C-8 PLUME IDENTIFICATION/GROUNDWATER ASSESSMENT WORK PLAN DUPONT WASHINGTON WORKS FACILITY AND LOCAL, LETART AND DRY RUN LANDFILLS

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1.0 INTRODUCTION

A multi-media consent order (Order No. GWR-2001-019; Consent Order) was entered into between the West Virginia Department of Environmental Protection (WVDEP), the West Virginia Department of Health and Human Resources – Bureau for Public Health (WVDHHR-BPH) and DuPont on November 15, 2001. The Consent Order identified a series of requirements and tasks to be performed by the parties (WVDEP, WVDHHR-BPH, and DuPont) in order to determine whether there has been any impact on human health and the environment as a result of releases of ammonium perfluorooctanoate (C-8), CAS Number 3825-26-1, to the environment from DuPont operations at the Washington Works facility and the associated landfills (Local, Letart, and Dry Run).

The Consent Order established the C-8 Groundwater Investigation Steering Team (GIST) to oversee investigations and activities that will be conducted to assess the presence and extent of C-8 in drinking water, groundwater, and surface water at and around the facility and the associated landfills.

Pursuant to Attachment A of the Consent Order, three tasks will be performed by DuPont and evaluated by the GIST, Tasks A, B, and C. Task A: Groundwater Use and Well Survey/Groundwater Monitoring involves evaluating C-8 in groundwater initially within a one-mile radius from the Washington Works facility and the three landfills. Areas of investigation were expanded to a two-mile radius from the facility and the Local Landfill based on the results obtained. Expansion of the one-mile radius is not required for the Letart and Dry Run Landfills. The report presenting the results for the one-mile radius sampling was submitted to the GIST (DuPont, 2002a). Included with these sampling activities was sampling of public water supplies located one mile upstream and ten miles downstream of the facility. Again, the area of investigation was expanded based on results obtained. Currently, 12 public water supplies located within the segment extending approximately 3.5 miles upstream and approximately 53 miles downstream have been sampled. Available results are included in the One-mile Radius Survey and C-8 Sampling Report and Ohio River Public Water Supply Sampling (DuPont, 2002a).

Task B: Assessment of Existing Groundwater and Surface Water Monitoring Data includes the compilation of historical C-8 data, monitoring all wells at the landfills, and the development of a Groundwater Monitoring Plan (GMP) for the Washington Works facility and the Local, Letart, and Dry Run Landfills. The first part of the task has been completed. The historical C-8 data compilation report was submitted to the GIST for evaluation (DuPont, 2002b). The second part of Task B, monitoring C-8 in surface water and groundwater at the landfills, began in December 2001. Sampling will be performed monthly for four months, then will be performed quarterly. The December 2001, January 2002 and February 2002 Surface Water and Groundwater Monitoring Reports for Washington Works Facility and Local, Letart, and Dry Run Landfills have been submitted to the GIST (DuPont, 2002c; 2002d; 2002e).

The Proposed GMP for the Washington Works facility has been completed (DuPont, 2002f). It was submitted to the GIST for review and was approved following minor modifications (DuPont, 2002g). Groundwater sampling at the Washington Works

facility, based on the proposed GMP, began in late January 2002. Sampling will be conducted monthly for four months, then conducted quarterly. The results of C-8 sampling for the wells and outfalls at the facility are submitted with the results for the three landfills.

Task C: Plume Identification/Groundwater Assessment at each site will commence following the completion of Tasks A and B. This activity will include delineating the vertical and horizontal extent of C-8 impacted groundwater and specifically includes an assessment of C-8 impacted groundwater at the Letart Landfill and its impact on the Ohio River and public water supplies along the river as required by the Consent Order. As part of this task, a separate river water sampling plan has been submitted to the GIST for approval (DuPont, 2002h). The GIST verbally approved the river water-sampling plan on March 5, 2002.

The proposed work plan for Task C activities for the Washington Works facility and the associated landfills is presented in this document. The activities proposed were selected based primarily on the data obtained from Tasks A and B. Recommended activities were designed to identify groundwater plumes contributing to or with the potential to flow toward off-site receptors, with an emphasis on those areas where groundwater is used as a drinking water source.

1.1 Document Organization

This work plan is organized by section. Sections 2, 3, 4, and 5 present the scope of work proposed to investigate the Washington Works facility and the Local, Letart, and Dry Run Landfills, respectively.

Sections 2, 3, and 4, have the same format. In each of these sections, a general overview of each site is presented first. This is followed by summaries of the key findings and data gaps that were identified during development of the site conceptual model (SCM). The key findings were developed using information included in the historical data report, the monthly monitoring reports, and the available sampling results from the one-mile radius and public water supply sampling activities. The data gaps listed are those identified in the historical data report. Additional data gaps, identified after the submission of the historical data report or identified by the GIST, are also discussed. (For supporting information on the site background, key findings or the data gaps the reader is referred to the documents described in the introduction and listed in the references.) Following the summary of the data gaps is a summary of the activities proposed to fill the data gaps. A detailed justification for performing these activities is presented last.

Section 6 presents the prioritized path forward for implementing the recommended activities at each of the sites. Section 7 discusses reporting and includes a preliminary schedule for the activities. Section 8 contains the references cited in the work plan.

2.0 WASHINGTON WORKS FACILITY

Significant historical hydrogeological and groundwater quality data for C-8 are available for the Washington Works facility from previous investigations that have been conducted. Most recently, these data were summarized in Section 2 of the historical data report. As part of the historical data report, the SCM for the Washington Works facility [originally developed during the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) (DuPont, 1999)] was refined based on additional data gathered since the RFI was completed. While refining the SCM, data gaps were identified.

In the following sections, the key findings for the Washington Works facility are summarized, and the data gaps identified for the Washington Works facility SCM are presented. A summary of proposed activities to fill these data gaps is then presented. Following the summary of proposed activities are a more detailed discussion of each data gap and the justification for implementing the proposed activities designed to fill these data gaps.

2.1 Key Findings

Based on the historical data report, the monthly monitoring reports, and the results available for the one-mile radius and public water supply C-8 sampling in the vicinity of the facility, several key findings were identified:

- The highest concentrations of C-8 measured in groundwater (up to 47,500 ug/L) were detected in wells clustered in one area of the facility. These wells are located in and around the western end of the Riverbank Landfill and the former Anaerobic Digestion Ponds solid waste management units (SWMUs) that are positioned adjacent the Ohio River.
- Concentrations of C-8 that were measured in 46 other monitoring and temporary wells located across the site are relatively lower, ranging from <0.1 to 67 ug/L. C-8 concentrations in 18 of these 46 wells were less than 10 ug/L. In 11 wells, C-8 concentrations were less than 1ug/L.
- Groundwater elevation contour maps indicate that continued pumping of on-site well fields near and parallel to the river (i.e., Ranney Well, the DuPont-Lubeck Well Field, and the East Well Field) lowers the groundwater level in the alluvial aquifer to below river stage. This likely induces surface water from the river to flow into the alluvium toward the production wells, replacing water pumped from storage in the aquifer.
- C-8 was detected in eight public water supply well fields located along the Ohio River near the facility. The furthest well fields were located as far upstream as Belpre (approximately 3.5 miles upstream of the facility) and as far downstream as Tuppers Plains (approximately 19 miles downstream of the facility). Sampling was also performed at the City of Parkersburg well field (located one half mile upstream of Belpre) where C-8 was not detected in four of the five water supply

wells sampled. Although C-8 was detected in the fifth water supply well at Parkersburg (the well closest to the facility), it was measured at a concentration of 0.069 ug/l, just above the practical quantitation limit (PQL; 0.05 ug/L). C-8 was not detected in groundwater from the five water supply wells at the Ravenswood well field, located 30 miles downstream of the facility.

2.2 Data Gaps

In the historical data report, the following data gaps were identified during the development of the Washington Works facility SCM:

- Additional monitoring wells are needed to further delineate C-8 concentrations in groundwater and to evaluate groundwater flow direction, particularly in the bedrock aquifer.
- Continued refinement of the groundwater model for the Washington Works facility is required to re-evaluate that groundwater captured by the pumping wells is preventing off-site migration of C-8 impacted groundwater.
- Surface water quality in the Ohio River needs to be evaluated. A separate work plan, the Ohio River Water Sampling Proposal for the Washington Works Facility and the Letart Landfill was submitted to the GIST to address this issue (DuPont, 2002f).

An additional question/data gap includes identifying the C-8 migration pathway or pathways from the Washington Works facility to the Little Hocking Water Association Wells, located immediately across the river in Ohio.

2.3 Summary—Recommended Activities to Fill Data Gaps

Activities proposed to fill the above-described data gaps in the Washington Works facility SCM are summarized below and are discussed in detail in Section 2.4.

- Install three new bedrock wells at locations near existing wells that are screened in the alluvial aquifer. Use new geologic data to characterize the bedrock under the site. Figure 1 shows the locations of the three proposed new bedrock wells.
- Conduct hydrogeologic testing, using the three new bedrock wells to evaluate aquifer characteristics of the underlying bedrock aquifer.
- Expand and refine the groundwater model for the unconfined alluvial aquifer to include the Ohio River and nearby production wells pumping groundwater from the alluvium. The refined model will be used to evaluate groundwater flow under and around the Washington Works facility and to evaluate the potential for flow from the plant towards the Little Hocking well field.
- Conduct field reconnaissance to identify additional surface water features located on-site. Sample surface water from new locations identified during this effort.
- Continue to monitor C-8 in groundwater in both the unconfined alluvial aquifer and underlying bedrock aquifer (utilizing the newly installed bedrock wells).

Continue to monitor C-8 in surface water at existing locations identified in the Consent Order.

- Refine the Washington Works facility SCM based on the additional data gathered during the above listed activities.

2.4 Detailed Justification

The first data gap identified in the historical data report recommends the installation of additional monitoring wells to further delineate C-8 concentrations in groundwater and to evaluate groundwater flow direction, particularly for groundwater flow in the bedrock.

The Consent Order and the West Virginia/National Pollutant Discharge Elimination System (WVNPDES) permit for the Washington Works facility require surface water and groundwater sampling of the alluvial aquifer. This sampling was to be performed monthly for four consecutive months, beginning in December 2001; then it will be performed quarterly. This additional sampling will provide the data needed to evaluate the extent and migration of C-8 in the alluvial aquifer and will also provide additional data on surface water quality.

The installation of three additional bedrock wells is recommended to fill the first data gap. The locations of the three proposed bedrock wells are shown in Figure 1 and monitoring well installation details are presented in Appendix A. The installation of these bedrock wells will be clustered near existing wells screened in the unconfined alluvial aquifer. Data measured at well clusters will evaluate the vertical gradients between the two aquifers and the direction of groundwater flow in the bedrock aquifer under the facility. Groundwater sampling of the three new bedrock wells will provide data needed to determine if the bedrock aquifer has been impacted by C-8 from the facility. Well installation and sampling methods are detailed in the Sampling and Analysis Plan (SAP) in Appendix A.

The second data gap identified for the facility in the historical data report is related to the continued refinement of the groundwater model for the Washington Works facility. Refinement of the model is required in order to reevaluate the extent of groundwater captured by the pumping wells at the site and determine the likelihood that off-site migration of C-8 impacted groundwater is occurring. This is particularly important given that C-8 has been recently detected in the Little Hocking Water Association well field, located directly north of the facility on the other side of the Ohio River. Once the groundwater model has been refined, it can be used to evaluate the likelihood that a groundwater migration pathway exists from the facility to the Little Hocking Well Field across the Ohio River.

The third data gap identified in the Washington Works facility SCM is that surface water quality in the Ohio River should be evaluated. A separate work plan was developed and submitted to the GIST addressing this issue (DuPont, 2002f).

The final recommended activity for the Washington Works facility is the integration of all the new data gathered during implementation of the work plan activities and the results of the refined groundwater model into a revised SCM. The revised SCM should

accurately represents the geological, hydrogeological, and human health and ecological exposure pathways for the current conditions at the site.

3.0 LOCAL LANDFILL

The Local Landfill is located immediately south of the Washington Works facility and consists of three separate closed cells, which operated from 1964 to the mid-1980s under West Virginia/National Pollutant Discharge Elimination System (WVNPDES) Permit No. 0076538. Materials landfilled included scrap product, scrap metal, wood pallets and bins, and Powerhouse ash. The specific source of C-8 in groundwater and surface water samples collected from on-site locations has not yet been determined. When the cells were closed, the cells were covered with approximately 2 feet of low permeability soil.

Historical hydrogeological and groundwater quality data for C-8 are available for the Local Landfill from previous investigations that have been conducted. Most recently, these data were summarized in Section 3 of the historical data report (DuPont, 2002b). As part of the historical data report, a SCM for the Local Landfill was developed, and data gaps were identified.

In the following sections, the key findings for the Local Landfill are summarized and the data gaps identified during the development of the Local Landfill SCM are presented. A summary of proposed activities to fill these data gaps is then presented. Following the summary of proposed activities are sections providing a more detailed discussion of each data gap and the justification for implementing the proposed activities to fill the data gaps.

3.1 Key Findings

Based on the historical data report, the monthly monitoring reports, and the results available from the one-mile radius monitoring for C-8 in the vicinity of the Local Landfill, DuPont has identified several key findings:

- Groundwater migration in the significant underlying bedrock aquifer flows towards the Washington Works facility to the north.
- The elevation of the significant underlying aquifer [~710-730 feet above mean sea level (MSL)] is higher than the elevations at the Washington Works facility (~ 600-650 feet MSL).
- The measured concentrations of C-8 in groundwater in LLMW-4 and LLMW-6, two monitoring wells located downgradient of the landfill cells, have displayed a decreasing trend over time, 39 to 1.4 ug/L and 15 to 3 ug/L respectively. Data from the most recent sampling events are higher, possibly indicating that the C-8 concentrations are increasing at these wells. However, an analytical method change was also implemented around this same time (November 2001). Additional data is required to more accurately evaluate possible trends.
- The measured concentrations of C-8 in the upgradient monitoring well, LLMW-9, and in LLMW-10, located in one of the cells, have ranged from non-detectable to 0.22 ug/L.

- Measured concentrations of C-8 in surface water from the six outfalls, two stream samples, and a leachate sample have ranged from non-detectable to 82.4 ug/L. Many of these sampling points are associated with seeps, the leachate collection ponds, and discharge pipes coming from the collection ponds.
- C-8 has been detected in water samples from wells, springs and cisterns at properties located within a one-mile radius of the Local Landfill. Results from the one-mile radius sampling event shows that 43 wells, four springs, and six cisterns were sampled. All of the samples collected had quantifiable levels of C-8 with the concentrations ranging from 0.252 to 10.9 ug/L. Six of the wells are used for drinking water and the C-8 concentration in these wells ranged from 0.328 to 2.8 ug/L. However, no distinct groundwater flow path from Local Landfill is apparent based on current monitoring well measurements.

In the historical data report, the following data gaps were identified during the development of the Local Landfill SCM:

- Identify the locations of seeps in the valley walls and measure C-8 concentrations in the surface water sampled from these seeps.
- Measure the C-8 concentrations in streams and other surface water features.
- Acquire additional geological data to refine the SCM.
- Install additional monitoring wells to provide additional groundwater flow data and groundwater quality data.
- Gather additional C-8 concentration data from monitoring wells for plume delineation.

3.2 Summary—Recommended Activities to Fill Local Landfill Data Gaps

The following activities are proposed to fill the above-described data gaps in the Local Landfill SCM:

- Conduct additional sampling to better characterize the C-8 concentrations of known surface water features located on-site.
- Combine topographic map analysis and field reconnaissance to identify additional surface water features, particularly searching for seeps along the southern sides of the three landfill cells. Integrate any new surface water features into the field-sampling program to determine if C-8 impacts have occurred.
- Install four clusters of shallow and deep bedrock monitoring wells located along the boundaries of the landfill property (see Figure 2). Conduct slug tests in the newly installed wells to determine aquifer characteristics. Conduct hydrogeological investigations to determine aquifer relationships, such as the vertical gradient between the overburden and bedrock zones. Continue to evaluate groundwater quality in the underlying significant aquifer, including data from the newly installed wells.

- Refine the Local Landfill SCM based on the additional data generated during the above listed activities.

3.3 Detailed Justification

The first and second data gaps listed for the Local landfill show the need for additional data on the location of surface water features, particularly seeps in the valley walls around the three landfill cells. In addition, further characterization of water quality (with respect to C-8) is needed. The first two recommended activities address these data gaps. The first recommended activity is to continue sampling of known surface water features at the site to further characterize C-8 concentrations in these surface waters. The Consent Order requires monthly sampling of specific outfalls for four consecutive months beginning in December 2001, followed by quarterly sampling thereafter.

The second activity will include a topographic map study and conducting field reconnaissance to identify additional surface water features, particularly seeps located along the southern sides of the three landfill cells. If unidentified surface water features are found, these surface water features will be integrated into the field-sampling program to determine if C-8 impacts have occurred. In addition, the former Local Landfill dewatering pit

Investigating the southern side of the landfill is needed because C-8 has been detected in residential wells, springs, and cisterns located south of the landfill (DuPont, 2002a). The migration pathway for C-8 to these residential wells has not yet been determined, therefore, the Local Landfill is considered to be a possible C-8 source. In evaluating this possibility, additional surface water features need to be identified and sampled and additional groundwater flow data needs to be obtained.

The third and fourth data gaps identify the need for additional geological and hydrogeological data to more accurately represent the geology and hydrogeology of the bedrock in the SCM, particularly on the southern side of the site because of the off-site C-8 impacts to the south. Currently, four bedrock monitoring wells are located at the site, two downgradient of the landfill cells (LLMW-4 and LLMW-6), one upgradient of the cells (LLMW-9) near the southern property boundary, and one located within the cell located in the center of the property (LLMW-10) (see Figure 2). All groundwater elevation maps using data from these four wells show bedrock groundwater flow toward the north. Additional monitoring wells are required to confirm groundwater flow to the north.

The installation of four new well clusters is recommended to help provide additional monitoring points and additional geological and hydrogeological data for the site. The shallow well in each cluster will be screened in the first water bearing zone, if present. A determination will be made in the field regarding the installation of the shallow well. The deep well will be screened in the underlying significant aquifer. Additional well installation details are provided in the SAP (Appendix A).

The locations of the four new well clusters are shown in Figure 2. The first cluster will be located between the creek draining the southern edge of the site and the edge of the western cell. The second cluster will be located along the eastern edge of the eastern cell.

The third and fourth well clusters will be located along the northern edge of the site. One cluster will be located where the former LLMW-5 shallow well was located. The other cluster will be located on the eastern side of the easternmost cell. These two well clusters will also be used to evaluate groundwater flow direction and the vertical gradients between the shallow and deep wells.

The fifth data gap identifies the need for additional C-8 concentration data from the monitoring wells for plume delineation in the bedrock. The fourth recommendation is that all monitoring wells continue to be sampled, including the newly installed wells. The Consent Order requires monthly sampling of the existing wells for four consecutive months beginning in December 2001, followed by quarterly sampling thereafter.

The final recommended activity for the Local Landfill is the integration of the new data gathered during implementation of the work plan into a refined SCM that better represents the geological, hydrogeological, and human health and ecological exposure pathways for the current conditions at the site.

4.0 LETART LANDFILL

The Letart Landfill is located about 46 river miles downstream of the Washington works facility, just north of the town of Letart in Mason County, West Virginia. It was in operation from the early 1960s to 1995. Letart Landfill received waste from the Fluoropolymer manufacturing process at the plant that consisted primarily of scrap product, scrap metal, wood pallets and bins, and miscellaneous trash. This waste is believed to be the source of C-8 in the groundwater and surface water samples collected from on-site locations.

The landfill was operated and closed under West Virginia Solid Waste/National Pollutant Discharge Elimination System Permit No. WV0076066. This permit requires quarterly groundwater monitoring, surface water monitoring, and engineered cap maintenance.

The Letart Landfill was permanently closed by installing an engineered multi-layer geosynthetic and soil cap (DuPont, 2001). Included in the closure activities were the installation of a leachate collection system, erosion and drainage control measures, and chain-link fencing. The cap construction was completed in April 2001.

In the following sections, the key findings for the Letart Landfill and the data gaps identified for the Letart Landfill SCM are presented. A summary of proposed activities to fill these data gaps is then presented. Following the summary of proposed activities are sections providing a more detailed discussion of each data gap and the justification for the proposed activities to fill the specific data gap.

4.1 Key Findings—Letart Landfill

Based on the historical data report, the monthly monitoring reports, and the results available from the one-mile radius and public water supply monitoring for C-8 in the vicinity of the Letart Landfill, DuPont has identified several key findings:

- Stratigraphic analysis of bedrock under the Letart Landfill has shown the presence of six sandstone units separated by shale units. These sandstone units have been designated (from shallowest to deepest) as Zones A through F. Zone F has been designated the underlying significant aquifer because it is laterally continuous under the landfill.
- Maximum concentrations of C-8 in the individual zones at Letart are as follows: Zone A = 294,000 ug/L, Zone C = 1,700 ug/L, Zone D/E = 3,060 ug/L, Zone F = 1,890 ug/L.
- Zone F groundwater flows mainly west/southwesterly. However, a component of flow was observed towards the north in a newly installed monitoring well (LMW-11), but additional monitoring is required to verify this component of flow.
- The quantity of leachate collected by the leachate collection system has dramatically decreased following the installation of the engineered cap system. The concentration of C-8 in the leachate has also been decreasing since October 1999 (from 3240 to 50.1 ug/L as of January 2002).

- The concentration of C-8 in the Rt. 33 stream has ranged from 0.573 to 2.23 ug/L with the most recently measured value of 1.9 ug/L.
- Results from the one-mile radius sampling event shows that 30 off-site wells were sampled. Twelve of the samples collected were from wells used for drinking water. Of these, eight had non-detectable levels of C-8, three had levels that were detected at a level above the limit of detection (0.01 ug/L) but below the limit of quantification (0.05ug/L) and only one sample had C-8 concentration above the limit of quantification at a value of 0.139 ug/L.

4.2 Data Gaps for the Letart Landfill

In the historical data report, the following data gaps were identified during the development of the Letart Landfill SCM:

- Identify and sample seeps (for C-8) in the valley walls, particularly in the steep valley wall along the Ohio River and to the northwest of the landfill.
- Measure the C-8 concentrations in surface water features, particularly in the Rt. 33 stream.
- Measure the C-8 concentrations in the Ohio River.
- Acquire additional geological data to refine the SCM.
- Install additional monitor wells to provide additional groundwater flow data and groundwater quality data.
- Gather additional C-8 concentration data from monitoring wells for plume delineation.

4.3 Summary—Recommended Activities to Fill Letart Landfill Data Gaps

The following activities are proposed to fill the above-described data gaps in the Letart Landfill SCM:

- Conduct additional sampling to better characterize the C-8 concentrations of known surface water features located on-site, particularly in the Rt. 33 stream.
- Combine topographic map analysis and field reconnaissance to identify additional surface water features, particularly searching for seeps along the northwestern side of the landfill and along the southwestern area near the Ohio River. Integrate these new surface water features in the field-sampling program to determine if C-8 impacts have occurred.
- Install six wells [screened in the first water-bearing zone encountered and in the Zone F aquifer] along the edges of the landfill in locations where wells do not currently exist (see Figure 3). Conduct slug tests in the newly installed wells to determine the hydraulic conductivity of the aquifers. Conduct hydrogeological investigations to evaluate the relationships between the bedrock aquifers and to verify groundwater flow directions at the site.

- Refine the Letart Landfill SCM based on the additional data gathered during the above listed activities.

4.4 Detailed Justification

The first and second data gaps listed for the Letart Landfill show the need for additional data on the location of surface water features and seeps in the valley walls around the landfill. In addition, better characterization of water quality (with respect to C-8) is needed. The first two recommended activities address these data gaps.

The first activity is the continued monitoring of known surface water features at the site to better characterize C-8 concentration in these surface waters. The Consent Order requires monthly sampling of specific outfalls for four consecutive months beginning in December 2001, followed by quarterly sampling, thereafter. Several other surface water-monitoring points (not required by the permit or Consent Order) are also being sampled. In particular, additional monitoring points will be selected along the Rt. 33 stream to better characterize C-8 concentrations downstream of the landfill.

The second activity will include evaluating topographic maps and conducting field reconnaissance to identify additional surface water features, especially seeps located along the steep slopes northwest of the landfill and the southeast sides of the landfill adjacent to the Ohio River. If unidentified surface water features are found, these surface water features will be integrated into the field-sampling program to determine if C-8 impacts have occurred.

Filling the third data gap will evaluate if C-8 from the landfill is detected the Ohio River. A separate proposal, the Ohio River Water Sampling Proposal for the Washington Works facility and the Letart Landfill (DuPont 2002f), describing river water sampling activities and locations was submitted to the GIST for approval.

The fourth, fifth, and sixth data gaps (related to the acquisition of additional geological, groundwater flow data and groundwater quality data for SCM refinement and plume identification) are addressed in part by the proposed installation of six new wells. Figure 3 shows the location of the proposed wells. Details of the monitoring well installation are provided in the SAP (Appendix A).

One F Zone well, LMW-12 will be located downslope and northwest of monitoring wells LMW-1 and LMW-7. At two locations, LMW-13, and LMW-14, well clusters are proposed. For each well cluster, one well will be screened in the first water-bearing zone encountered and the other well will be screened in the F Zone. A determination will be made in the field regarding the depth of screened interval for the shallow well. Well cluster LMW-13 will be positioned to the southwest of the landfill. Well cluster LMW-14 will be installed east of the landfill, on the edge of the steep slope overlooking the Ohio River. LMW-15, an F Zone well, will be located in the valley at the toe of the landfill.

Data collected at the proposed well and well cluster locations will allow for more a accurate determination of vertical gradients and groundwater flow direction around the landfill. In addition, because clusters of wells will be installed at these locations, the hydraulic gradients between the upper water-bearing unit and Zone F can be better

characterized. Finally, the positioning of a well cluster in the valley at the toe of the landfill will allow for further evaluation of groundwater flow towards the Ohio River and to determine if a high conductivity zone is present in the valley center, where bedrock fracturing is most likely.

Continued monitoring of groundwater quality is required by the Consent Order and is needed for plume delineation. Refinement of the SCM (the final proposed activity) based on new data obtained during the installation of the new well clusters and continued monitoring of existing and proposed monitoring wells and surface water features will allow for more accurate C-8 plume delineation, filling the final data gap listed.

5.0 DRY RUN LANDFILL

The Dry Run Landfill is located west of the town of Lubeck, in Wood County, West Virginia, about eight miles southwest of the Washington Works facility and the Local Landfill. The landfill covers approximately 17 acres of a 535-acre parcel of land owned by DuPont. The landfill was constructed within the drainage basin of Dry Run, a tributary of the North Fork of Lee Creek, which is a tributary of the Ohio River. The landfill began operation in 1986 and is still active at present, operated under West Virginia Solid Waste/National Pollutant Discharge Elimination System Permit No. WV 0076244.

The Dry Run Landfill receives waste from the Washington Works facility consisting of non-hazardous waste including scrap product, scrap metal, wood pallets, fly ash and bins, and miscellaneous trash. The primary C-8 source is believed to be the sludge from the closure of the Washington Works facility anaerobic digestion ponds that were placed in the landfill at Dry Run in 1990. The Dry Run Landfill remaining capacity calculations for 2001 show 4.4 years of remaining life on the existing cell based on a 128,000 yd^3/yr net fill volume consumption (DuPont, 2000).

In the following sections key findings for the Dry Run Landfill and the data gaps identified for the Dry Run SCM are presented. A summary of proposed activities to fill these data gaps is then presented. Following the summary of proposed activities are sections providing a more detailed discussion of each data gap and the justification for implementing the proposed activities to fill the data gaps.

5.1 Key Findings—Dry Run Landfill

Based on the historical data report, the monthly monitoring reports, and the results available from the one-mile radius monitoring for C-8 in the vicinity of the Dry Run Landfill, DuPont has developed several key findings:

- C-8 concentrations in groundwater at the Dry Run Landfill range from non-detectable to 16.5 ug/L.
- The highest concentrations of C-8 in groundwater were detected in monitoring wells DRMW-13 and DRMW-13A, a bedrock well and a shallow well cluster located at the base of the landfill (western end).
- The geology at the western end of the landfill is fairly well characterized. No data is available for the bedrock in the central portion of the landfill or for the upper portion of the landfill (eastern end).
- C-8 concentrations in surface water features have ranged from 0.88 to 87 ug/L. Higher concentrations (17 to 398 ug/L) are associated with the leachate collection system and sampling points downgradient of the system.
- Results from the one-mile radius-sampling event for the Dry Run Landfill show a total of 54 wells, springs, and cisterns were sampled. Of these, 13 wells, one spring and one cistern are used for drinking water. Five of these samples showed

non-detectable C-8 levels (<0.01 ug/L). Two wells showed levels between the limit of detection (0.01ug/L) and the limit of quantification (0.05 ug/L). Samples from six of the wells and the spring and cistern had quantifiable levels of C-8, ranging from 0.0505 to 0.339 ug/L.

5.2 Summary—Data Gaps for the Dry Run Landfill

In the historical data report, the following data gaps were identified during the development of the Dry Run Landfill SCM:

- Identify and sample seeps (for C-8) in the valley walls.
- Measure the C-8 concentration in streams and other surface water features.
- Install additional monitoring wells to provide additional groundwater flow data and to further characterize groundwater quality
- Acquire additional geological data to refine the SCM.
- Gather additional C-8 concentration data from monitoring wells for plume delineation.

5.3 Summary—Recommended Activities to Fill Dry Run Landfill Data Gaps

The following activities are proposed to fill the above-described data gaps in the Dry Run SCM:

- Conduct additional sampling to better characterize the C-8 concentrations of known surface water features located on-site and of those crossing over the site boundaries, specifically sampling surface water from Lee Creek.
- Combine topographic map analysis and field reconnaissance to identify additional surface water features, particularly seeps. Integrate these new surface water features in the field-sampling program to determine if C-8 impacts have occurred.
- Install six new well clusters, three located along the perimeter of the landfill and one located further downgradient from the existing downgradient well cluster (see Figure 4).
- Refine the Dry Run Landfill SCM based on the additional data gathered during the above listed activities.

5.4 Detailed Justification

The first and second data gaps listed for the Dry Run landfill indicate the need for locating unidentified surface water features and seeps in the valley walls around the landfill. In addition, further characterization of water quality (with respect to C-8) is needed. The first two recommended activities address these data gaps.

The first activity includes the continued monitoring of known surface water features at the site to better characterize C-8 concentrations in these surface waters. The Consent

Order requires monthly sampling of specific outfalls for four consecutive months beginning in December 2001, followed by quarterly sampling, thereafter.

The second activity involves evaluating topographic maps and conducting field reconnaissance to identify additional surface water features, with specific emphasis on seeps located northwest and downgradient of the landfill. If unidentified surface water features are found, the seeps will be included in the field-sampling program to determine the presence of C-8.

The third data gap identifies the need for additional groundwater flow and groundwater quality data. The fourth data gap recognizes that these additional data will be required to refine the SCM. The fifth data gap involves the collection of additional C-8 data to allow for plume delineation. Three activities are recommended to address these data gaps. The first activity involves the installation of new well clusters and evaluating the new geologic data generated during the installation. The second activity involves collecting additional groundwater quality data by continued monitoring of the existing and the newly installed monitoring well clusters. The third activity involves using this newly acquired data to refine the SCM and to delineate the C-8 plume.

The installation of six new well clusters is recommended to help provide additional monitoring points as well as additional geological and hydrogeological data for the site. The geologic and hydrogeological data obtained during the installation of these well clusters will be used to refine the SCM and for plume delineation. Groundwater samples from these wells will be used to further characterize C-8 concentrations and to monitor changes in concentration over time.

The installation of six new well clusters is proposed. The shallow well in each cluster will be screened in the first water bearing zone, if present. A determination will be made in the field regarding the installation of the shallow well. The deep well will be screened in the underlying significant aquifer. Additional well installation details are provided in the SAP (Appendix A).

Figure 4 shows the proposed locations for these clusters. Five of these well clusters will be located adjacent to the edges of the landfill boundary with three clusters located on the southwest side and two on the north side. Data from these four well clusters will more accurately define the stratigraphy and hydrogeology under the landfill. A sixth well cluster is proposed that will be located further downgradient that the existing downgradient cluster, DRMW-13 and DRMW-13A (see Figure 4). Because DRMW-13 and DRMW-13A have shown the highest concentrations historically and are the furthest downgradient from the landfill, additional downgradient wells are required for plume delineation.

Continued monitoring of the existing monitoring well clusters and the proposed monitoring well clusters will provide additional data on the C-8 concentrations in groundwater and the changes in concentration over time. The Consent Order requires monthly sampling of all landfill monitoring wells for four consecutive months beginning in December 2001, followed by quarterly sampling, thereafter. Additional monitoring may be proposed for the new wells to accurately characterize groundwater quality with respect to C-8 and for plume delineation.

The geologic and hydrologic data obtained during the installation of the well clusters will also be used to refine the SCM. Refinement of the SCM , another proposed activity, based on new data obtained during the installation of the new well clusters and continued monitoring of existing and proposed monitoring wells and surface water features will allow for more accurate C-8 plume delineation.

6.0 PATH FORWARD

The objective of the work proposed in this work plan is to determine the vertical and horizontal extent of C-8 concentrations in groundwater exceeding 1 ug/L. To meet this objective, the work proposed in this plan has been prioritized by task at the Washington Works facility and each of the three landfills. The general order for starting these tasks is the same for all sites and a preliminary schedule is provided.

- June 2002 – GIST Reviews and comments on the Proposed Work Plan. Compilation of data needed for the groundwater model refinement began in the end of February 2002 and model calibration and refinement is near completion. The first task is the Preparation for field activities, which will take place during June.
- July/August 2002 - The second task is the installation of the proposed monitoring wells at each site. During installation of these wells, additional geological data will be gained that will be utilized to further refine the SCMs for the three landfills and the Washington Works facility. Sampling of monitoring wells will continue as required by the Consent Order. The newly installed monitoring wells will become incorporated into the sampling program as soon as possible. Concurrent with the monitoring well installation will be the surface water investigation for each site. Identified surface water features and seeps will be sampled and flagged and the locations will be noted on maps so that these new surface water features can be included in future surface water sampling events. Sampling of already identified surface water features will continue as required by the Consent Order.
- August/September 2002 - The third task is the hydrogeologic characterization of the aquifer using the newly installed wells. The data acquired from this testing will be utilized in refining the SCMs for the three landfills and the Washington Works facility.
- October 2002 - The fourth task is the actual refinement of the SCMs for each site using the data acquired in the first three tasks.
- October/November 2002 - The fifth task is the C-8 plume delineation task. This involves combining the surface and groundwater monitoring data with the refined SCMs to delineate and further characterize the C-8 plumes.
- December 2002 - The final activity will include documenting the activities completed in a report. However, while the above-listed tasks are being completed, a monthly update report will be issued to the GIST. Each monthly report will include a summary of completed activities, the status of current activities and a schedule of the next planned activities. In this report, any significant issues encountered during the reporting period will be documented. In addition, any changes in procedures that are required or recommended will be included. The final report issued will follow the same format as the historical data report with a separate section for the Washington Works facility, and the three landfills.

7.0 REFERENCES

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FIGURES

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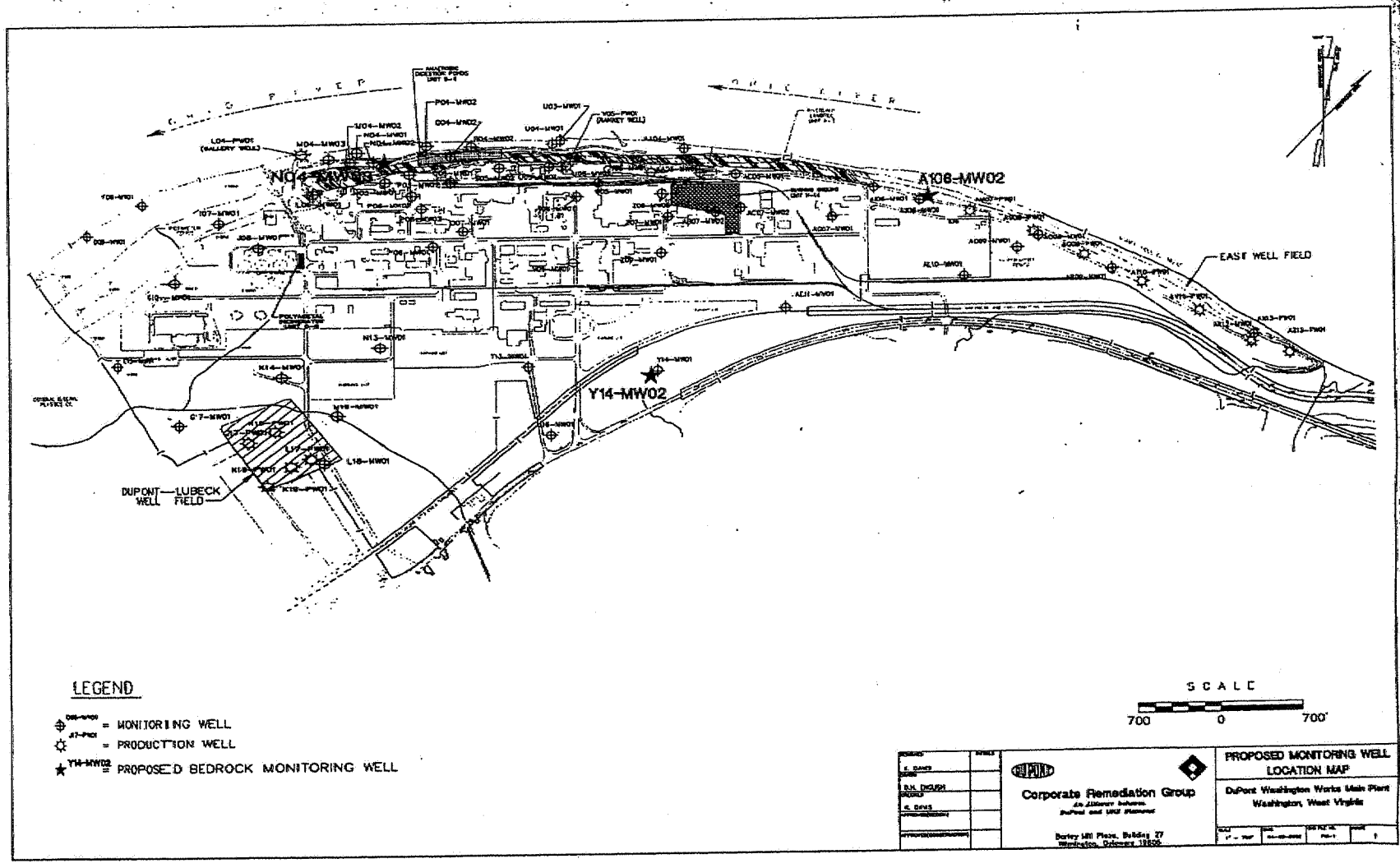

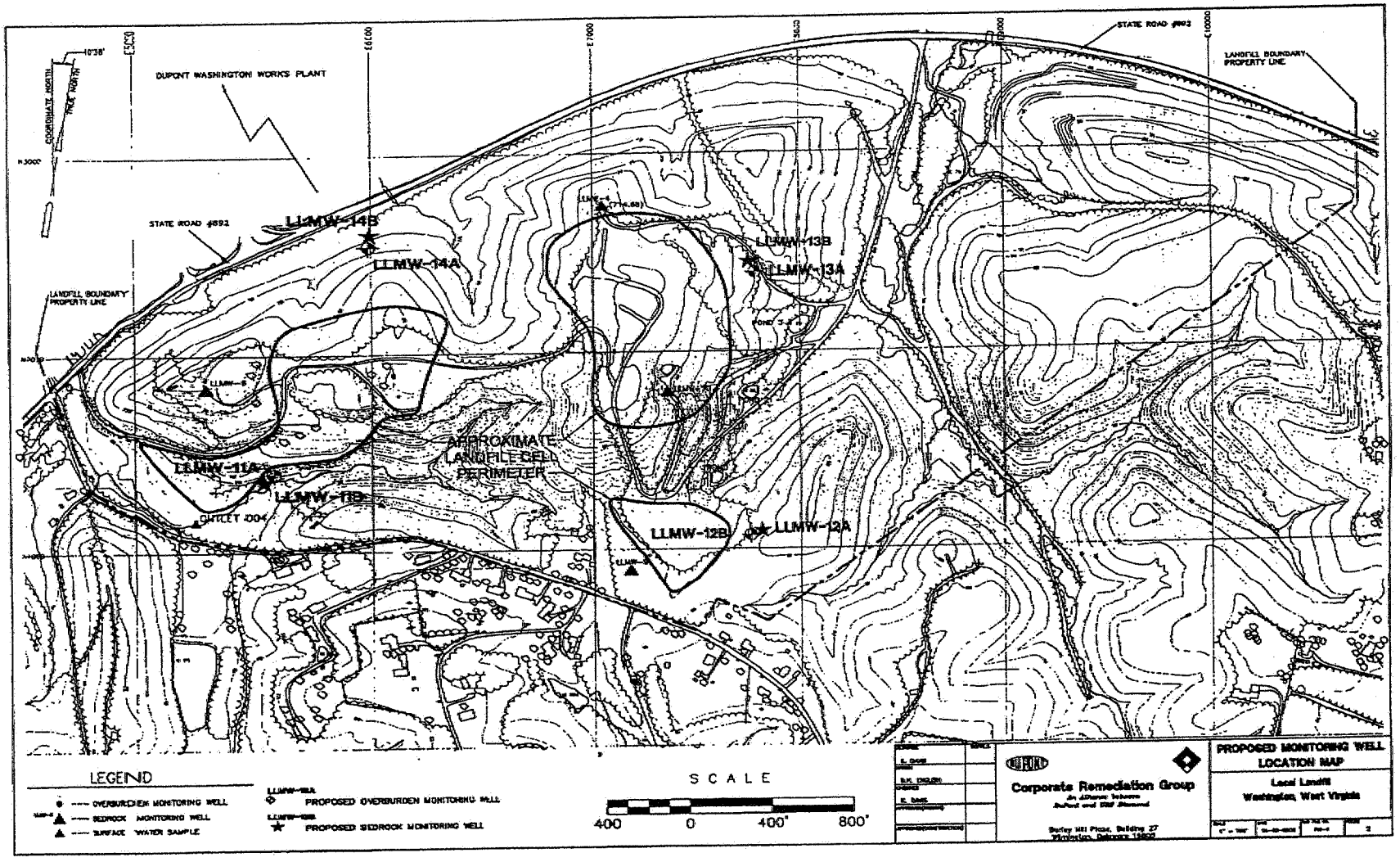

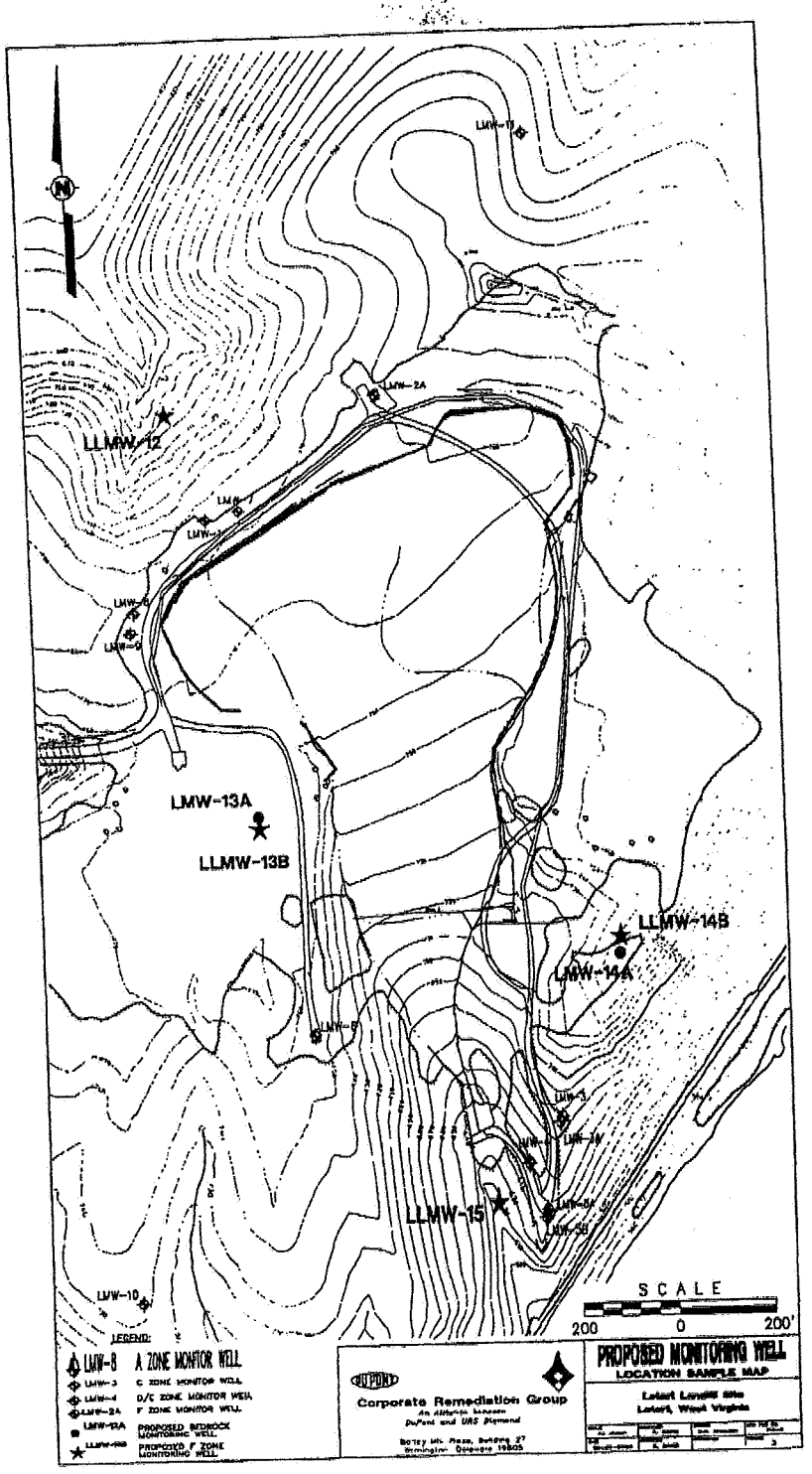

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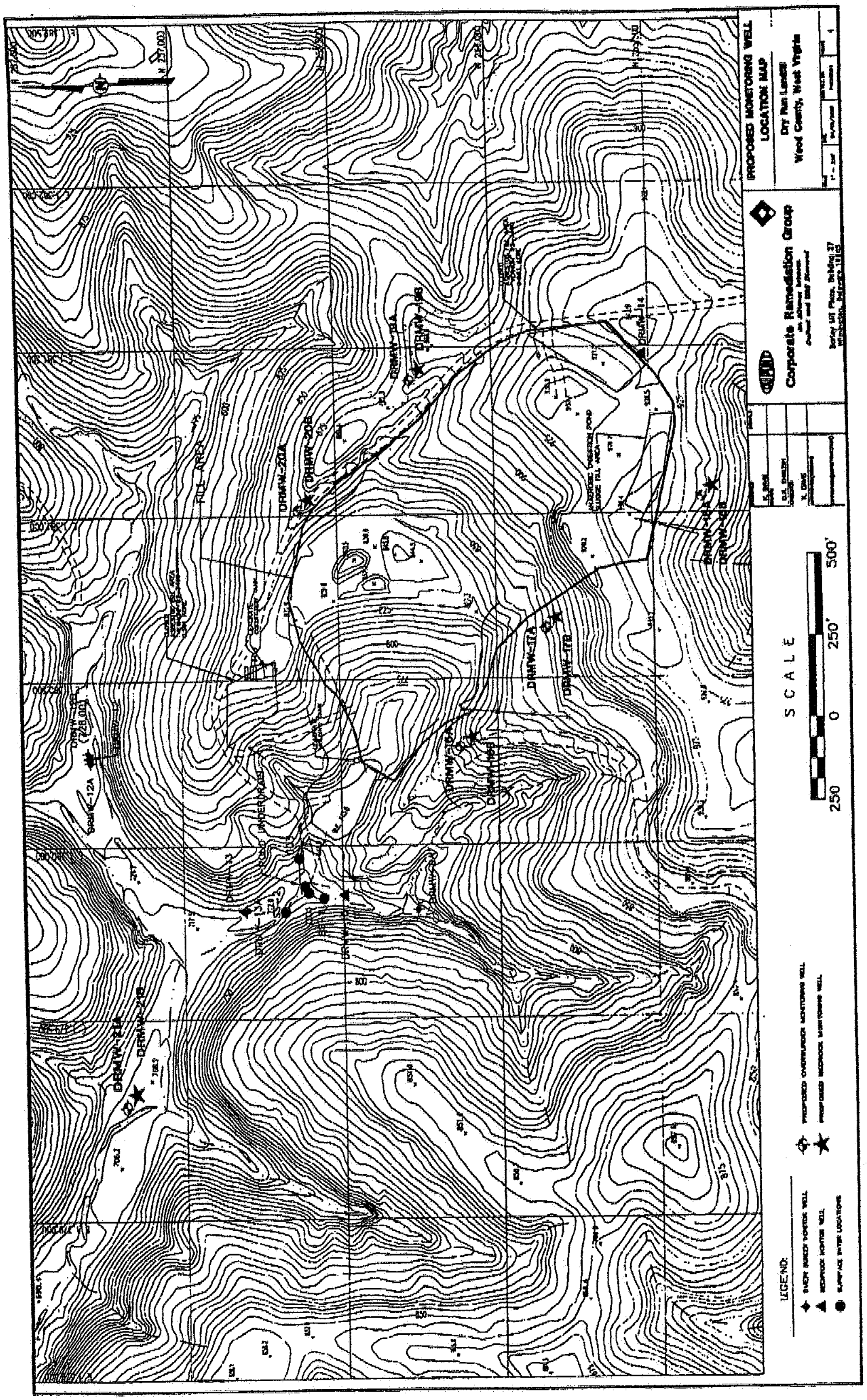

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