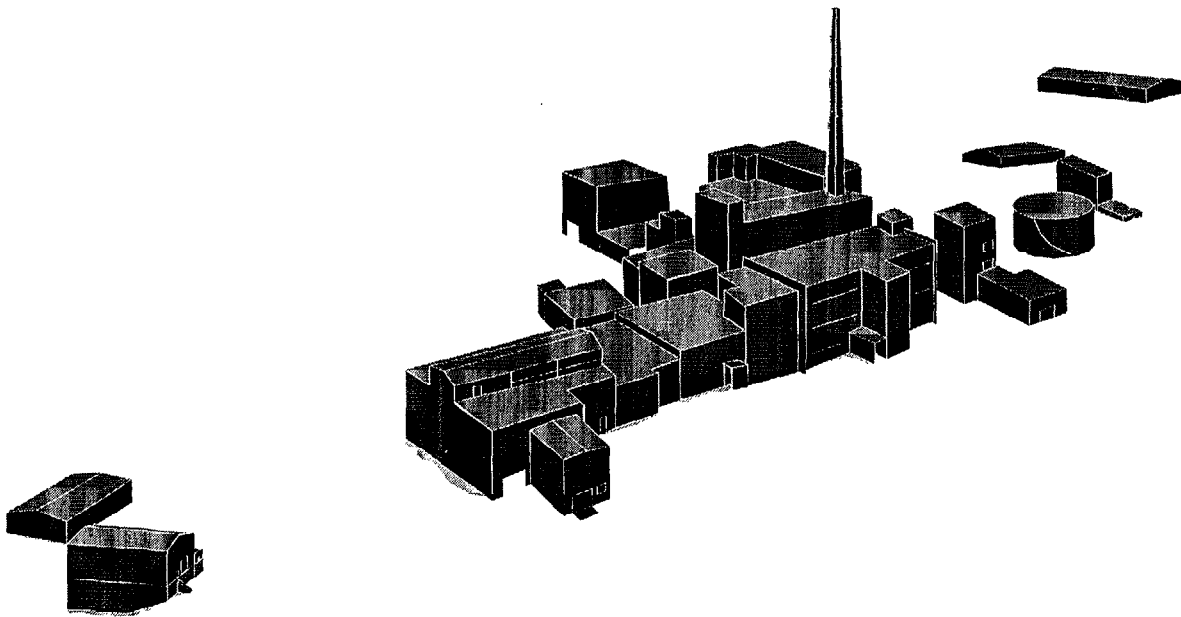
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**West Valley
Nuclear Services Company
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1997 Geoprobe Investigation On The North Plateau

At The West Valley Demonstration Project



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West Valley Demonstration Project

West Valley, New York 14171

West Valley Demonstration Project

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1997 GEOPROBE INVESTIGATION ON THE NORTH PLATEAU
AT THE WEST VALLEY DEMONSTRATION PROJECT

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WVNS RECORD OF REVISION

DOCUMENT

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<u>Rev. No.</u>	<u>Description of Changes</u>	<u>Revision On Page(s)</u>	<u>Dated</u>
0	Original Issue	All	01/15/98
PC1	Figure 3-3, Leading Edge of the Sr-90 Groundwater Plume on the North Plateau - Removed 1994 soil borings from figure	13	02/09/98

WVNS RECORD OF REVISION CONTINUATION FORM

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1.0 INTRODUCTION

1.1 Background

In 1994, a geoprobe groundwater and soil sampling program (WVDP-220) was conducted to characterize the Strontium-90 (Sr-90) plume on the North Plateau at the West Valley Demonstration Project (WVDP) (see Figure 1-1). This program also helped to find the source of Sr-90 contamination beneath the process building, identify a preferential pathway for Sr-90 migration near the leading edge of the plume and to establish a link between Sr-90 groundwater contamination and surface water contamination in the Swamp Ditch.

Since the 1994 geoprobe program, groundwater sampling has continued as part of the site groundwater monitoring program and has been initiated at well points and recovery wells associated with the North Plateau Groundwater Recovery System (NPGRS). These sampling data show that Sr-90 activities have increased at monitoring wells 8603 and 804, which were outside the plume area identified in 1994. Increasing Sr-90 activities at well 8603 result from continuing migration of the Sr-90 plume, however, the extent of plume migration in this area has not been defined since 1994. The source of minor activity increases at well 804 also needs to be understood. Possible sources for this contamination are:

- The groundwater plume near well 8603 (eastern lobe) had migrated toward 804; and
- The groundwater plume near the NPGRS (western lobe) had migrated westward beneath the Construction and Demolition Debris Landfill (CDDL) toward 804.
- Surface water infiltration through contaminated soil in a drainage ditch near 804.

1.2 1997 Geoprobe Sampling Program

In July and October/November of 1997, the WVDP implemented a second subsurface probing program on the North Plateau. This program was developed to further characterize the vertical distribution and areal extent of radiological contamination of the North Plateau near the leading edge of the plume. The following is a list of goals that were established for the 1997 geoprobe program:

- Three dimensional characterization of the leading edge of the Sr-90 plume and comparison with activities observed in the 1994 geoprobe study;
- Defining the eastern lobe of the Sr-90 plume near well 8603;
- Evaluating the hydrogeology and Sr-90 distribution between wells 8603 and 105;
- Determining the source of Sr-90 in groundwater around monitoring well 804; and
- Evaluating plume migration north of the NPGRS.

To accomplish these goals, groundwater was sampled from 29 geoprobe locations. Soil samples were collected from 9 of the 29 locations to provide a geologic characterization of the saturated interval. Three well points were installed for periodic groundwater sampling (see Figure 1-2 for well points WP-16, WP-17, and WP-18).

In July 1997 two lines of geoprobe sampling points were installed south of the CDDL. The first series of sampling points (GP-1-97 through GP-5-97) was located between monitoring wells 116 and 105 (see Figure 1-2). These points were selected to help characterize groundwater contamination near 8603 and explain the Sr-90 distribution between 8603 and 105.

A second series of geoprobe points (GP-6-97 through GP-14-97) was located along the south side of the roadway adjacent to the CDDL. These locations were selected for additional characterization of the western and eastern lobes of the Sr-90 plume. Groundwater was collected at 5-foot depth intervals from all points.

Upon review of the July 1997 data, it was determined that additional geoprobe sampling was necessary to achieve plume characterization goals. Geoprobe locations GP-15-97 through GP-29-97 and three (3) well points were added in October and November of 1997. Geoprobe locations GP-19-97 through GP-23-97 were selected to further characterize the eastern lobe (1,000 pCi/L contour). GP-15-97, GP-16-97, and GP-18-97 were sampled to help determine the source of gross beta activity at well 804. Locations GP-17-97, GP-25-97, and GP-26-97 were selected to evaluate the Sr-90 distribution near well 804 and plume movement toward the plateau edge.

Well points WP-16, WP-17 and WP-18 were also installed during the October/November geoprobe program for periodic groundwater sampling of gross beta and Sr-90 in the eastern lobe of the plume. These locations were selected after the geoprobe sampling was complete. Well diagrams for WP-16, WP-17, and WP-18 can be found in Appendix A.

2.0 ANALYTICAL DATA AND PROCEDURES

2.1 Groundwater

The focus of the sampling program was to characterize contamination in the surficial Sand and Gravel unit on the North Plateau. The surficial Sand and Gravel unit overlies a low permeability Lavery till. A presampling plan was prepared based on knowledge of the groundwater table and the depth of the Lavery till.

In total, 29 geoprobe sampling locations were selected for groundwater analysis (GP-1-97 through GP-29-97), during the 1997 geoprobe investigation. All groundwater samples were analyzed for gross beta and Sr-90. Sr-90 analysis was generally completed within 24 hours of sampling and was used in making field decisions and modifications to sampling locations.

Analytical data from the geoprobe investigation were assessed via WVDP Level 1 validation methods. Section 3.0 discusses the radiological distribution and data results. Field procedures are presented in Appendix B.

2.2 Soil

Of the 29 geoprobe locations, nine (9) had continuous soil samples collected from them (GP-1-97, GP-2-97, GP-3-97, GP-12-97, GP-14-97, GP-19-97, GP-20-97, GP-21-97, and GP-24-97). Soil samples were collected for geological characterization. The geological logs can be found in Appendix A.

3.0 NORTH PLATEAU HYDROGEOLOGY AND RADIOLOGICAL PLUME ANALYSIS

3.1 Sr-90 Distribution during the 1994 Geoprobe Study

A geoprobe survey conducted in 1994 provided the first detailed characterization of the Sr-90 activity in groundwater on the North Plateau. A contour map of the highest Sr-90 activities at each geoprobe sampling point is presented in Figure 1-1. This map shows the start of plume migration along a preferential pathway at the northernmost portion of the plume. The groundwater plume in this area is referred to as the western lobe of the Sr-90 plume. The NPGRS presently intercepts most of the Sr-90 plume which migrates through this area.

At the time of the 1994 Geoprobe Study, the Sr-90 plume had not yet reached monitoring well 8603 and surrounding geoprobe points GP-5 and GP-6. Subsequent groundwater monitoring data have shown an increasing Sr-90 trend at 8603. The groundwater plume in this area is referred to as the eastern lobe.

3.2 Groundwater Flow

Since the 1994 geoprobe investigation, the Sr-90 plume has continued to move. Current groundwater flow patterns were examined to help explain plume migration. Groundwater elevation contours on November 7, 1997 are illustrated in Figure 3-1. In general, groundwater within the study area flows perpendicular to the groundwater elevation contours. Sr-90 plume migration typically followed the direction of groundwater flow.

The following groundwater flow patterns are illustrated in Figure 3-1:

- Groundwater south of the NPGRS flows towards the recovery wells;
- Groundwater north of the NPGRS flows towards the swampy area west of the CDDL and to the Swamp Ditch;
- Groundwater beneath the CDDL flows in a NNE direction;
- There is a steep drop in groundwater elevation between wells 8603 and 105

3.3 Sr-90 Results for the 1997 Geoprobe Investigation

Sr-90 and gross beta analytical results for the 1997 geoprobe investigation are presented in Table 3-1. However, only Sr-90 data will be evaluated in this report, since Sr-90 and its daughter product Yttrium-90 (Y-90) account for virtually all of gross beta activity in the plume.

Sr-90 activity data are plotted for each geoprobe sampling location (from shallowest to deepest sampling interval) on Figure 3-2. A Sr-90 groundwater contour map was developed (Figure 3-3) to evaluate plume distribution for the highest activity at each sampling location. Groundwater monitoring well data from June 1997, and recovery well and well point sampling data from July 1997 were also used to interpret Sr-90 contours.

Three cross sections were selected within the study area (Figure 3-4) to evaluate the three-dimensional nature of the Sr-90 plume. Cross sections A-A' (Figure 3-5) and B-B' (Figure 3-6) are roughly perpendicular to groundwater flow and plume migration. Cross section C-C' (Figure 3-7) is approximately parallel to groundwater flow and migration directions.

3.4 1997 Description of the Western Lobe of the Sr-90 Plume

The western lobe of the Sr-90 plume passes between Lag Storage Area (LSA) 4 and monitoring well 116 (Figure 3-3). The plume is well defined near the NPGRS, however plume contours north of monitoring well 801 have been inferred, based on historical surface water sampling data. Sr-90 migration in the western lobe appears to be drawn toward the swampy area west of the CDDL and toward the Swamp Ditch. These areas are believed to intercept the western lobe and minimize further Sr-90 migration.

The 10,000 pCi/L contour within the western lobe extends north of the pump and treat system to just beyond GP-06-97 and GP-07-97. The 1,000 pCi/L contour is believed to extend beneath the western end of the CDDL and include a portion of the swampy area west of the CDDL. The 100 pCi/L contour has been extended just north of the Swamp Ditch, based on the low levels of Sr-90 detected in this area during the 1994 geoprobe study.

The vertical distribution of Sr-90 in the western lobe also appears to be influenced by the Swamp Ditch and nearby swampy area. Cross section B - B' (Figure 3-6) shows that the 10,000 pCi/L and 1,000 pCi/L contours are primarily found in the upper half of the saturated interval in the western lobe (from GP-06-97 through GP-09-97). This is not surprising since groundwater generally has an upward flow component near swampy areas.

3.5 1997 Description of the Eastern Lobe of the Sr-90 Plume

The eastern lobe of the Sr-90 plume flows between geoprobe point GP-21-97 and monitoring well 105 (Figure 3-3). Plume migration is in a NNE direction.

Within the eastern lobe, the 10,000 pCi/L contours lies within a narrow band that extends from GP-20-97 to GP-28-97. The 1,000 pCi/L contour includes the area from GP-04-97 to well 8603. A thin band of the 1,000 pCi/L contour extends between GP-11-97 and GP-12-97, and then to GP-16-97. Geoprobe point GP-02-97 is in a region of low Sr-90 activity surrounded by the 1,000 pCi/L area. The 100 pCi/L contour runs between monitoring well 105 and WP-11 and between GP-18-97 and GP-13-97. The contour roughly parallels the 1,000 pCi/L contour.

A second area surrounded by a 100 pCi/L Sr-90 contour lies near the southeast corner of the CDDL. This area includes GP-17-97, GP-26-97 and monitoring well 804. Sr-90 activities greater than 100 pCi/L are limited to the top portion of the saturated interval.

An area of low Sr-90 activity (less than 100 pCi/L) separates the east and west lobes of the plume in the area between monitoring well 116 and GP-21-97. Saturated soil in this area is believed to have low hydraulic conductivity, which causes the Sr-90 plume to split into the east and west lobes.

Three cross sections (Figure 3-4) pass through and help to characterize the eastern lobe of the Sr-90 plume. Cross section A-A' (Figure 3-5) examines the southern end of the eastern lobe. The 10,000 pCi/L contour on A-A' is limited to a single sampling interval at GP-20-97 at a depth of 17 to 19 ft. The 1,000 pCi/L and 100 pCi/L contours roughly parallel each other in the area between GP-21-97 and well 105. This all appears to be one lobe that is locally split by an area of low activity (and presumably low hydraulic conductivity) at GP-02-97. Sr-90 activities greater than 1,000 pCi/L are found in most of the saturated interval in this area except above the Lavery till, and near the east and west edges of the lobe.

Groundwater contamination in the eastern lobe along cross section B-B' (Figure 3-6) predominantly occurs near the water table. Sr-90 activities less than 400 pCi/L are found at geoprobe points GP-10-97, GP-11-97 and GP-12-97. Higher activities are believed to occur at depth within a small area that lies between GP-11-97 and GP-12-97.

Cross section C-C' (Figure 3-7) is oriented to delineate a "finger-like" zone of higher Sr-90 activities within the eastern lobe. This zone passes through GP-20-97, GP-28-97, WP-16 and GP-16-97. At all 4 locations this zone occurs near an elevation of 1365 ft. Soil samples collected within the zone at GP-20-97 contained thin layers of well graded coarse sand and/or gravel that could provide a preferential path for Sr-90 migration (see Appendix A). The narrow width of the zone can also be observed in the Sr-90 contour map in Figure 3-3.

Cross section C-C' also illustrates the relationship of the water table, Sr-90 plume and CDDL fill. The highest activities in the plume occur in the lower half of the saturated interval. A small portion of the 100 and 1,000 pCi/L contours is believed to extend beneath the southern end of the CDDL. However, the plume along C-C' appears to be approximately 13 ft below the estimated base of the CDDL fill. At the time of groundwater measurement, the water table appears to be between 5 and 6 feet below the estimated base of the CDDL fill along the C-C' cross section.

3.6 Comparison of 1994 and 1997 Sr-90 Plumes

Western Lobe

A comparison of the 1994 and 1997 Sr-90 plumes near the leading edge of the plume is presented in Figure 3-8. This figure shows that a portion of the western lobe of the plume has continued to migrate toward the swampy area east of the CDDL, and on to the Swamp Ditch. In 1994, the 1,000 pCi/L portion of the plume had not yet reached the Swamp Ditch, however contaminated groundwater seepage in the swampy area did flow to the ditch.

Western lobe plume migration between 1994 and 1997 is believed to have resulted from residual contamination of saturated soil, prior to installation of the NPGRS. Once the saturated soil became contaminated, Sr-90 was slowly released to the groundwater.

Influence of NPGRS on Western Lobe

In spite of residual contamination of saturated soil, the NPGRS appears to have minimized additional Sr-90 migration in the western lobe. The 2-well system (installed in November 1995) and particularly the 3-well system (installed in September 1996) have effectively captured the Sr-90 plume within the western lobe. Previous evaluations indicate that the NPGRS captures about 90% of the activity that would migrate through the western lobe.

Trending evaluation of key monitoring points also indicate that the NPGRS has been effective. Figure 3-9 shows Sr-90 activities in monitoring well 801 before and after operation of the NPGRS. Prior to NPGRS operation, Sr-90 activities were sharply increasing. Following NPGRS operation, 801 activities have stabilized and no longer show an increasing trend.

Figure 3-10 illustrates the influence of NPGRS operation on activities at surface monitoring point WNSWAMP. Surface water at this monitoring point is sampled from the Swamp Ditch prior to flowing off the North Plateau into Franks Creek (see Figure 3-3). Contaminated groundwater from the western lobe seeps into the Swamp Ditch.

The Sr-90 trend in Figure 3-10 indicates that the NPGRS has had a significant effect in first stabilizing and then decreasing activities at WNSWAMP. A 12-month rolling average is used for this evaluation to average seasonal highs and lows and allow a better trend to be observed. WNSWAMP monthly data are generally higher in dry periods and lower in wet weather.

Eastern Lobe

In 1994, the eastern lobe of Sr-90 plume had not yet developed. The 1,000 pCi/L contour was southwest of monitoring well 8603 and the Sr-90 activity at 8603 was 61 pCi/L (May 1994). Since 1994 Sr-90 activities have increased and were detected at 2,480 pCi/L in June 1997.

Low activities were also detected in monitoring well 105 in 1994 (14 pCi/L gross beta activity in May 1994). Well 105 activities continue to be low, but have shown a slight increase (44 pCi/L gross beta activity in June 1997).

3.7 Hydrogeologic Data and Activity Data Near Wells 8603 and 105

Hydrogeologic data near monitoring wells 8603 and 105 suggest that the Sr-90 plume should be rapidly moving toward well 105. However, low gross beta activity results indicate that plume movement at well 105 is very slow. This section describes previously collected data and new results from the 1997 geoprobe investigation which were used to evaluate this situation.

The groundwater elevation at well 8603 is typically 4 to 6 feet higher than at well 105 (see Figure 3-1) although the wells are only about 50 feet apart.

Slug tests results in well 8603 measured a hydraulic conductivity of approximately 0.003 cm/sec. Slug test results for well 105 were unmeasurable, which generally indicates that the hydraulic conductivity of the well was too high for this test method.

The geologic log of 8603 (Appendix A) indicates that much of the saturated interval consists of a well graded gravel (GW). Geologic logs from well 105 and nearby geoprobe points GP-01-97 and GP-24-97 show that most of the saturated interval contains silty gravel (GM).

There is a large difference between Sr-90 (and gross beta) results in wells 8603 and 105. Third quarter 1997 results show a Sr-90 activity of 2480 pCi/L at well 8603 and a gross beta activity at well 105 of 44 pCi/L (or approximately 22 pCi/L of Sr-90). This same general activity trend was observed in geoprobe point GP-01-97 (which lies between wells 8603 and 105) where the highest Sr-90 activity detected was 162 pCi/L.

4.0 CONCLUSIONS

4.1 Western Lobe Sr-90 Migration and Plume Characteristics

The western lobe continues to be the primary route for Sr-90 migration at the leading edge of the groundwater plume (Figure 3-3). Most Sr-90 activities greater than 1,000 pCi/L occur within the upper half of the saturated interval.

Sr-90 contaminated groundwater north of the NPGRS appears to be intercepted by the Swamp Ditch which flows east, off the plateau to Franks Creek, then to Buttermilk Creek. Sr-90 has not been detected above background levels in Cattaraugus Creek water downstream of the confluence with Buttermilk Creek.

Most of the activity currently seeping into the Swamp Ditch is believed to result from the leaching of Sr-90 from saturated soil that was contaminated prior to the installation of the 3-well NPGRS. It is likely that the Sr-90 plume north of the NPGRS will continue to migrate due to residual soil contamination.

The 3-well NPGRS appears to be capturing more than 90% of the Sr-90 activity that flows through the western lobe. Operation of the 3-well system has also resulted in decreasing 12-month average Sr-90 activities at WNSWAMP and stabilized activities at downgradient monitoring well 801. Residual soil contamination north of the NPGRS and the portion of the western lobe not captured by the system may prevent 801 activities from quickly decreasing.

4.2 Eastern Lobe Migration and Plume Characteristics

The 1997 geoprobe investigation provided the first detailed characterization of the eastern lobe of the Sr-90 plume. The southern end of the lobe (including the 100 pCi/L contour) is approximately 120 feet wide and lies between geoprobe point GP-21-97 and well 105. Most of the eastern lobe lies south of the east-west service road next to the CDDL. Along cross section A-A' (Figure 3-5) contamination of greater than 1,000 pCi/L occurs in most of the saturated thickness, except at the deepest groundwater sampling intervals and near the east and west edges of the lobe.

A thin "finger-like" zone within the saturated interval appears to provide a small preferential pathway for Sr-90 migration in the eastern lobe. This zone is relatively thin and narrow, and occurs in the lower depths of the saturated interval. The Sr-90 plume within this "finger-like" zone trends toward the NNE and appears to extend beneath the southern end of the CDDL. However, the depth of the water table and the plume appear to be below the estimated base of the CDDL fill.

Higher Sr-90 activity within the "finger-like" zone may occur within layers of well graded sand and gravel, as observed in GP-20-97. These layers contain less silt and clay and appear to be more permeable than surrounding soil.

4.3 Hydrogeologic Conditions Between 8603 and 105

Although there is a steep hydraulic gradient between 8603 and 105, this is not the primary direction of plume migration. Groundwater samples from well points WP-11 through WP-14 and surrounding 1997 geoprobe sampling locations show that plume migration follows a NNE trend, corresponding to coarser-grained soils. Coarser-grained soils (such as well graded sand and gravels) generally have higher hydraulic conductivity than finer-grained soils (such as silty sand and gravels). Hydraulic conductivity appears to be the predominant factor controlling plume migration in this area and throughout the North Plateau.

Based on the geologic log for well 105 and the low Sr-90 activities observed here, the hydraulic conductivity at this location appears to be less than that suggested by slug test results. The silty gravel (GM) in 105 should have considerably less hydraulic conductivity than the well graded gravel (GW) encountered in 8603. The low activities in well 105 have been slowly increasing but this area is not seen as a significant pathway for plume migration. Sr-90 plume distribution and migration patterns have been thoroughly characterized by the 1997 geoprobe program and will continue to be evaluated by groundwater sampling in monitoring wells and well points.

4.4 Sr-90 Contamination Southeast of CDDL

Minor contamination in groundwater near the southeast corner of the CDDL (near well 804) does not appear to come from either the eastern or western lobes of the Sr-90 plume (see Figure 3-3). Geoprobe and well point data could find no connection between Sr-90 contamination in this area and the eastern or western lobes. Furthermore, Sr-90 contamination near 804 only occurs near the water table in a localized area.

The source of slight Sr-90 groundwater contamination near well 804 is believed to have resulted from residual soil contamination in a nearby drainage ditch. During the spring of 1994, high water table conditions caused contaminated groundwater to seep into the drainage ditch adjacent to the NPGRS. This water flowed east in the ditch, through a culvert beneath the road, and around the south and east sides of the CDDL to WNSWAMP. Some of the soil in the ditch became contaminated, particularly southeast of the CDDL, where the water ponded. This represents the source of contamination for well 804.

Contaminated groundwater no longer seeps into the ditch since operation of the NPGRS. However, noncontaminated surface water continues to pond in the ditch southeast of the CDDL during wet weather. Infiltration of ponded water through contaminated ditch sediments is suspected to have caused localized, shallow groundwater contamination.

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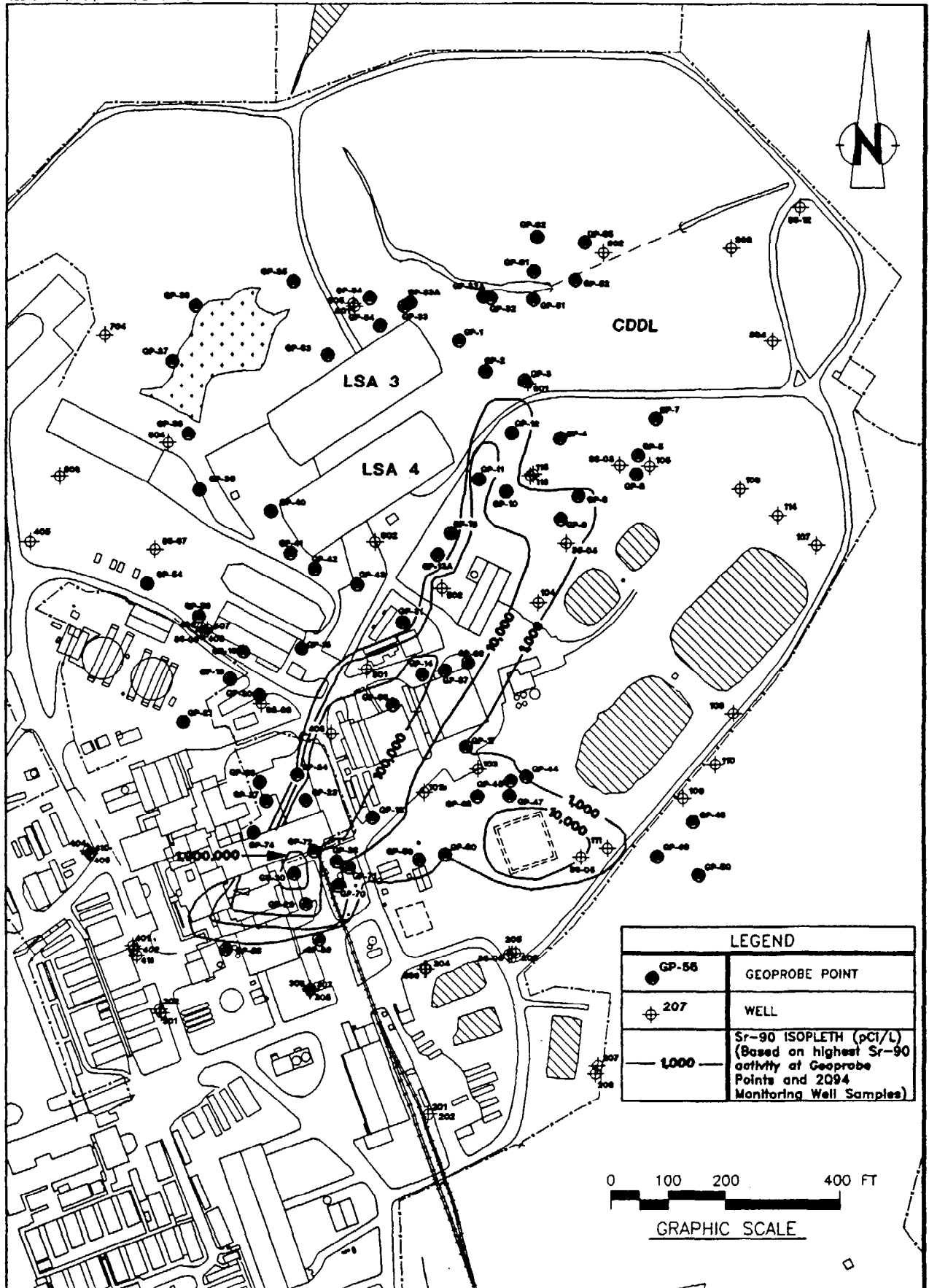
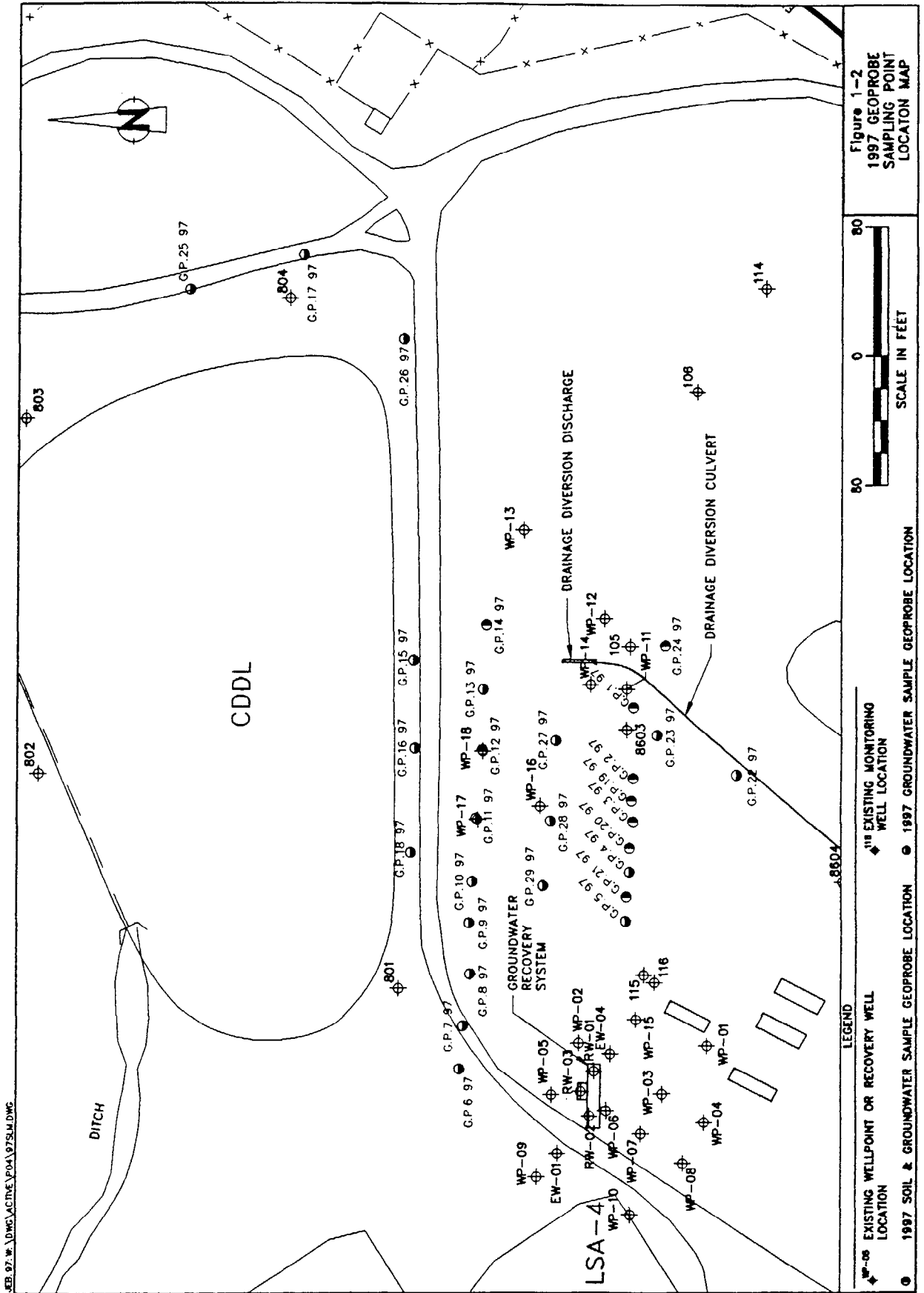
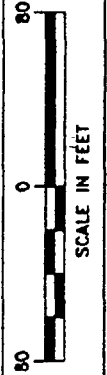


Figure 1-1 1994 Sr-90 Groundwater Plume on the North Plateau



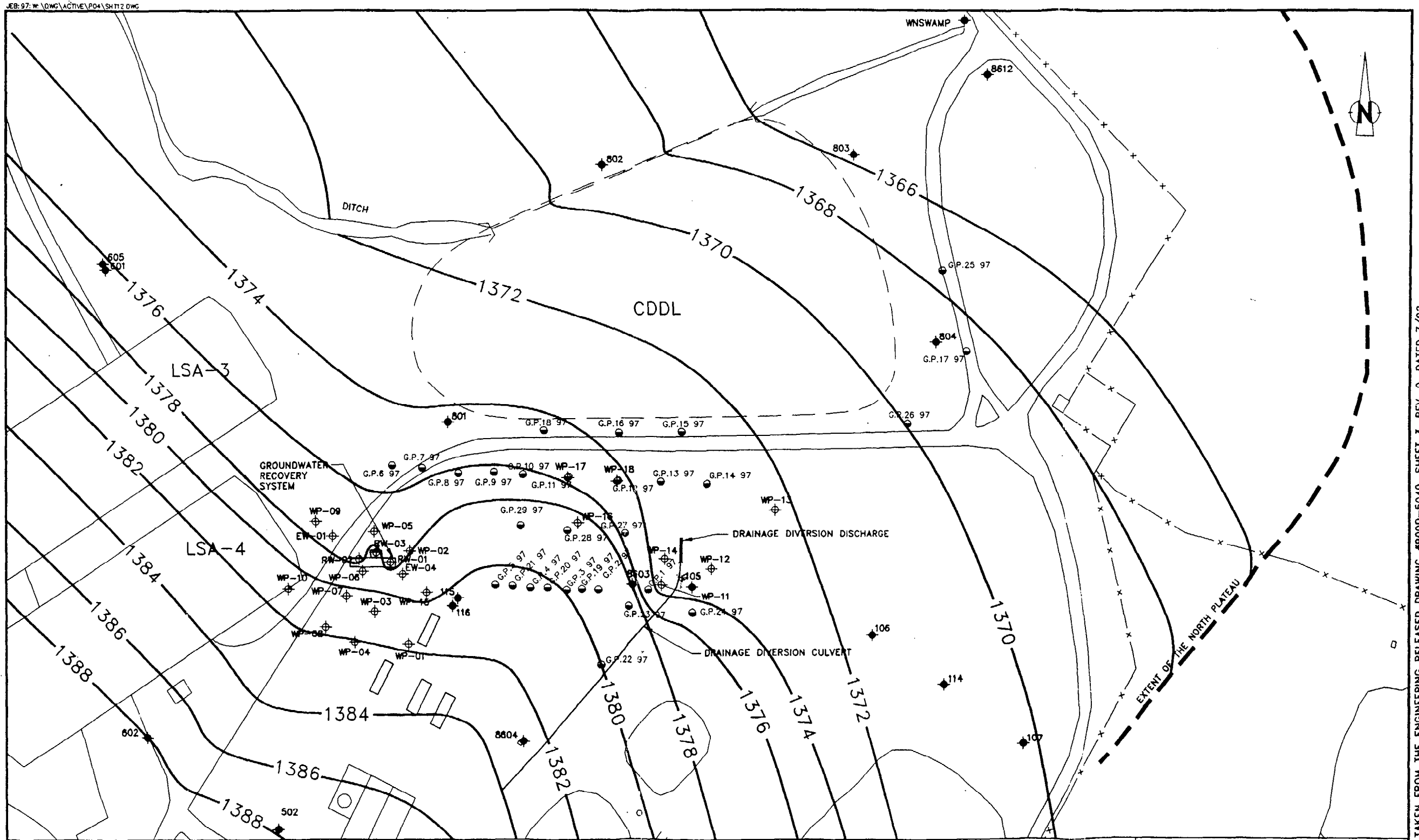
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Figure 1-2
 1997 GEOPROBE
 SAMPLING POINT
 LOCATION MAP



LEGEND

- ◆ WP-09 EXISTING WELLPOINT OR RECOVERY WELL LOCATION
- 1997 SOIL & GROUNDWATER SAMPLE GEOPROBE LOCATION
- ◆ WP-18 EXISTING MONITORING WELL LOCATION
- 1997 GROUNDWATER SAMPLE GEOPROBE LOCATION



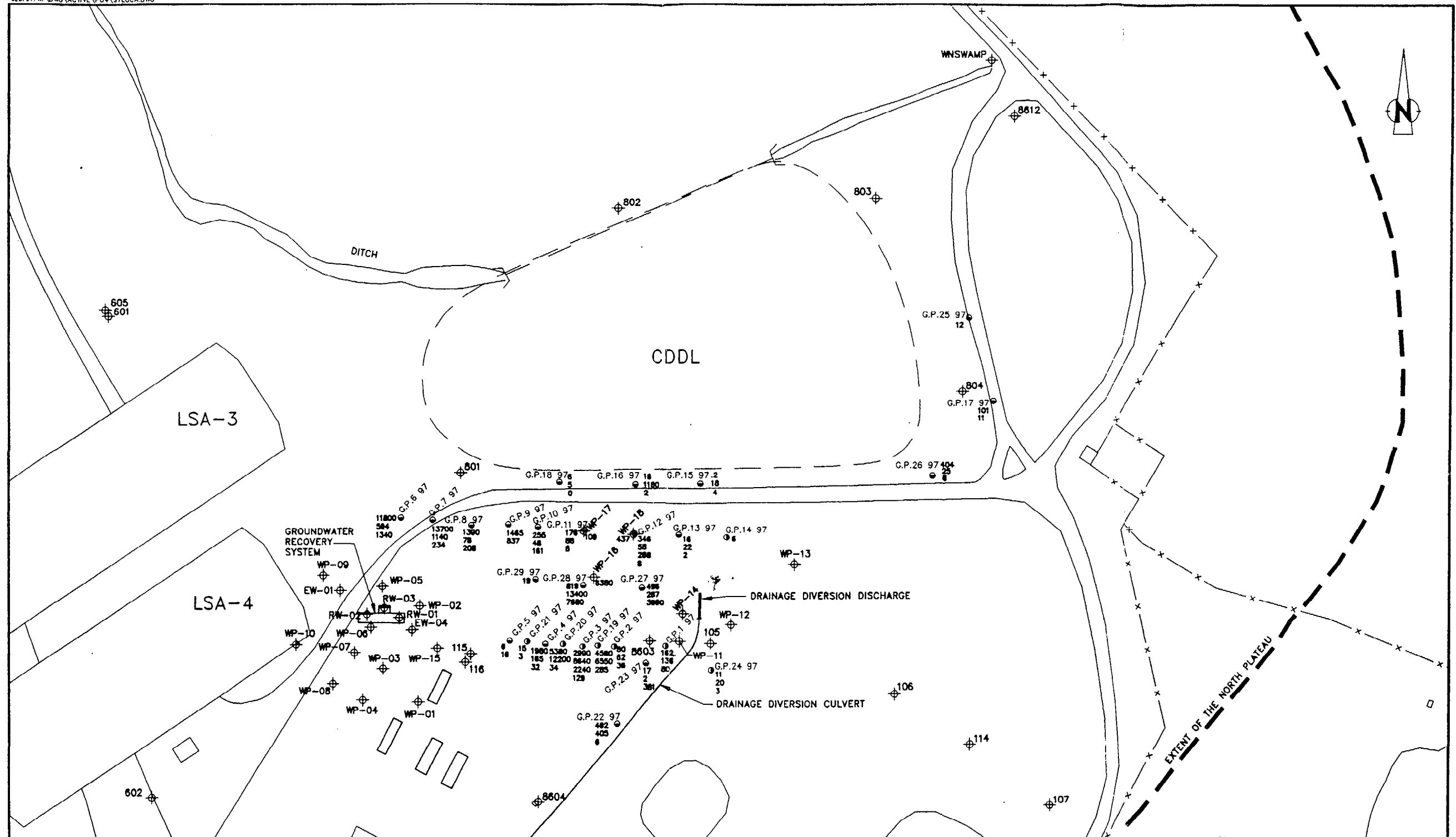
LEGEND		
⊕ WP-05	EXISTING WELLPOINT OR RECOVERY WELL LOCATION	◆ 115
— 1384 —	GROUNDWATER ELEVATION (feet)	● 1997 GEOPROBE LOCATION
		◆ 115
		EXISTING MONITORING WELL LOCATION

SCALE IN FEET

Figure 3-1
 NOVEMBER 7, 1997
 GROUNDWATER ELEVATION CONTOURS
 FOR THE GEOPROBE STUDY AREA
 ON THE NORTH PLATEAU

MAP BASE WAS TAKEN FROM THE ENGINEERING RELEASED DRAWING #9000-5040, SHEET 3, REV. 0, DATED 7/92.

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LEGEND

- ⊕ WP-05 EXISTING WELLPOINT LOCATION
- ⊕ 115 EXISTING MONITORING WELL LOCATION
- ⊙ 1997 SOIL AND GROUNDWATER SAMPLE LOCATION
- ⊙ 1997 GROUNDWATER SAMPLE GEOPROBE LOCATION

1980 } Sr-90 ACTIVITIES (pCi/L) FROM SHALLOWEST
 185 } TO DEEPEST GROUNDWATER SAMPLING DEPTH
 32 }

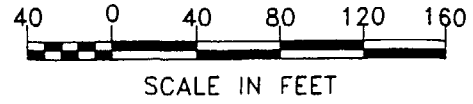
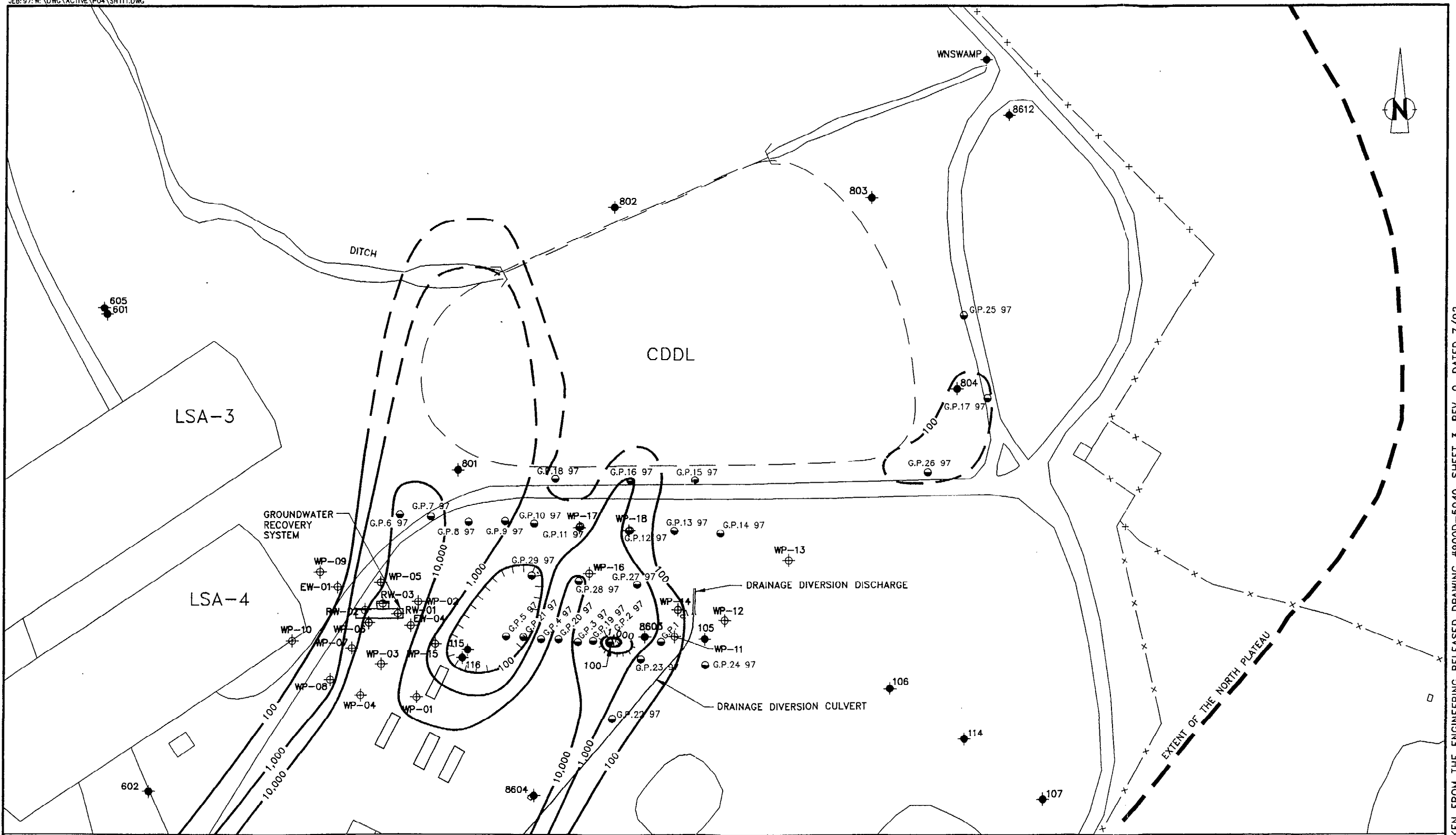


Figure 3-2
 SR-90
 GROUNDWATER ACTIVITIES
 AT 1997 GEOPROBE
 SAMPLING LOCATIONS

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LEGEND	
	EXISTING WELLPOINT OR RECOVERY WELL LOCATION
	Sr-90 CONTOUR (pCi/L)
	EXISTING MONITORING WELL LOCATION
	1997 GEOPROBE LOCATION

NOTE:
 Sr-90 CONTOURS BASED ON 7/97, 10/97, and 11/97 GEOPROBE SAMPLING;
 7/11/97 GROUNDWATER RECOVERY SYSTEM WELL SAMPLING;
 AND 3Q97 QUARTERLY GROUNDWATER MONITORING DATA

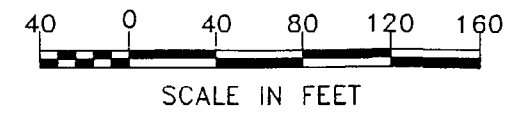
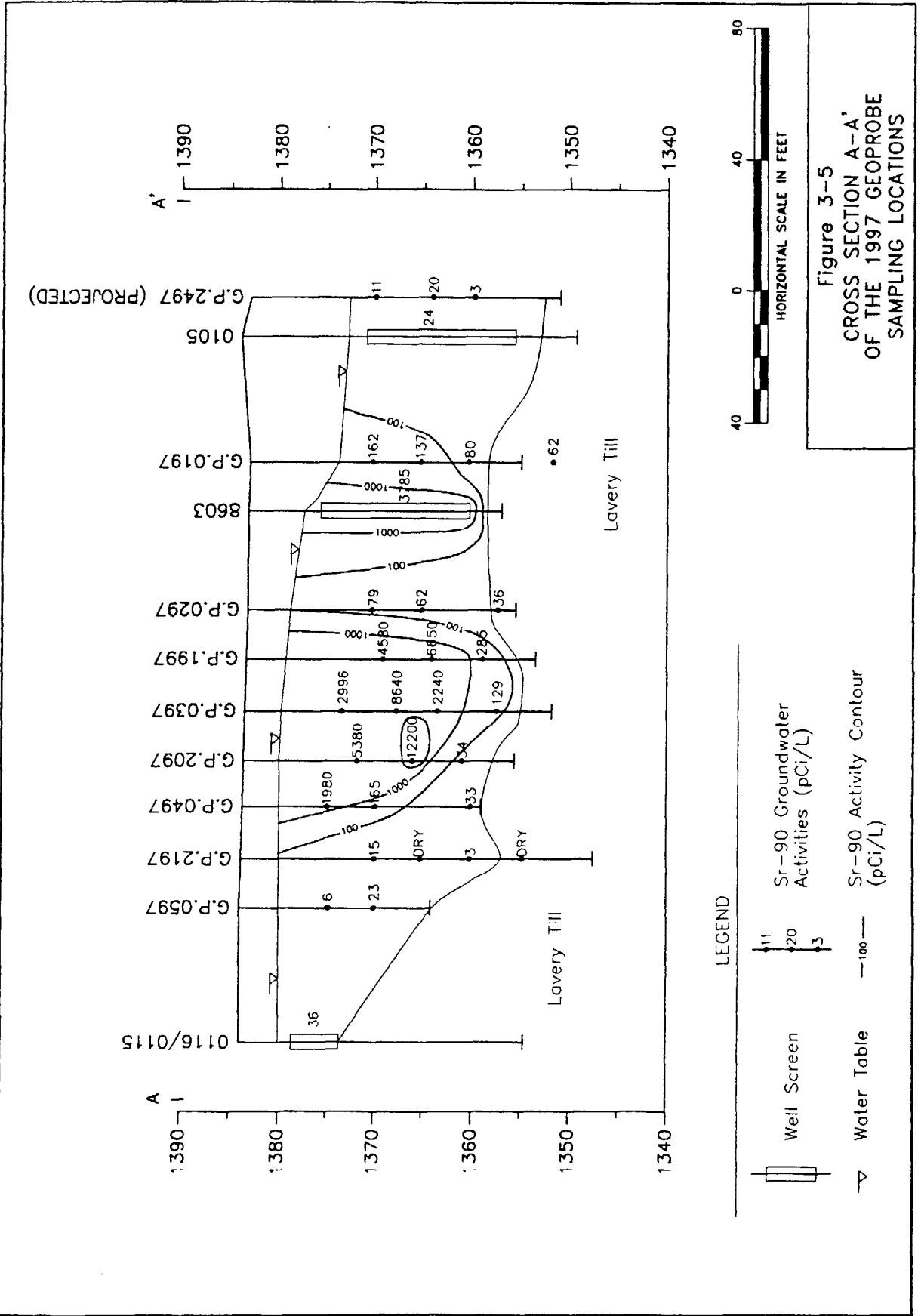
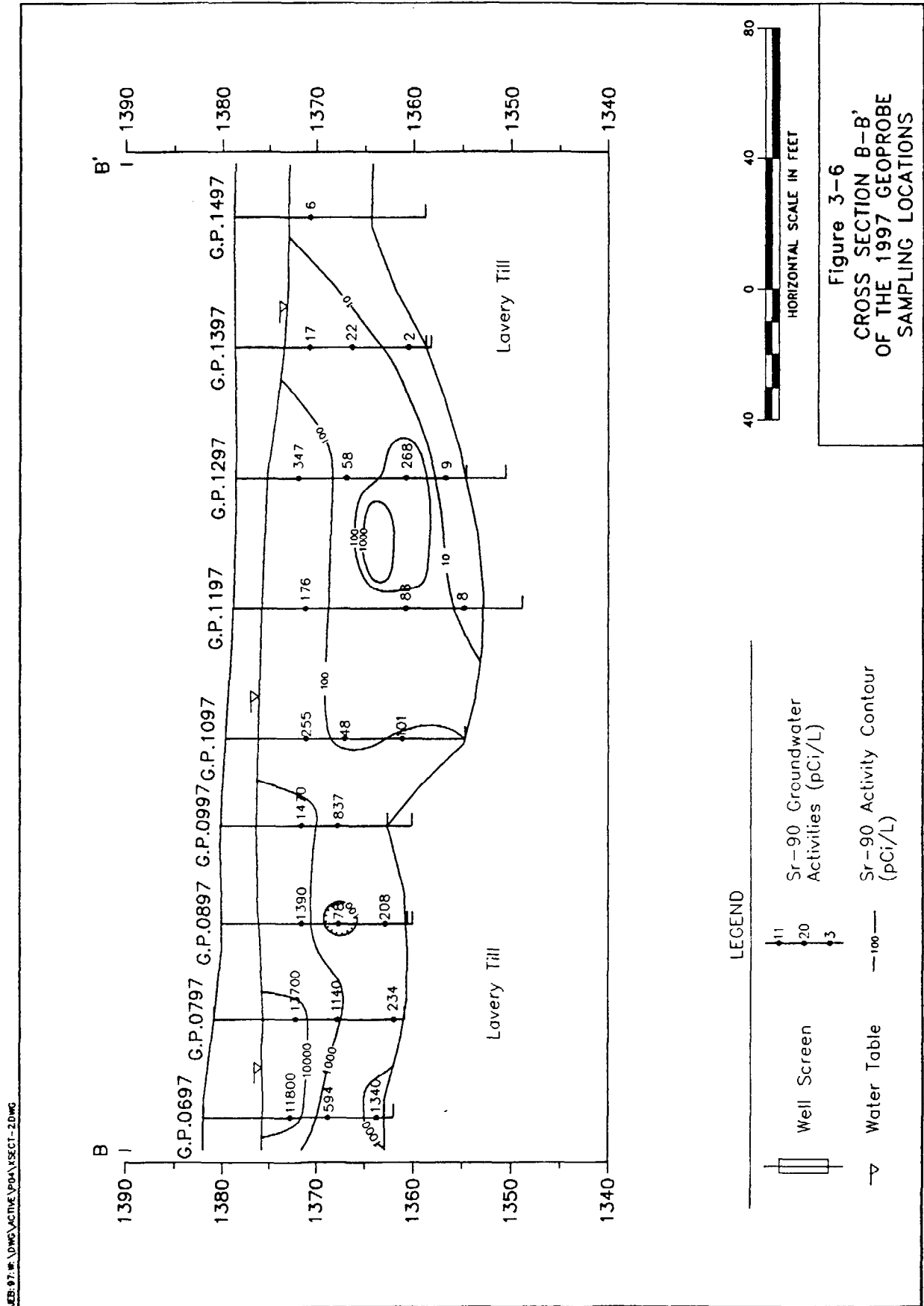


Figure 3-3
 LEADING EDGE OF THE SR-90
 GROUNDWATER PLUME ON
 THE NORTH PLATEAU

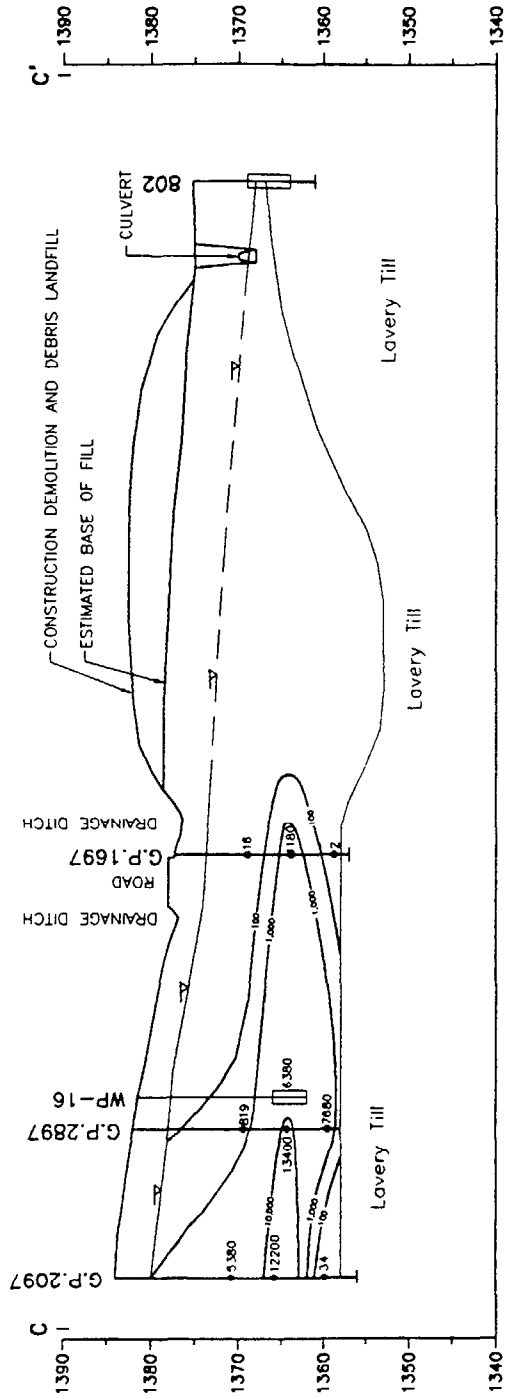
MAP BASE WAS TAKEN FROM THE ENGINEERING RELEASED DRAWING #900D-5040, SHEET 3, REV. 0, DATED 7/92.

\\EB:97\WV\DMO\ACT\NE\VPRA\VECT-3.DWG

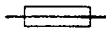
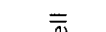
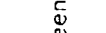





SR-90:W:\DWG\ACTIVE\POA\YSECT-4.DWG



LEGEND

-  Well Screen
-  Water Table
-  Sr-90 Activity Contour (pCi/L)
-  Sr-90 Groundwater Activities (pCi/L)

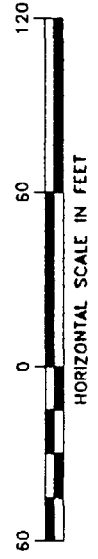
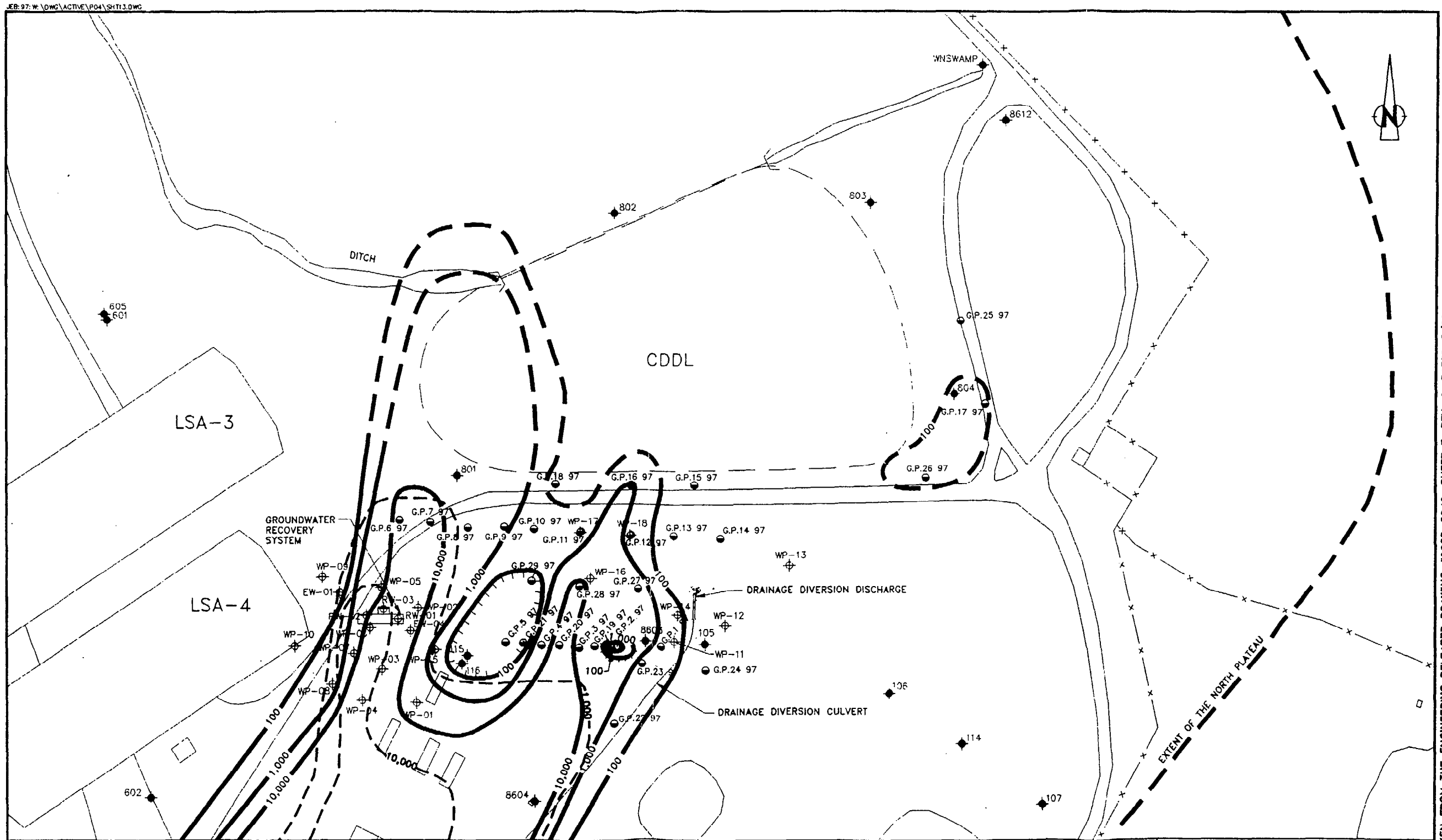


Figure 3-7
 CROSS SECTION C-C'
 THROUGH THE EAST SR-90
 PLUME LOBE AND THE CDDL



LEGEND

◆ WP-05	EXISTING WELLPOINT OR RECOVERY WELL LOCATION	◆ 115	EXISTING MONITORING WELL LOCATION
—	1997 Sr-90 CONTOUR (pCi/L)	●	1997 GEOPROBE LOCATION
- - -	1994 Sr-90 CONTOUR (pCi/L)		

NOTE:
 Sr-90 CONTOURS BASED ON 7/97, 10/97, and 11/97 GEOPROBE SAMPLING;
 7/11/97 GROUNDWATER RECOVERY SYSTEM WELL SAMPLING;
 AND 3Q97 QUARTERLY GROUNDWATER MONITORING DATA

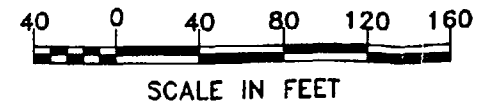


Figure 3-8
 COMPARISON OF SR-90 GROUNDWATER PLUME DURING 1994 AND 1997 GEOPROBE SAMPLING PROGRAMS

MAP BASE WAS TAKEN FROM THE ENGINEERING RELEASED DRAWING #9000-5040, SHEET 3, REV. 0, DATED 7/92.

Figure 3-9 Sr-90 Activities in Monitoring Well 801

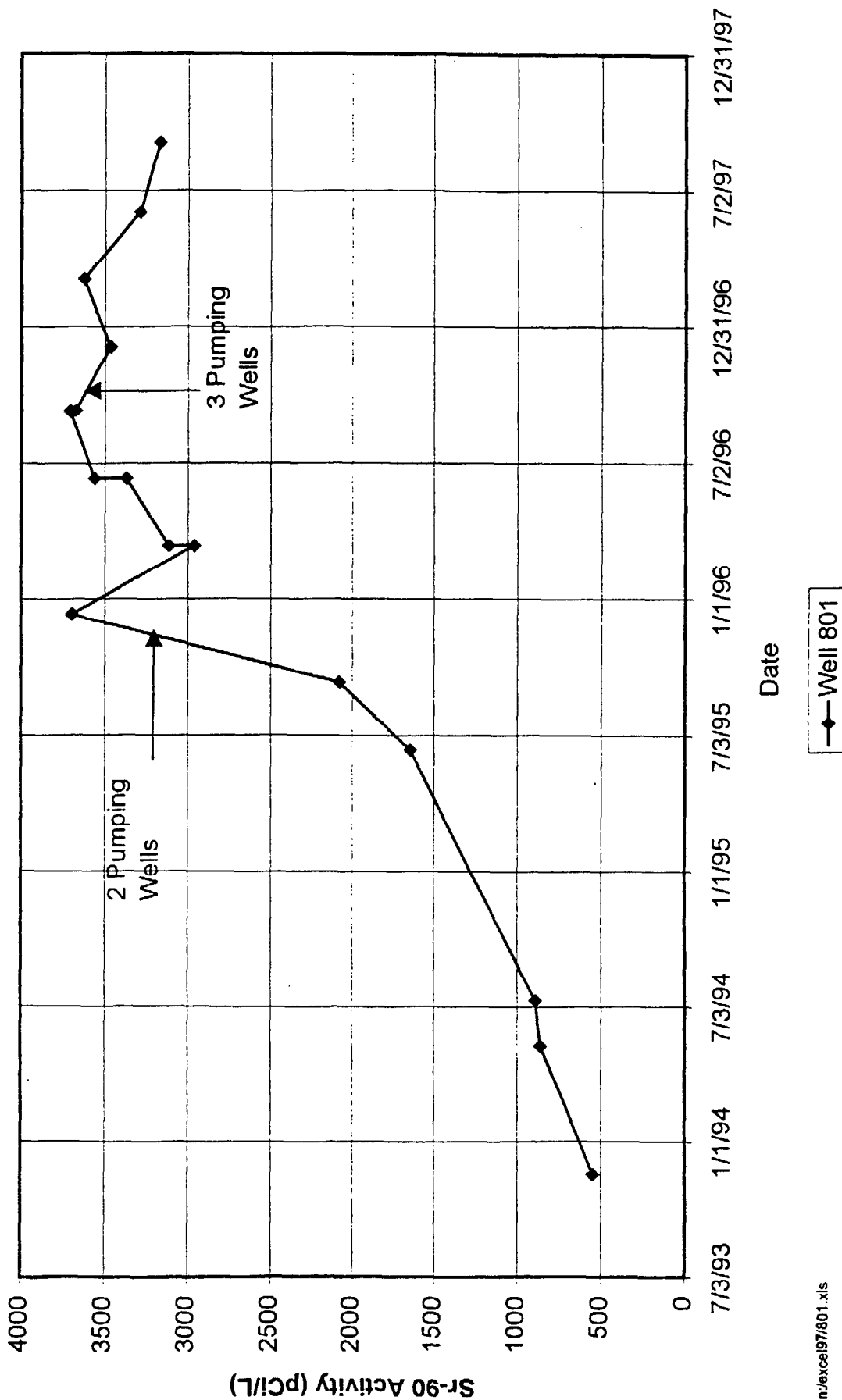
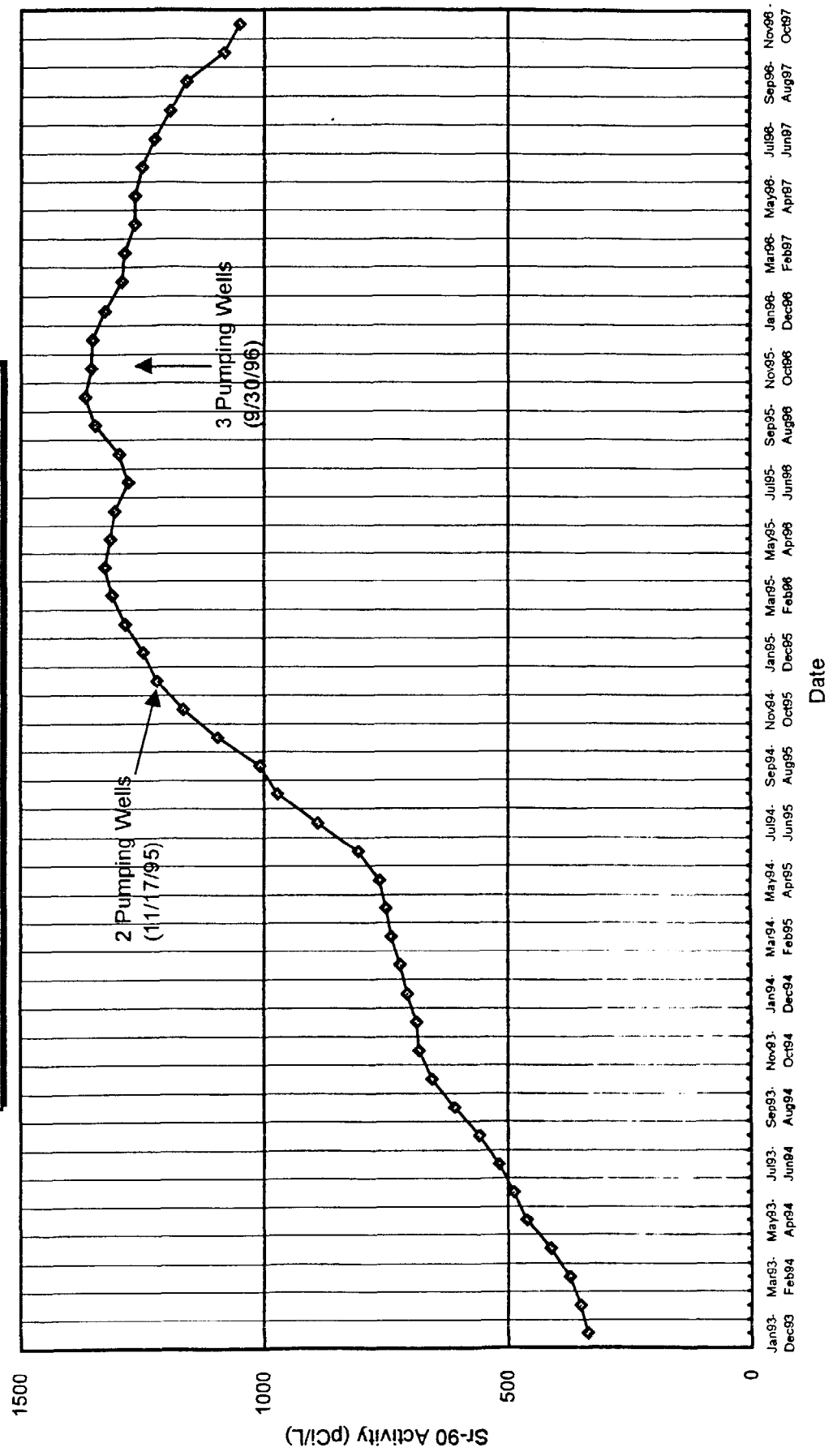


Figure 3-10 Rolling 12-Month Average of Sr-90 Activity at WNSWAMP



—◆— Sr-90

**TABLE 3-1
 GEOPROBE GROUNDWATER SAMPLE DATA**

GEOPROBE POINT NUMBER	SAMPLE ID	SAMPLE COLLECTION DATE	SAMPLING DEPTH (FT)	GROSS BETA pCi/L	Sr-90 pCi/L	COMMENTS
GP0197	97-05887	7/18/97	12.5-14.0	305	162	Good Recovery
*	97-05888	7/18/97	17.5-19.0	222	136	Good Recovery
	97-05889	7/18/97	22.5-24.0	151	80	Good Recovery
GP0297		7/21/97	7.5-9.0			No Water
	97-05891	7/21/97	12.5-14.0	140	80	Good Recovery
*	97-05893	7/21/97	17.5-19.0	88	62	Good Recovery
	97-05894	7/21/97	25.5-27.0	86	36	Poor Recovery
GP0397	97-05895	7/21/97	10.5-12.0	7300	2990	Good Recovery
	97-05897	7/22/97	15.5-17.0	19000	8640	Fair to Good Recovery
*	97-05898	7/22/97	20.5-22.0	4910	2240	Good Recovery
	97-05899	7/22/97	24.5-26.0	249	129	Fair Recovery
GP0497	97-05900	7/23/97	8.5-10.0	4220	1980	Good Recovery
	97-05901	7/23/97	13.5-15.0	372	165	Good Recovery
		7/23/97	18.5-20.0			No Water
	97-05903	7/23/97	23.0-24.5	44	32	Poor to Fair Recovery
GP0597	97-05905	7/23/97	8.5-10.0	18	6	Fair Recovery
	97-05906	7/23/97	13.5-15.0	14	16	Good Recovery
		7/23/97	18.5-20.0			No Water
GP0697	97-05908	7/24/97	8.5-10.0	24900	11800	Fair to Good Recovery
	97-05909	7/24/97	13.5-15.0	1210	594	Fair to Good Recovery
	97-05910	7/24/97	17.5-19.0	2690	1340	Poor Recovery
GP0797	97-05911	7/25/97	8.5-10.0	28200	13700	Good Recovery
	97-05913	7/25/97	13.5-15.0	2340	1140	Fair to Good recovery
	97-05914	7/25/97	18.5-20.0	489	234	Good Recovery
GP0897*	97-05916	7/25/97	8.5-10.0	2810	1390	Good Recovery

GEOPROBE POINT NUMBER	SAMPLE ID	SAMPLE COLLECTION DATE	SAMPLING DEPTH (FT)	GROSS BETA pCi/L	Sr-90 pCi/L	COMMENTS
	97-06350	7/26/97	12.5-14.0	120	78	Poor Recovery
	97-06351	7/26/97	17.0-18.5	353	208	Poor Recovery
GP0997	97-06354	7/29/97	8.5-10.0	2895	1465	Good Recovery
	97-06356	7/29/97	13.5-15.0	1680	837	Good Recovery
		7/29/97	17.0-20.0			No Water
GP1097	97-05884	7/18/97	8.5-10.0	464	255	Poor Recovery
	97-05885	7/18/97	13.5-15.0	111	48	Good Recovery
	97-05886	7/18/97	18.5-20.0	281	161	Good Recovery
		7/18/97	23.5-25.0			No Water
GP1197	97-05879	7/17/97	8.5-10.0	334	176	Fair to Good recovery
		7/17/97	13.5-15.0			No Water
	97-05881	7/17/97	17.5-19.0	166	88	Poor Recovery
	97-05882	7/17/97	23.5-25.0	14	8	Good recovery
		7/17/97	28.5-30.0			No Water
GP1297	97-05873	7/16/97	7.5-9.0	750	346	Good Recovery
	97-05875	7/16/97	12.5-14.0	96	58	Good Recovery
	97-05876	7/16/97	17.5-19.0	526	268	Good Recovery
	97-05877	7/16/97	22.0-23.5	6	8	Poor Recovery
GP1397	97-05867	7/16/97	9.0-10.5	48	16	Good Recovery
	97-05870	7/16/97	13.5-15.0	56	22	Poor to Fair Recovery
	97-05871	7/16/97	18.5-20.0	4	2	Poor Recovery
GP1497*	97-05869	7/15/97	8.0-9.5	12	6	Fair Recovery
		7/15/97	10.0-14.5			Poor to Fair Recovery 0 Samples Taken
GP1597	97-06364	11/05/97	8.0-10.0	6	0.2	Fair Recovery
	97-06365	11/05/97	13.0-15.0	38	18	Poor to Fair Recovery
*	97-06366/ 06367	11/05/97	18.0-20.0	5	4	Good to Fair Recovery

GEOPROBE POINT NUMBER	SAMPLE ID	SAMPLE COLLECTION DATE	SAMPLING DEPTH (FT)	GROSS BETA pCi/L	Sr-90 pCi/L	COMMENTS
GP1697		11/05/97	3.0-5.0			No Water
*	97-06360/ 06361	11/05/97	8.0-10.0	32	16	Good Recovery
	97-06362	11/05/97	12.0-15.0	2270	1180	Good Recovery
		11/05/97	13.0-15.0			No Water
	97-06363	11/05/97	18.0-20.0	6	2	Good Recovery
GP1797	97-08837	11/03/97	8.0-10.0	210	101	Poor Recovery
	97-08839	11/03/97	13.0-15.0	15	11	Poor Recovery
		11/03/97	16.0-20.0			No Water
GP1897	97-08834	10/31/97	8.0-10.0	73	6.56	Fair to Good Recovery
	97-08835	10/31/97	13.0-15.0	27	5	Fair Recovery
	97-08836	10/31/97	17.5-19.5	11	ND	Fair to Good Recovery
GP1997	97-08812	10/28/97	14.0-16.0	8960	4580	Fair to Poor Recovery
	97-08813	10/28/97	19.0-21.0	12800	6650	Good to Fair Recovery
	97-08814	10/28/97	24.0-26.0	516	285	Good Recovery
GP2097	97-08809	10/28/97	12.0-14.0	10300	5380	Good Recovery
*	97-08810	10/28/97	17.0-19.0	22600	12200	Fair Recovery
	97-08811	10/28/97	22.0-24.0	214	34	Fair Recovery
GP2197	97-08806	10/27/97	13.0-15.0	43	15	Poor Recovery
		10/27/97	17.0-20.0			No Water
	97-08807	10/27/97	23.0-25.0	4	3	Good Recovery
		10/27/97	27.0-30.0			No Water
*GP2297	97-08820	10/29/97	12.0-14.0	925	492	Good Recovery
	97-08821	10/29/97	17.0-19.0	620	405	Good Recovery
	97-08822	10/29/97	22.0-24.0	16	6	Poor Recovery
*GP2397	97-08816	10/29/97	12.0-14.0	32	17	Good Recovery
	97-08817	10/29/97	16.0-19.0	16	2	Fair to Poor Recovery

GEOPROBE POINT NUMBER	SAMPLE ID	SAMPLE COLLECTION DATE	SAMPLING DEPTH (FT)	GROSS BETA pCi/L	Sr-90 pCi/L	COMMENTS
GP2497	97-08824	10/30/97	14.0-16.0	16	11	Poor Recovery
	97-08825	10/30/97	19.0-21.0	28	20	Good to Fair Recovery
	97-08826	10/30/97	24.0-26.0	3	3	Poor Recovery
GP2597		10/30/97	3.0-5.0			No Water
	97-06358	11/04/97	8.0-10.0	27	12	Poor Recovery
		11/04/97	12.0-15.0			No Water
		11/14/97	16.0-20.0			No Water
GP2697	97-08844	11/04/97	4.5-6.5	846	404	Fair Recovery
*	97-08841/ 08842	11/04/97	9.0-11.0	57	25	Good to Fair Recovery
	97-08843	11/04/97	14.0-16.0	35	8	Good Recovery
GP2797	97-08827	10/30/97	12.0-14.0	831	496	Good Recovery
	97-08828	10/30/97	16.0-19.0	559	267	Good Recovery
	97-08829	10/30/97	22.0-24.0	7460	3980	Good Recovery
GP2897	97-08831	10/31/97	12.0-14.0	1550	819	Poor Recovery
	97-08832	10/31/97	16.0-19.0	25100	13400	Fair to Poor Recovery
	97-08833	10/31/97	22.0-24.0	14600	7680	Fair Recovery
GP2997	97-06369	11/06/97	12.0-14.0	43	19	Poor Recovery
		11/06/97	16.0-19.0			No Water
		11/06/97	22.0-24.0			No Water

* -NOTES A DUPLICATE SAMPLE WAS TAKEN FOR Sr-90 ANALYSIS AT THIS DEPTH

**APPENDIX A
GEOLOGIC LOGS AND
WELL CONSTRUCTION DIAGRAMS**

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Site Id: GP0197	Location: North Plateau
Elevation: 1382.87'	Datum: Mean Sea Level
State Plane North: 893490.76	Measuring Point: 1382.87'
State Plane East: 481372.96	Total Depth: 28.00'
Completed Depth: 28.00'	Borehole Dia.: 1.50in
Date(s): 07/08/97 - 07/08/97	Drilling Method: Direct Push - Geoprobe
Consulting Firm: Dames & Moore	Logged By: M.P.Regan
Contractor: SJB Drilling	Certified By: Z.Z.Zadins
Project Name: NPGRS Program	Purpose: Water Probe Point Sample
Project Number: 30822-056	Remarks: Surface Conditions: Grassy, Gravelly, Flat Beta/Gamma Background = 100 - 150 cpm

Elevation (ft)	Depth (ft)	Recovery	Sample No.	Graphic Log	Material Description
1380			01		1) 0.0" - 8.0" Grassy rootlets, grading brown to gray brown. 8.0" - 40.0" Gravelly silt with some sand grading to finer silts at bottom. Larger gravel with clays in bottom 12.0". (GM/GC) 2) 0.0" - 2.0" Gray silty sandy clay; Disturbed with some angular to rounded gravel; Dry. (GC) 20.0" - 30.0" Damp dark-brown sandy silt with some organics; Some well rounded pebbles. (GM) 3) 0.0"-8.0" Damp dark-brown sandy silt; As above. Grading to a gravelly gray sandy silt; Dryer towards bottom; Sub angular pebbles present throughout. (GM) 4) Saturated, brown, sandy silt. Sub angular gravel throughout. (GM) 5) As above: Becoming more gravelly towards bottom. (GM) 6) 0.0"-18.0" As above but slightly more gravel; Becoming denser and dryer towards bottom. (GM) 18.0"-30.0" Grayish brown sandy silt clay with some rounded pebbles. (GM/CH) 7) 0.0"-12.0" Brown weathered silty clay grading of 24.0" of unweathered silty clay with some pebbles throughout. (CH) End of Borehole (EOB) = 28.0' Below Grade.
			02		
	10		03		
1370			04		
			05		
	20		06		
1360			07		
	30				
1350					
	40				
1340					
	50				
1330					

Site Id: GP0297	Location: North Plateau
Elevation: 1383.60'	Datum: Mean Sea Level
State Plane North: 893490.93	Measuring Point: 1383.60'
State Plane East: 481329.23	Total Depth: 28.00'
Completed Depth: 28.00'	Borehole Dia.: 1.50in
Date(s): 07/09/97 - 07/09/97	Drilling Method: Direct Push - Geoprobe
Consulting Firm: Dames & Moore	Logged By: M.P.Regan
Contractor: SJB Drilling	Certified By: Z.Z.Zadins
Project Name: NPGRS Program	Purpose: Water Probe Point Sample
Project Number: 30822-056	Remarks: Surface Conditions: Wet, Slightly mounded, Spotty Beta/Gamma Background = 100 - 150 cpm

Elevation (ft)	Depth (ft)	Recovery	Sample No.	Graphic Log	Material Description
1380			01		1) 0.0" - 4.0" of organic brown silt with rootlets throughout grading to gravelly silty clay. Brown clay increasing towards bottom becoming gray. Disturbed. Wet. (GM/CL)
			02		2) 0.0" - 5.0" total recovery - saturated sandy-silty increasingly gravelly. Brown, uniformed throughout. (GM)
	10		03		3) 0.0" - 22.0" saturated sandy silt - as above. Gravel uniform throughout. Some layering of sand. Brown. (GM)
1370			04		4) As above with a little less sand. Very saturated. Large highly weathered sandstone stuck in shoe. Brown. (GM)
			05		5) 0.0" - 22.0" as above, becoming sandy towards bottom. (GM)
	20		06		22.0" - 40.0" dense, silty, pebbly brown weathered clay; some sand mixed throughout. (GC)
1360			07		6) 0.0" - 6.0" Very coarse sand, pebbles, brown. (GP/SW) Large stone at 6.0". 6.0" - 36.0" Uniform saturated fine sand, silty and some clay. 36.0"-43.0" Fine sand, less silty/clay. 43.0" - 48.0" Brown silty clay. (GM)
	30				7) 0.0" - 18.0" Silty clay w/pebbles and fine sand throughout; Grading to grayish silty clay w/less sand. (ML/CH) 30.0" - 36.0" Coarse sand, less clay and silt. Uniform particle size. (SM)
1350					End of Borehole (EOB)=28.0' Below Grade. Hole grouted with Portland Cement/Bentonite grout.
	40				
1340					
	50				
1330					

Site Id: GP0397	Location: North Plateau
Elevation: 1383.60'	Datum: Mean Sea Level
State Plane North: 893490.79	Measuring Point: 1383.60'
State Plane East: 481302.22	Total Depth: 32.00'
Completed Depth: 32.00'	Borehole Dia.: 1.50in
Date(s): 07/10/97 - 07/10/97	Drilling Method: Direct Push - Geoprobe
Consulting Firm: Dames & Moore	Logged By: M.P.Regan
Contractor: SJB Drilling	Certified By: Z.Z.Zadins
Project Name: NPGRS Program	Purpose: Water Probe Point Sample
Project Number: 30822-056	Remarks: Surface Conditions: Muddy, grassy, Slight slope Beta/Gamma Background = 100 - 150 cpm

Elevation (ft)	Depth (ft)	Recovery	Sample No.	Graphic Log	Material Description
1380	0	01			1) 0.0" - 3.0" Dark silt with grassy material. 3.0" - 30.0" Silty clay; gray with little gravel. Disturbed and densely packed. (GM/GC)
		02			2) 0.0" - 10.0" Gray silty clay as above grading to less consolidated sandy silt with pebble to stone size gravel throughout. Brown. (GC)
	10	03			3) As above but with less silt. Very sandy towards bottom; Damp from 0.0" - 6.0"; Wet from 6.0" - 30.0". More consolidated towards middle of sample. (GC)
1370		04			4) Very uniform brown medium to coarse sand. No gravel present. Little silt. Saturated throughout. (SW)
		05			5) 0.0" - 18.0" As above grading to increased silts and clays. Approx. 150 cpm AB activity at 18.0' - layer of fine silts becoming more dense at bottom, brown, some pebbles, saturated. (SW/GM)
	20	06			
1360		07			6) 0.0" - 18.0" Loose coarse-medium sand with some silts. 18.0" - 48.0" Silty clay with some sand and pebbles grading towards gray at bottom; More consolidated. (GM)
		08			7) Loose, sandy, gravel with some silt; Grayish in color; Saturated. Rounded pebbles throughout. (GM)
	30				8) 0.0" - 12.0" of loosely packed gravelly sand as above; saturated. 12.0" - 48.0" Dense silty clay with some rounded pebbles, grading from brown to gray brown. Damp. (GM/CH)
1350					End of Borehole (EOB): 32.0' Below Grade. Hole grouted w/Portland Cement/bentonite grout.
	40				
1340					
	50				
1330					

Site Id: GP1297	Location: North Plateau
Elevation: 1378.67'	Datum: Mean Sea Level
State Plane North: 893586.65	Measuring Point: 1378.67'
State Plane East: 481346.51	Total Depth: 28.00'
Completed Depth: 28.00'	Borehole Dia.: 1.50in
Date(s): 07/10/97 - 07/11/97	Drilling Method: Direct Push - Geoprobe
Consulting Firm: Dames & Moore	Logged By: M.P.Regan
Contractor: SJB Drilling	Certified By: Z.Z.Zadins
Project Name: NPGRS Program	Purpose: Water Probe Point Sample
Project Number: 30822-056	Remarks: Surface Conditions: Grassy, Sloping towards ditch Beta/Gamma Background = 100 - 150 cpm

Elevation (ft)	Depth (ft)	Recovery	Sample No.	Graphic Log	Material Description
			01		1) 0.0" - 4.0" of dark brown organic rich silt; Some gravel and rootlets. 4.0" - 38.0" of disturbed silty clay with large gravel throughout; Brownish. (GC)
			02		2) As above; 34.0" with last 12.0" becoming wet to saturated. Some smaller pebbles throughout. (GC)
1370	10		03		3) Brown saturated silty sand with increasing gravel towards bottom. Loosely packed throughout top half of recovery, more consolidated at bottom. (SM/GM)
			04		4) As above with layer of gravel throughout; Saturated. Pebble sized gravel at bottom. (GM)
1360	20		05		5) 0.0" - 18.0" as above; coarse sand some silt and pebbles. (GM) 18.0" - 36.0" Silty brown clay; densely packed; (CL) Very little gravel. 36.0" - 48.0" loose silty fine sand. Brown; Saturated. (SM)
			06		6) 0.0" - 26.0" Brown fine sand with some silts; no Gravel. (SM) 26.0"-48.0" silty, gravelly, loosely packed. Some larger gravel; Gray. Saturated. (GM)
			07		7) Silty clay; Brown grading to gray at bottom. Damp with small rounded pebbles. (CH)
1350	30				End of Borehole (EOB) : 28.0' Below Grade Hole Grouted with Portland Cement/Bentonite Grout.
1340	40				
1330	50				
1320					

Site Id: GP1497	Location: North Plateau
Elevation: 1378.61'	Datum: Mean Sea Level
State Plane North: 893582.99	Measuring Point: 1378.61'
State Plane East: 481424.64	Total Depth: 20.00'
Completed Depth: 20.00'	Borehole Dia.: 1.50in
Date(s): 07/14/97 - 07/14/97	Drilling Method: Direct Push - Geoprobe
Consulting Firm: Dames & Moore	Logged By: M.P.Regan
Contractor: SJB Drilling	Certified By: Z.Z.Zodins
Project Name: NPGRS Program	Purpose: Water Probe Point Sample
Project Number: 30822-056	Remarks: Surface Conditions: Grassy, Dry, Sloping to ditch Beta Gamma Background = 100 cpm

Elevation (ft)	Depth (ft)	Recovery	Sample No.	Graphic Log	Material Description
1370	10	01-04	01-04	[Graphic Log Symbols]	1) 0.0" - 7.0" Silty, brown gravelly; Some grass rootlets. (GM) 7.0" - 18.0" Brown silt with pebbles. (GM) - 18.0"-31.0" Brown silt with some clay; Unconsolidated; disturbed. (GC)
1360	20	05	05	[Graphic Log Symbols]	2) 0.0" - 10.0" As above but saturated. (GC) 10.0" - 22.0" loose sandy gravel with some silts; Brown. Damp grading to wet at bottom. (GC/GM)
1350	30				3) 0.0" - 18.0" As above but saturated. (GC/GM) 18.0" - 38.0" increased silty clay; Poorly sorted gravels throughout; Damp tightly packed; Brown. (GM)
1340	40				4) 0.0" - 18.0" Loose, saturated brown sandy gravel; some silt. (GM) 18.0" - 18.0" brown coarse sand trace gravel. (SW) 18.0" - 38.0" Gray silty clay; Dense; Damp with some rounded pebbles. (CH)
1330	50				5) Silty dense clay; As Above. (CH)
1320					End of Borehole (EOB) : 20.0' Below Grade. Hole grouted with Portland Cement, Bentonite Grout.

Site Id: GP1997	Location: North Plateau
Elevation: 1383.79'	Datum: Mean Sea Level
State Plane North: 893492.07	Measuring Point: 1383.79'
State Plane East: 481315.44	Total Depth: 30.00'
Completed Depth: 30.00'	Borehole Dia.: 2.00in
Date(s): 10/22/97 - 10/23/97	Drilling Method: Direct Push-Geoprobe 48" & 24" MacroTube
Consulting Firm: Dames & Moore	Logged By: M.P.Regan
Contractor: Zebra Environmental	Certified By: Z.Z.Zodins
Project Name: NPGRS Program	Purpose: Water Probe Point Sample
Project Number: 30822-109	Remarks: Surface conditions: Grassy slight slope, wet. Beta/Gamma Background = 100 cpm

Elevation (ft)	Depth (ft)	Recovery	Sample No.	Graphic Log	Material Description
1380	0	100%	1	●●●●●●●●●●	1) 0.0" - 6.0" Organic brown with roots throughout.(OL) 6.0" - 48.0" Dense disturbed silty clay with rounded gravel; gray; dry.(GC) B/BG:BB
	2	100%	2	●●●●●●●●●●	2) 0.0" - 24.0" as above.(GC) 24.0" - 48.0" Loose brown dry silty sandy gravel, some larger gravel.(GM) B/BG:BB
	3	100%	3	●●●●●●●●●●	3) 0.0" - 20.0" As above with small rounded pebbles. 20.0" - 36.0" As above but wet and some larger gravel; loosely packed and brown.(GM) B/BG:BB
1370	4	100%	4	●●●●●●●●●●	4) 0.0" - 24.0" As above - saturated; some larger gravel some cleaner sand.(GM) 24.0" - 36.0" Dense silty clay; some fine sand some small pebbles and layering; damp but not saturated.(CL)
	5	100%	5	●●●●●●●●●●	36.0" - 48.0" Loose saturated silty sandy gravel Brown; larger gravel.(GM) B/BG:BB
	6	100%	6	●●●●●●●●●●	5) 0.0" - 20.0" As above with coarse sand and silt; loosely packed; saturated.(GM) 20.0" - 36.0" Dense layered silty clay - damp some pebbles. gray.(CL)
1360	7	100%	7	●●●●●●●●●●	36.0" - 41.0" Coarse, loose sand; saturated some silt and trace of clay.(SM)
	8	100%	8	●●●●●●●●●●	41.0" - 48.0" Dense silty clay - as above.(CL) B/BG:BB
	9	100%	9	●●●●●●●●●●	6) 0.0" - 10.0" (24" macrotube) Coarse clean sand, very little gravel. some silt; saturated.(SM)
1350	10	100%	10	●●●●●●●●●●	10.0" - 16.0" Silty pebbly clay with some fine sand.(CL) 16.0" - 18.0" Some small gravel; coarse sand and silt. Wet.(GM) B/BG:100 cpm AB
				●●●●●●●●●●	7) 0.0" - 12.0" (24" macrotube) Coarse clean sand, very little silt; Saturated. (SW) B/BG:80 cpm AB. 12.0" - 24.0" Fine silt, sand and some clay with some rounded pebbles, Wet. (SM) B/BG:0 cpm AB.
	40			●●●●●●●●●●	8) 0.0" - 20.0" (24" macrotube) As above - Wet fine sand and silt; Brown.(SM) 20.0" - 24.0" Medium to small gravel with some silt and sand; Saturated; Brown.(GM) B/BG:BB
1340				●●●●●●●●●●	9) 0.0" - 12.0" (24" sample) Fine sand and silt, gray brown with some clay; no gravel; saturated.(SM) B/BG:BB
	50			●●●●●●●●●●	10) 0.0" - 3.0" (24" sample) Coarse sand with some silt. Saturated.(SM) 3.0" - 15.0" Dense silty clay with some rounded pebbles; very stiff, damp.(CH) B/BG:BB
1330					End of Borehole (EOB) - 30.0' Below Grade. Hole grouted with Portland Cement/Bentonite Grout.

Site Id: GP2097	Location: North Plateau
Elevation: 1383.87'	Datum: Mean Sea Level
State Plane North: 893493.04	Measuring Point: 1383.87'
State Plane East: 481285.62	Total Depth: 28.00'
Completed Depth: 28.00'	Borehole Dia.: 2.00in
Date(s): 10/23/97 - 10/23/97	Drilling Method: Direct Push - Geoprobe 48" MacroTube
Consulting Firm: Dames & Moore	Logged By: M.P.Regan
Contractor: Zebra Environmental	Certified By: Z.Z.Zadins
Project Name: NPGRS Program	Purpose: Water Probe Point Sample
Project Number: 30822-109	Remarks: Surface conditions: Wet grassy topsoil. Beta/Gamma Background = 100 cpm

Elevation (ft)	Depth (ft)	Recovery	Sample No.	Graphic Log	Material Description
1380	0	100%	1	●●●●●●●●●●	1) 0.0" - 4.0" Wet, brown organic silt.(OL) 4.0" - 48.0" Damp silty clay with some larger gravel; disturbed gray-brown, dry. (GC) B/BG:BB
1370	10	100%	2	●●●●●●●●●●	2) 0.0" - 24.0" as above - Wet; disturbed. (GC) 24.0" - 48.0" Disturbed dry silty sandy gravel with some silt. Very loose. (GM) B/BG:BB
1360	20	100%	3	●●●●●●●●●●	3) 0.0" - 26.0" Wet Mottled silty sand with layering of clay and gravel - disturbed.(GM) 26.0" - 28.0" Grayish dry broken gravel 28.0" - 30.0" Blackish dry slag-like material. Grain size equal to medium sand. Disturbed. B/BG:BB
1350	30	100%	4	●●●●●●●●●●	4) 0.0" - 14.0" Wet sandy silty gravel; Brown.(GM) 14.0" - 18.0" Silty wet clay; some rounded pebbles.(CH) 18.0" - 24.0" Sand and gravel - as above.(GM) 24.0" - 30.0" Silty clay; wet - as above.(CH) 30.0" - 32.0" Fine sand with some silt.(SM) 32.0" - 40.0" Silty clay - as above.(CH) 40.0" - 48.0" Moist sandy silty gravel - as above.(GM) 48.0" - 48.0" Medium fine sand; wet with some silt. (SM) B/BG:BB
1340	40	100%	5	●●●●●●●●●●	5) 0.0" - 6.0" Wet, silty gravel; brown.(GM) 6.0" - 12.0" Silty fine sand with increased clay.(SM) 12.0" - 18.0" Coarse, loose sand with small rounded gravel, saturated. B/BG:80 cpm AB.(SW) 18.0" - 21.0" Wet silty clay.(CL) 21.0" - 26.0" Wet sandy gravel.(SW) 26.0" - 28.0" Fine sand; moist to wet; some silt.(SM) B/BG:BB
1330	50	100%	6	●●●●●●●●●●	6) 0.0" - 3.0" Silty wet clay; grayish.(CL) 3.0" - 15.0" coarse sand; small rounded gravel, some silt and clay; wet and loose.(GM) 15.0" - 34.0" Silty clay with some fine sand and a trace of gravel.(CL) 34.0" - 45.0" Coarse sand with some rounded gravel.(GM) 45.0" - 48.0" Damp stiff silty clay some fine sand and rounded pebbles.(CL) B/BG:BB
			7	●●●●●●●●●●	7) 0.0" - 18.0" Inner layering sandy gravel with silty clay. Gray-brown; wet.(GM/CL) 18.0" - 48.0" Stiff, silty clay with some rounded pebbles, damp, gray. Top 18.0" material lost in crushed sample tube.(CL) B/BG:BB
					End of Borehole (EOB) = 30.0' Below Grade. Hole grouted with Portland Cement/Bentonite Grout.

Site Id: GP2197	Location: North Plateau
Elevation: 1383.95'	Datum: Mean Sea Level
State Plane North: 893494.75	Measuring Point: 1383.95'
State Plane East: 481255.36	Total Depth: 36.00'
Completed Depth: 36.00'	Borehole Dia.: 2.00in
Date(s): 10/24/97 - 10/24/97	Drilling Method: Direct Push - Geoprobe 48" MacroTube
Consulting Firm: Dames & Moore	Logged By: M.P.Regan
Contractor: Zebra Environmental	Certified By: Z.Z.Zadins
Project Name: NPGRS Program	Purpose: Water Probe Point Sample
Project Number: 30822-109	Remarks: Surface conditions: Wet, grassy new topsoil. Beta/Gamma Background = 100 cpm

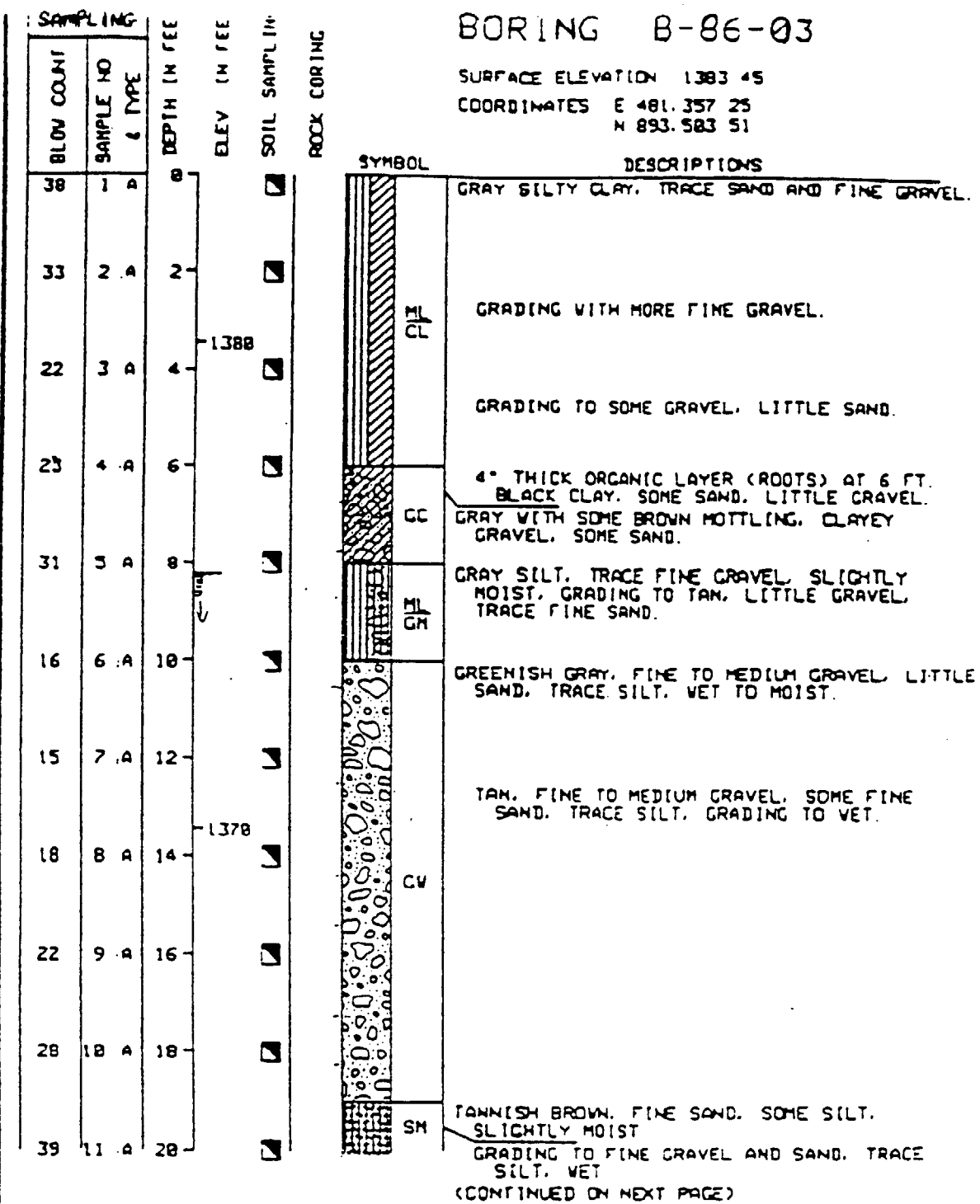
Elevation (ft)	Depth (ft)	Recovery	Sample No.	Graphic Log	Material Description
1380			1		1) 0.0" - 6.0" Brown organic silty sand; rootlets.(OL) 8.0" - 48.0" Disturbed silty sandy clay. Gray. Dry. Some larger gravel; Mottled. (CL) B/BG-BB
			2		2) 0.0" - 38.0" as above with less clay. Dry. Large stone at top of recovery. (CL) B/BG-BB
	10		3		3) 0.0" - 18.0" As above with less silt; brown.(CL) 18.0" - 20.0" Damp silty clay brown, very little gravel.(CL) 20.0" - 32.0" Dense silty clay with small rounded pebbles. Dry with some Mottling. (CL) B/BG-BB
1370			4		4) 0.0" - 40.0" Inner layed intervals of silty clay and loose saturated sandy silty gravel. Layers approximately 6.0" - 10" wide. Some fine sand towards bottom. (CL/GM) B/BG-BB
	20		5		5) 0.0" - 4.0" Loose saturated silty sandy gravel.(GM) 4.0" - 16.0" Silty wet fine sand.(SM) 16.0" - 24.0" Coarse silty wet sand.(SM) 24.0" - 44.0" Dense damp silty gray clay with some rounded pebbles.(CL) B/BG-BB
1360			6		6) 0.0" - 6.0" Loose silty clayey coarse sand, very wet.(SM) 6.0" - 28.0" Dense wet silty clay with some pebbles.(CL) 28.0" - 30.0" Loose silty gravel, wet.(GM) 30.0" - 36.0" Dense brown-gray silty clay.(CL) B/BG-BB
	30		7		7) 0.0" - 4.0" Loose wet silty sandy gravel.(GM) 4.0" - 18.0" Wet silty dense clay with rounded pebbles. Some fine sand; Brown-gray. (CL)
1350			8		8) 0.0" - 18.0" Wet silty sandy clay - some gravel.(GM) Brown some denser clay towards bottom.(CL) B/BG-BB
	40		9		9) 0.0" - 44.0" As above - Dense silty clay with small pebbles. Moist to wet.(CH) B/BG-BB
1340					End of Borehole (EOB) : 36.0' Below Grade. Hole grouted with Portland Cement/Bentonite Grout.
	50				
1330					

Site Id: GP2497	Location: North Plateau
Elevation: 1383.35'	Datum: Mean Sea Level
State Plane North: 893469.95	Measuring Point: 1383.35'
State Plane East: 481410.90	Total Depth: 32.00'
Completed Depth: 32.00'	Borehole Dia.: 2.00in
Date(s): 10/21/97 - 10/22/97	Drilling Method: Direct Push-Geoprobe 48" & 24" MacroTube
Consulting Firm: Dames & Moore	Logged By: M.P.Regan
Contractor: Zebra Environmental	Certified By: Z.Z.Zadins
Project Name: NPCRS Program	Purpose: Water Probe Point Sample
Project Number: 30822-109	Remarks: Surface Conditions: - Grassy,Slight Slope towards the north. Beta/Gamma Background= 150 - 200 cpm

Elevation (ft)	Depth (ft)	Recovery	Sample No.	Graphic Log	Material Description
1380	0	1			1) 0.0" - 6.0" Organic, Grassy rootlets, brown.(OL) 6.0" - 48.0" Dense gray Silty clay, disturbed with rounded pebbles throughout. Damp; trace of sand. (CL) B/BG:BB
	10	2			2) 0.0" - 40.0" as above with slightly more moisture and gravel (CL) 40.0" - 48.0" Dark brown silty sand with some organics - larger angular gravel with light brown silty sand towards the bottom.(GM) B/BG:BB
1370	20	3			3) 0.0" - 30.0" Dense dark gray silty clay with some larger pebbles - disturbed: damp.(CL) 30.0" - 48.0" Dry sandy silt - less clay loose with some larger gravel; less disturbed.(GM) B/BG:BB
	30	4			4) 0.0" - 20.0" wet gravel - grayish with coarse sand; some silts and clay; unconsolidated.(GM) 20.0" - 30.0" as above except brown and less clay saturated with some larger gravel.(GM) B/BG:BB
1360	40	5			5) 0.0" - 30.0" As above with increased water very loose silty gravelly sand; brown; trace of clay.(GM) B/BG:BB
	50	6			6) 0.0" - 36.0" As above - very saturated; some larger weathered gravel; very little clay.(GM) B/BG:BB
1350	60	7			7) 0.0" - 40.0" As above with fairly uniform, very coarse sand Larger gravel in bottom 10". Very wet; Brown (GM) B/BG:BB
	70	8			8) 0.0" - 18.0" (24" macrotube) Silty clayey fine sand brown weathered, some rounded pebbles - wet.(CL) B/BG:BB
1340	80	9			9) 0.0" - 20.0" (24" macrotube) Dense damp gray silty clay with rounded pebbles throughout. (CH) B/BG:BB
1330	90				End of Borehole (EOB) = 32.0' Below Grade. Hole grouted with Portland Cement Bentonite Grout.

BORING B-86-03

SURFACE ELEVATION 1383.45
 COORDINATES E 481.357 25
 N 893.583 51



BORING B-86-03

(PAGE 2)

SAMPLING		DEPTH IN FEET	ELEV IN FEET	SOIL SAMPLING	ROCK CORING
BLOW COUNT	SAMPLE NO & TYPE				
		28			
38	12 A	22		<input checked="" type="checkbox"/>	
29	13 A	24	1368	<input checked="" type="checkbox"/>	
		26			

SYMBOL	DESCRIPTIONS
SM	TANNISH BROWN. FINE GRAVEL SAND AND SILT. WET
GS	GRADING TO TAN. FINE SAND. SOME SILT.
FC	GRAY. SILTY CLAY/TILL.

BORING COMPLETED ON 7/9/86


SHEET 1 OF: 1	BORING LOG	HOLE/WELL NO.: 0105
DATE STARTED: 11/3/89		SURFACE ELEVATION: 1,383.89
DATE FINISHED: 11/7/89		
DRILLER: EMPIRE SOILS INV. HAMBURG, NY	DAMES & MOORE	NORTHING 893,502.37
INSPECTOR: JTB		EASTING 481,405.82
PROJECT: WVDP DOE/RCRA WELLS		LOCATION: NORTH OF LAGOON 5
JOB NUMBER: 10805-410-023		SSWMU Locale: 1

DEPTH IN FEET	INCHES DRIVEN / RECOVERED	SAMPLE TYPE-NO.	BLOWS ON SAMPLER		LITHOLOGY	DESCRIPTION / NOTES		
			0 / 6	6 / 12				
			12 / 18	18 / 24				
5	24/10	SS-1	4	7		Damp, brown, organic TOPSOIL composed of silt, little gravel and fine to medium grained sand, trace clay. (OL)		
	24/13	SS-2	7	12		Damp, brown to gray, SILT, some fine sand, trace fine subangular gravel. (SM)		
	24/19	SS-3	5	5		Damp, brown to gray, SILT, little fine sand, trace clay, trace subangular gravel. (SM/GM)		
	24/12	SS-4	4	8		Damp, brown, SILT, some fine to medium gravel, little fine sand, trace clay, green mottling. (SM/GM)		
	24/10	SS-5	2	4		Areas near the main plant may consist of reworked and/or backfilled material; Which are difficult to distinguish in the field.		
10	24/19	SS-6	5	7		18	20	Saturated, brown to gray, SILT and fine to coarse GRAVEL, some fine to coarse sand, trace orange mottling. (GM)
	24/14	SS-7	7	15		23	29	
	24/10	SS-8	7	8		11	19	
20	24/15	SS-9	13	8		Saturated, brown, fine to medium GRAVEL, some fine to coarse sand, some silt, trace clay. (GM)		
	24/13	SS-10	6	11			11	10
	24/15	SS-11	6	7			13	12
	24/11	SS-12	5	16			18	20
25	24/6	SS-13	22	22		Wet, brown, fine to coarse GRAVEL, some fine sand, little silt, trace clay. (GM)		
	24/15	SS-14	12	20			32	85
	24/15	SS-15	34	27			20	12
30	24/19	SS-16	8	12		Moist, oxidized, brownish, SILT and CLAY, trace very fine sand, weathered. (ML/CL)		
	24/20	SS-17	10	15			24	32
			26	33			Moist, gray, SILT and CLAY, trace fine subangular to subrounded gravel, unweathered. (ML/CL)	
35						AUGERED TO 32.0 FT. SAMPLED TO 34.0 FT. NO WATER IN BOREHOLE UPON COMPLETION NO RADIATION DETECTED ABOVE BACKGROUND BT R/S		

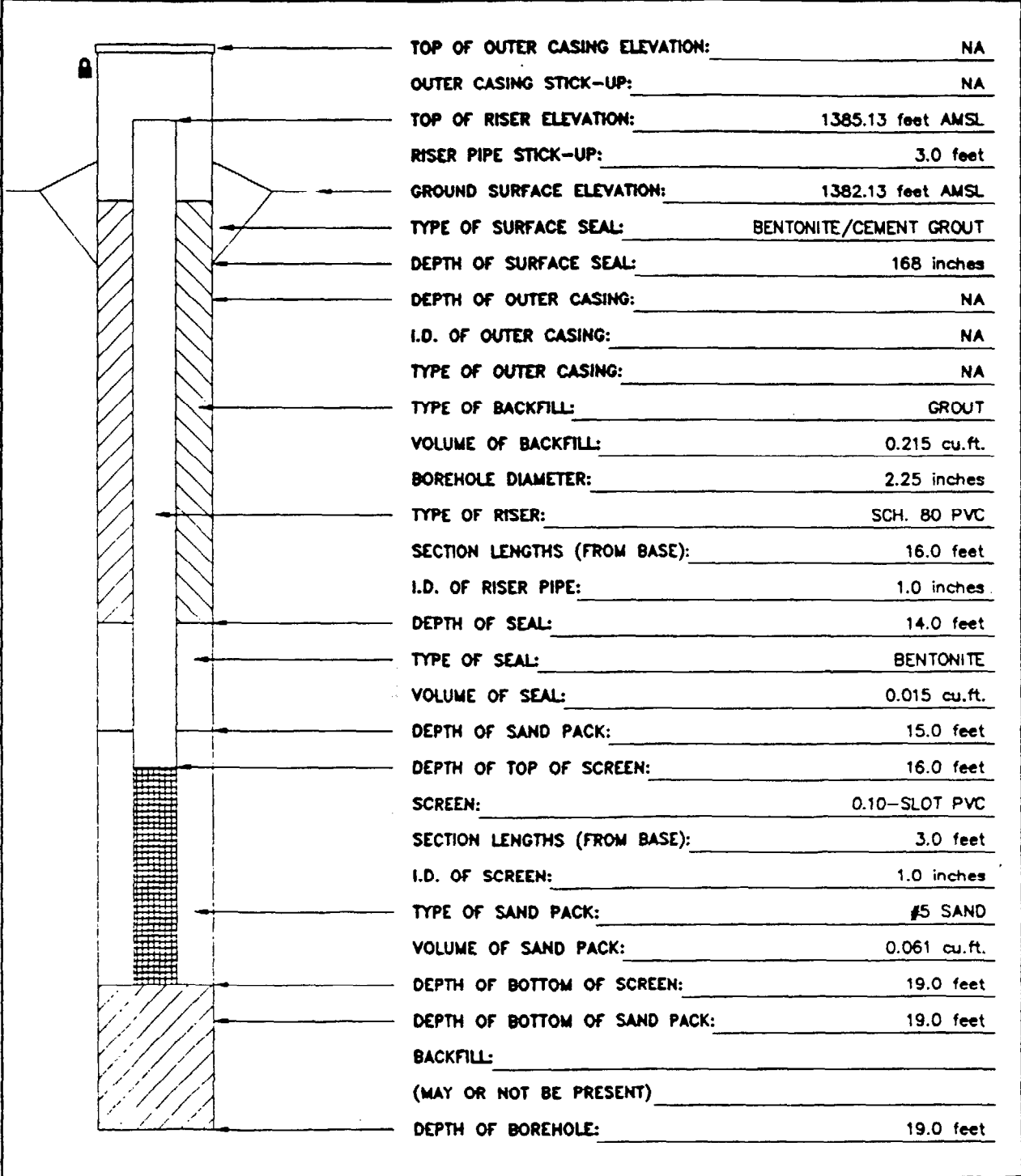
CLASSIFICATION: VISUAL (MODIFIED BURMISTER),USCS

METHOD OF SAMPLING: ASTM D1586-84

JEB: 97: W:\INACTIVE\BORING\WP-16-97.DWG


<p>HOLE/WELL NO: WP-16-97 DATE STARTED: 11/06/97 DATE FINISHED: 11/06/97 DRILLER: ZEBRA ENVIRONMENTAL FIELD GEOLOGIST: M.P. REGAN</p>	 <p>DAMES & MOORE A DAMES & MOORE GROUP COMPANY</p>	<p>SHEET 1 OF 1</p> <p>SURFACE ELEVATION: 1382.13 GROUNDWATER DEPTH: 3.69' B.G. MEASUREMENT DATE: 11/07/97 NORTHING: 893549.14 EASTING: 481311.98</p>
<p>OVERBURDEN WELL CONSTRUCTION</p>		

PROJECT: N.P. GEOPROBE INVESTIGATION	LOCATION: NORTH PLATEAU - WVDP
JOB NUMBER: 30822-109	SWMU LOCALE:

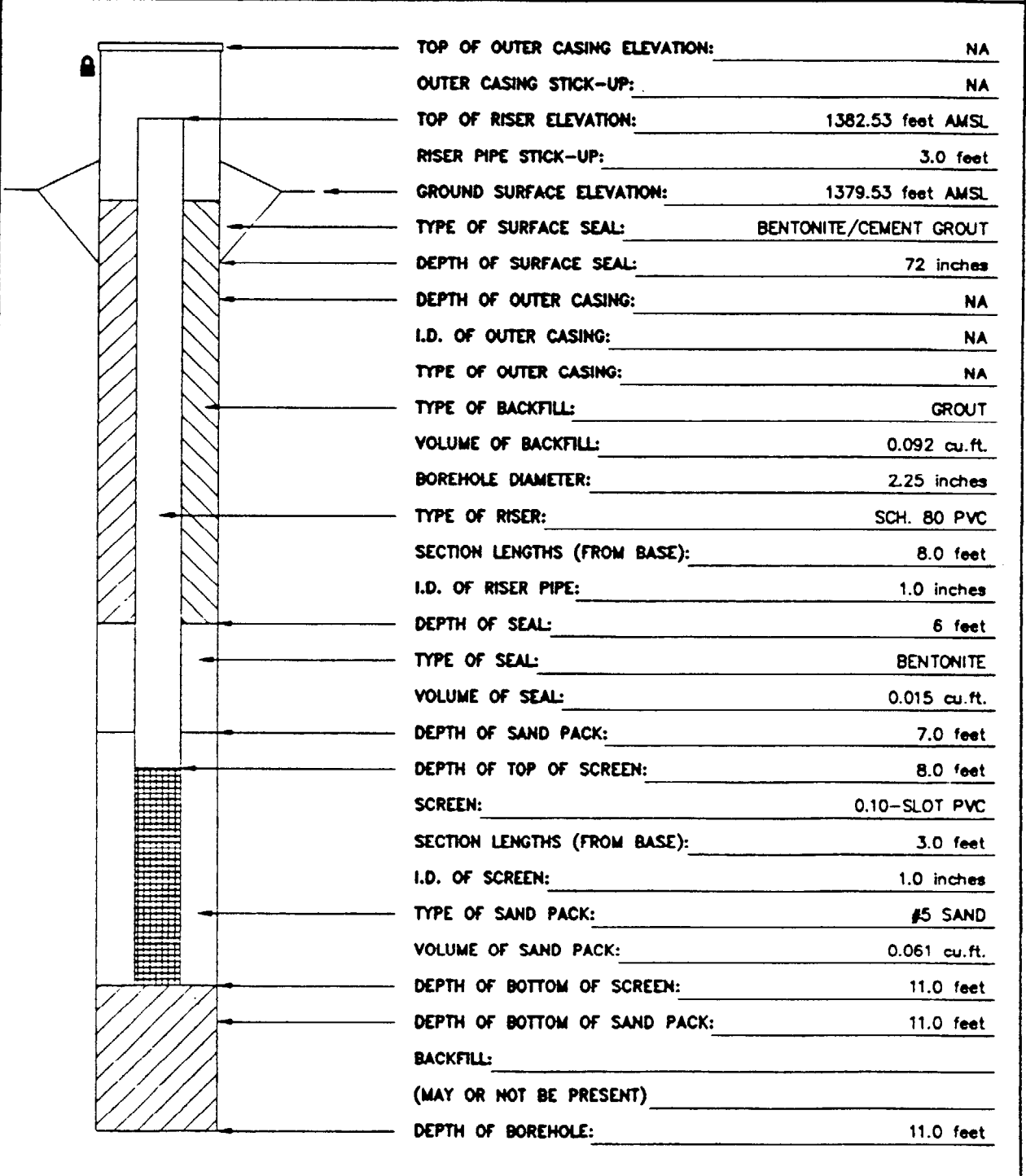


TOP OF OUTER CASING ELEVATION:	NA
OUTER CASING STICK-UP:	NA
TOP OF RISER ELEVATION:	1385.13 feet AMSL
RISER PIPE STICK-UP:	3.0 feet
GROUND SURFACE ELEVATION:	1382.13 feet AMSL
TYPE OF SURFACE SEAL:	BENTONITE/CEMENT GROUT
DEPTH OF SURFACE SEAL:	168 inches
DEPTH OF OUTER CASING:	NA
I.D. OF OUTER CASING:	NA
TYPE OF OUTER CASING:	NA
TYPE OF BACKFILL:	GROUT
VOLUME OF BACKFILL:	0.215 cu.ft.
BOREHOLE DIAMETER:	2.25 inches
TYPE OF RISER:	SCH. 80 PVC
SECTION LENGTHS (FROM BASE):	16.0 feet
I.D. OF RISER PIPE:	1.0 inches
DEPTH OF SEAL:	14.0 feet
TYPE OF SEAL:	BENTONITE
VOLUME OF SEAL:	0.015 cu.ft.
DEPTH OF SAND PACK:	15.0 feet
DEPTH OF TOP OF SCREEN:	16.0 feet
SCREEN:	0.10-SLOT PVC
SECTION LENGTHS (FROM BASE):	3.0 feet
I.D. OF SCREEN:	1.0 inches
TYPE OF SAND PACK:	#5 SAND
VOLUME OF SAND PACK:	0.061 cu.ft.
DEPTH OF BOTTOM OF SCREEN:	19.0 feet
DEPTH OF BOTTOM OF SAND PACK:	19.0 feet
BACKFILL:	
(MAY OR NOT BE PRESENT)	
DEPTH OF BOREHOLE:	19.0 feet


JEB: 97: W: \INACTIVE\BORING\WP-17-97.DWG

HOLE/WELL NO: WP-17-97 DATE STARTED: 11/06/97 DATE FINISHED: 11/06/97 DRILLER: ZEBRA ENVIRONMENTAL FIELD GEOLOGIST: M.P. REGAN	 DAMES & MOORE <small>A DAMES & MOORE GROUP COMPANY</small>	SHEET 1 OF 1 SURFACE ELEVATION: 1379.53 GROUNDWATER DEPTH: 4.85' B.G. MEASUREMENT DATE: 11/06/97 NORTHING: 893588.35 EASTING: 481303.40
OVERBURDEN WELL CONSTRUCTION		

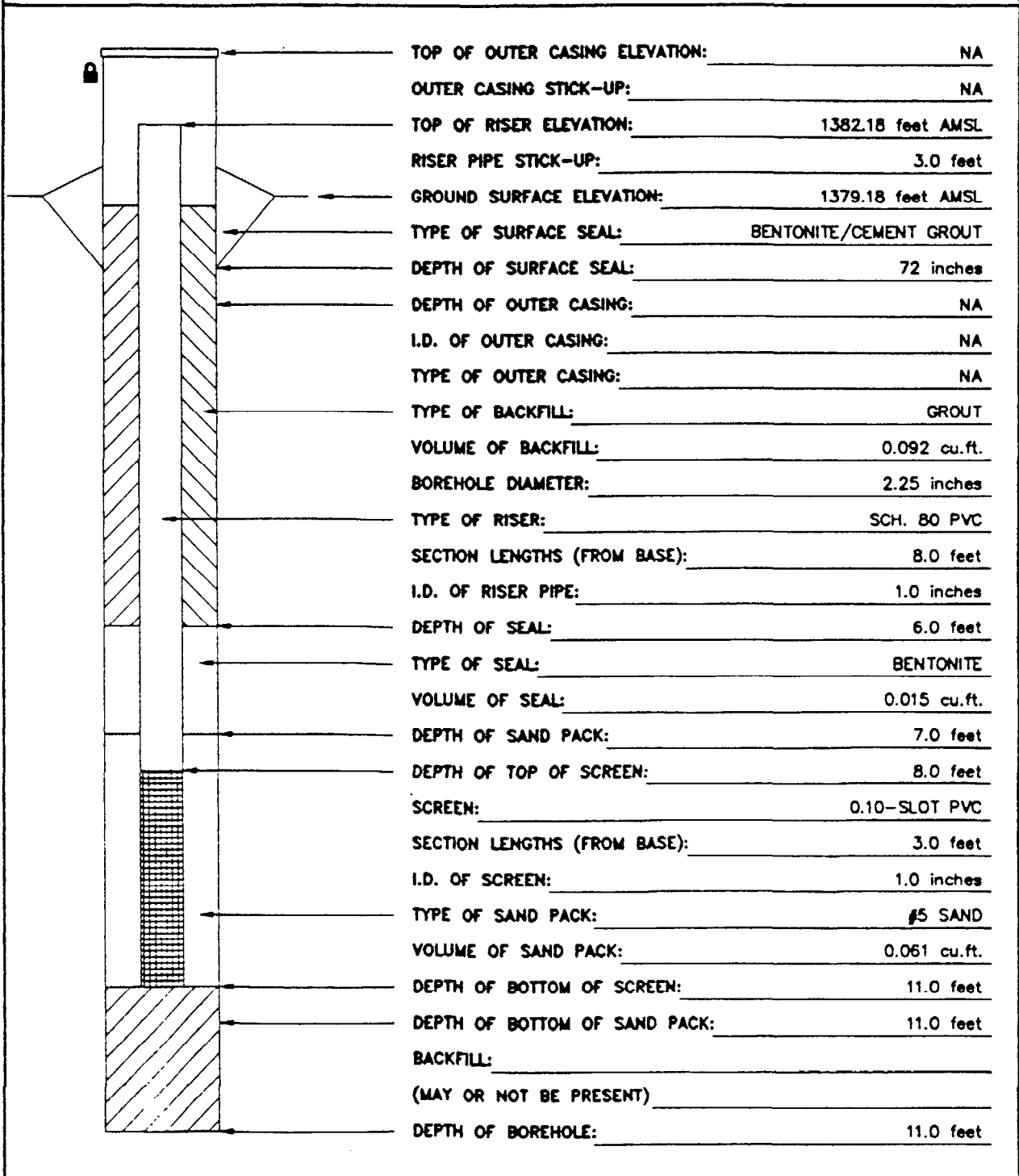
PROJECT: N.P. GEOPROBE INVESTIGATION JOB NUMBER: 30822-109	LOCATION: NORTH PLATEAU - WVDP SWMU LOCALE:
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EB: 97: W \INACTIVE\BOPNG\WP-18-97.DWG

<p>HOLE/WELL NO: WP-18-97 DATE STARTED: 11/06/97 DATE FINISHED: 11/06/97 DRILLER: ZEBRA ENVIRONMENTAL FIELD GEOLOGIST: M.P. REGAN</p>	 <p>DAMES & MOORE A DAMES & MOORE GROUP COMPANY</p> <p>OVERBURDEN WELL CONSTRUCTION</p>	<p>SHEET 1 OF 1</p> <p>SURFACE ELEVATION: 1379.18 GROUNDWATER DEPTH: 4.03' B.G. MEASUREMENT DATE: 11/07/97 NORTHING: 893585.24 EASTING: 481345.61</p>
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PROJECT: N.P. GEOPROBE INVESTIGATION	LOCATION: NORTH PLATEAU - WVDP
JOB NUMBER: 30822-109	SYMU LOCALE:



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**APPENDIX B
FIELD PROCEDURES**

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Field Procedures

Appendix B describes procedures used during the characterization program to meet the data gathering requirements of the program while ensuring worker safety and to minimize the spread of contamination.

Controlled Area

Appropriate measures were taken to facilitate surface management of the probe materials and minimize the number of personnel directly involved in this operation. A work area was defined at each location to control contamination that may have been produced during sampling operations. The controlled area was roped off and labeled with the appropriate signs by the Radiation Protection (RP) Technician. The controlled work area at each location was large enough to accommodate the following:

- A truck or drill rig with an attached probing unit;
- A laydown area for sampling tools removed from the sampling location; and
- One 55-gallon steel lined yellow drum for spent disposable supplies such as towels, wipes, gloves, plastic, and other solid trash (radiological areas only).

Groundwater Sampling Procedures

A truck or drill rig, equipped with the probe advancement system, were used to drive the subsurface probe to selected depths. The probe system is a hydraulically powered percussion/probing machine that can be used for sampling groundwater and soil. The probing tool consists of 1-inch OD, flush-joint, and hollow stem rods which are fitted with an expendable cone-shaped point. Variations of this basic set-up are used for different types of sampling.

The following procedures were used to advance the probe to collect groundwater samples:

- Advanced probe (fitted with 3/8-inch polyethylene tubing attached to a screen point sampler) down to a depth at least 5 feet below the water table;
- Pulled up the probe rods 2 feet to expose the screen point to the groundwater;
- Attached 3/8-inch tubing to a peristaltic pump and purged probe to dryness or purged an amount of water equal to at least three static volumes of water in the probe. Purged water was collected in 5-gallon carboys labeled with sample location and transferred to 55-gallon drums;
- After purging, the water was pumped directly into sample bottles;
- Removed probe and tubing from the test hole;
- Advanced clean probe rod and screen point sampler to a depth 5 feet below the first sampling interval and repeated sampling procedure. Clean sample tubing was used for each sample.

Groundwater samples were collected in this manner to the top of the Lavery till, at approximately five foot intervals, geology permitting. Depth of the Lavery till was estimated based on the topographic and top of till contour maps. However, the probe was advanced until there was an increase in the difficulty to drive the probe. Greater resistance in probe advancement corresponded to the top of the Lavery till. This sampling procedure allowed groundwater to be collected throughout the saturated interval in the Sand and Gravel Unit.

All groundwater samples were pumped directly into labeled sample bottles using a peristaltic pump and disposable tubing. The samples were analyzed for both gross beta and Sr-90. The sampling procedure was similar to EM-6, Groundwater Sampling (Dames and Moore, December 15, 1994). Specific sampling instructions were included in a work order prior the start of the program. Most of the samples were filtered in the field, except those that were extremely turbid were filtered the laboratory. Samples were preserved with nitric acid, to obtain a pH less than 2, by the on-site Environmental Laboratory.

Sample Handling

Bottles were labeled with a unique sample number, date, time of sample collection, and required analysis. The containerized samples were surveyed by a Radiation Projects technician and placed in shipping coolers. The shipping coolers were hand-delivered to the on site Environmental Laboratory for analysis. These samples were delivered under standard chain-of-custody protocols presented in EM-52, Environmental Sample Receipt, Handling, Storage, Packaging and Shipment (Dames and Moore, May 24, 1996).

Subsurface Soil Sampling Procedures

Subsurface soil sampling was performed using direct push of a hollow 1.5-inch diameter rod equipped either a two or four foot long, soil sampling tube. This allowed for the continuous collection of soils from grade to a depth where the Lavery till could be verified. Geologic logs were prepared using visual inspections by the field geologist. Soil sampling was conducted in the following manner:

- Attached assembled 1 7/16-inch diameter soil sampler onto leading probe rod and advance to top of sampling intervals;
- Detached probe point from soil sampler;
- Drove the sampler 24 or 48 inches to obtain soil sample;
- Retracted the probe rods from the hole and detached sampler from the rods;
- Sample was kept in the clear plastic soil sampler rod; and
- Radiation Protection (RP) surveyed the sample for radioactivity.

All soil samples were kept directly in 1-inch soil sampler plastic cylinders. These samples were retained for geological proposes only. EM-500, Drilling, Soil Sampling, and Geological Logging Procedures (Dames and Moore, April 5, 1995) were followed.

Decontamination Procedures

The probing rods were broken down to their shortest lengths and delivered to the decontamination area wrapped in a layer of herculite. Equipment decontamination was conducted at a centralized decontamination area. All sampling equipment was decontaminated between sample locations and also at the end of the program for release and off-site use.

The procedures used for equipment decontamination were as follows:

- i) Washed and brushed equipment with nonphosphate detergent to remove contamination;
- ii) Rinsed with clean tap water;

- iii) Laid the equipment aside on herculite to dry and had the RP technician screen the equipment; and
- iv) Wiped equipment and screened wipes for radiological contamination (RP technician).

If the initial decontamination was unsuccessful, the above steps were repeated up to three times. All equipment was free released per Radiation Protection.

Closure of the Test Holes and Probing Locations

Approval for hole closure was given after all required samples were collected, logged, and placed in the designated storage area. Bentonite grout was poured down the test hole and filled to ground surface. The holes were then staked and labeled. At program completion, all test holes were surveyed and plotted on a site map.

Field Data Management

All information collected during the subsurface probing program was recorded in a bound field logbook. The field logbook included the following information:

- field sample identification;
- date and time of sampling/measurement;
- sample location;
- sample description;
- sample depth;
- parameters or analysis being reported;
- associated Quality Assurance/Quality Control samples;
- any field measurements taken with field instruments;
- background readings and measurement units;
- identification of sampling personnel;
- sampling activities and how approval was obtained; and
- blank areas at the bottom of a page or between entries should be marked and initialed so that no data
- Any field decisions that were made and pertinent information associated with the decision

Still photographs were taken throughout the program. All field books and photographs are stored in fire proof cabinets for safety.

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