NF-013

Formerly Utilized Sites Remedial Action Program (FUSRAP)

ADMINISTRATIVE RECORD

for

Niagara Falls Storage Site

U.S. Department of Energy

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089182

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Field Office, Oak Ridge
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Distribution

PERFORMANCE MONITORING REPORT FOR THE NIAGARA FALLS STORAGE SITE WASTE CONTAINMENT STRUCTURE FOR CALENDAR YEAR 1990

The enclosed report is prepared annually by the Department of Energy (DOE) to document the performance of the Niagara Falls Storage Site (NFSS) waste containment structure. The waste containment structure was built by DOE to isolate and contain approximately 250,000 yd^3 of low-level radioactive wastes generated during the cleanup of the NFSS site and surrounding properties.

The report summarizes the findings of the monitoring of the performance of the containment structure for calendar year 1990. This monitoring includes semiannual walkover inspections of the cap, analysis of data from aerial and surface civil surveys of the structure, and evaluation of data from monitoring devices inside the cell that can detect changes in water levels.

The conclusion of the report is that the waste containment structure continues to perform as designed and is maintaining its effectiveness in isolating the wastes from the public and the environment.

The continued monitoring of the cell performance will be documented annually; the reports should be available in the spring of each year. If you do not wish to receive these reports, if you would like to add someone to the distribution list, or if you have any questions related to this program, please contact me at (615) 576-7477.

Sincerely,

Ronald E. Kirk

Ronald E. Kirk, Site Manager
Former Sites Restoration Division

Enclosure

089182

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Formerly Utilized Sites Remedial Action Program (FUSRAP)
Contract No. DE-AC05-91OR21949

PERFORMANCE MONITORING REPORT FOR THE NIAGARA FALLS STORAGE SITE WASTE CONTAINMENT STRUCTURE

Lewiston, New York

Calendar Year 1990

March 1992

Bechtel National, Inc.

0988-1335.1

DOE/OR/21949-303

PERFORMANCE MONITORING REPORT
FOR THE NIAGARA FALLS STORAGE SITE
WASTE CONTAINMENT STRUCTURE,
LEWISTON, NEW YORK,
FOR CALENDAR YEAR 1990

MARCH 1992

Prepared for

United States Department of Energy

Oak Ridge Field Office

Under Contract No. DE-AC05-91OR21949

By

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Bechtel National, Inc.

Oak Ridge, Tennessee

Bechtel Job No. 14501

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ACRONYMS

DCG	derived concentration guideline
DOE	Department of Energy
FUSRAP	Formerly Utilized Sites Remedial Action Program
MSL	mean sea level
NFSS	Niagara Falls Storage Site
PPT	pneumatic pressure transducer
TETLD	tissue-equivalent thermoluminescent dosimeter
VWPT	vibrating wire pressure transducer
WCS	waste containment structure

UNITS OF MEASURE

Bq	becquerel
cm	centimeter
ft	foot
g	gram
ha	hectare
in.	inch
km	kilometer
L	liter
m	meter
mm	millimeter
mi	mile
μCi	microcurie
ml	milliliter
mR	milliroentgen
mrem	millirem
pCi	picocurie
s	second
yr	year

1.0 INTRODUCTION

A performance monitoring program was developed in 1986 for the waste containment structure (WCS) at the Niagara Falls Storage Site (NFSS). NFSS is a part of the Department of Energy (DOE) Formerly Utilized Sites Remedial Action Program (FUSRAP), a program initiated in 1974 to identify and decontaminate or otherwise control sites where residual radioactive contamination (exceeding current guidelines) remains from the early years of the nation's atomic energy program. The WCS contains soil contaminated with residual radioactive materials, rubble, and radioactive residues removed from various areas of NFSS and vicinity properties during remedial action conducted by DOE from 1981 through 1986. The design and construction of the WCS and the closure and post-closure activities have been previously documented (Bechtel 1986a, 1986b).

The purpose of the performance monitoring program is to verify that the main engineering elements of the WCS are functioning to minimize infiltration of rainfall, prevent pollution of groundwater, and prevent radon emanation. This report presents the findings of performance monitoring conducted at the WCS during calendar year 1990. The data collected during the initial performance monitoring period in 1986 established a baseline for the interpretations contained in this report (Bechtel 1987).

The performance monitoring program is distinct from the environmental monitoring program conducted at NFSS, and it will continue for a shorter time. The performance monitoring program will continue at least through 1991, and may be maintained for a longer period depending on the results observed. To evaluate the effectiveness of the containment facility accurately, it is necessary to assess the data from both the performance monitoring program and from the broader environmental monitoring program. The environmental monitoring program monitors radon concentrations in air; radium, uranium, and heavy metals concentrations in surface water, groundwater, and sediment; and external gamma radiation levels. It includes data from both the onsite and offsite monitoring wells, and from the 36 wells added to the monitoring list since 1986. Complete results of the environmental monitoring program are published annually in a separate report (Bechtel 1991). Summary information from that report is included in Subsection 3.3 of this document.

This report includes a summary of performance monitoring results for calendar year 1990. It contains data for surface, subsurface, and environmental monitoring; conclusions based on walkover surveys; comparisons with previous data; and actions required. The vibrating wire pressure transducer (VWPT) pore water pressure readings for this period have been expressed as hydraulic head and are plotted in Appendix A.

1.1 LOCATION AND DESCRIPTION

NFSS is a DOE surplus facility located in northwestern New York in the Township of Lewiston (Niagara County). The site is located in a generally rural setting approximately 6.4 km (4 mi) south of Lake Ontario and 16 km (10 mi) north of the City of Niagara Falls. NFSS and its regional setting are shown in Figure 1-1. Figure 1-2 is a site plan of NFSS, a prominent feature of which is the WCS.

The WCS occupies 4 ha (10 acres) of the 77.4-ha (191-acre) NFSS. As shown in Figure 1-3, the WCS outer perimeter is formed by a dike and cutoff wall, each constructed of compacted clay and incorporated into the finished structure. The cutoff wall extends a minimum of 45 cm (18 in.) into an underlying gray clay unit. The gray clay unit and the cutoff wall/dike serve as adsorption barriers to vertical and horizontal migration of contaminants from the structure. Figure 1-4 presents an orthographic projection of the WCS in three views.

An engineered, compacted clay cover is placed immediately over the waste and extends beyond the perimeter dike, completely enclosing the waste. This clay cover is the principal barrier against moisture intrusion and radon emanation. The clay cover is overlain by a surface layer of loosely compacted, 45-cm- (18-in.-) thick cover of soil and topsoil. This surface layer forms a

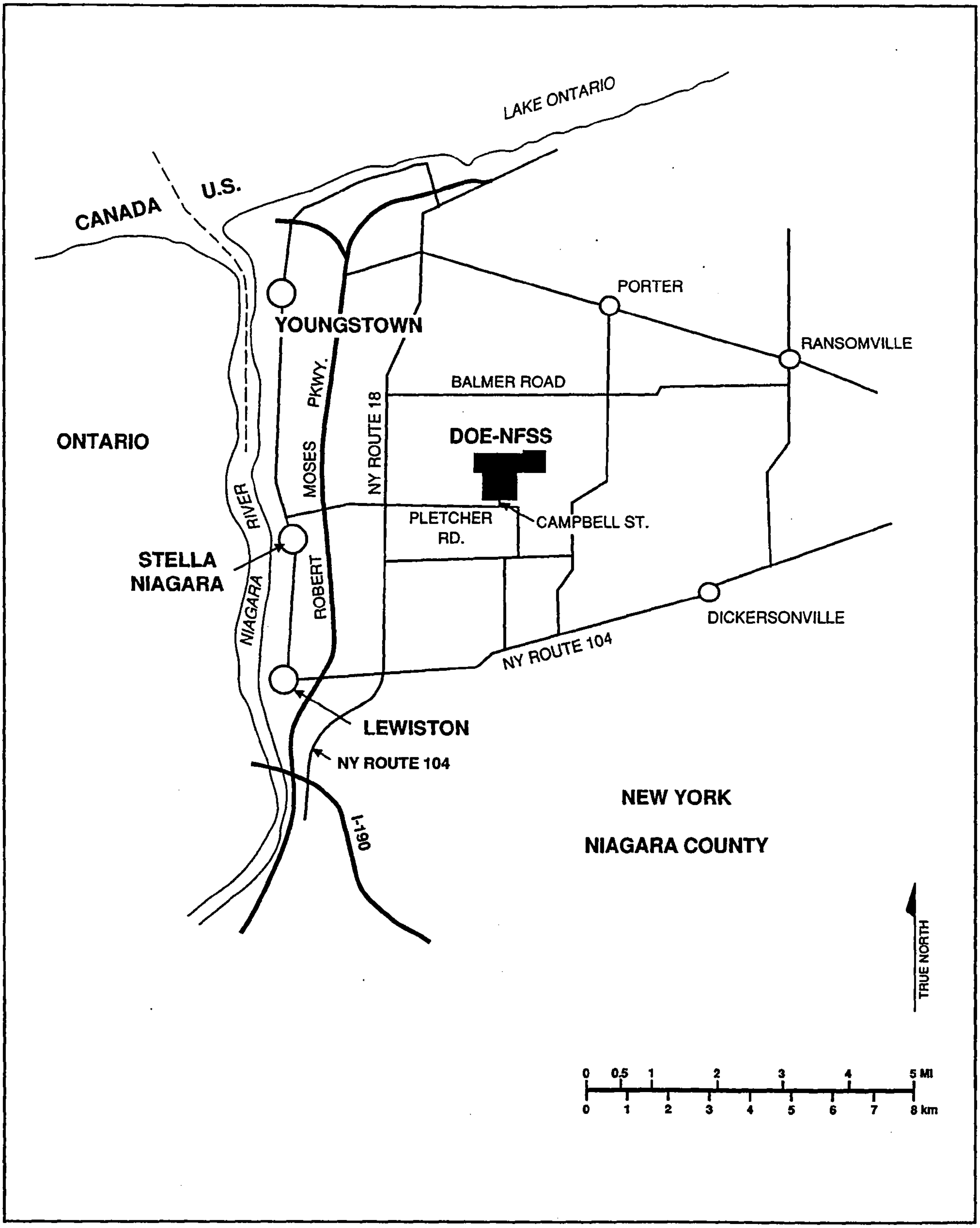

Figure 1-1
Regional Setting of NFSS

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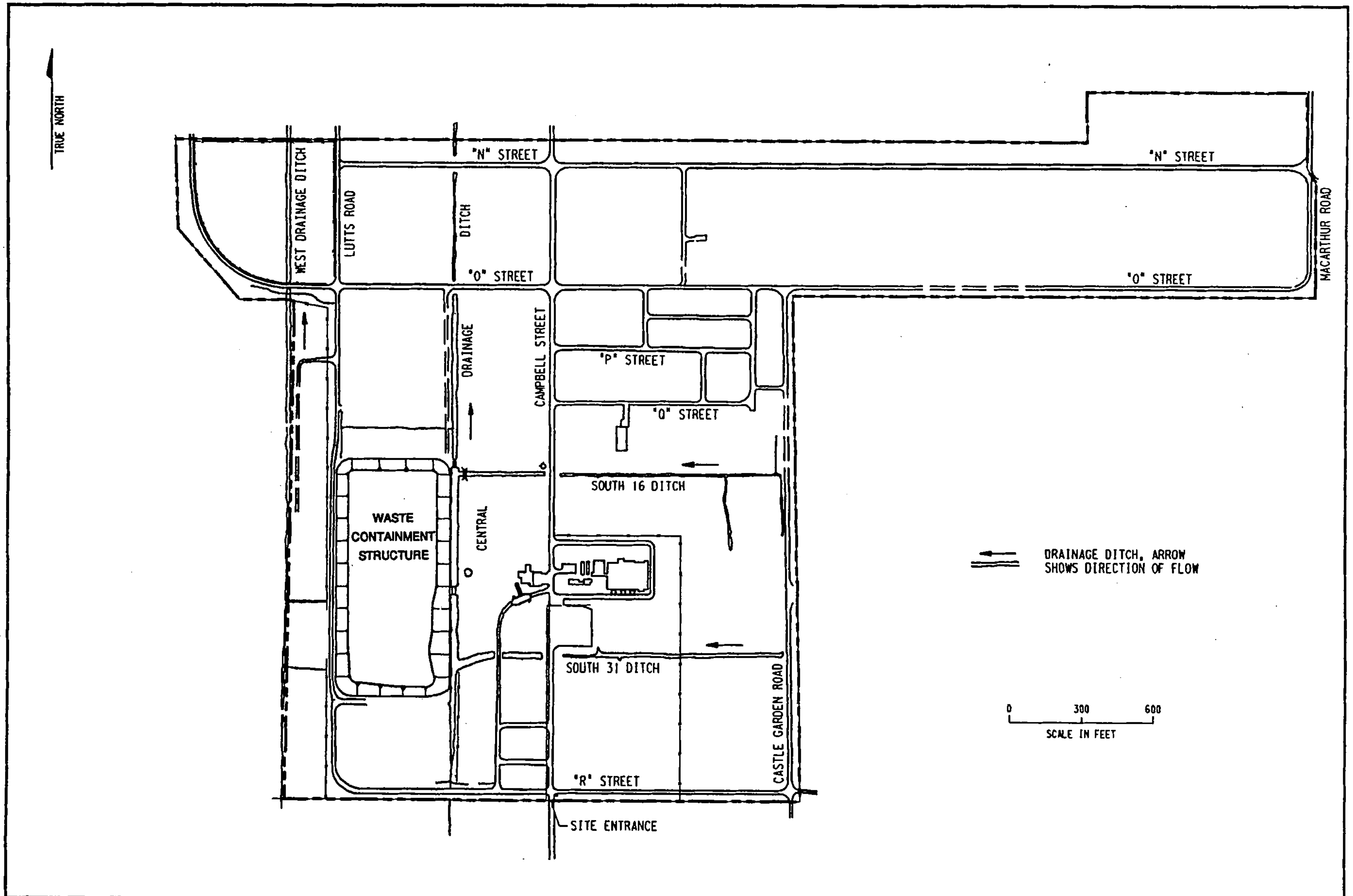

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Figure 1-2
Site Plan of NFSS

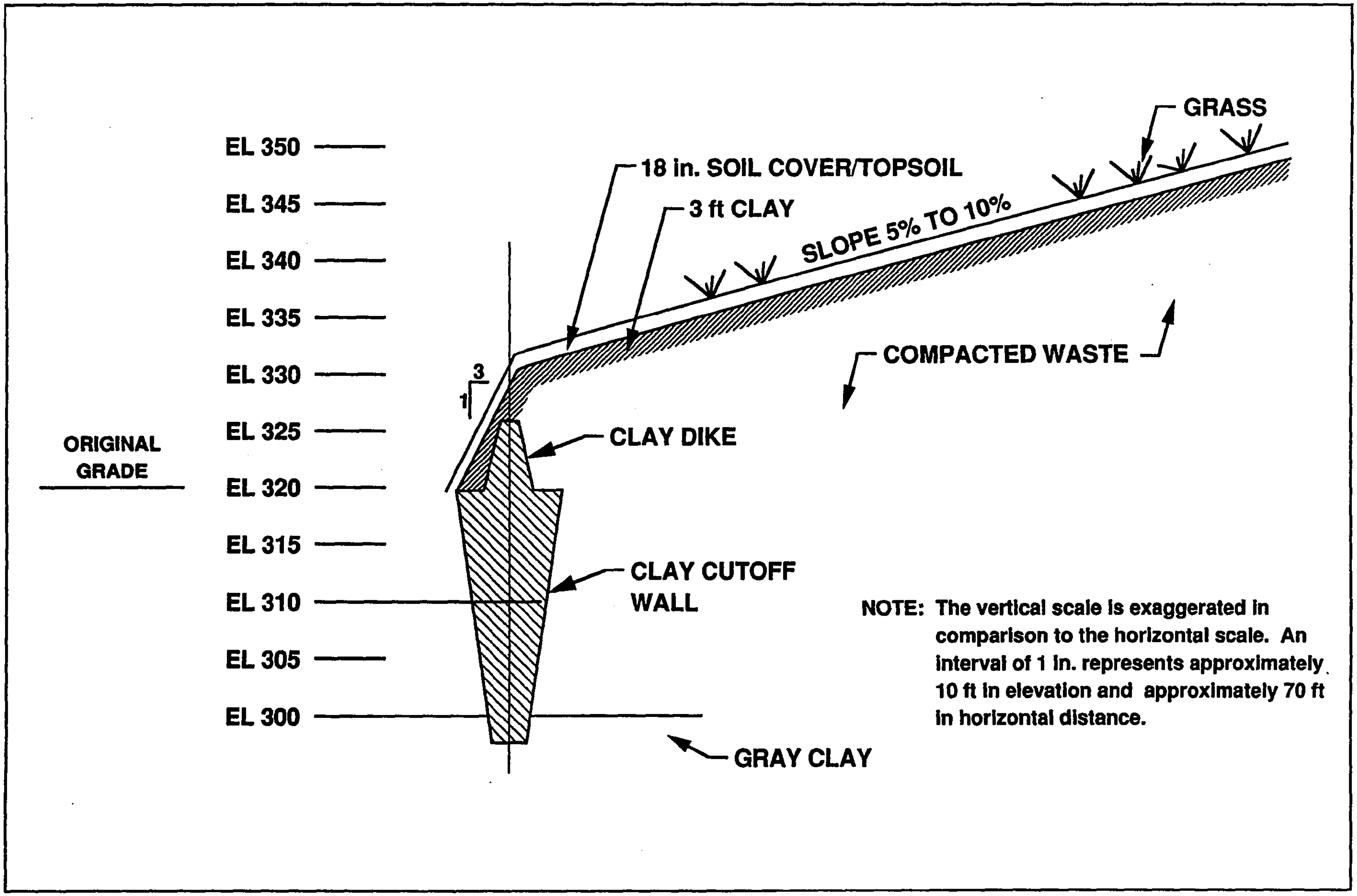

Figure 1-3
Cross Section of the NFSS WCS

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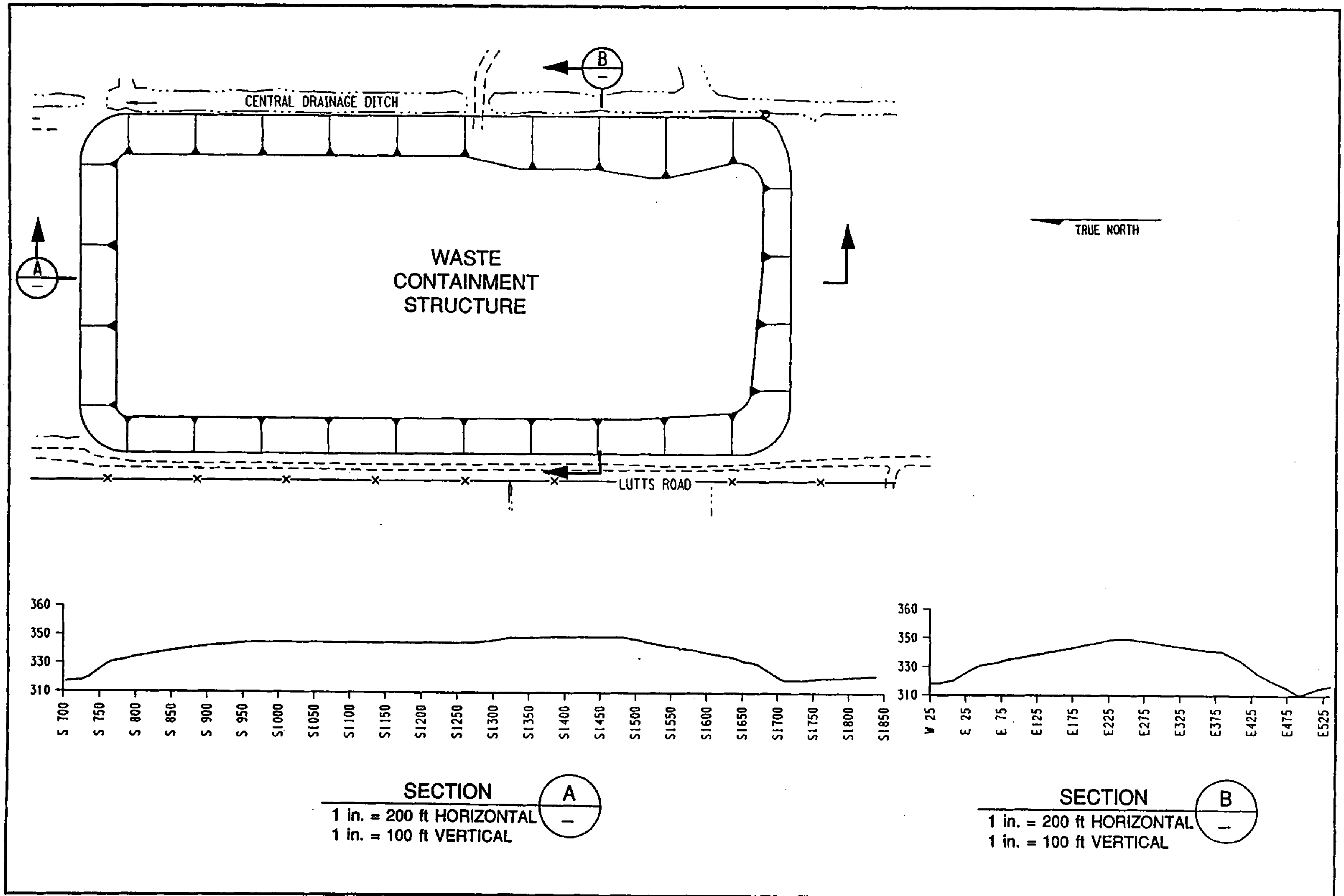

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Figure 1-4
Orthographic Projection of the WCS

protective blanket to reduce the effects of frost and prevent drying that could result in the formation of tension cracks within the clay layer. It also provides a base for shallow-rooted grass. The clay layer, soil cover, and topsoil compose the short-term, or interim, closure system for the WCS.

1.2 PROGRAM OBJECTIVE

The primary objective of the performance monitoring p the early detection of trends that could indicate weakness developing in the WCS. The monitoring system serves as the basis for a preventive maintenance program to ensure that corrective action is taken before the integrity of the structure is compromised. Consequently, surface and subsurface monitoring techniques are used. Possible indications of structural distress include:

- Differential settlement of the wastes
- Desiccation cracking of the clay cover
- Deep surface erosion
- Animal burrows
- Deep-rooted vegetation
- Rapid rise of the potentiometric (saturated) surface inside the containment structure
- Residual reduction in soil density caused by frost heave

2.0 SUMMARY OF PERFORMANCE MONITORING PROGRAM

The performance monitoring program at NFSS was initiated in November 1986 to monitor the surface and subsurface conditions of the WCS. Surface monitoring techniques are used to check waste placement, the various layers of the WCS cover, and surface drainage. Internal instrumentation monitors the performance of the clay cap, the gray clay unit, and the cutoff wall/dike.

Surface monitoring activities include topographic surveys, walkover surveys, and annual aerial photography. Initial aerial photographs were taken in early October 1986 to provide baseline photographic data. This aerial mapping provided a reference for detection of changes in the surface contours of the WCS to supplement the information provided by the topographic and walkover surveys.

The topographic and walkover surveys were initially performed in the fall of 1986, following closure of the WCS. These activities established the baseline for subsequent annual performance monitoring surveys. Data obtained at that time represented the initial condition of the WCS and provided the basis for determining whether any additional maintenance actions are required. As a result of the initial and subsequent walkovers, several actions have been taken to maintain the required performance. These actions include adding topsoil to low areas, seeding and fertilizing, installing erosion control netting, and repairing well casings. The results of surface monitoring for 1990 are discussed in Subsection 3.1, and required actions are discussed in Section 5.0.

Internal monitoring instrumentation includes 13 VWPTs to monitor pore-water pressure and a secondary system of 3 pneumatic pressure transducers (PPTs) to verify the operation of the VWPTs. The locations of these devices are shown in Figure 2-1. The PPTs were installed adjacent to three of the VWPTs. In previous performance monitoring reports, the PPT results were presented and indicated that the VWPTs were performing correctly (Bechtel 1987; 1989; 1990). However, since the sole purpose of the PPTs was to

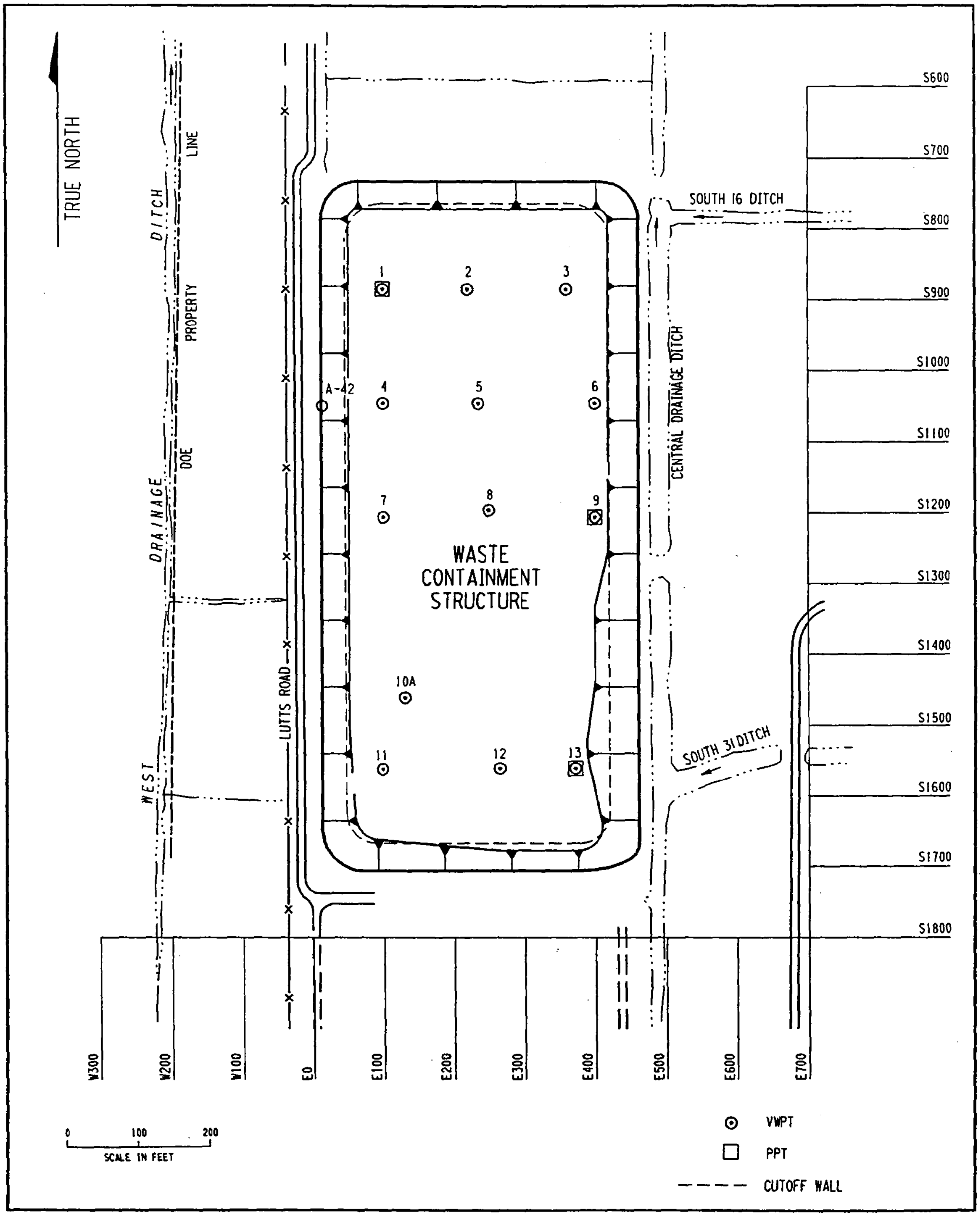

Figure 2-1
Locations of VWPTs and PPTs on the WCS

verify data obtained from the VWPTs (which were providing automatic and more accurate readings), the manual readings from the PPTs were disconnected during 1990.

The VWPTs record readings automatically each day, and data for each instrument are compiled and analyzed monthly to allow early detection of any accumulation of water inside the WCS. A summary of the data from the VWPTs is presented in Appendix A.

Walkover surveys and data collected from monitoring wells and VWPTs confirm that the WCS is functioning as predicted and is effectively isolating the waste.

3.0 PERFORMANCE MONITORING DATA

This section provides the results of performance monitoring and a summary of the results of environmental monitoring at NFSS for calendar year 1990. The specific details of hydraulic head monitoring results for this period are provided in Appendix A. Complete environmental monitoring information is provided in the 1990 annual site environmental report (Bechtel 1991).

3.1 SURFACE MONITORING

3.1.1 Aerial Photography

The most recent aerial contour mapping of the WCS surface was performed in November 1990 (see Figure 3-1). The latest aerial photograph of the WCS was taken in November 1990 (see Figure 3-2). When compared with the October 1986 aerial photograph (Figure 3-3), the 1990 photograph clearly shows that formerly bare areas in the middle and at the south end of the WCS now have well-established turf. The water-holding ponds shown in the 1986 photograph have been filled and, therefore, are not in the 1990 view. The 1990 photograph documents the improved condition of the WCS as a result of maintenance performed under the performance monitoring program.

3.1.2 Grid Survey

The initial grid survey of the WCS surface was performed in 1986 on the predetermined grid shown in Figure 3-4. The grid was established using 30.5-m (100-ft) spacing. At each grid intersection, 5- by 5- by 20-cm (2- by 2- by 8-in.) wooden stakes were driven flush with the surface of the topsoil, and their elevations were measured. Subsequent grid surveys have been performed twice each year and correspond to the annual spring and fall walkovers. The elevations and changes observed at these grid intersections are reported in Table 3-1 and represented in Figures 3-5 through 3-7.

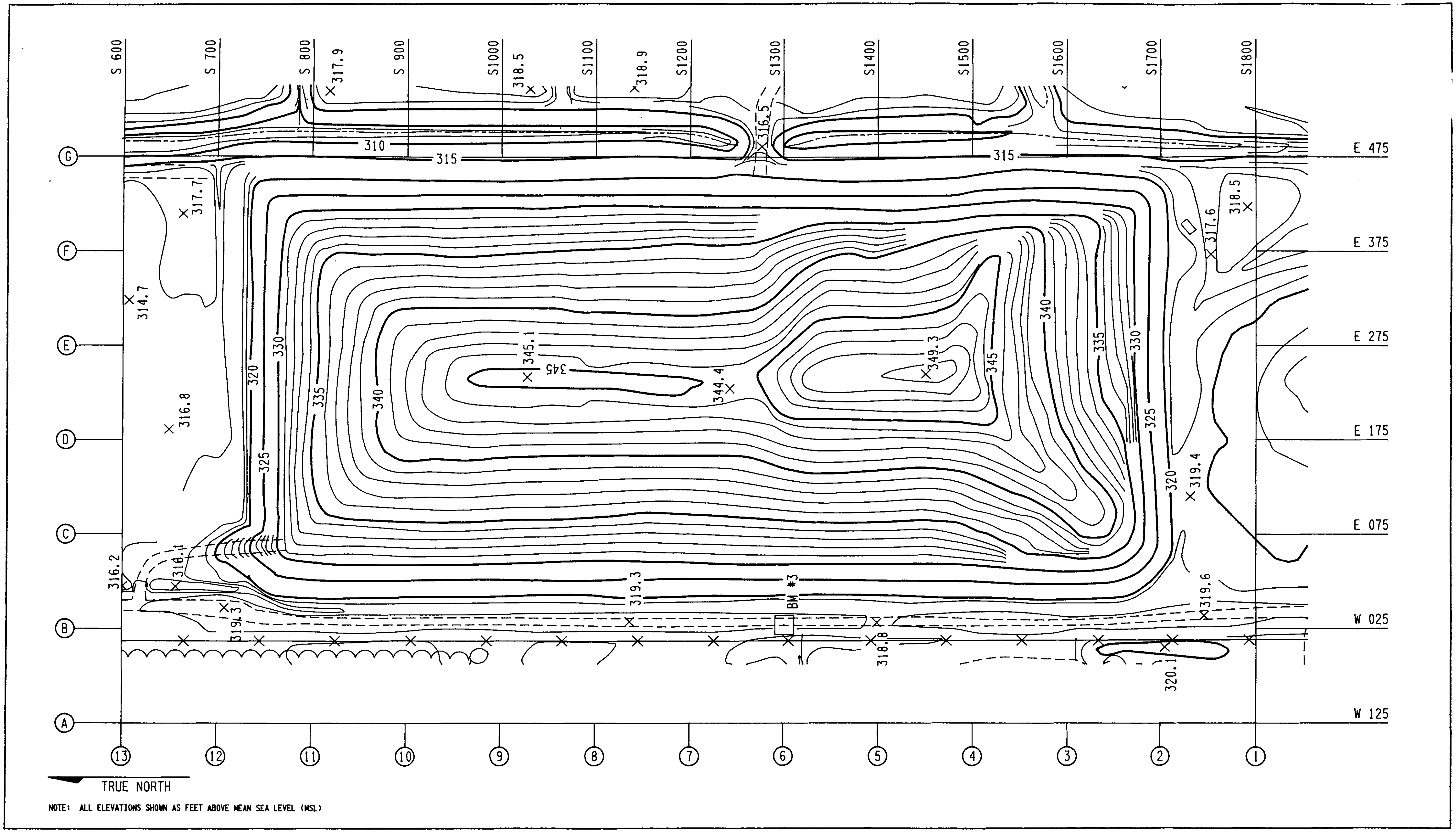

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Figure 3-1
Aerial Contour Map of the NFSS Waste Containment Structure – November 1990

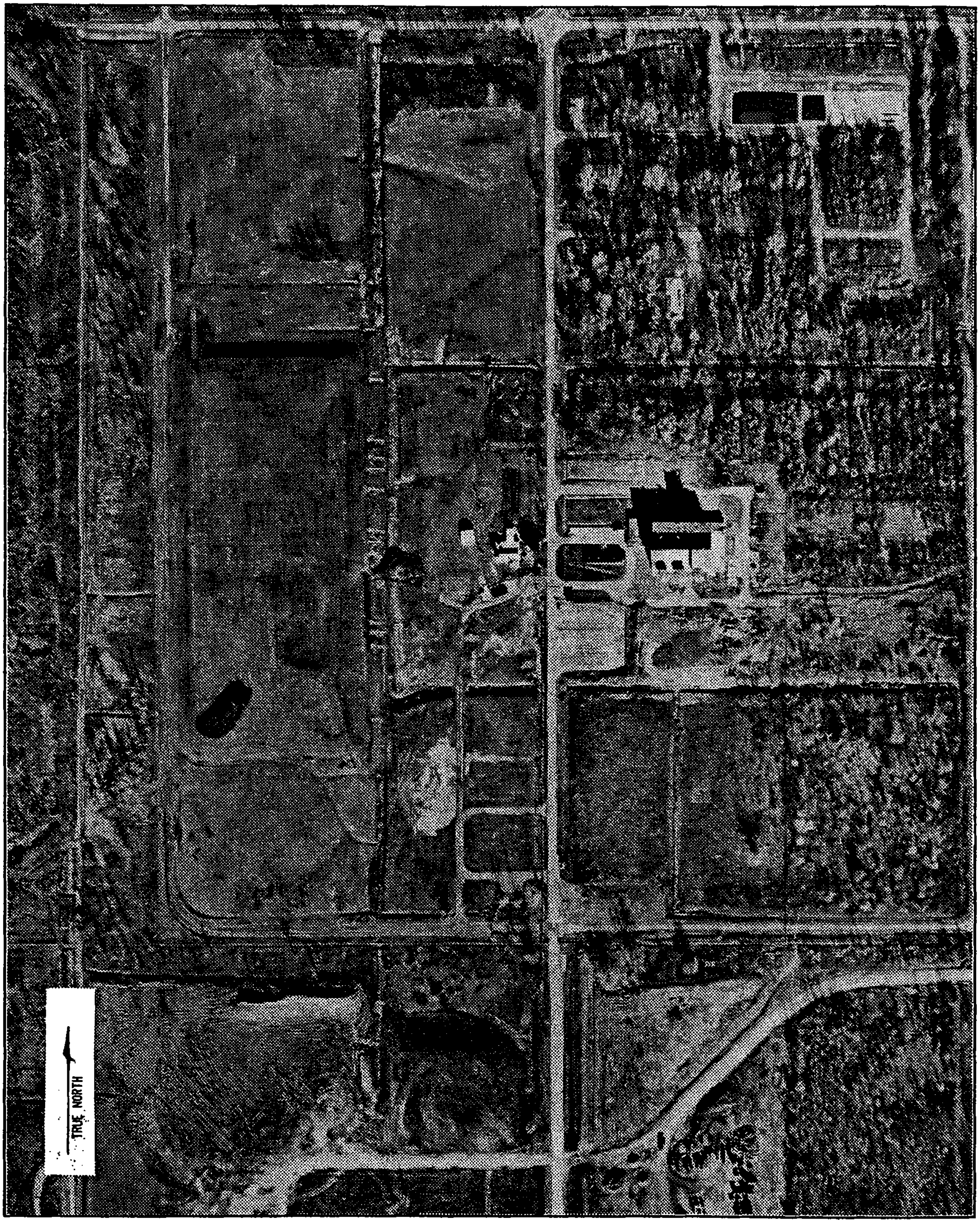

Figure 3-2
Aerial View of the NFSS WCS, November 1990

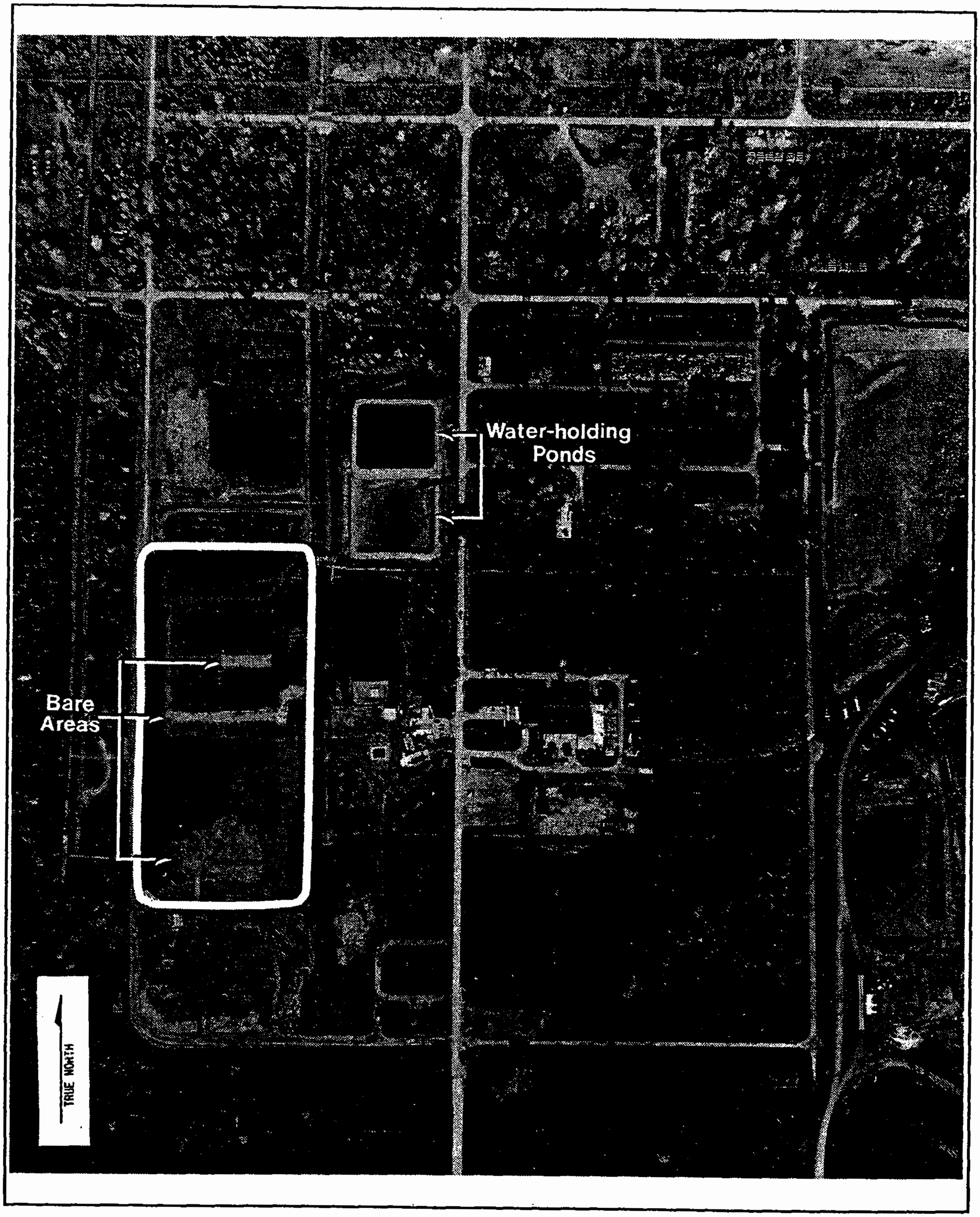

Figure 3-3
Aerial View of the NFSS WCS, October 1986

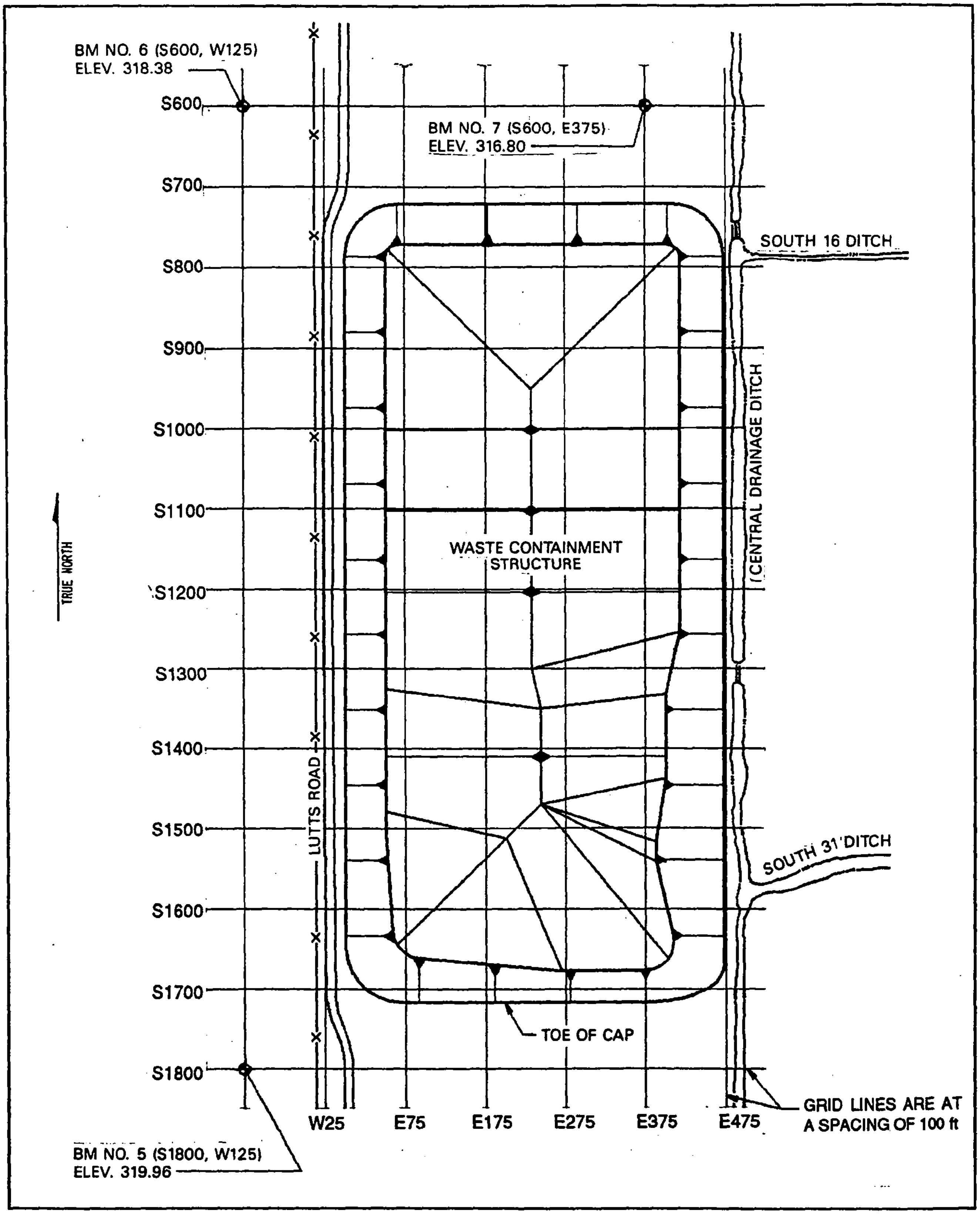

Figure 3-4
Survey Grid for the NFSS WCS

Table 3-1

Grid Surveys for the Niagara Falls Storage Site

Site Coordinates		Elevation (ft MSL)[a]				
South	East	10/14/86	04/19/90		10/16/90	
700	75	318.20	318.17	[-0.03][b]	--	[0.00][b]
700	175	317.20	317.07	[-0.13]	317.04	[-0.16]
700	275	317.10	316.59	[-0.51]	316.61	[-0.49]
700	375	317.20	316.04	[-1.16]	316.03	[-1.17]
800	75	332.20	333.14	[0.94]	333.09	[0.89]
800	175	334.70	334.58	[-0.12]	334.61	[-0.09]
800	275	334.50	334.43	[-0.07]	334.40	[-0.10]
800	375	333.50	333.50	[0.00]	333.49	[-0.01]
900	75	333.90	333.82	[-0.08]	333.81	[-0.09]
900	175	341.20	341.21	[0.01]	341.19	[-0.01]
900	275	341.70	341.64	[-0.06]	341.62	[-0.08]
900	375	334.60	334.63	[0.03]	334.61	[+0.01]
1000	75	333.60	333.58	[-0.02]	333.57	[-0.03]
1000	175	341.80	341.65	[-0.15]	341.61	[-0.19]
1000	275	343.10	342.87	[-0.23]	342.90	[-0.20]
1000	375	334.50	334.42	[-0.08]	334.39	[-0.11]
1100	75	333.10	332.98	[-0.12]	333.02	[-0.08]
1100	175	341.40	341.40	[0.00]	341.38	[-0.02]
1100	275	342.50	342.44	[-0.06]	342.45	[-0.05]
1100	375	334.90	334.76	[-0.14]	334.78	[-0.12]
1200	75	333.00	332.96	[-0.04]	332.90	[-0.10]
1200	175	341.20	341.16	[-0.04]	341.09	[-0.11]
1200	275	342.30	342.21	[-0.09]	342.21	[-0.09]
1200	375	335.00	334.88	[-0.12]	334.86	[-0.14]
1300	75	333.60	333.58	[-0.02]	333.54	[-0.06]
1300	175	342.40	342.40	[0.00]	342.37	[-0.03]
1300	275	344.70	344.62	[-0.08]	344.58	[-0.12]
1300	375	337.50	337.44	[-0.06]	337.45	[-0.05]
1400	75	333.70	333.69	[-0.01]	333.66	[-0.04]
1400	175	343.20	343.13	[-0.07]	343.07	[-0.13]
1400	275	347.40	347.00	[-0.40]	347.01	[-0.39]
1400	375	339.60	339.41	[-0.19]	339.40	[-0.20]

Table 3-1
(continued)

Site Coordinates		Elevation (ft MSL)[a]				
South	East	10/14/86	04/19/90		10/16/90	
1500	75	334.50	334.41	[-0.09][b]	334.38	[-0.12][b]
1500	175	343.20	343.05	[-0.15]	343.03	[-0.17]
1500	75	334.50	334.41	[-0.09]	334.38	[-0.12]
1500	175	343.20	343.05	[-0.15]	343.03	[-0.17]
1500	275	347.10	346.66	[-0.44]	346.57	[-0.53]
1500	375	343.30	343.10	[-0.20]	343.10	[-0.20]
1600	75	338.80	338.75	[-0.05]	338.73	[-0.07]
1600	175	339.80	339.65	[-0.15]	339.65	[-0.15]
1600	275	337.50	337.40	[-0.10]	337.42	[-0.08]
1600	375	337.80	337.61	[-0.19]	337.60	[-0.20]
1700	75	323.10	323.07	[-0.03]	323.08	[-0.02]
1700	175	321.20	321.12	[-0.08]	321.14	[-0.06]
1700	275	319.90	319.79	[-0.11]	319.85	[-0.05]
1700	375	320.50	320.29	[-0.21]	320.43	[-0.07]
1800	75	320.20	319.99	[-0.21]	320.09	[-0.11]
1800	175	320.50	320.73	[0.23]	320.54	[0.04]
1800	275	321.40	320.61	[-0.79]	320.60	[-0.80]
1800	375	317.60	317.59	[-0.01]	317.59	[-0.01]

[a]Feet above mean sea level.

[b]Values in brackets indicate changes in elevation from the 1986 survey.

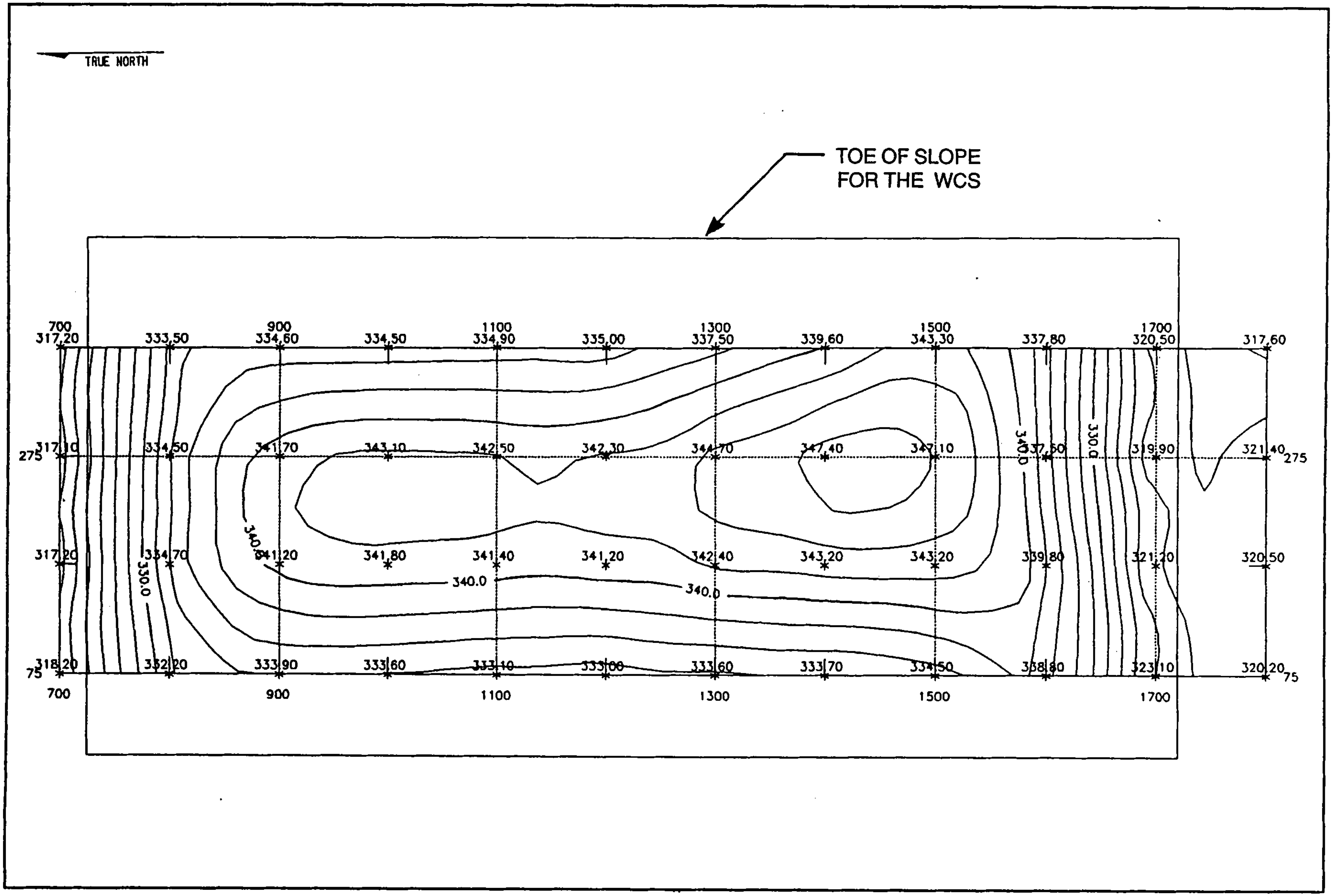

Figure 3-5
WCS Baseline Grid Survey, October 1986

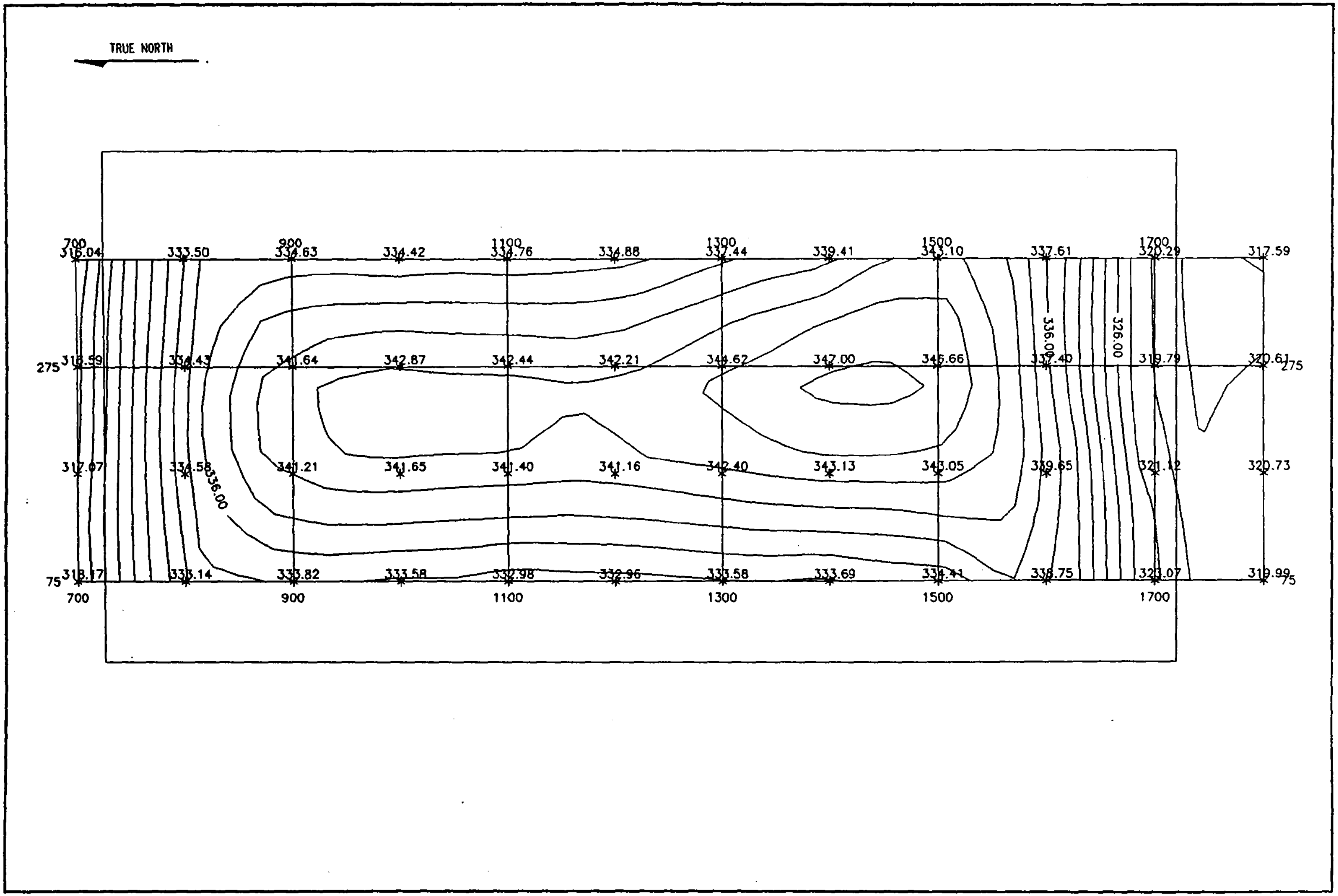

Figure 3-6
WCS Grid Survey, April 1990

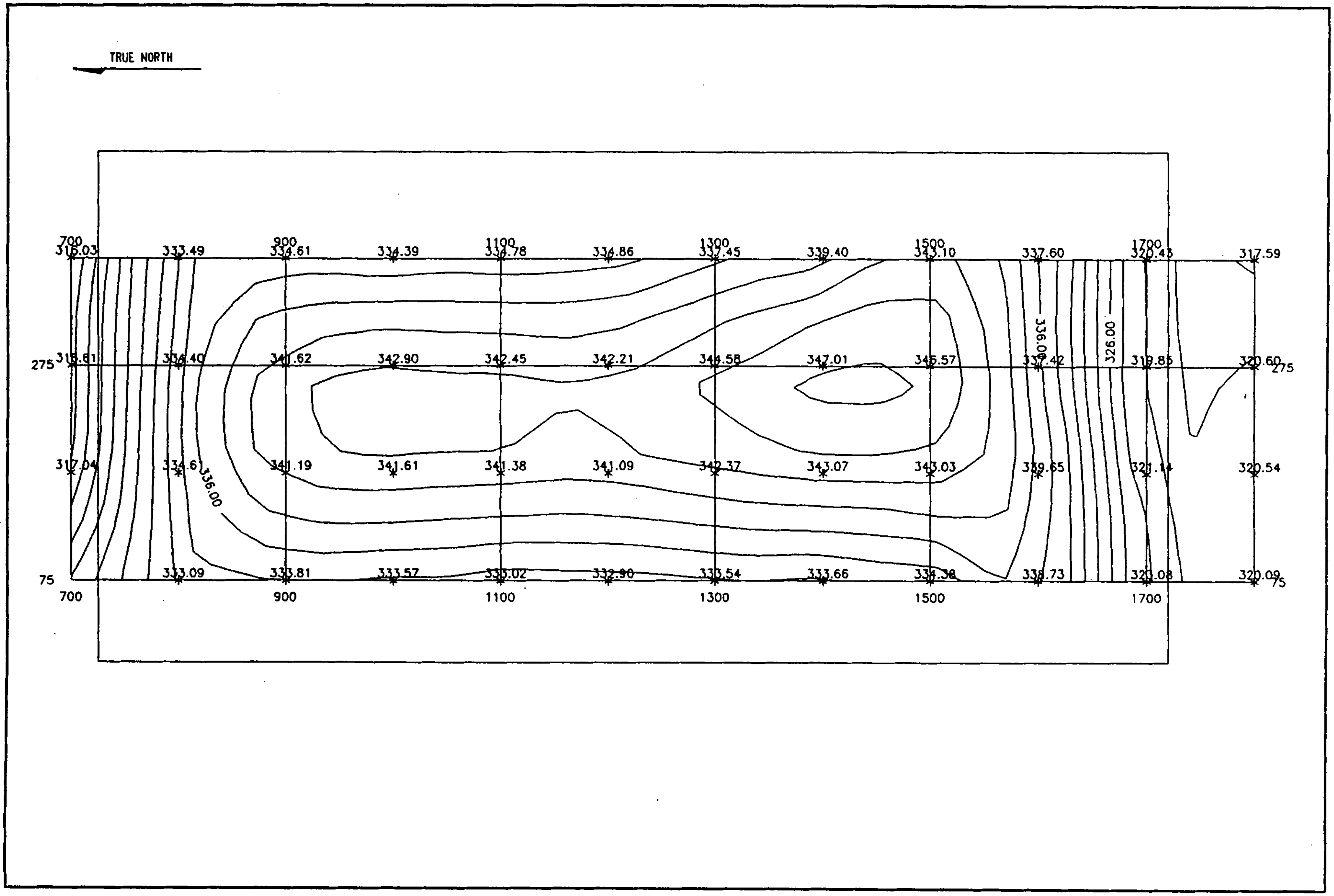

Figure 3-7
WCS Grid Survey, October 1990

Permanent bench marks were installed at three grid intersections: S1800, W125; S600, W125; and S600, E375. The bench marks are tied to the New York State Plane Coordinate System; the corresponding coordinates on this system are N1,170,797.56, E392,146.12; N1,171,997.47, E392,146.32; and N1,171,997.39, E392,646.28, respectively. Each bench mark is a permanent concrete block flush with the surface with a brass designation marker embedded in the concrete.

Figures 3-5 through 3-7 are topographic representations of the elevations of the WCS as determined by the grid survey performed in conjunction with the fall and spring walkovers. Figure 3-5 represents the WCS in its original 1986 configuration, or as-built condition, and is used as the baseline map. Figures 3-6 and 3-7 are topographic representations of the WCS as surveyed for the corresponding walkover using the grid survey program. A comparison of each grid survey with the baseline survey performed in 1986 reveals evidence of slight subsidence in the southern portion of the WCS. Specifically, grid intersection point S1500, E275 exhibits the greatest amount of subsidence at 0.15 m (0.53 ft). This region of the WCS contains the remnants of Building 411. During construction of the WCS, the foundation for Building 411 was used as the primary containment for the L-30, F-32, and K-65 residues. Continuing consolidation of the residue materials after placement probably accounts for the subsidence.

The grid survey for the walkover conducted in spring 1990 indicates that the rate of subsidence in the southern portion of the WCS is decreasing. Because the subsidence from waste consolidation is general rather than isolated and the WCS is an interim configuration, the subsidence does not threaten the integrity of the WCS.

3.1.3 Walkover Survey

The walkover survey of the WCS during the spring and fall of each year was developed as the means by which the WCS would be evaluated for overall performance. The walkover survey team consists of representatives from engineering, geology, and site operations. This section of the report presents the results of the spring and fall 1990 walkover surveys.

The initial walkover survey was performed on November 17 and 18, 1986. This survey was intended to determine whether any actions are required beyond normal maintenance. The survey team evaluated settlement or movement; cracking; undesired plant growth; and other minor conditions such as localized areas of sparse grass, tire tracks, poor water drainage, and isolated areas of erosion on the WCS cap. To conduct the walkover survey, team members walk a preplanned route, based on the established grid, that ensures complete and systematic inspection of the cap. The walkover survey generally covers the WCS, major site drainage ditches, and other features determined by the team to be pertinent to the stability of the site.

The NFSS walkovers detailed in this section were performed following the same walkover pattern used in previous performance appraisals. Close-spaced, north-south routes were followed starting at the southwest corner of the WCS. The walkover team members were free to adjust their routes along each traverse to view the cap surface in whatever detail seemed appropriate. Team members kept notes of conditions that required maintenance and placed pin-flag markers at those locations to assist the maintenance team in relocating them.

Calendar Year 1990

Walkovers were performed in May and October 1990. Conditions at the WCS continue to improve compared to those observed initially in 1986. The WCS has well-established turf, and the rate of general ground subsidence observed and reported in the last performance monitoring report appears to be diminishing. In previous walkovers it was necessary to report and track minor anomalies in the WCS surface, including such conditions as bare areas and debris contained in the clay and topsoil that was exposed to the surface by frost heave. Overall improvement in the condition of the WCS surface now allows the walkovers to concentrate on more significant features. Although minor surface areas of the WCS are still inspected and noted, they are not reported in detail as part of the walkover. Minor surficial areas of concern are addressed by the onsite operations staff and repaired as warranted. Minor surface problems observed during the spring 1990 walkover were repaired before the fall 1990 walkover was conducted.

Both 1990 walkovers began at the southwest corner of the WCS and proceeded north along site grid line B (Figure 3-1). The walkovers consisted of several passes along the longitudinal lines of the WCS.

During the spring walkover, minor cracks were evident on most parts of the surface of the WCS. These cracks tended to be larger on the north and south faces of the WCS, measuring approximately 0.3 cm to 1.3 cm (1/8 in. to 1/2 in.) wide and 5.1 cm to 10.2 cm (2 in. to 4 in.) deep. The clayey nature of the topsoil cover of the WCS is most likely responsible for the recurrent cracking. Although the cracking is not severe and does not pose an immediate threat to the integrity of the WCS, any cracking in the topsoil liner of the WCS allows infiltration of water. In previous walkovers, it was noted that the condition of the liner fluctuates with weather conditions. The widespread cracking is most evident during the fall walkovers, just before onset of the wet season. The primary purpose of the top layer of WCS materials [45.7 cm (18 in.) of topsoil and turf] is to shed rainfall, prevent topsoil erosion, and encourage evapotranspiration of water. During the summer months, which in past years have been characterized by long dry spells, the topsoil layer develops cracks caused by desiccation. In the wetter fall months, the cracks close up and no repair work is required.

A comparison of corresponding grid surveys for the spring and fall walkovers indicates normal fluctuations in ground elevations. As indicated in Table 3-1, some grid coordinate locations are showing subsidence; in particular, the area covering the remnants of Building 411. This area contains K-65 residues and other

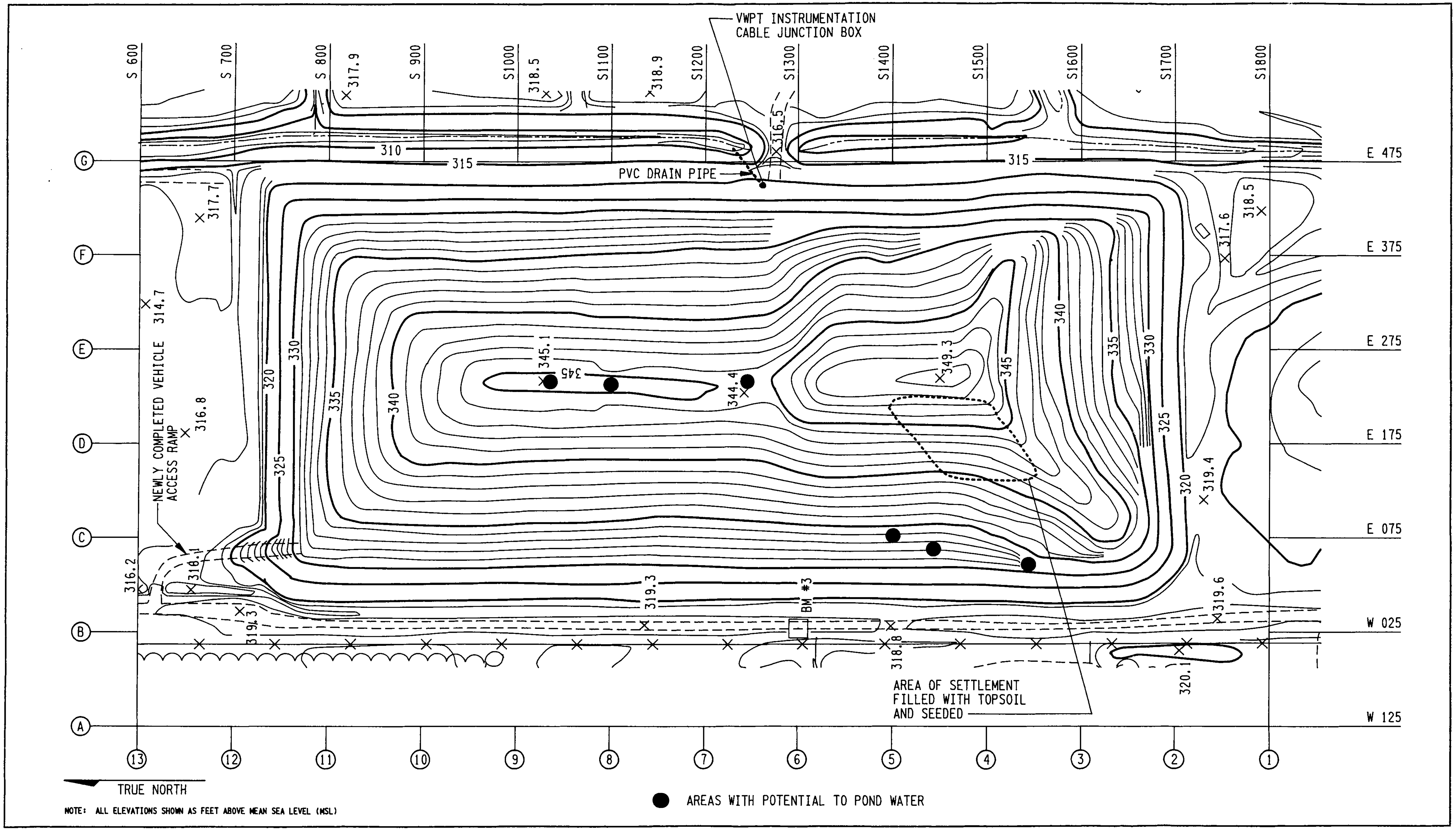

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Figure 3-8
Survey Grid for the 1990 Walkovers at the NFSS WCS

the turf is in acceptable condition. The improved turf condition is most evident on the north face of the WCS, but general improvement is visible over the entire surface of the WCS.

Water runoff for the WCS appears to occur via sheet flow in most areas. Occasional swales or erosional ditches are evident, but appear to be minor. During the spring 1990 walkover, it was noted that the sheet flow is being interrupted at the flat areas of the transition from the WCS to the central drainage ditch. Water was concentrating at the edge of the transition zone and forming erosional channels into the Central Ditch. The poor plant growth along the banks of the Central Ditch has contributed to the problem. In addition, the outfall of the ditch that drains the area immediately north of the WCS was eroded and required reconstruction. As of the fall 1990 walkover, the drainage problems had been repaired. Each erosional channel was excavated and reshaped, a geotextile liner was placed in the newly excavated area, and the ditch was backfilled with No. 2 crushed stone riprap. The outfall area of the ditch that drains the area immediately north of the WCS was repaired in a similar manner.

During the spring walkover, as in previous inspections, team members noted that the VWPT cable junction manhole was continuing to fill with water. During the summer the manhole was repaired. The repair involved excavating to the bottom of the precast manhole and drilling a hole into the wall of the manhole to provide drainage. A 3-in. PVC drain pipe was inserted into the new opening. Approximately 6.1 m (20 ft) of pipe was installed from the manhole drain to the central ditch. It was noted that the backfill over the 3-in. drain pipe may slough in the near future and pull the drain pipe away from the bottom of the manhole. The area around the pipe outlet will be monitored to check for movement.

In past walkovers, the engineering department has recommended that an access ramp be constructed at the northwest corner of the WCS to reduce rutting and wear from vehicles driven onto the structure. During repair work on the WCS, it was noted that for the heavy equipment to gain access to the WCS, such an access ramp would have to be constructed. The ramp has been completed and should serve the site until the final cover is installed.

3.2 SUBSURFACE MONITORING

In the fall of 1986, 13 VWPTs and 3 PPTs were installed inside the WCS, as shown in Figure 2-1. The three PPTs were installed at the same elevation and in the same boreholes as VWPTs 1, 9, and 13. The PPTs are used to check the operation and accuracy of the VWPTs. VWPT readings were initiated on November 4, 1986. Monthly readings of the PPTs began in July 1987. The data from the PPT readings indicated that the VWPTs were performing accurately; therefore, the manual data collection from the PPTs was discontinued in 1990. The VWPT instrument numbers, grid locations, recorder channels, ground surface elevations, and instrument elevations from 1987 are summarized in Table 3-2.

The VWPT data for this report include readings from January 1990 through December 1990. VWPT data are not available for late August and early September 1990 because of diagnostic testing that was performed on the automatic reader box during that period. The data from the VWPTs have been converted to hydraulic head and are plotted in Appendix A. In general, the plots exhibit a continuation of the seasonal trends observed in previous years. These trends are characterized by a maximum head elevation in early spring (March or April) and a minimum head elevation in the fall (September or October).

Exceptions to these trends were observed at VWPT-3, VWPT-11, and VWPT-12. Instrument 11 failed to operate for the entire calendar year. Instruments 3 and 12 had complex operating histories of several reading and nonreading cycles. Currently, it is uncertain whether the irregular readings of instruments 3 and 12 are the result of changes in pore pressure within the WCS or whether they result from electrical problems. Diagnostic testing to identify and correct the problems associated with these instruments is continuing.

Table 3-2

Summary of Subsurface Monitoring Instruments, 1987

Instrument (Borehole) Number	Site Grid Coordinates South	Site Grid Coordinates East	Recorder Channel	Elevation (ft MSL[a]) Ground (Cap) Surface	Elevation (ft MSL[a]) Instrument[b]
1	885	100	11	335.2	321.2
2	885	220	12	341.4	320.7
3	885	360	13	335.6	320.1
4	1045	100	14	335.4	321.4
5	1045	235	15	344.9	320.6
6	1045	400	16	332.9	320.6
7	1205	100	17	335.3	320.6
8	1195	250	18	343.6	319.6
9	1205	400	19	334.8	322.6
10A[c]	1460	130	10	338.9	327.6
11	1561	98	1	339.0	323.8
12	1560	265	2	341.4	329.4
13	1560	370	3	341.5	329.0

[a]Feet above mean sea level.

[b]Instrument elevations for 1987 are based on as-built conditions. Instrument elevations for 1986 are based on design conditions.

[c]Instrument 10 was damaged during construction; instrument 10A was installed as a replacement.

The data collected to date do not that exhibit any trends indicating the development of weaknesses in the clay cap, the cutoff wall, the cutoff dike, or the gray clay unit.

3.3 ENVIRONMENTAL MONITORING

NFSS environmental monitoring results summarized in this document are reported in the annual site environmental monitoring report for calendar year 1990 (Bechtel 1991). This subsection presents the results of environmental monitoring for all four quarters of 1990 for radon and external gamma radiation levels, as well as radium-226 and uranium concentrations found in surface water, sediments, and groundwater adjacent to and in the vicinity of the WCS.

3.3.1 Radon Levels

Radon concentrations were obtained quarterly in 1990. Radon detectors are maintained at 18 onsite, 19 property-line, and 9 offsite (background) locations, as shown in Figures 3-9 and 3-10. Detectors are spaced along the site boundary to ensure adequate detection capability under most atmospheric conditions.

The maximum ambient air radon concentration detected onsite was 1.6 pCi/L (0.059 Bq/L) (including background), at location 24. The annual average radon concentration onsite, including background, ranged from 0.3 to 0.7 pCi/L (0.01 to 0.03 Bq/L). Annual average radon concentrations at the property line ranged from 0.3 to 0.4 pCi/L (0.01 to 0.02 Bq/L). No quarterly level or annual average was higher than the DOE annual guideline of 3.0 pCi/L.

To determine the radon flux from the WCS, 180 charcoal canisters were placed on the storage pile. Five charcoal canisters were placed on each of the interim storage piles. The canisters remained on the piles for 24 hours and were then collected, sealed, and shipped for analysis. No major weather event that might

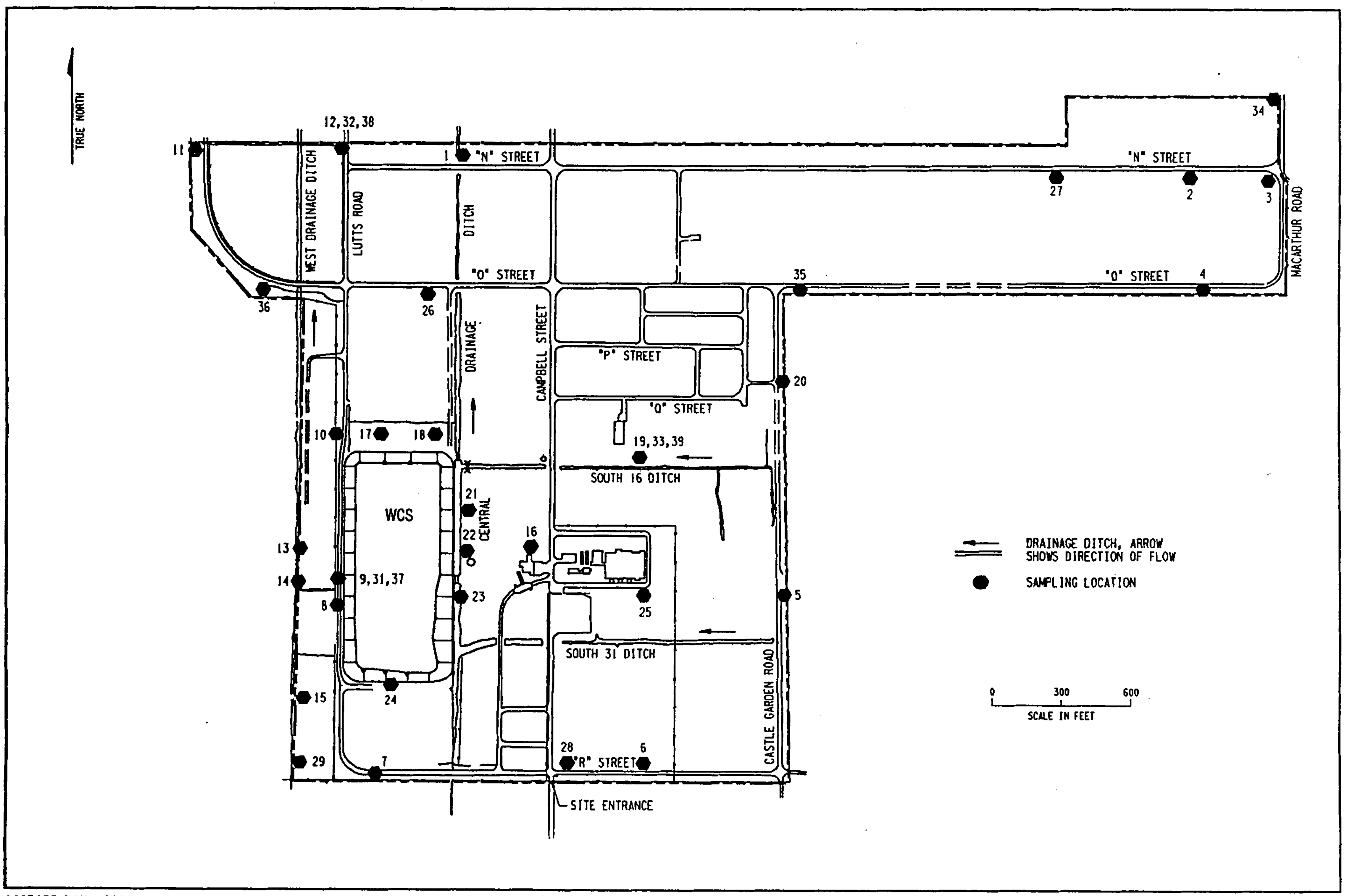

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Figure 3-9
Onsite and Fenceline Radon and External Gamma Radiation Monitoring Locations at NFSS

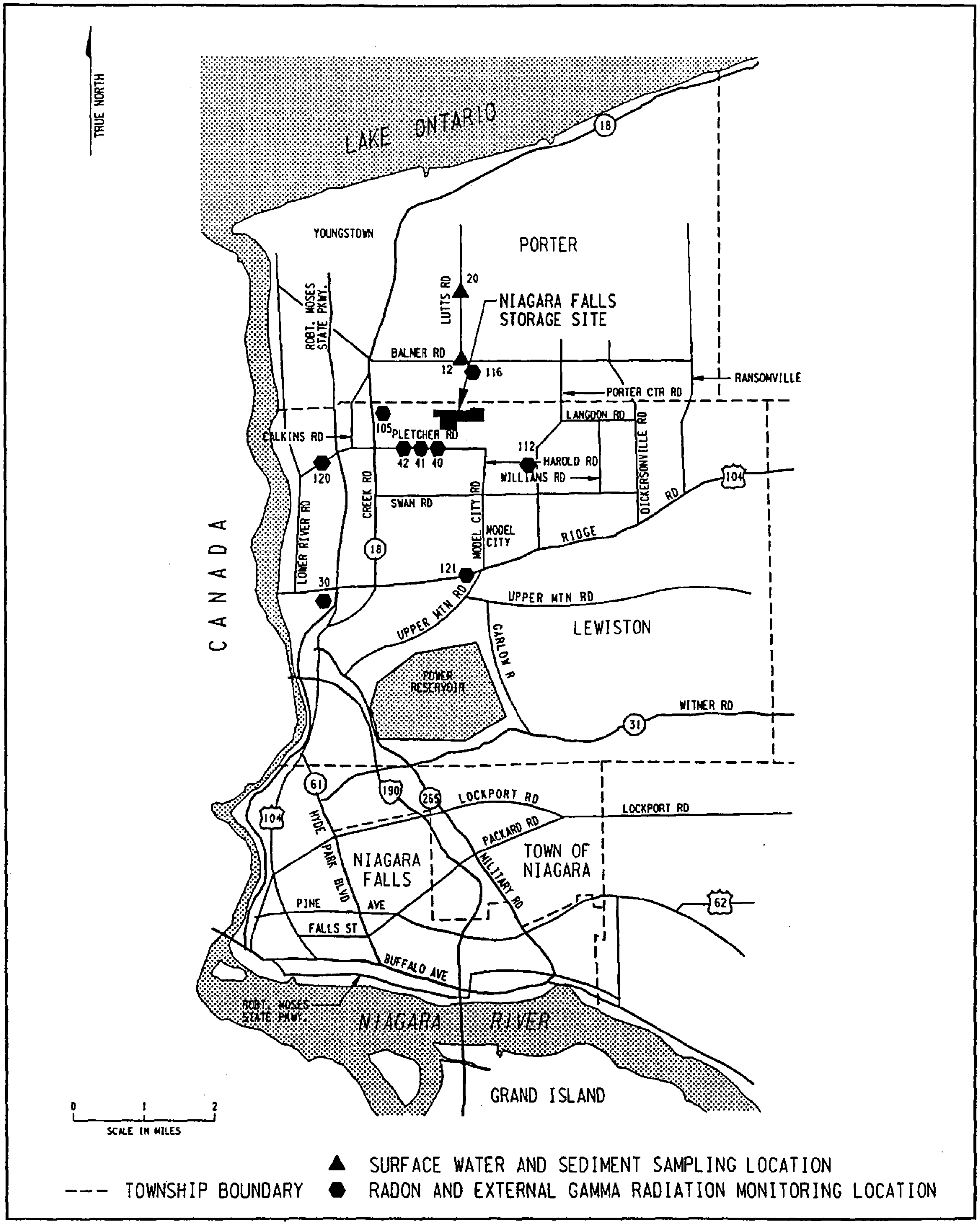

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Figure 3-10
Offsite Surface Water, Sediment, Radon, and External Gamma Radiation Monitoring Locations for NFSS

conceivably have affected the sampling occurred either within three days prior to or during the sampling.

The radon results from the WCS showed an average flux rate of 0.09 pCi/m^2/s (3E-3 Bq/m^2/s), with minimum and maximum levels of 0.02 and 0.58 pCi/m^2/s (7E-4 and 22E-3 Bq/m^2/s). These results demonstrate that the WCS is in compliance with the limit of 20 pCi/m^2/s set forth in 40 CFR Part 61, Subpart Q. The standard (20 pCi/m^2/s) is an averaged value. The two smaller interim storage piles were also determined to be in compliance with the regulation; their average flux rate was 0.02 pCi/m^2/s (7E-4 Bq/m^2/s).

3.3.2 External Gamma Radiation Levels

Since 1988, the external gamma radiation monitoring system has used tissue-equivalent thermoluminescent dosimeters (TETLDs) to provide realistic values of radiation dose to the tissues of the body.

External gamma radiation levels are measured at 18 onsite, 19 property-line, and 9 offsite locations. Three of the detectors are on the perimeter of the former location of the tower used to store K-65 residues. All gamma radiation detector locations correspond to the radon detector locations shown in Figures 3-9 and 3-10.

Although TETLDs are state-of-the-art detectors, of the accuracy the dosimeter is approximately ±10 percent at levels between 100 and 1,000 mR/yr and ±25 percent at radiation levels in the range of 70 mR/yr. Therefore, for the low levels that are being monitored at NFSS (in the 70-mR/yr range), there can be seemingly large differences resulting from inaccuracies of detection and the processing system.

The annual average gamma radiation exposure level was 3 mR/yr onsite and 2 mR/yr at the property line, excluding a background level of 66 mR/yr. The highest annual average external gamma radiation level at the property line, excluding background, was 7 mR/yr (location 5).

3.3.3 Surface Water and Sediment Sampling

Surface water samples were collected quarterly at sampling locations established on the basis of potential contaminant migration and water discharge routes from the site. Surface water samples were analyzed for total uranium and radium-226. Onsite sampling locations for surface water (9, 10, and 11) are shown in Figure 3-11; offsite locations (12 and 20) are shown in Figure 3-10. Location 9 is an upstream background location established at the South 31 Ditch in October 1988. Locations 12 and 20 are 1.6 and 3.2 km (1 and 2 mi) downstream, respectively, from the northern boundary of NFSS. Because surface water runoff from the site discharges via the Central Drainage Ditch, all sampling locations except location 9 were placed along that ditch. Sampling of water supplied by a local municipal water system upstream of NFSS was suspended in 1986 because data from previous years indicated no total uranium or radium-226 concentrations discernibly different from background levels in these waters.

Table 3-3 presents 1990 concentrations of total uranium and radium-226 in surface water. Annual average concentrations of total uranium ranged from 5E-9 to 9E-9 μCi/ml (0.2 to 0.33 Bq/L) at onsite (upstream) locations and 8E-9 to 9E-9 μCi/ml (0.3 to 0.33 Bq/L) at offsite (downstream) locations. Annual average background was 7E-9 μCi/ml (0.3 Bq/L). Total uranium concentrations were well below the derived concentration guideline (DCG) of 600E-9 μCi/ml.

The annual average concentration of radium-226 was 0.4E-9 μCi/ml (0.02 Bq/L) at onsite locations and 0.7E-9 to 0.9E-9 μCi/ml (0.26 to 0.3 Bq/L) at offsite (downstream) locations. Annual average background was 0.5E-9 μCi/ml (0.02 Bq/L). Radium-226 concentrations were well below the DCG of 100 E-9 μCi/ml.

Sediment samples were collected quarterly at surface water sampling locations where sediment is present. Onsite sampling locations (9, 10, and 11) are shown in Figure 3-9; downstream, offsite locations (12 and 20) are shown in Figure 3-10. Downstream

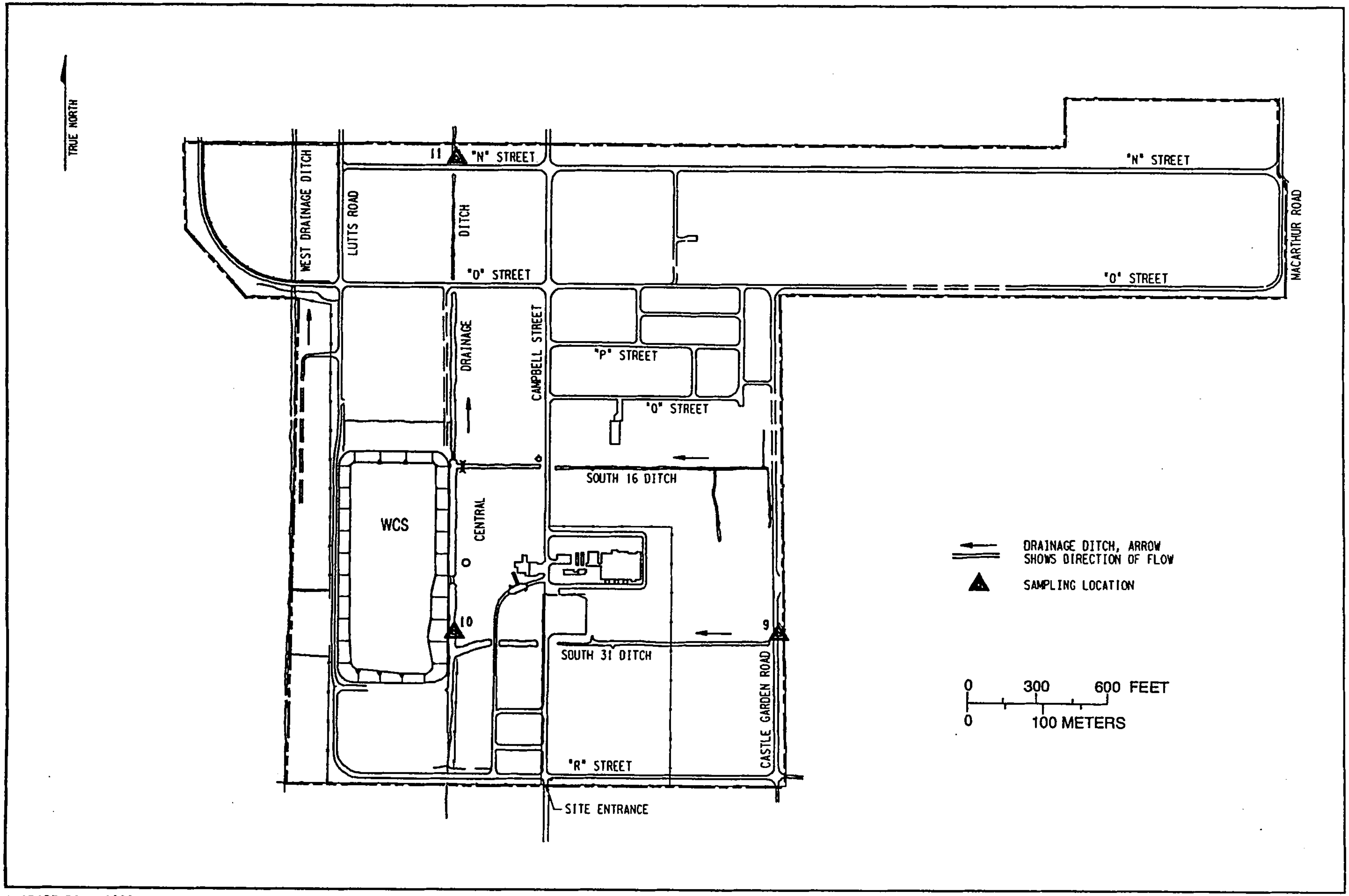

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Figure 3-11
Onsite Surface Water and Sediment Sampling Locations at NFSS

Table 3-3

Concentrations[a] of Total Uranium and Radium-226 in Surface Water at NFSS, 1990

Sampling Location[b]	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Min.	Max.	Avg.
Total Uranium							
9[c]	4	3	11	9	3	11	7
10	6	3	4	7	3	7	5
11	7	6	5	18	5	18	9
12[d]	9	3	11	12	3	12	9
20[d]	9	3	12	6	3	12	8
Radium-226							
9[c]	0.3	0.7	0.7	0.3	0.3	0.7	0.5
10	0.1	0.5	0.9	0.3	0.1	0.9	0.4
11	0.6	0.4	0.4	0.2	0.2	0.6	0.4
12[d]	0.3	0.2	2.8	0.3	0.2	2.8	0.9
20[d]	0.3	0.2	2.0	0.2	0.2	2.0	0.7

[a]Concentrations are given in units of E-9 μCi/ml.
Note: E-9 μCi/ml is equivalent to 0.037 Bq/L.

[b]Sampling locations are shown in Figures 3-10 and 3-11.

[c]Location 9 serves as a background sampling station.

[d]Offsite, downstream sampling station.

locations were established to determine the effect of the site on sediments in the vicinity. Location 9 is a background location established at the South 31 Ditch in October 1988.

Sediment samples were analyzed for total uranium and radium-226. Currently, there are no DCGs for radionuclides in sediment; therefore, sediment concentrations are compared with FUSRAP soil guidelines.

Table 3-4 presents 1990 concentrations of total uranium and radium-226 in sediment at NFSS. Annual average concentrations of total uranium ranged from 1.8 to 2.5 pCi/g (0.067 to 0.093 Bq/g) at onsite locations and 1.6 to 1.7 pCi/g (0.059 to 0.063 Bq/g) at offsite (downstream) locations. The annual average value for the upstream location was 3.7 pCi/g (0.14 Bq/g). The higher value at location 9 (the upstream location) is probably caused by residual radioactivity (below guidelines) remaining from previous remedial action activities. Total uranium concentrations were close to background throughout the year and below the FUSRAP soil guideline of 90 pCi/g established for NFSS.

Annual average concentrations of radium-226 ranged from 0.8 to 1.0 pCi/g (0.03 to 0.04 Bq/g) at onsite locations and 0.8 to 1.0 pCi/g (0.03 to 0.04 Bq/g) at offsite (downstream) locations. Annual average background was 1 pCi/g (0.04 Bq/g). Radium-226 levels were close to background throughout the year and below the FUSRAP soil guidelines.

3.3.4 Groundwater Sampling

The monitoring well system is designed to provide sufficient coverage of both upgradient and downgradient conditions. Sampling locations were selected based on the inventory of radioactive materials in various areas of the site and on available hydrogeological data. Site sampling locations are BH-48, to establish background conditions; onsite (BH-5, BH-49, A-42, A-49, A-50, A-52); and normal downgradient (BH-61), to determine the effects of the site on groundwater in the vicinity (Figure 3-12). Wells with the prefix "A" and suffix "S" are in the upper

Table 3-4

Concentrations[a] of Total Uranium and Radium-226 in Sediment at NFSS, 1990

Sampling Location[b]	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Min.	Max.	Avg.
			Total Uranium				
9[c]	1.6	3.3	5.1	4.6	1.6	5.1	3.7
10	1.3	2.1	1.6	2.1	1.3	2.1	1.8
11	1.2	1.7	3.5	3.6	1.2	3.6	2.5
12[d]	1.7	1.4	1.6	2.1	1.4	2.1	1.7
20[d]	1.1	1.5	1.8	2.0	1.1	2.0	1.6
			Radium-226				
9[c]	1.4	1.5	0.8	1.9	0.8	1.9	1
10	0.7	0.9	0.5	1.0	0.5	1.0	0.8
11	1.0	1.3	0.7	2.0	0.7	2.0	1
12[d]	0.9	0.7	0.4	1.0	0.4	1.0	0.8
20[d]	0.7	1.0	0.6	1.7	0.6	1.7	1

[a]Concentrations are given in units of pCi/g. Background is not subtracted from the values shown. Note: 1 pCi/g is equivalent to 0.037 Bq/g.

[b]Sampling locations are shown in Figures 3-10 and 3-11.

[c]Location 9 serves as an upstream sampling station.

[d]Offsite, downstream sampling location.

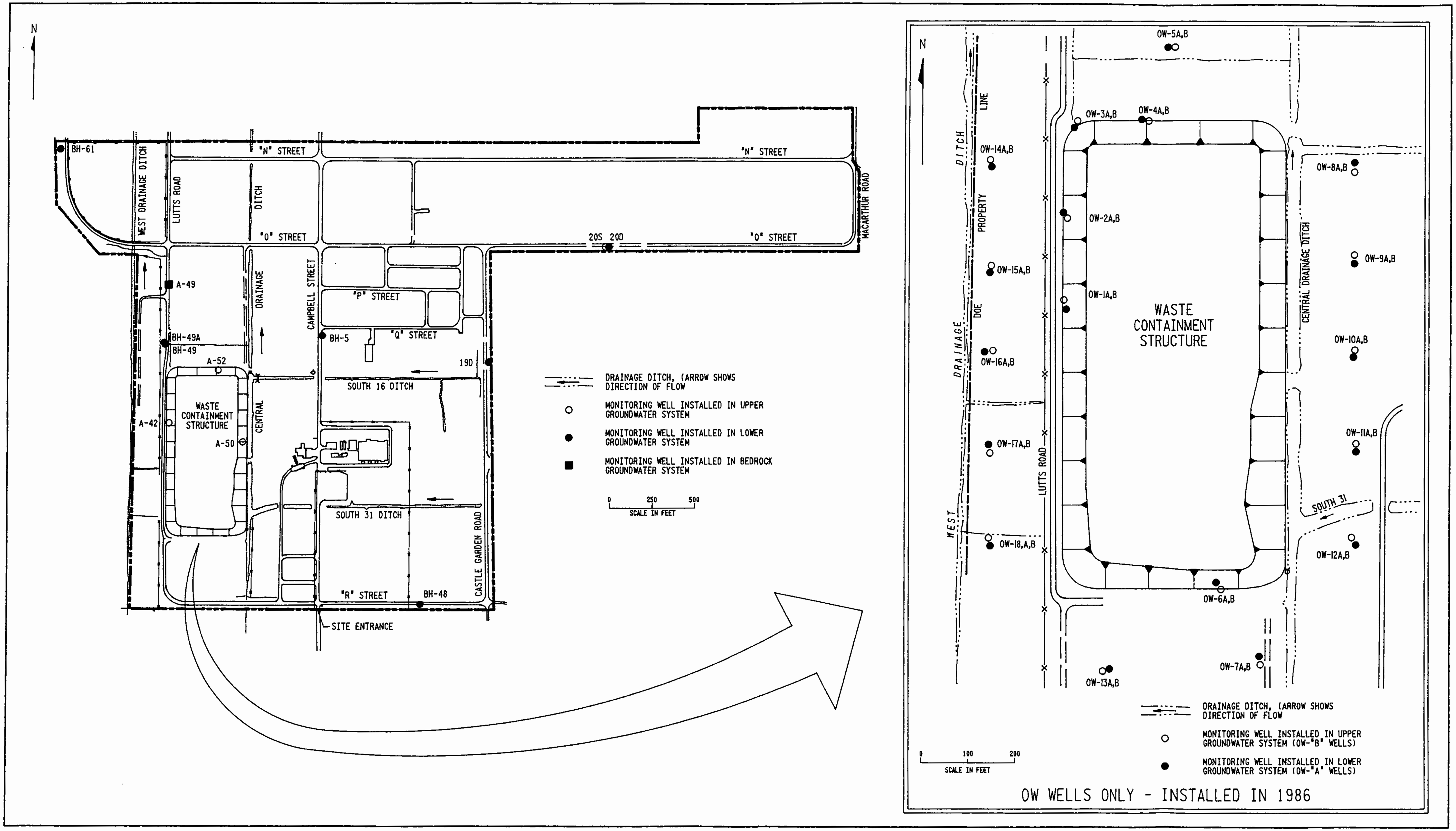

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Figure 3-12
Groundwater Wells Monitored for Radioactive and Chemical Contamination in 1990

groundwater system; those with the prefix "BH" and suffix "D" are in the lower system. However, most of the monitoring wells are located near the WCS. In late 1986, 36 wells ("OW" wells in Figure 3-12) were installed along the WCS perimeter to monitor groundwater in the vicinity of the storage facility more closely. These wells were added to the environmental monitoring program in April 1987. "OW" wells with the suffix "A" are in the lower groundwater system; those with the suffix "B" are in the upper system. To provide specific information on possible contaminant movement from the pile, special attention is given the "OW" wells. The two groundwater systems monitored by these wells are discussed separately, and focused attention is given to the wells around the WCS. Well OW-14B is the upgradient well for monitoring the upper groundwater system around the WCS; the gradient slope in 1990 ranges from northeast to southeast. Wells OW-8B, OW-9B, OW-10B, OW-11B, and OW-12B are downgradient wells for the upper system. Well OW-12A is the upgradient well for the lower system; the gradient is generally to the northwest. Wells OW-3A, OW-4A, OW-5A, OW-14A, and OW-15A are the downgradient wells for the lower system.

Wells A-42A, A-50, and A-52 are also near the WCS; however, these wells are not considered part of the WCS monitoring system because they were installed prior to the completion of the WCS cover. Well A-42 is completed in a sand lens of unknown extent. Due to elevated uranium values in well A-42, its chemical, radiological, and hydrogeological behavior was the subject of a special investigation in December 1988. Results indicate that the sand lens in which this well is completed is not in good hydraulic connection with the zones of completion of adjacent wells. Additionally, results of a sequential sampling program conducted in 1989 indicate that radioactive contamination in well A-42 is probably associated with contaminated soils in or near the well.

Three new wells (19D, 20S, and 20D) were added to the environmental monitoring program in June 1990 and first sampled in October 1990. These wells were added to monitor groundwater near the NFSS/Modern Disposal landfill boundary for chemicals.

Quarterly groundwater samples were analyzed for radium-226 and total uranium in the same manner as surface water samples.

Radium-226 concentrations in groundwater samples are presented in Table 3-5. The annual average concentrations of radium-226 in background well BH-48 and normal downgradient well BH-61 were 0.7E-9 μCi/ml (0.03 Bq/L) and 0.4E-9 μCi/ml (0.1 Bq/L), respectively. Average annual concentrations for the remaining onsite wells (excluding the "OW" wells) ranged from 0.3E-9 to 2E-9 μCi/ml (0.01 to 0.07 Bq/L). Annual average concentrations for the wells monitoring the WCS area ranged from 0.2E-9 to 0.8E-9 μCi/ml (0.01 to 0.03 Bq/L). There were no differences in upgradient and downgradient values in the upper or lower groundwater systems for WCS area wells (Table 3-6). Radium-226 concentrations were all below the DCG of 100E-9 μCi/ml.

Total uranium concentrations in groundwater samples are presented in Table 3-7. Annual average concentrations of total uranium in site upgradient (BH-48) and downgradient (BH-61) locations were 3E-9 μCi/ml (0.1 Bq/L). Average annual concentrations for the remaining onsite wells (excluding the "OW" wells) ranged from 3E-9 to 76E-9 μCi/ml (0.1 to 2.8 Bq/L), with the elevated value of 76E-9 μCi/ml (2.8 Bq/L) found in well A-42. Annual average concentrations for the wells monitoring the WCS area ranged from 3E-9 to 31E-9 μCi/ml (0.1 to 1.2 Bq/L). There were no significant differences in values for the background and downgradient wells in the lower groundwater system. However, average concentrations in downgradient wells monitoring the upper groundwater system were approximately four times that in the upgradient well (Table 3-8).

Table 3-5

Concentrations[a] of Radium-226

in Groundwater at NFSS, 1990

Sampling Location[b]	Quarter 1	2	3	4	Min.	Max.	Avg.
OW-1A	0.3	0.2	0.5	0.2	0.2	0.5	0.3
OW-1B	0.2	0.4	0.6	0.1	0.1	0.6	0.3
OW-2A	0.2	0.2	0.5	0.3	0.2	0.5	0.3
OW-2B	0.1	0.1	0.4	0.1	0.1	0.4	0.2
OW-3A	0.3	0.3	0.4	0.3	0.3	0.4	0.3
OW-3B	0.2	0.3	0.4	0.2	0.2	0.4	0.3
OW-4A	0.3	0.3	0.6	0.1	0.1	0.6	0.3
OW-4B	0.2	0.4	0.6	0.1	0.1	0.6	0.3
OW-5A	0.3	0.3	0.8	0.8	0.3	0.8	0.6
OW-5B	0.4	0.5	0.6	0.4	0.4	0.6	0.5
OW-6A	0.2	0.1	0.6	0.1	0.1	0.6	0.3
OW-6B	0.3	0.2	0.3	0.1	0.1	0.3	0.2
OW-7A	0.2	0.5	0.8	0.2	0.2	0.8	0.4
OW-7B	0.2	0.2	0.3	0.5	0.2	0.5	0.3
OW-8A	0.3	0.1	0.7	0.7	0.1	0.7	0.5
OW-8B	0.2	0.3	0.5	0.1	0.1	0.5	0.3
OW-9A	0.2	0.3	0.5	0.1	0.1	0.5	0.3
OW-9B	0.3	0.2	0.4	ND[c]	ND	0.4	0.3
OW-10A	0.2	0.2	0.3	0.1	0.1	0.3	0.2
OW-10B	0.3	0.2	0.3	0.2	0.2	0.3	0.3
OW-11A	0.4	0.3	0.6	0.3	0.3	0.6	0.4
OW-11B	0.3	0.2	0.3	0.4	0.2	0.4	0.3
OW-12A	0.4	0.3	0.4	0.3	0.3	0.4	0.4
OW-12B	0.2	0.2	0.9	0.4	0.2	0.9	0.4
OW-13A	0.3	0.4	0.4	0.4	0.3	0.4	0.4
OW-13B	0.2	1.1	1.0	0.8	0.2	1.1	0.8
OW-14A	0.2	0.2	0.3	0.2	0.2	0.3	0.2
OW-14B	0.1	0.3	0.7	0.7	0.1	0.7	0.5
OW-15A	0.3	0.3	0.7	0.9	0.3	0.9	0.5
OW-15B	0.2	0.1	0.9	0.4	0.1	0.9	0.4
OW-16A	0.3	0.1	0.7	0.3	0.1	0.7	0.4
OW-16B	0.1	0.2	1.7	0.3	0.1	1.7	0.6
OW-17A	0.1	0.2	0.6	0.3	0.1	0.6	0.3
OW-17B	0.3	0.2	0.7	0.2	0.2	0.7	0.4
OW-18A	0.2	0.4	0.9	0.7	0.2	0.9	0.6
OW-18B	0.2	0.3	0.5	0.4	0.2	0.5	0.4
BH-5	0.3	0.3	0.6	0.4	0.3	0.6	0.4
BH-48[d]	0.6	0.6	1.0	0.5	0.5	1.0	0.7
BH-61[e]	0.3	0.3	0.6	0.2	0.2	0.6	0.4
A-42	0.7	1.1	1.5	0.3	0.3	1.5	0.9
A-49	ND	2.9	1.8	0.3	ND	2.9	2
A-50	0.7	0.4	0.6	0.1	0.1	0.7	0.5

Table 3-5

(continued)

Sampling Location[b]	Quarter 1	2	3	4	Min.	Max.	Avg.
A-52	0.1	0.5	0.9	0.1	0.1	0.9	0.4
BH-49	ND	0.4	0.5	0.1	ND	0.5	0.3
19D[f]	--	--	--	0.3	--	--	--
20S[f]	--	--	--	0.4	--	--	--
20D[f]	--	--	--	0.5	--	--	--

[a]Concentrations are given in units of E-9 μCi/ml.
Note: 1E-9 μCi/ml is equivalent to 0.037 Bq/L.

[b]Sampling locations are shown in Figure 3-12.

[c]ND - No data available.

[d]Background well.

[e]Downgradient well.

[f]New well; established June 1990.

Table 3-6

Concentrations[a] of Radium-226 in Groundwater in the Vicinity of the WCS, 1990

Sampling Location[b]	Quarter 1	2	3	4	Min.	Max.	Avg.
Upper Groundwater System							
Upgradient							
OW-14B	0.1	0.3	0.7	0.7	0.1	0.7	0.5
Downgradient							
OW-8B	0.2	0.3	0.5	0.1	0.1	0.5	0.3
OW-9B	0.3	0.2	0.4	ND[c]	ND	0.4	0.3
OW-10B	0.3	0.2	0.3	0.2	0.2	0.3	0.3
OW-11B	0.3	0.2	0.3	0.4	0.2	0.4	0.3
OW-12B	0.2	0.2	0.9	0.4	0.2	0.9	0.4
						Average	0.3
Lower Groundwater System							
Upgradient							
OW-12A	0.4	0.3	0.4	0.3	0.3	0.4	0.4
Downgradient							
OW-3A	0.3	0.3	0.4	0.3	0.3	0.4	0.3
OW-4A	0.3	0.3	0.6	0.1	0.1	0.6	0.3
OW-5A	0.3	0.3	0.8	0.8	0.3	0.8	0.6
OW-14A	0.2	0.2	0.3	0.2	0.2	0.3	0.2
OW-15A	0.3	0.3	0.7	0.9	0.3	0.9	0.5
						Average	0.4

[a]Concentrations are given in E-9 µCi/ml. Note: 1E-9 µCi/ml is equivalent to 0.037 Bq/L.

[b]Sampling locations are shown in Figure 3-12.

[c]ND - No data available.

Table 3-7
Concentrations[a] of Total Uranium in Groundwater at NFSS, 1990

Sampling Location[b]	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Min.	Max.	Avg.
OW-1A	3	3	4	3	3	4	3
OW-1B	3	3	6	3	3	6	4
OW-2A	3	3	6	3	3	6	4
OW-2B	7	9	8	3	3	9	7
OW-3A	3	5	6	4	3	6	5
OW-3B	14	9	13	12	9	14	10
OW-4A	3	3	3	3	3	3	3
OW-4B	6	5	6	5	5	6	6
OW-5A	5	3	3	3	3	5	4
OW-5B	3	12	9	7	3	12	8
OW-6A	3	3	3	3	3	3	3
OW-6B	11	20	12	17	11	20	15
OW-7A	3	3	3	3	3	3	3
OW-7B	5	9	9	11	5	11	9
OW-8A	3	3	3	4	3	4	3
OW-8B	13	13	14	14	13	14	14
OW-9A	3	3	3	3	3	3	3
OW-9B	9	20	10	ND[c]	ND	20	10
OW-10A	3	3	3	3	3	3	3
OW-10B	7	7	5	9	5	9	7
OW-11A	3	3	3	3	3	3	3
OW-11B	26	48	26	22	22	48	31
OW-12A	3	3	3	4	3	4	3
OW-12B	9	14	10	11	9	14	10
OW-13A	3	3	3	3	3	3	3
OW-13B	22	19	14	19	14	22	19
OW-14A	3	3	3	3	3	3	3
OW-14B	4	5	3	5	3	5	4
OW-15A	3	3	3	3	3	3	3
OW-15B	7	8	8	6	6	8	7
OW-16A	3	3	3	3	3	3	3
OW-16B	3	6	5	5	3	6	5
OW-17A	3	3	3	3	3	3	3
OW-17B	7	6	4	6	4	7	6
OW-18A	3	3	3	3	3	3	3
OW-18B	20	20	19	16	16	20	19
BH-5	3	3	3	3	3	3	3
BH-48[d]	3	3	3	3	3	3	3
BH-61[e]	3	3	3	3	3	3	3
A-42	78	101	66	57	57	101	76
A-49	ND	3	4	5	ND	5	4
A-50	16	7	3	4	3	16	8

Table 3-7

(continued)

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Sampling Location[b]	Quarter 1	2	3	4	Min.	Max.	Avg.
A-52	9	16	15	18	9	18	15
BH-49	ND	3	3	3	ND	3	3
19D[f]	--	--	--	3	--	--	--
20S[f]	--	--	--	9	--	--	--
20D[f]	--	--	--	2	--	--	--

[a]Concentrations are given in terms of E-9 µCi/ml.
Note: 1E-9 µCi/ml is equivalent to 0.037 Bq/L.

[b]Sampling locations are shown in Figure 3-12.

[c]ND - No data available.

[d]Background well.

[e]Downgradient well.

[f]New well; established June 1990.

Table 3-8
Concentrations[a] of Total Uranium in Groundwater in the Vicinity of the WCS, 1990

Sampling Location[b]	Quarter 1	2	3	4	Min.	Max.	Avg.
Upper Groundwater System							
Upgradient							
OW-14B	4	5	3	5	3	5	4
Downgradient							
OW-8B	13	13	14	14	13	14	14
OW-9B	9	20	10	ND[c]	9	20	10
OW-10B	7	7	5	9	5	9	7
OW-11B	26	48	26	22	22	48	31
OW-12B	9	14	10	11	9	14	11
						Average	15
Upgradient							
OW-12A	3	3	3	4	3	4	3
Downgradient							
OW-3A	3	5	6	4	3	6	5
OW-4A	3	3	3	3	3	3	3
OW-5A	5	3	3	3	3	5	4
OW-14A	3	3	3	3	3	3	3
OW-15A	3	3	3	3	3	3	3
						Average	4

[a]Concentrations are given in E-9 µCi/ml. Note: 1E-9 µCi/ml is equivalent to 0.037 Bq/L.

[b]Sampling locations are shown in Figure 3-12.

[c]ND - No data available.

4.0 COMPARISON WITH PREVIOUS DATA

Surface conditions at the WCS have improved greatly since performance monitoring began in November 1986. Turf conditions are generally good over the entire WCS. Some bare areas exist, but these are significantly fewer and smaller than have been observed in any previous year. There are bare areas and wheel tracks on the northwest access slope of the WCS where the irrigation vehicle and other vehicles have been repeatedly driven up and down the slope.

There are no areas on the WCS with visible drainage or erosion problems. However, the west side slope of the central drainage ditch in the area of the WCS has eroded and has degraded to an unsatisfactory condition. There is no visible evidence of new subsidence of the WCS. In addition, the subsidence survey results indicate only minor fluctuations (see Table 3-1). Based on the topographic data currently available for the WCS, there does not appear to be a significant trend other than a consolidation of the waste in the area of Building 411, and the subsidence appears to be general rather than isolated.

The 1990 annual site environmental report shows no change in the quality of the water collected from the groundwater wells surrounding the WCS. The report also shows that NFSS is in compliance with the DOE radiation protection standard regarding radon levels, external gamma radiation levels, radioactive contamination of surface water runoff, and calculation of potential dose to the public (Bechtel 1991).

A trend toward water-level equalization within the WCS has continued as predicted. The grass covering the WCS is maturing and appears to be limiting erosion. The desiccation cracking in the topsoil first observed in 1987 worsened in 1988 because of drought, but has since improved significantly.

5.0 ACTIONS REQUIRED

Items requiring action were noted during the two walkovers in April 1990 and October 1990. These items have been discussed thoroughly in this document and, if not addressed, could potentially jeopardize the integrity of the WCS. Follow-up reviews will be taken to ensure appropriate consideration of these actions. Those actions that need to be considered are:

- Review the turf management program to determine the steps necessary to further improve the condition of the turf

- Continue turf management as required; correct the general lack of vigor of the turf to minimize desiccation cracks and erosion

- Implement an appropriate weed control program, as required, and follow up on designated treatment areas

- Perform diagnostic testing on the geotechnical internal monitoring instruments to determine the cause of irregular readings for three of the instruments; once identified, correct the problem

- Grade the southwest toe of slope of the WCS to drain the area

REFERENCES

Bechtel National, Inc., 1986a. Design Report for the Interim Waste Containment Facility at the Niagara Falls Storage Site, DOE/OR/20722-21, Oak Ridge, Tenn. (May).

Bechtel National, Inc., 1986b. Closure/Post-Closure Plan for the Interim Waste Containment Facility at the Niagara Falls Storage Site, DOE/OR/20722-85, Oak Ridge, Tenn. (May).

Bechtel National, Inc., 1987. Performance Monitoring Report for the Niagara Falls Storage Site Waste Containment Structure for Calendar Year 1986, DOE/OR/20722-159, Oak Ridge, Tenn. (July).

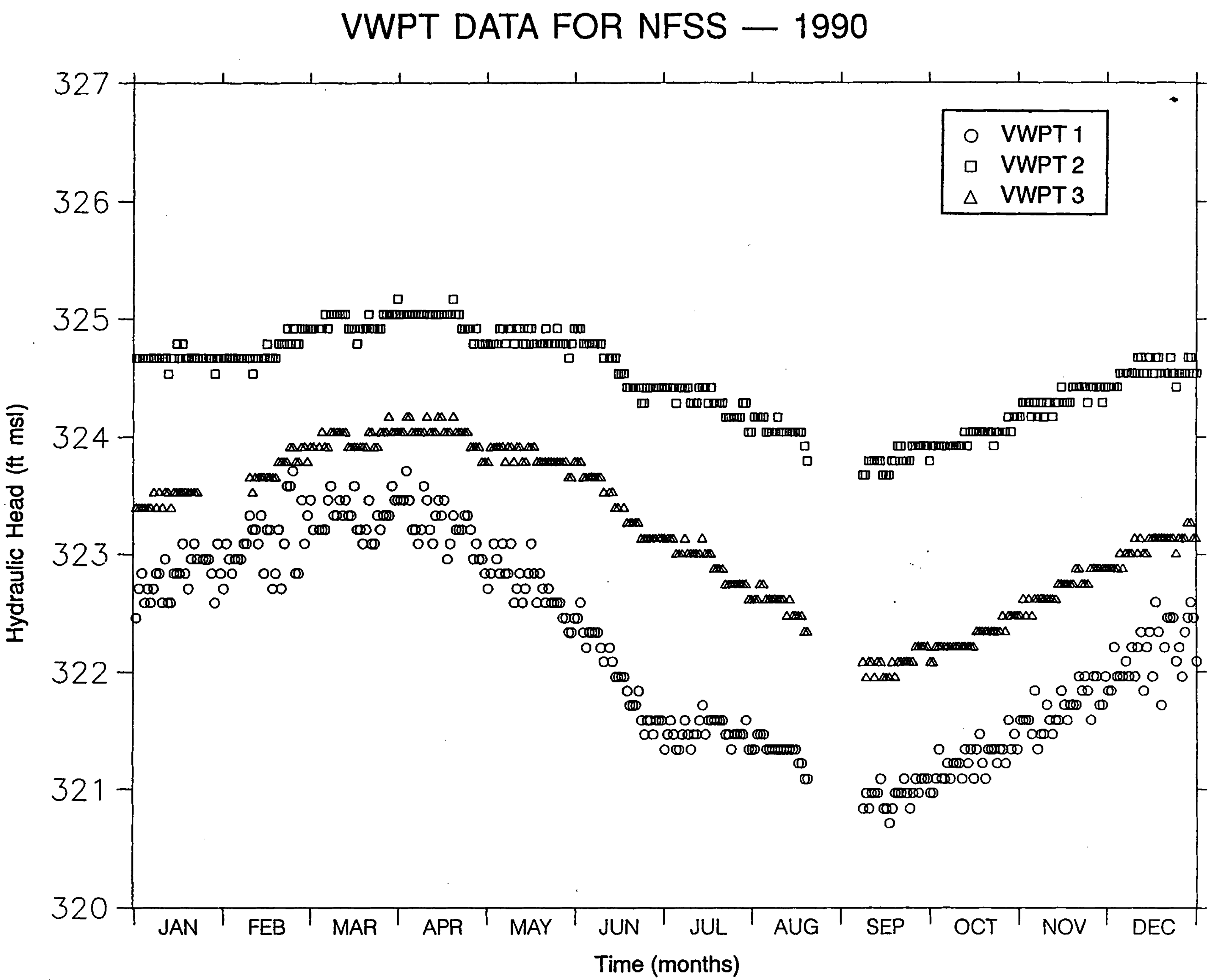
Bechtel National, Inc., 1989. Performance Monitoring Report for the Niagara Falls Storage Site Waste Containment Structure for Calendar Year 1987 and January-July 1988, DOE/OR/20722-208, Oak Ridge, Tenn. (January).

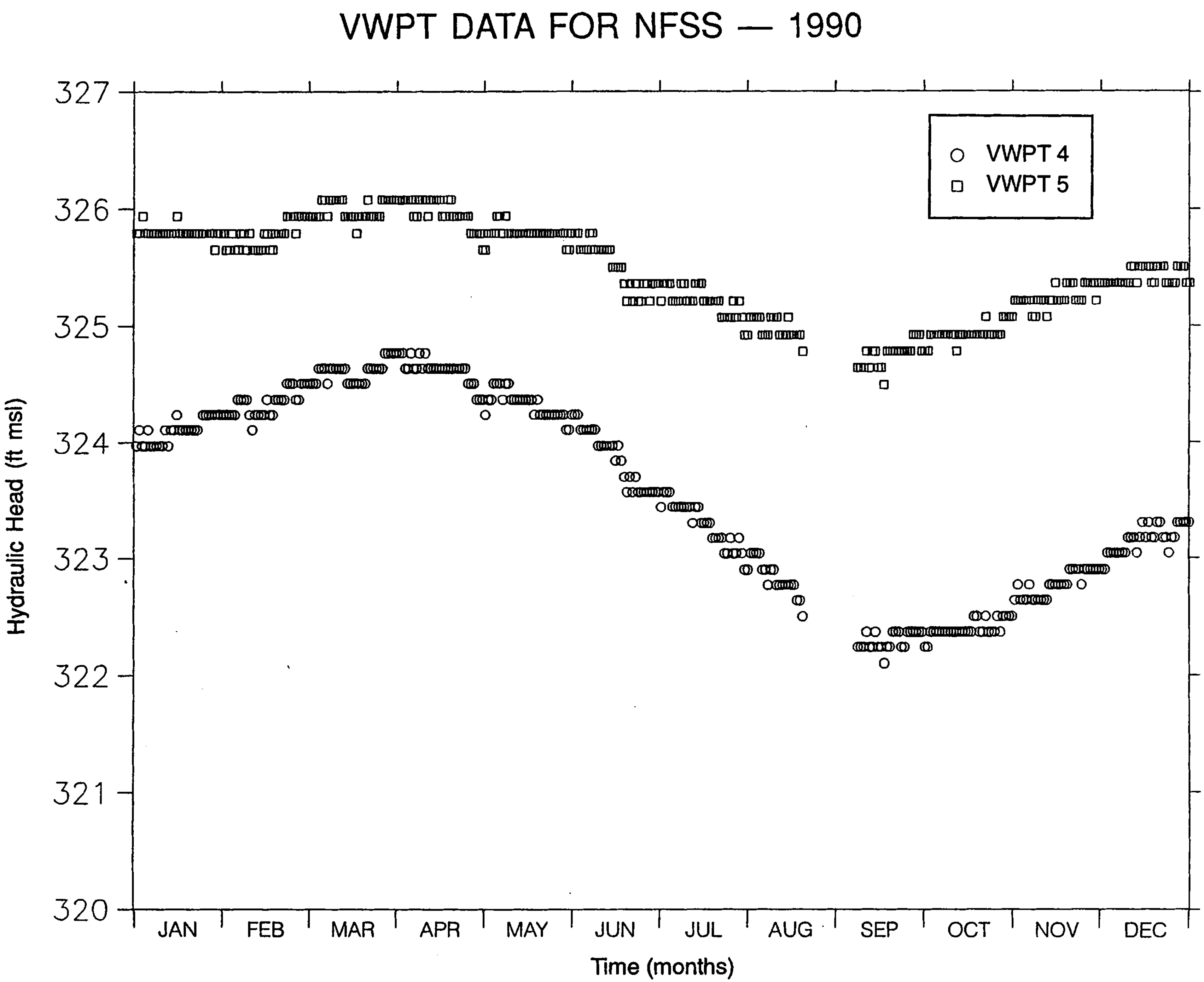
Bechtel National, Inc., 1990. Performance Monitoring Report for the Niagara Falls Storage Site Waste Containment Structure for July - December 1988 and Calendar Year 1989, DOE/OR/20722-270, Oak Ridge, Tenn. (June).

Bechtel National, Inc., 1991. Niagara Falls Storage Site Annual Environmental Report, for Calendar Year 1990, DOE/OR/21949-289, Oak Ridge, Tenn. (August).

APPENDIX A

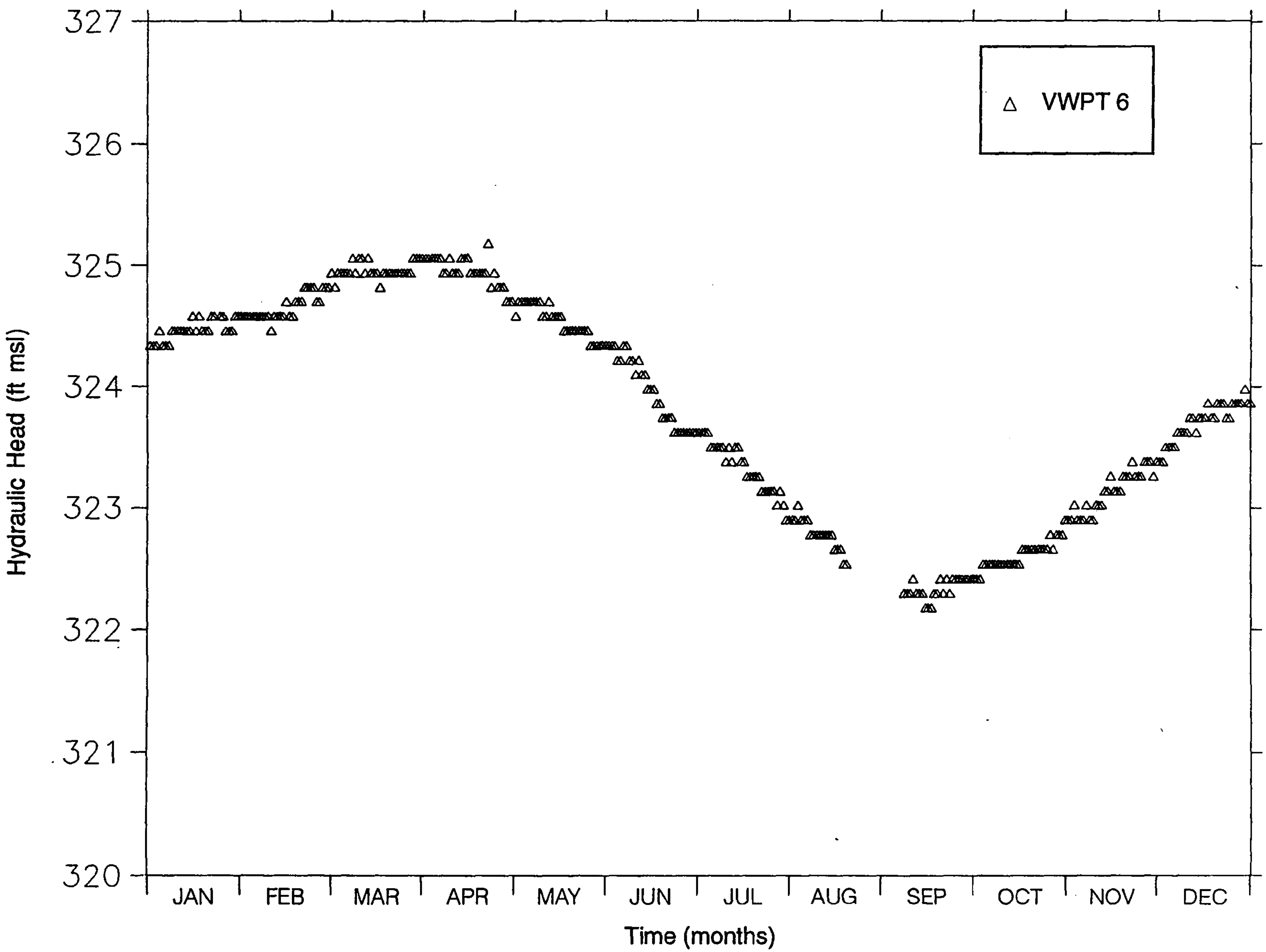
SUMMARY OF VWPT DATA FOR CALENDAR YEAR 1990

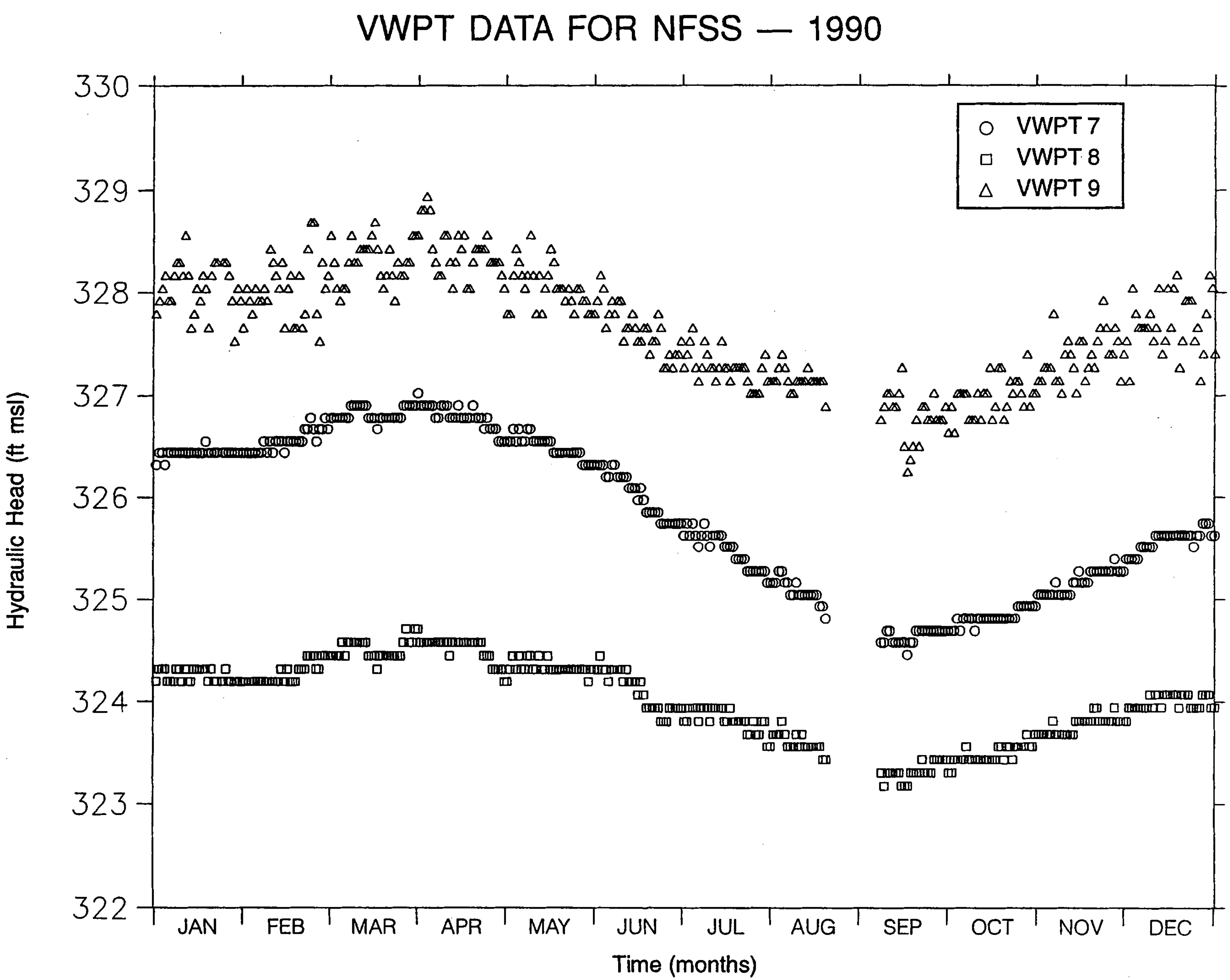

VWPT DATA FOR NFSS — 1990
327
326
325
324
323
322
321
320
Hydraulic Head (ft msl)
VWPT 1
VWPT 2
VWPT 3
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Time (months)



VWPT DATA FOR NFSS — 1990
VWPT 4
VWPT 5
Hydraulic Head (ft msl)
327
326
325
324
323
322
321
320
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Time (months)

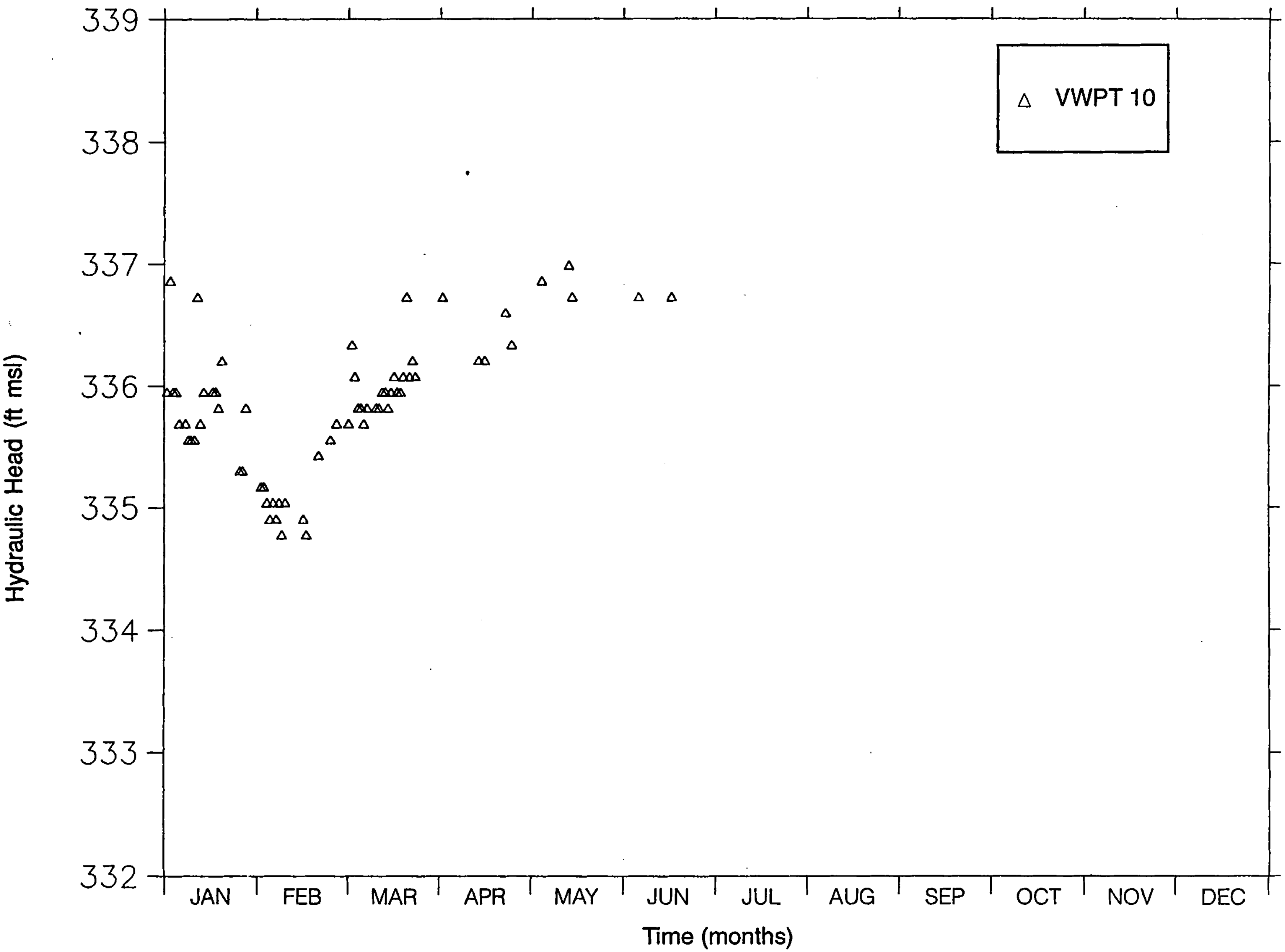
VWPT DATA FOR NFSS — 1990





VWPT DATA FOR NFSS — 1990
VWPT 7
VWPT 8
VWPT 9
Hydraulic Head (ft msl)
330
329
328
327
326
325
324
323
322
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Time (months)

VWPT DATA FOR NFSS — 1990



VWPT DATA FOR NFSS — 1990