3.0 ENVIRONMENTAL MONITORING PROGRAM - DESCRIPTION AND RESULTS

This report reflects some of the changes in the environmental monitoring network which have been implemented in the past three years to provide an enhanced level of environmental surveillance in anticipation of high-level waste solidification activities. The surveillance program as implemented in 1984 was operated throughout 1985 (including effluent, on-site, and off-site monitoring). This program is summarized in tabular form in Appendix A-1. A number of monitoring points have been added to the projected 1986 program to define more clearly the effects, if any, of several new project activities scheduled for the near future (see Appendix A-2).

The major pathways for off-site movement of radionuclides are by surface runoff and airborne transport. The environmental monitoring program therefore emphasizes the collection of air and surface water samples. The ingestion and assimilation of radionuclides by game animals and fish that include the WNYNSC in their range is another potentially significant pathway which is monitored by collection and analyses of appropriate specimens.

In addition to the radiological environmental monitoring program, WVNS participates in the State Pollution Discharge Elimination System (SPDES) and operates under state-issued air and water discharge permits for nonradiological plant effluents. Section 3.2 summarizes nonradiological monitoring in 1985 and Appendix C-5 provides greater detail on these activities.

3.1 Radiological Monitoring

Air, water, and selected biological media were sampled and analyzed to meet Department of Energy and plant Technical Specification monitoring requirements. To provide appropriate reference parameters, several additional sampling points were added in 1985 in support of project activities as they became operational (see Appendix A-1).

3.1.1 Radioactivity in Air

In 1985, airborne particulate radioactivity was collected continuously by four perimeter air samplers at locations shown in Figure 3-1 and by three remote samplers. The concentrations measured at each of these stations are given in Tables C-2.2.1 through -2.2.7. Three of the perimeter air samplers, mounted on 4-metre high towers, maintain an average air flow of about 40 litres/min (1.5 ft^3/min) through a 47 mm glass fiber filter. During 1984 the fourth perimeter air sampler was added on Rock Springs Road near the residence which would be subject to the highest average relative concentration of airborne effluent from a long-term, ground-level release from the plant (AFRSPRD, see Figure 3-1), and the three remote samplers were located in Great Valley, Springville, and West Valley (Figure 3-2). Concentrations measured at Great Valley (AFGRVAL) are considered to be representative of natural background. These four new samplers operate with the same air flow rate as the three mounted on towers, but the sampler head is at 1.7 metres above the ground (the height of the average human breathing zone). 1985 was the first full year of operation for the four samplers sited in 1984.

The filters were collected weekly and analyzed after a seven-day decay period to remove interference from short-lived naturally occurring radioactivity. Gross alpha and gross beta measurements of each filter were made using a low-background gas proportional counter. The average concentrations ranged from 9.1 E-15 to 5.9 E-14 microcuries per millilitre (uCi/ml) of beta activity, and 3.8 E-16 to 3.2 E-15 uCi/ml of alpha activity. Additionally, quarterly composites consisting of 13 weekly filters from each sample station were analyzed. Cs-137 was detected in 5 samples, including two from the background station at Great Valley. Sr-90 was detected in 18 of the 28 samples, including 2 of 4 from the background station. The highest concentrations measured were 0.0002% and 0.002% of the concentration guides listed in DOE Order 5480.1 for releases to uncontrolled areas for Cs-137 and

Sr-90 respectively. None of the measured concentrations were statistically larger than background at the 99% confidence level.

In all cases, the measured monthly gross activities were below 2 E-12 uCi/ml beta, and 2 E-14 uCi/ml alpha, the most limiting DOE concentration guides for any of the isotopes present at WVDP. (The standards and concentration guides for radionuclides of interest at West Valley from DOE Order 5480.1 are reproduced as Appendix B.) Results of the analyses of perimeter air sample filters are presented in Appendix C-2. For comparison, the 1982 and 1983 data from the New York State Department of Health indicated a normal background concentration of gross beta activity in air which averaged 2 E-14 uCi/ml in Albany, New York (Huang, 1984). Annual data for the three samplers which have been in operation since 1983 are compared in Figure C-2.2. The values average about 1.8 E-14 uCi/ml of gross beta activity in air, with no apparent trend. The annual average gross beta concentration at the Great Valley background station was 1.9 E-14 uCi/ml in 1985.

At four perimeter locations, three of which coincide with air samplers, fallout is collected in open pots. The data from these collections also are presented in Appendix C-2, Table C-2.3.

The total quantity of gross alpha and beta radioactivity released each month from the main stack, based on the weekly filter measurements, is shown in Table C-2.1 of Appendix C-2. The results of analyses for specific radionuclides in the four quarterly composites of stack effluent samples are also listed in Table C-2.1.

The main ventilation stack (ANSTACK) sampling system was modified in mid-1984 by adding an alpha monitor and a new isokinetic sampling head. A high flow rate and multiple nozzles assure a representative sample for both the long-term collection filter and the on-line monitoring system. Variations in concentrations of airborne radioactivity reflect the level of in-cell decontamination activities within the facility (Figure C-2.1). Even at this point of discharge, average radioactivity levels were still below the concentration guides for airborne radioactivity in an unrestricted area.

Because of the low concentrations, the large volume samples from the plant stack provide the only practical means of determining the amount of specific radionuclides released from the facility.

In November of 1985 a sampling system similar to the main stack system was put on-line to monitor the cement solidification system ventilation stack (ANCSSTK). Based on analyses of the weekly samples, no detectable radioactivity was discharged from this point in 1985. Two other facilities are routinely monitored for airborne radioactivity releases. These are the Low-Level Waste Treatment (LLWT) facility for radioactive water treatment, and the contaminated clothing laundry. The total amount of radioactivity discharged from both of these facilities is 1% of the airborne radioactivity released from the site, and is not significant in dose calculations.

3.1.2 Radioactivity in Surface Water and Sediment

Four automatic samplers collect surface water at points along the site drainage channels. One of these is located off-site, beside Cattaraugus Creek at Felton Bridge just downstream of the confluence with Buttermilk Creek, the major surface drainage from the WNYNSC (Figure 3-1). This sampler (WFFELBR) continuously removes a small volume of water (approximately 400 ml/hr) from the creek; a stream stage-level chart recorder provides a means of flow-weighting the weekly composite based on relative stream depth. Gross alpha, beta, and tritium analyses are performed each week, and a weighted monthly composite is analyzed for Sr-90 and gamma emitting isotopes. A grab sample taken monthly from a background location at Cattaraugus Creek upstream of the Buttermilk Creek confluence (WFBIGBR) is analyzed for gross alpha, beta, and tritium. The most elevated concentrations in samples from Cattaraugus Creek during 1985 show Sr-90 to be less than

2.5 percent of the concentration guide for release to an unrestricted area. Gross alpha and gamma emitting isotopes were so low as to be below the detection limit in Cattaraugus Creek water for 7 of 12 and 11 of 12 months respectively (Table C-1.6) On the average, however, the concentration of gross beta radioactivity in Cattaraugus Creek increases detectably after Buttermilk Creek joins it. A comparison of monthly gross beta activities for three years is presented in Figure C-1.2.

Three surface water monitoring stations in addition to the Cattaraugus Creek sampler are in service upstream of the Buttermilk Creek/Cattaraugus Creek confluence. These samplers currently operate in a time composite mode, collecting a 2.5 ml aliquot every half-hour. At each station the composite samples are collected biweekly, composited monthly, and analyzed for tritium, gross alpha, and gross beta radioactivity. A quarterly composite of the biweekly collection is analyzed for gamma-emitting isotopes and Sr-90. These installations collect water from an upstream background location on Buttermilk Creek (WFBCBKG) and a downstream location at Thomas Corners Road near the confluence of Cattaraugus Creek (WFBCTCB). The third station (WNSP006) is on Franks Creek (also known as Erdman Brook) just upstream of the point where Project site drainage leaves the security area (Figure 3-3). Radiological concentration data from these sample points show that average gross radioactivity concentrations are generally higher in Buttermilk Creek below the WVDP site than above, presumably because of the small amount of activity from the site which enters via Franks Creek. The range of gross beta activity, for example, was <9.4 E-10 to 6.3 E-9 uCi/ml upstream in Buttermilk Creek at Fox Valley (WFBCBKG) and from 4.3 E-9 to 1.7 E-8 uCi/ml in Buttermilk Creek at Thomas Corners Bridge (WFBCTCB).

Sediments from Buttermilk Creek and Cattaraugus Creek were analyzed for gross activity, Sr-90, and for gamma-emitting isotopes. The results are comparable to previous analyses during 1983 and 1984. Data for 1985 are presented in Table C-1.10. A comparison of 1983 and

1985 gross beta activity in sediment from Buttermilk Creek is presented in Figure C-1.3. Data for 1984 were not available.

The largest single source of radioactivity released to surface waters is the discharge from the low-level waste treatment system through the Lagoon 3 weir (WNSP001, Figure 3-3) and into Erdman Brook. There were four batch releases (a total of about 34.8 million litres) from Lagoon 3 in 1985. The effluent was grab sampled daily during the 22 days of release and analyzed. The total amounts of activity in the effluent are listed in Table C-1.1. Of the activity released from Lagoon 3, 3.6% of tritium and 4.2% of other gross radioactivity originated in the New York State disposal area (based on measurements of water transferred in 1985 from the state area to the LLWT) and not from previous or current Project operations (see Table C-1.11).

3.1.3 Radioactivity in the Food Chain

Samples of fish and game animals were collected both near and remote from the site during periods when they would normally be taken by sportsmen for consumption. Milk and beef from cows grazing near the site and at remote locations were also collected and analyzed during 1985. The results of these analyses are presented in Appendix C-3.

Fish samples were taken semiannually during 1985 above the Springville dam from the portion of Cattaraugus Creek which receives WNYNSC drainage (BFFCATC, see Table C-3.4). Nine fish were collected from this section of the stream during each period. The Sr-90 content in flesh and skeleton, and gamma emitting isotopes in flesh were determined for each specimen.

Control data (BFFCTRL and BFFBCFV) are included in this report to permit comparison with the concentrations found in fish taken from site-influenced drainage. For this purpose a similar number of fish were taken from waters that are not influenced by site runoff and their edible portions were analyzed for the same isotopes; these control (natural background) samples were representative of the species collected in Cattaraugus Creek downstream from the WVDP. The concentrations of strontium-90 in the edible flesh in 1985 show a slight decrease compared to 1984 data (WVNS, 1984). The Sr-90 content in the skeleton continued the downward trend from previous measurements during recent years (Figure C-3.2). The log-normal statistical treatment of the fish data presented in Table C-3.4 is specified by the site reporting requirements.

Portions of a single deer from a resident herd on the east side of the WNYNSC were analyzed. The concentration of cesium-137 and Sr-90 in deer flesh was a bit lower than the concentration in the previous year's sample (Figure C-3.3). Data from a control, or background, deer sample collected in 1985 from an Alleghany County location 40 km from the site are shown in Table C-3.2 for comparison. The concentration of radioactivity in meat from semiannual samples of local beef animals was indistinguishable from the concentration in control samples (Table C-3.2).

Although the dairy cattle sampled monthly in 1985 reside adjacent to the site and receive the maximum exposure of any dairy herd, the concentration of Sr-90 in quarterly composites of milk ranged only from 1.7 to 3.3 pCi/l (see Table C-3.1). Sr-90 in single milk samples collected in 1985 from two other dairy farms near the site measured 4.35 and 3.19 pCi/l. Iodine-129 and gamma emitting isotopes were not detectable in any milk samples. The annual control milk sample from the Albany, New York area, provided under a cooperative agreement by the New York State Department of Health laboratory and analyzed by WVDP, showed a concentration of 2.9 pCi/l of Sr-90 in 1984, and 0.7 pCi/l in 1985.

Based on the samples analyzed in 1985 (Table C-3.3), there was no detectable difference in the radioactivity of corn grown at near-site and remote locations. The near-site sample was collected at the

AFTCORD site (Figure 3-1). The background sample was collected at the BFBCTRL point (Figure 3-2).

In Section 4 of this report, radionuclides present in the human food chain are discussed and their contribution to the radiation exposure of the public is assessed. Although the maximum concentrations of radioactivity found in some biological samples were above background levels, the dose associated with consumption of these samples would be far below the protection standards.

3.1.4 Direct Environmental Radiation

1985 was the second complete year in which direct penetrating radiation monitoring at WVDP relied solely on TL-700 LiF thermoluminescent dosimeters (TLDs). The uncertainty of individual results and averages were acceptable and measured exposure rates were comparable to those of 1983. Exposure rates measured during 1984 tended to be somewhat lower on the average than the 1983 or 1985 values (see Figure C-4.3). There were no significant differences in 1985 readings from the background TLDs (locations 17 and 23) and those on the WNYNSC perimeter (see Figure 3-1 for TLD perimeter locations).

Dosimeters used to measure ambient penetrating radiation during 1985 were processed on-site. The system used Harshaw TL-700 lithium fluoride chips which are maintained apart from the occupational dosimetry TLDs as a select group solely for environmental monitoring. The environmental TLD package consists of five TLD chips laminated in a thick card bearing the I.D. and other information. These cards are placed at each monitoring location for one calendar quarter (3 months) and then processed to obtain the integrated gamma radiation exposure.

Monitoring points are located, as shown on Figures 3-1 and 3-2, around the site perimeter and access road, at the waste disposal area, and at background locations remote from the WVDP site. Appendix C-4 provides a summary of the results for each of the 25 locations by calendar quarter along with averages for comparison.

The quarterly averages and individual location results show differences due to seasonal variation in snow cover. During the first quarter (January through March) of 1985 the average quarterly exposure decreased due to snow cover. The second quarter (April to June) average was also low due to snow cover and spring rains. The third quarter of 1985 (July to September), with no snow cover and low rainfall, had the highest quarterly average. Moderate rainfall and snow cover in the fourth quarter (October to December) decreased the quarterly average to a level comparable to the second quarter. These data indicate that seasonal variation due to rainfall and snow cover has a significant effect on ambient penetrating radiation measurements around the WVDP site, as was noted in 1984 (Figure C-4.3).

Presumably because of their proximity to the LLW disposal area, the dosimeters at two locations which are not part of the off-site monitoring program (18 and 19 on Figure 3-1) showed a small increase in radiation exposure compared to the WNYNSC perimeter locations. Location 25, on the public access road through the site north of the facility, also showed a small increase due to the storage of decontamination wastes near location 24 later in the year.

Location 24 on the north security fence, like locations 18 and 19, is not included in the environmental monitoring program; however, it is a co-location site for a U. S. Nuclear Regulatory Commission (USNRC) TLD (Table D-1.4). This point received an average exposure of 0.75 milliroentgen per hour during the last quarter of 1985. This exposure is primarily attributable to the nearby storage of sealed containers of radioactive components and debris from plant decontamination efforts. This point is well within the WNYNSC boundary (as are 18 and 19) and not readily accessible to the public.

3.2 Nonradiological Monitoring

West Valley Demonstration Project effluents are regulated for nonradiological parameters by the New York State Department of

Environmental Conservation (NYSDEC). Stationary sources of atmospheric pollutants are authorized by either a permit to construct or a certificate to operate. Liquid effluents are monitored as a requirement of the State Pollution Discharge Elimination System (SPDES) permit issued and enforced by NYSDEC.

3.2.1 Air Discharges

The WVDP presently holds 5 certificates to operate stationary sources and 2 permits to construct new sources of airborne effluents. These permits are for minor sources of regulated pollutants such as particulates, nitric acid mist, and oxides of nitrogen. Monitoring these parameters is not required because of their insignificant concentrations and small mass discharge.

The individual air permits held by the WVDP are identified and described in Table C-5.1.

3.2.2 Aqueous Discharges

The WVDP holds a SPDES permit which identifies the outfalls where liquid effluents are released (shown in Figure C-5.1) to Erdman Brook and specifies the sampling and analytical requirements for each outfall. During 1985, this permit was renewed in a substantially modified form. Prior to September 1, 1985 the permit listed six outfalls, each with specific monitoring requirements. These permit conditions are described in Table C-5.2.

The new SPDES permit became effective on September 1, 1985. This permit eliminated two in-process monitoring points and the outfall where Erdman Brook leaves the controlled area of the site (WNSP006). Added to the permit is the french drain outfall near the low-level waste treatment lagoons. These changes were made to include only outfalls discharging to Erdman Brook.

The new permit also includes initial and final requirements. The initial requirements identify monitoring requirements and limits for separate outfalls from the sewage treatment plant and utility room, whereas the final requirements allow for combining these waste streams into a new outfall. The conditions and requirements of the new SPDES permit are summarized in Table C-5.3.

The most significant features of the new SPDES permit are a requirement to report data as flow weighted concentrations and the application of a "net" discharge limit for iron. The net limit allows for subtraction of incoming (background) amounts of iron from the values reported in the Project effluent. The flow weighted limits apply to the total discharge of Project effluents but allow maximum credit for dilute waste streams in determining compliance with effluent concentration limits specified in the permit.

3.2.3 Results

The SPDES monitoring data are displayed in Figures C-5.2 through C-5.15. Generally, these data indicate that Project effluents were within permit limits. However, the WVDP reported a total of 21 noncompliance episodes. These are discussed in Appendix C-5.

3.2.4 Pollution Abatement Projects

During 1985 the WVDP completed construction of two pollution abatement projects, a new sewage treatment plant and an effluent mixing basin. These projects were necessary to bring WVDP effluents within the SPDES permit limits as mandated by a NYSDEC consent order.

The sewage treatment facility provides extended aeration (biological) treatment for an average flow of 10,000 gallons of raw sewage per day. This plant is sized to accommodate the increased work force at the WVDP and produce an effluent of acceptable pH and BOD concentration.

The second project is the utility room (SPDES outfall 005) and sewage treatment plant (SPDES outfall 004) effluent mixing basin, which is now identified as SPDES outfall 007. This mixing basin eliminates slug discharge of particulate laden backflush water from the plant's intake water clarifier, and mixes pure clarifier overflow water with effluent from the sewage treatment plant. The resulting effluent has less impact on Erdman Brook because it is continuous, thereby preserving the stream bed during periods of low flow, and is lower in concentration of iron, suspended solids and BOD.

3.3 Groundwater Monitoring

3.3.1 Hydrology of the Site

The hydrogeology of the WVDP site has been and continues to be extensively investigated. Appendix E provides a simplified but accurate synopsis of the site geology and the pathways for contaminant migration through this geologic system. A generalized east-west cross-section through the site is depicted in Figure 3-5.

3.3.2 Groundwater Monitoring

A program of sampling groundwater both on the Project site as well as from wells at residences around its perimeter was carried out in 1985. The shallow wells in this program fall into four groups:

1. A group of dug shallow wells installed north of and immediately surrounding the main plant building were monitored for several years before Project start-up and are therefore used for reference to examine long-term trends.

2. The U.S. Geological Survey (USGS) series 80 wells form an outer ring around the facility dug wells.

3. The USGS series 82 wells are grouped around the formerly-licensed disposal area. Selected series 75 wells also fall into this category.

4. Private wells around the perimeter are used for drinking water by site neighbors (half of these are sampled each year).

Appendix A gives more information on sampling requirements and on the location of these wells (shown in Figures A-3, A-5 and A-6). Appendix C-1 summarizes results of the radiological analyses of samples from the wells (Tables C-1.7, -1.8, and -1.9). Except for those on-site wells that historically show localized contamination, there was no indication of fuel-cycle isotopes in these wells. One well, WNW824A1, (see Figure A-3 for location near west corner of disposal area), has demonstrated a rise in tritium concentration over the past two years. During well construction it was thought that this well was in an area of permeable backfill near a disposal trench, and the increasing tritium concentrations support this hypothesis. Increases in the gross activity in shallow wells near the now-closed Lagoon 1 (wells B, D and G, Figure A-3) are thought to be transient and are attributed to the localized disturbances from excavation and movement of heavy machinery while Lagoon 1 was being closed. The tritium concentration in well J-5 appears to have peaked in the spring of 1985 and is within the range of past measurements. A small increase in tritium concentration in wells WNW821A and B in the fall of 1985 was noted and will be compared to future measurements to determine if a trend is developing.

In order to monitor more effectively several specific on-site areas which have the potential for radiological and nonradiological ground water contamination, a more comprehensive ground water monitoring program has been approved by DOE for implementation in 1986. The intent of the program is to add to the existing network those parameters and locations which would demonstrate full compliance with the technical requirements of RCRA (Resource Conservation and

Recovery Act) as called for by DOE Order 5480.2. Procedural compliance with techniques designed for nonradiological contaminant evaluation will be a major consideration in sample collection, analysis and quality control for the nonradiological as well as the radiological aspects of the proposed, expanded ground water monitoring plan.

3.4 Special Monitoring

In November of 1983, contamination was encountered in a recently drilled USGS series 82 ground water monitoring well near the formerly licensed NFS solid radioactive waste disposal area. In the samples analyzed, the organic contaminant contained concentrations of alpha emitters on the order of 10^{-5} uCi/ml and beta/gamma emitters at about 10^{-4} uCi/ml. This led to an extensive examination of ground and surface water near that location. Samples were collected from closely spaced sampling wells and surface streams adjacent to the suspect area. Although subsequent evaluations and test borings did confirm the subsurface presence of a contaminated organic fluid, monitoring of surface water and wells adjacent to surface waters failed to show any transport away from the immediate vicinity of the disposal area. In 1985, continued monitoring of all downstream points (including more frequent sampling of drainage water immediately below the suspect area) indicated no detectable increase in radioactive contaminants. A decontamination effort initiated in 1984 continued to remove and isolate the fluid from the subsurface disposal area.

During the summer and fall of 1984, a comprehensive aerial survey of the WNYNSC including the West Valley Demonstration Project site was performed by EG&G under DOE sponsorship. Measurements utilized not only state-of-the-art gamma radiation instruments but also high resolution photography and multi-spectral scanning data. The final report is in preparation by EG&G and careful attention is being given to comparisons with previously acquired data from the same area.

Although preliminary data indicate a general reduction in overall gamma radiation around the WNYNSC, a final evaluation has not been completed, and a definitive analysis is not yet available.

A limited spill of tritiated condensate water from a tank in the waste tank farm in March of 1985 was contained within the immediate area of the incident. Samples of the spilled water contained tritium at one-tenth of the concentration allowable in restricted areas. Environmental surveillance of the spill area drainage pathways at the site security fence over several days detected a small rise in the concentration of tritium in surface water to about 0.1% of the concentration guide for unrestricted water use. This level is approximately the same as tritium concentrations in normal runoff from nearby areas not affected by the spill. Water, air and soil samples from the spill drainage area were analyzed for other nuclides and found to be indistinguishable from background samples taken previously.

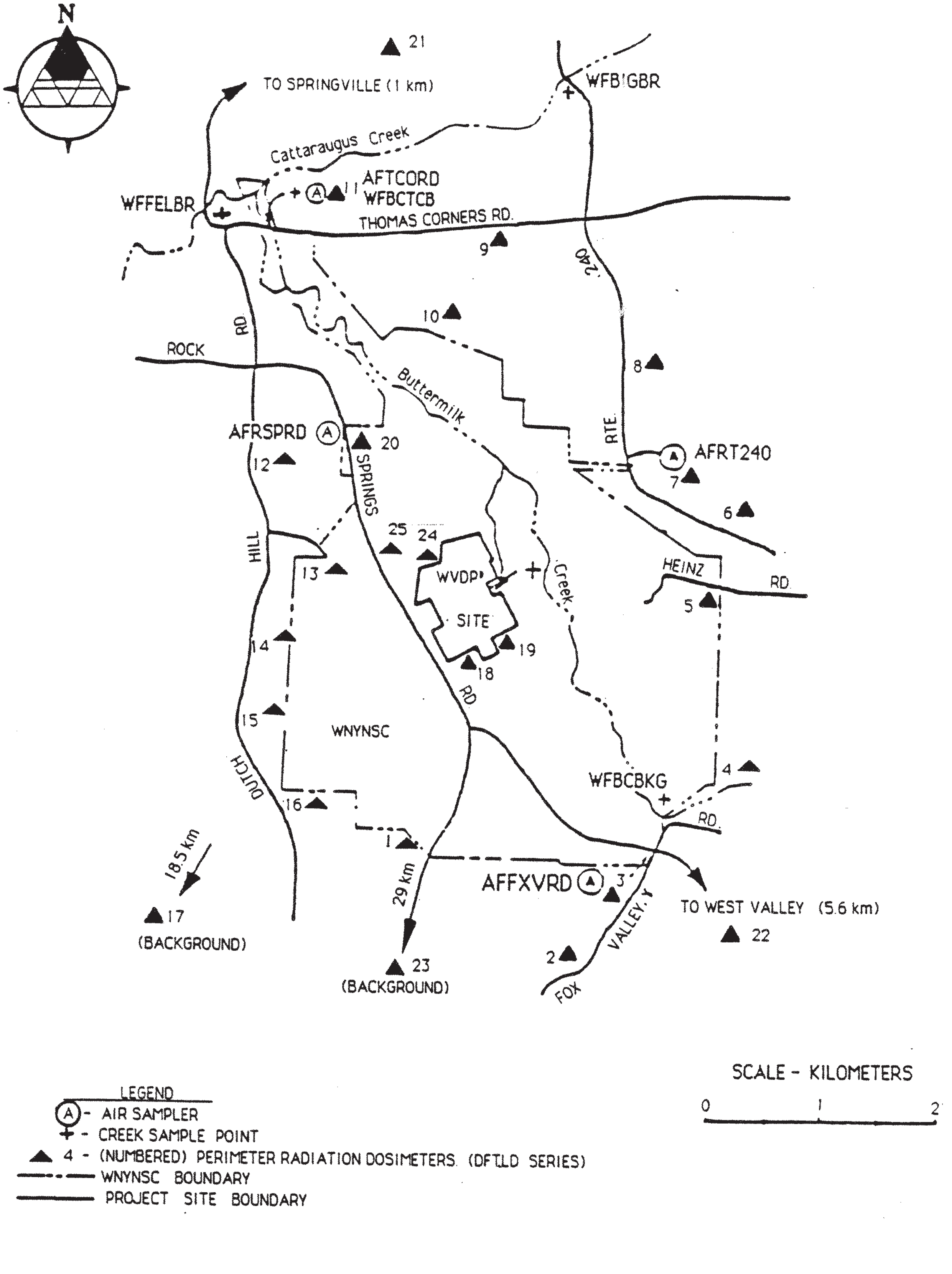


FIGURE 3-1
Locations of Perimeter Environmental Monitoring Stations


ENVIRONMENTAL SAMPLING POINTS
MORE THAN 5 km FROM WVDP SITE
N
AFSPRVL
WFWEL10
BFFCTRL
10 km
20 km
30 km
AFWEVAL
WFWEL06
DFTLD17
AFGRVAL
BFDCTRL
BFBCTRL
LEGEND
- Thermoluminescent Dosimetry
- Air Sampler
- Drinking Water Well Supply
- Meat Sampling Point
5
0
5
10
15
20
25
30 Kilometers

FIGURE 3-2

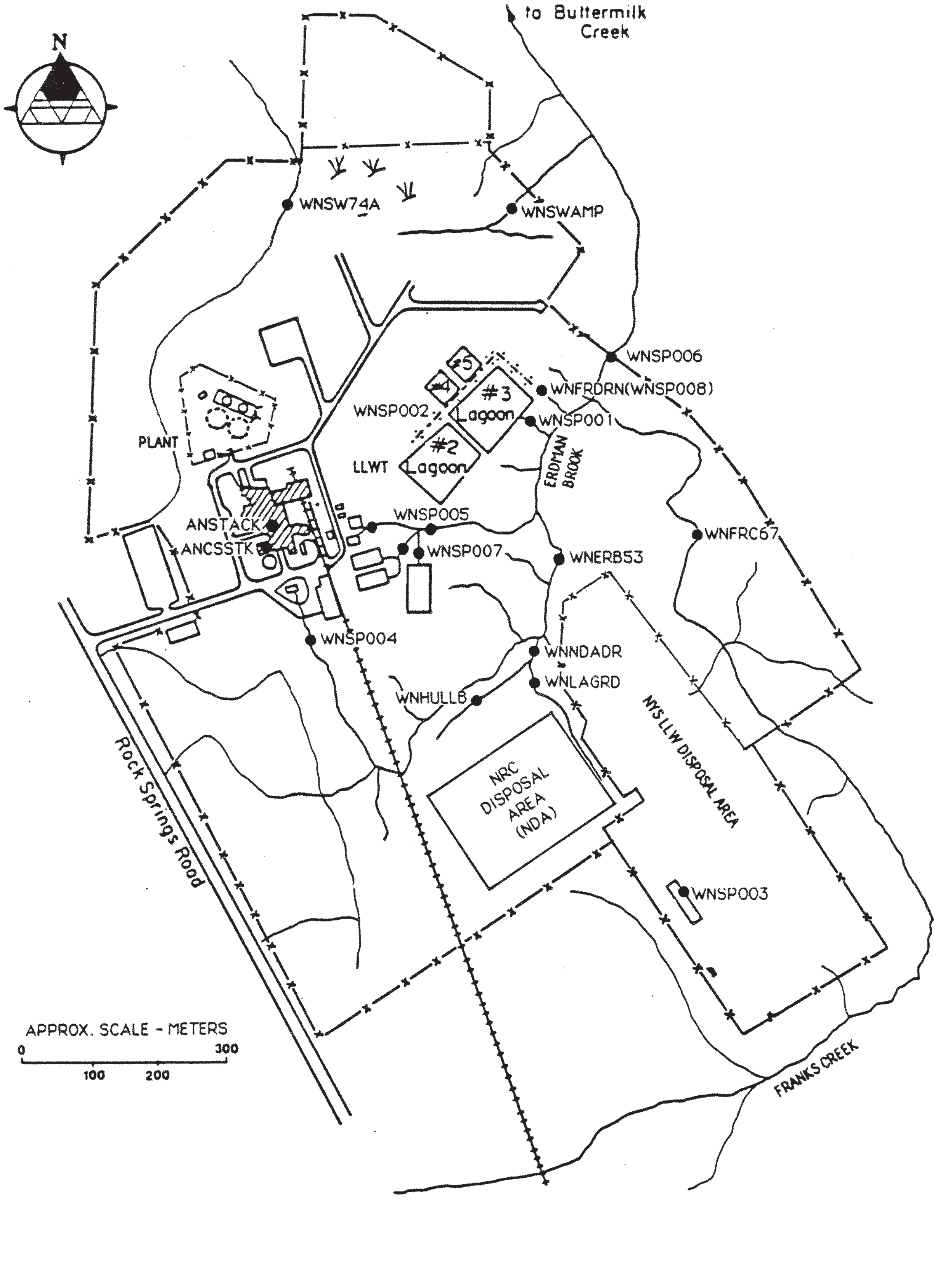


FIGURE 3-3
Location of Effluent
Radiological Monitoring Points On-site

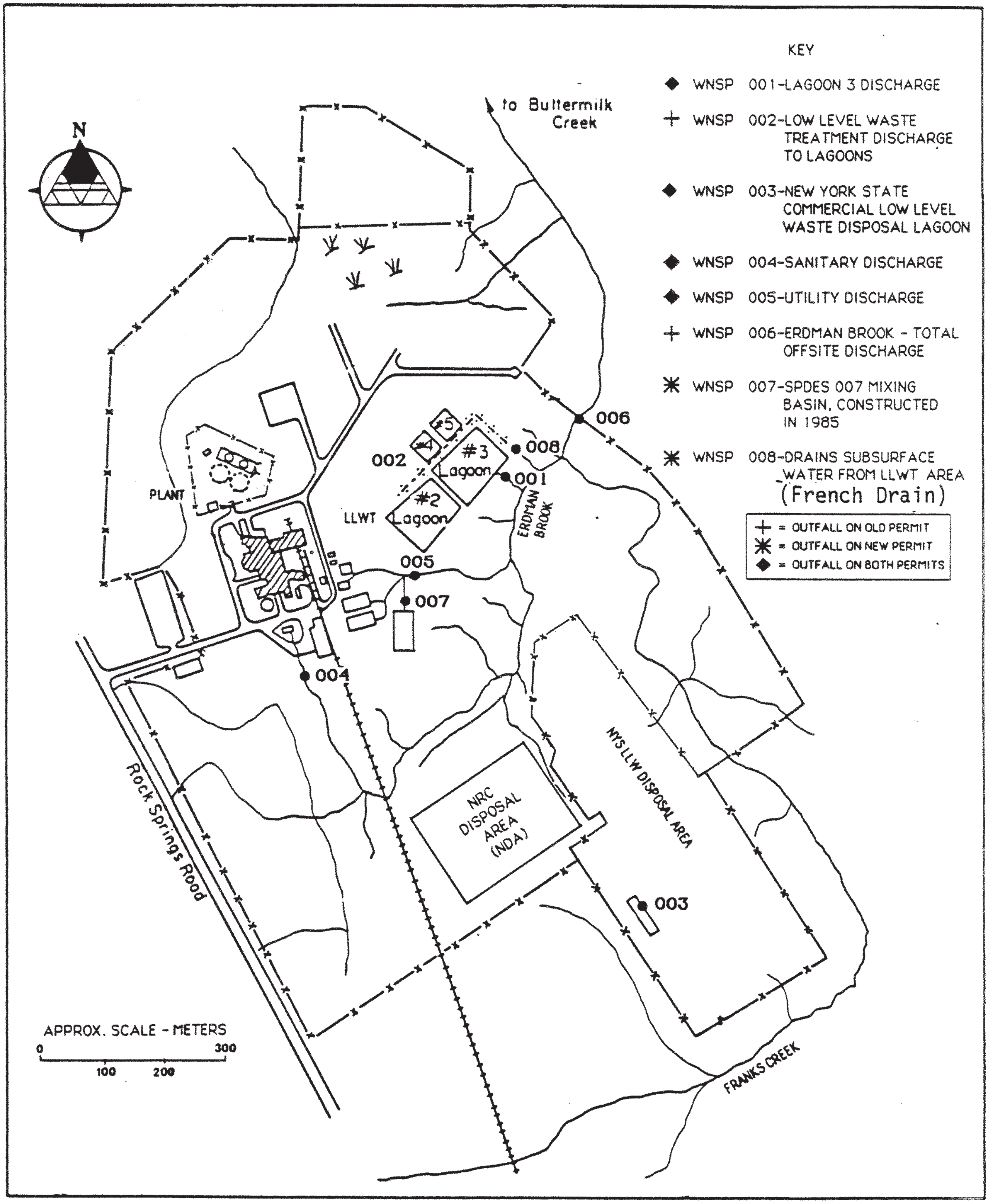
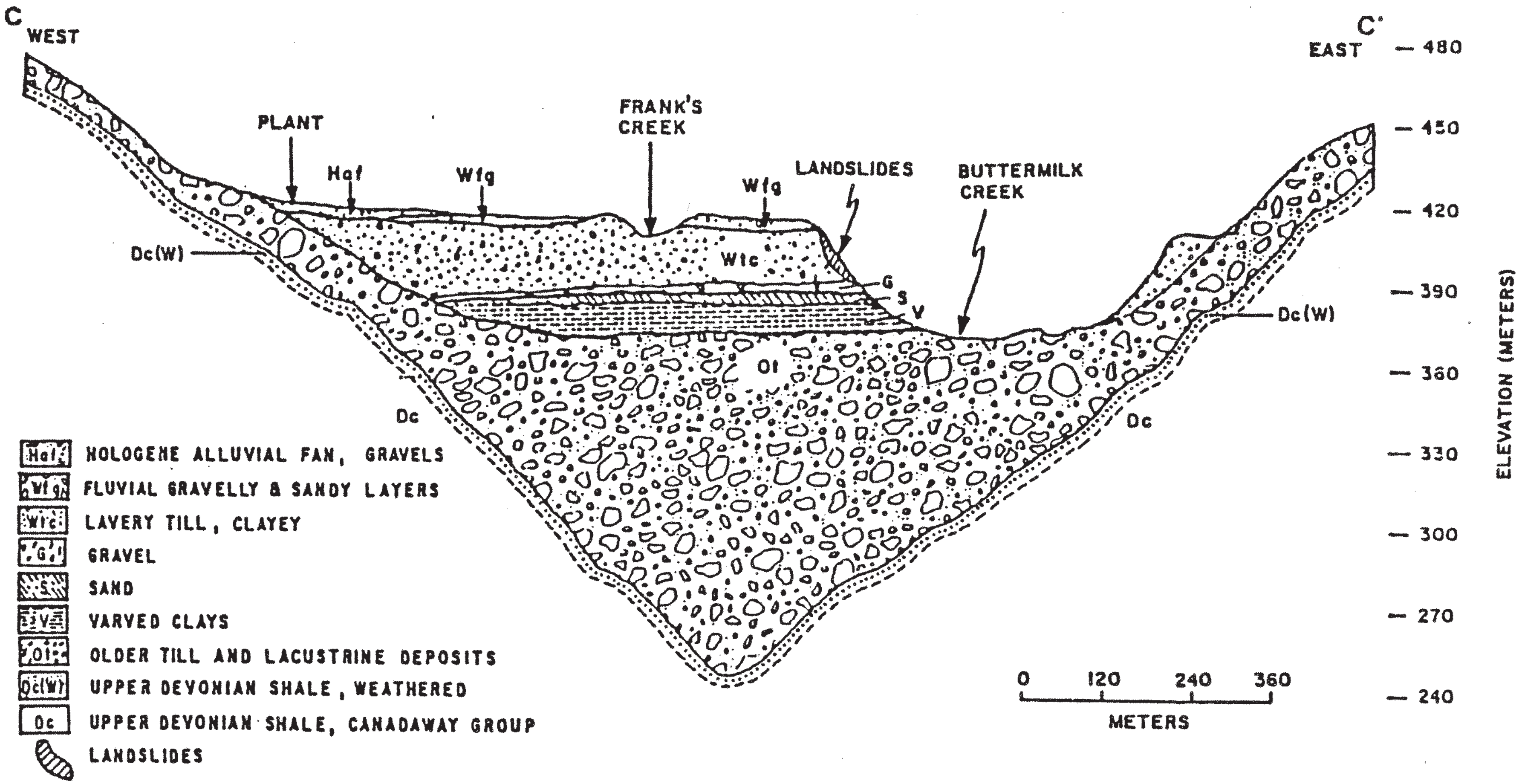


FIGURE 3-4
Locations of SPDES Monitoring Points On-site



NOTE:
Vertical scale = 1/4 horizontal scale.
Adapted from Dana et al. (1979a).

GENERALIZED EAST-WEST GEOLOGIC CROSS SECTION
AT THE WEST VALLEY DEMONSTRATION PROJECT

FIGURE 3-5