BBL
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engineers & scientists

Transmitted Via Federal Express

March 29, 2001

Mr. Salvatore Calandra
NYSDEC
270 Michigan Avenue
Buffalo, New York 14203-2999

Re: Spill File No. 9400483
BBL Project #: 869.77

Dear Mr. Calandra:

Blasland, Bouck & Lee, Inc. (BBL) prepared this report on behalf of General Motors Corporation (GM) to document the investigations performed to address oily soils and light non-aqueous-phase liquid (LNAPL) observed at the former GM Buffalo Plant, located at 1001 East Delavan Avenue, Buffalo, New York. These observations were reported to the New York State Department of Environmental Conservation (NYSDEC) who assigned it as Spill No. 9400483. Four field mobilizations (July 1996, October 1997, May 1998, and June 1998) were required to complete the investigation. The Buffalo Plant is currently owned by American Axle & Manufacturing, Inc. (AAM). Figure 1 shows the site plan.

Background

During an investigation conducted in 1994, Haley and Aldrich, Inc. (H&A) initially identified oily soils in five locations (the Former Knuckle-Job Area, the Gleason Machine Area, the Maintenance Garage Area, the Fire Loop Repair Area (West), and the Former Underground Storage Tank (UST) Fill Station Area) and observed light non-aqueous phase liquid (LNAPL) in two monitoring wells (MW-101 and B-2) at the Buffalo Plant. GM submitted analytical data from the oil and oily soil samples to NYSDEC in August 1994. Subsequently, LNAPL was observed in a third monitoring well (MW-103), and AAM encountered oily soils in three areas (the Sprinkler System Fire Loop Repair Area (East), the Truck Scale Excavation Pit, and the Railroad Gondola Car Scale Area) while excavation was undertaken as part of construction activities at the site. These areas were added to Spill File 9400483 in 1995. Table 1 summarizes the areas where LNAPL and/or oily soils were observed.

TABLE 1

Summary of Oily Soil and LNAPL Detections

Description of Discovery Method	Reported By	Manufacturing Location
SB-103 (soil boring/monitoring well)	GM	Former Knuckle-Job Area
SB-104 & SB-105 (soil boring/ monitoring well)	GM	Gleason Machine Area
SB-107 (soil boring/monitoring well)	GM	Maintenance Garage Area
SB-116 (soil boring/monitoring well)	GM	Fire Loop Repair Area (West)
SB-117 (soil boring/monitoring well)	GM	Former UST Fill Station Area
MW-101 (soil boring/monitoring well)	GM	Tank No. 5 Area
B-2 (soil boring/monitoring well)	GM	B- 26 Coolant Pit (previously reported as Spill 9104671)
MW-103 (soil boring/monitoring well)	GM	Tank No. 11 Area
Excavation	AAM	Sprinkler System Fire Loop Repair Area (East)
Excavation	AAM	Truck Scale Excavation Pit
Excavation	AAM	Railroad Gondola Car Scale Area

Objectives

There were three principal objectives of the investigations. First, to determine whether LNAPL is present in the subsurface in the areas with oily soil identified in Table 1. The second objective of the investigations was to determine the horizontal extent of LNAPL where present. The third objective of the investigations was to evaluate risk associated with concentrations of semi-volatile organic compounds (SVOC) detected in soil through an Exposure Assessment.

To attain these objectives, the following scope of work was performed:

- Two additional soil samples were collected for laboratory analysis of SVOC content using EPA Method 8270;
- Seventy four soil samples were collected for field screening for LNAPL during monitoring well installation;
- Twenty six monitoring wells were installed to determine whether LNAPL would accumulate; and
- Six groundwater samples were collected for laboratory analysis for SVOC content using EPA Method 8270.

TECHNICAL APPROACH

Soil

During the first phase of the field investigations (July 1996), three soil borings were installed with a hydraulic probe equipped with stainless steel tubes and disposable acetate liners. In October 1997 and subsequent investigations, the standard penetration test (SPT) was employed to obtain soil samples.

Soil samples collected in October 1997 were screened for the presence of LNAPL both visually and with a hydrophobic dye. The dye, Sudan IV, turns red in the presence of petroleum hydrocarbons. This test will detect hydrocarbons that are present in quantities too small to be observed visually.

Soil samples collected for laboratory analysis were composited over the 2-foot interval from which they were collected. Soil samples were analyzed for SVOC using EPA Method 8270.

LNAPL Definition

The Tank No. 5 Area, the Gleason Machine Area, and the Coolant Pit were assessed as a unit because of their proximity and their apparent interrelationship. The location of each area of investigation is shown on Figure 1.

LNAPL was observed at two levels. A shallow plume is present beneath the plant perched on top of a silty clay that occurs just below the construction fill. The fill layer is approximately seven feet thick, except in areas where excavations were performed to accommodate subsurface structures. In areas where subsurface structures are present, the fill extends to the top of the limestone bedrock. The surface of the limestone bedrock slopes from approximately 10 feet below land surface (BLS) at the northern end of the plant to approximately 20 feet BLS at the southern end of the plant. In the eastern portion of the Plant, these areas of thicker fill have provided a conduit for LNAPL to migrate a second, deeper plume that occurs below the clay and above the limestone bedrock. Therefore, LNAPL definition in this area was carried out at two levels. "Shallow" monitoring wells were screened to intercept the clay/fill boundary (typically 2 to 5 feet BLS). "Deep" monitoring wells were drilled to bedrock and screened in the lowest five feet of the borehole (approximately 15 to 20 feet BLS) to intercept the till, if present. Deep and shallow wells were installed in pairs. Boring logs can be provided upon request.

The monitoring wells were constructed of 2-inch-diameter Schedule 40 polyvinyl chloride (PVC). The monitoring wells consist of a 10-foot (1996 wells) or 5-foot (1997 and 1998 wells) 0.010-inch slotted PVC well screen and varying amounts of solid PVC riser.

Groundwater

Prior to collection of groundwater samples, the wells were purged. Generally, the wells purged dry before three well volumes could be removed. Groundwater samples were analyzed for SVOC using EPA Method 8270.

QA/QC

Quality Assurance (QA) practices were developed and implemented to ensure that appropriate data collection and analysis procedures were implemented, resulting in data of a known accuracy and precision. The QA practices were used to identify data quality objectives (DQO) appropriate for the data use, and field and laboratory data collection and analysis procedures required to generate data meeting the site-specific DQO.

Data Evaluation

Site analytical data were initially compared to STARS Memo #1 TCLP values and NYSDEC TAGM #4046 Soil Cleanup Values. Concentrations of SVOCs in some soil samples exceeded the TAGM #4046 Soil Cleanup Values. Therefore, an Exposure Assessment was performed in accordance with the NYSDEC guidance document "Guidelines for Petroleum Spill Site Inactivation" issued February 23, 1998 to evaluate the risk associated with SVOC concentrations in soil.

Volatile organic compounds (VOC) and SVOC concentrations were not detected above the STARS TCLP values in groundwater samples that did not contain LNAPL. SVOC concentrations in an oily groundwater sample from one monitoring well were well above the saturation values for the detected compounds. These concentrations were considered to be the result of the oil, and not of dissolved concentrations in the groundwater. Therefore, an Exposure Assessment was not performed for groundwater pathways.

Because many of the areas with impacted soil are located beneath the plant, which is still an active operation, an exposure assessment was performed for SVOCs following guidance published by NYSDEC in 1998. Since VOC and PCB concentrations did not exceed TAGM 4046 criteria, exposure assessment values were not calculated. Values were calculated for three exposure pathways for soil:

- Pathway 2, protection of groundwater;
- Pathway 3, inhalation of vapors and particulates, dermal contact, and ingestion of chemicals in subsurface soils for a construction worker receptor; and
- Pathway 4, volatilization to indoor air for a commercial/industrial worker.

NYSDEC default values were used for all parameters. Values for all three pathways for the SVOCs evaluated exceeded the value for pure product saturation in soil provided in the Exposure Assessment guidance. Therefore, the pure product saturation value was used for comparison with site analytical data. The results of the Exposure Assessment calculations are summarized in Table 3. Worksheets summarizing the input data and calculations can be provided upon request.

INVESTIGATION SUMMARY

Former Knuckle-Job Area
H&A reported oil-coated soil retrieved from the top of the clay in a soil boring (SB-103) performed near a former oil drain in this area. SVOC concentrations were detected in two soil samples collected from SB-103 and were submitted for analysis. These data, which were reported to NYSDEC in 1994, are summarized in Tables 3 (SVOC) and 4 (total petroleum hydrocarbons [TPH]). Concentrations of some SVOC compounds were above TAGM #4046 Soil Cleanup values. However, soil concentrations are below the Exposure Assessment Value.

To determine whether recoverable LNAPL was present, BBL attempted to install a monitoring well in this area in July 1996. However, the attempt was not successful because concrete encountered at a depth of 2.5 feet BLS could not be penetrated. In October 1997, BBL installed monitoring well MW-304 to a depth of 7.5 feet BLS using a drilling rig with a roller bit. Oil was not observed visually in the soil samples collected for screening during well installation, but was indicated by the hydrophobic dye in soil collected from 5 feet BLS. A measurable quantity of LNAPL had not accumulated in the monitoring well by December 22, 1997.

The site is an industrial area, access is restricted, and the area in question is beneath a concrete floor. Therefore, dermal contact with soil, particle ingestion, and inhalation of particles and vapors by a construction worker receptor is the only potentially complete exposure pathway. On the other hand, results of the Exposure Assessment indicate that soil concentrations are below the calculated risk-based values for this pathway. Therefore, no further action is required in this area.

Maintenance Garage Area
H&A reported oil and a TPH concentration of 62,000 mg/kg in a soil sample collected from the base of the fill unit in a soil boring (SB-107) located near a hydraulic lift (Table 4). Therefore, BBL performed a soil boring (SB-2-1) to a depth of 12 feet BLS. Soil samples were collected from the 6 to 8 and 8 to 10 feet BLS intervals and analyzed for SVOC.

Di-n-butyl phthalate was detected at a concentration of 1.8 milligrams per kilogram (mg/kg) in the soil sample collected from the 8 to 10 feet BLS interval from soil boring SB-2-1. This concentration is below the TAGM #4046 Soil Cleanup Value of 7.1 mg/kg. Concentrations of other SVOC constituents were below detection limits (BDL) in the two soil samples collected in this area. Soil analytical data are summarized on Tables 3 and 4.

Monitoring well MW-205 was installed to a depth of 11 feet in the location of soil boring SB-2-1 to determine whether LNAPL was present in the subsurface. No obvious odors or sheen were observed during well installation or development. LNAPL was not observed in the well.

The site is an industrial area, access is restricted, and the area in question is beneath a concrete floor. Therefore, dermal contact with soil, particle ingestion, and inhalation of particles and vapors by a construction worker receptor is the only potentially complete exposure pathway. On the other hand, results of the Exposure Assessment indicate that soil concentrations are below the calculated risk-based values for this pathway. Therefore, no further action is required in this area.

Fire Loop Repair Area (West)
H&A performed a soil boring (SB-116) adjacent to the west edge of the excavation in this area. Two soil samples, from 1-2 and 2-4 feet BLS, were collected for analysis for TPH, VOC (both samples) and SVOC (2- to 4- foot sample only). H&A reported oil coating the soil in the sample collected from 2-4 feet BLS, which is the base of the fill unit in this area. Concentrations of SVOCs and VOCs were below TAGM #4046 Soil Cleanup Values (Tables 3 and 4).

To determine whether recoverable LNAPL would accumulate, BBL installed monitoring well MW-200 to a depth of 11 feet (Figure 2). No obvious odors or sheen were observed during well installation or development. LNAPL was not observed in the well.

The site is an industrial area, access is restricted, and the surficial soil is not impacted. Therefore, dermal contact with soil, particle ingestion, and inhalation of particles and vapors by a construction worker receptor is the only potentially complete exposure pathway. Results of the investigations indicate that soil concentrations are below TAGM 4046 values. Therefore, no further action is required in this area.

Former UST Fill Station Area
H&A performed a soil boring (SB-117) in an area of oil-stained pavement 20 feet west of the former fill station. A soil sample collected from 1-2 feet BLS was analyzed for VOCs, SVOCs, polychlorinated biphenyls (PCBs), and TPH as motor oil. Concentrations of PCBs were BDL, and TPH as motor oil was detected at 226 mg/kg. Concentrations of VOCs and SVOCs were below TAGM #4046 Soil Cleanup Values.

H&A reported oil in soil collected from the top portion of the clay in this area. Therefore, BBL performed soil boring SB-6-1 to a depth of 11 feet BLS. A soil sample was collected from the 6- to 8-foot BLS interval and analyzed for SVOC. Concentrations of SVOC constituents were BDL. Soil analytical data are summarized in Tables 3 and 4.

Monitoring well MW-204 was installed to a depth of 11 feet in the location of soil boring SB-6-1 to determine whether LNAPL was present in the subsurface. No obvious odors or sheen were observed during well installation or development. LNAPL was not observed in the well.

The site is an industrial area, access is restricted, and the surficial soil was not impacted. Therefore, dermal contact with soil, particle ingestion, and inhalation of particles and vapors by a construction worker receptor is the only potentially complete exposure pathway. Results of the investigations indicate that soil concentrations are below TAGM 4046 values. Therefore, no further action is required in this area.

Fire Loop Repair Excavation (East), Railroad Gondola Car Scale Area, and Truck Scale Pit
The truck scale pit, the railroad gondola car scale area, and the fire loop repair excavation on the east side of the plant are the three areas of oily soil added to NYSDEC Spill No. 9400483 by AAM. AAM encountered oily soils during construction activities in these areas (Figure 1). AAM removed and disposed of the oily soils, and replaced them with clean fill.

Fire Loop Repair Excavation (East)

The fire loop repair excavation is outside the plant east of Tank No. 5 Area, the Gleason Machine Area, and the Coolant Pit area. Monitoring wells were installed in this area during definition of the extent of oil from that area. The source of the oil in the soils excavated from these areas may be Tank No. 5 or the

Gleason Machine Area. Monitoring wells MW-408 and MW-409, which define the eastern extent of LNAPL in the Tank No. 5 Area, the Gleason Machine Area, and the Coolant Pit area, also serve as monitoring points for the fire loop repair excavation area. No LNAPL accumulated in these wells. Groundwater samples were collected from monitoring wells MW-408 and MW-409 for SVOC analysis. SVOC concentrations were BDL in both wells. Because the excavated soil was replaced with clean fill, soil samples were not collected. Therefore, there is no human health exposure pathway. No further action is required in this area.

Railroad Gondola Car Scale Area

The railroad gondola car scale area is outside the plant south of the Gleason Machine Area. Monitoring well MW-502 provides a monitoring location for groundwater in the Railroad Gondola Car Scale area. Monitoring well MW-502 is screened across the base of the fill/top of the clay, which is where AAM observed the oily soils. No LNAPL accumulated in the well. Because the oily soils were excavated and replaced with clean fill, soil samples were not collected. Groundwater samples were collected from monitoring well MW-502 for SVOC analysis. SVOC concentrations were BDL. Because the excavated soil was replaced with clean fill, soil samples were not collected. Therefore, there is no human health exposure pathway. No further action is required in this area.

Truck Scale Pit

Monitoring well MW-501 was installed in the former truck scale pit excavation. No LNAPL was observed in MW-501. Because the excavated soil was replaced with clean fill, soil samples were not collected. Therefore, there is no human health exposure pathway. No further action is required in this area.

Tank No. 5, Gleason Machine, and B-26 Coolant Pit Areas

Because of their proximity to each other, these three areas were assessed as a unit. The Tank No. 5 area is approximately 60 feet east of the Coolant Pit, and may be the source of the LNAPL observed in the Coolant Pit. The Coolant Pit occupies the northern end of the Gleason Machine Area. The location of each area of concern is shown on Figure 1.

History

Tank No. 5 Area - Tank No. 5, a UST formerly containing virgin oil, was emptied, cleaned, and closed in place in 1990. H&A reported that oil-saturated soil was observed at approximately 9 feet BLS in soil borings installed adjacent to the tank in 1990 (H&A, 1993). TPH was detected at concentrations of 34,000 and 55,000 mg/kg in two soil samples collected for analysis during the installation of monitoring well MW-101 in this area. Concentrations of VOC in the sample collected from 6 to 6.4 feet BLS were below TAGM #4046 Soil Cleanup Values (Tables 3 and 4). Concentrations of some SVOC compounds exceeded the TAGM #4046 Soil Cleanup Values. Concentrations of benzo (a) pyrene and chrysene also exceeded the Exposure Assessment Value, which is the value for pure product saturation. LNAPL is present in this area and these concentrations reflect the oil content in the soil.

Gleason Machine Area - Historically, holes had been drilled in the floor in this area to drain accumulated lubricating oils. H&A reported oily soils at the base of the fill unit in two soil borings (SB-104 and SB-105) performed in the Gleason Machine Area. Concentrations of SVOC in five soil samples collected from SB-104 and SB-105 exceeded TAGM #4046 Soil Cleanup Values. Concentrations of benzo (a) pyrene and/or chrysene in three of the samples also exceeded the Exposure Assessment Value, which is the value for pure product saturation. LNAPL is present in this area and these concentrations reflect the oil content in the soil.

Coolant Pit - The B-26 Coolant Pit is a sub-grade vault with a base at the level of the till unit below the clay. When the coolant pit was cleaned after being decommissioned in 1991, LNAPL was observed seeping in at the joint between the floor and the east wall. This location is hydraulically downgradient from the former location of Tank No. 5. An LNAPL recovery system was subsequently installed in the Coolant Pit in 1992 and monitoring wells were installed at the northeast (B-1) and southwest corners of the Pit (B-2). This LNAPL discovery was reported as Spill No. 9104671. AAM currently reports to NYSDEC annually on the status of the system and provides monitoring well gauging data. However, the horizontal extent of LNAPL had not been defined.

Concentrations of some VOC and SVOC compounds were above TAGM #4046 Soil Cleanup Values. Concentrations in four samples were also above the Exposure Assessment Value. However, the site is an industrial area, access is restricted, and the area in question is beneath a concrete floor. Therefore, dermal contact with soil, particle ingestion, and inhalation of particles and vapors by a construction worker receptor is the only potentially complete exposure pathway.

Tank No. 5 Area, Gleason Machine Area, and Coolant Pit Area LNAPL Definition

H&A's work plan (H&A, 1995) called for installing six temporary wells with direct push technology to define the extent of LNAPL in this area. BBL attempted this approach in July 1996. However, no groundwater or LNAPL was retrieved in three direct push sampling locations with screens open from 6 to 10 (BH #1 and BH #3) or 8 to 10 feet BLS (BH #2). In an attempt to locate the water table, a solid-stem auger was used to drill to limestone bedrock in the location of BH # 3. A petroleum odor was observed in cuttings retrieved from 10 feet BLS, which was the base of the fill. Oily soils were not observed at this level. However, this location is apparently near the eastern limit of the shallow plume. Oil was observed on the end of a measuring tape dropped in the borehole when the top of the limestone was reached at 16 feet BLS. This LNAPL is part of the "deep" plume present in the till. No groundwater was encountered at any point in the borehole.

These observations support the presence of impacts at two levels in this area. Therefore, definition of the extent of LNAPL was completed by installing paired wells, one screened at the base of the fill/top of the clay and one screened in the till.

Soil samples were collected at 2-foot intervals from soil boring locations SB-7-1, SB-8-1, SB-8-2, SB-9-1, SB-9-2, SB-9-3, SB-9-4, SB-9-5, SB-9-6, SB-9-7, and SB-9-8 and screened for petroleum hydrocarbons using Sudan IV hydrophobic dye. The Sudan IV screening data are summarized in Table 5.

In October 1997, five monitoring wells were installed in the Tank No. 5 Area, the Gleason Machine Area, and the Coolant Pit area (Figure 1). Monitoring wells MW-305, MW-307, and MW-308 were installed to bedrock to define LNAPL in the till unit. Monitoring wells MW-306 and MW-309 were completed 2 feet into the top of the clay to determine whether LNAPL was also present on top of the clay. MW-309 was initially planned as a deep (bedrock) well. However, because oil-saturated soils were observed at the base of the fill unit, the well was completed as a shallow well. After installation, LNAPL was present in all five wells.

In May 1998, ten additional monitoring wells were installed in the Gleason Machine Area (Figure 1). The wells were installed in two-well clusters consisting of a shallow well screened in the fill unit and a deep well screened above the bedrock. The well clusters were installed to the north (MW-402 and MW-403), south (MW-400 and MW-401), east (MW-408 and MW 409), and west (MW-406 and MW-407) of

the Tank No. 5 Area, the Gleason Machine Area, and the Coolant Pit area and were placed as close to the Tank No. 5 Area and the Gleason Machine Area as was practically feasible. Monitoring wells MW-404 and MW-405 were installed downgradient of Plant No. 81 and adjacent to the BSA sewer tunnel. These locations were selected because the water-table elevation maps suggest that water beneath the plant migrates towards the tunnel, and consequently along the exterior sidewalls of the tunnel. Monitoring wells MW-400, MW-402, MW-404, MW-406, and MW-408 were installed to bedrock, and monitoring wells MW-401, MW-403, MW-405, MW-407, and MW-409 were completed in the fill unit. After installation, LNAPL was present in monitoring wells MW-400, MW-401, and MW-406. Only a few drops of oil were present in the groundwater in MW-404. This oil may represent LNAPL that has migrated along the sewer tunnel. Further investigation is necessary to confirm this assumption.

In June 1998, deep monitoring well MW-500 (Figure 1) was installed west of MW-406. No LNAPL was observed in this well. Monitoring well MW-104 (installed by H&A) is screened just above the bedrock. Although this well was originally installed to evaluate the Railroad Scale Area, continued observations indicate that LNAPL is not present (no till described in the soil boring log) in this area. Shallow monitoring well MW-502 (Figure 1) was installed adjacent to MW-104 to determine if LNAPL was present above the clay in this area. Attempts to install this well closer to the building were not successful due to numerous utility lines in the area. The locations of shallow and deep LNAPL are shown on Figures 2 and 3, respectively.

Tank No. 5 Area, Gleason Machine Area, and Coolant Pit Area Groundwater Sampling and Analysis

In May 1998, groundwater samples were collected from MW-404, MW-405, MW-408, and MW-409 for analysis of SVOC content. Groundwater samples could not be obtained from MW-402, MW-403, or MW-407 because they were either dry initially, or did not recharge after purging. Monitoring wells MW-500 and MW-502 were sampled in June 1998. Concentrations of all SVOC constituents were BDL in all samples except the sample from MW-404. Benzo (a) pyrene and indeno (1,2,3-cd) pyrene were detected at 33 and 14 micrograms per liter (ug/L), respectively. However, the sample collected from MW-404 was oily, and concentrations detected are most likely representative of the LNAPL and not dissolved constituents. This is supported by the fact that these concentrations are orders of magnitude above the theoretical water solubility of these chemicals. Therefore, there is no exposure pathway for groundwater. Table 6 is a summary of groundwater analytical data.

Tank No. 5 Area, Gleason Machine Area, and Coolant Pit Area Combined Sewer Water Sampling and Analysis

To determine whether LNAPL present in the subsurface in the Tank No. 5 Area, the Gleason Machine Area, and the Coolant Pit area was impacting water in the combined sewer system, a water sample was collected from a manhole in the south portion of the property (Figure 1) in September 1998. The sample was analyzed for SVOC using EPA Method 8270. Concentrations of semi-volatile constituents were BDL, with the exception of bis (2-ethylhexyl) phthalate. An estimated concentration of 4 ug/L of bis (2-ethylhexyl) phthalate, which is below the Method Reporting Limit (MRL), was quantified in the sample. However, bis (2-ethylhexyl) phthalate was also detected in the method blank, a laboratory QA/QC sample. Therefore, the bis (2-ethylhexyl) phthalate appears to be the result of laboratory contamination and not a measure of dissolved concentrations in the storm sewer water.

In September 1999, AAM personnel performed routine semi-annual sampling of the combined sewer effluent required by their BSA wastewater discharge permit. Concentrations of Total Extractable Hydrocarbons (TEH) were detected at 102 and 110 parts per million (ppm), which are slightly over the BSA-permitted discharge criterion of 100 ppm. Additional sampling and analysis in October 1999, April, 2000, and May 2000 confirmed the exceedances. AAM attempted to identify the source of the impacts through the following activities:

1. Videotaping a sanitary sewer lateral that discharges to the BSA sewer tunnel - This lateral passes through the B-26 Coolant Pit area at a depth of approximately 3 feet below grade. AAM has not been able to identify the source of the LNAPL from the videos, although an LNAPL coating was observed on the camera.
2. Visual inspection - AAM retained a contractor to physically inspect the BSA Sewer Tunnel. Some staining was observed on the sewer walls.
3. Sampling pipes emptying into the sewer - A value of 24,000 ppm oil and grease was detected in a sample from a pipe that is close to the B-26 Coolant Pit area.
4. Fingerprinting the oil - Samples were collected from the pipe with the high detection, the B-26 area, and the downstream location where the sewer sample was collected. The data indicated that the oils are similar. However, similar oils are used elsewhere in the facility, and the B-26 Coolant Pit could not be positively identified as the source.
5. Ensuring that the oil recovery system at B-26 cannot be disabled. AAM personnel observed in January that the B-26 system had been turned off. The system was restarted, but was later found to be turned off again. A security guard now regularly checks it to ensure that it is operating.

Following AAM assurance that the B-26 oil recovery system is operating properly, TEH levels in the October 2000 sampling event were below permitted levels. Therefore, AAM concluded that oil impacts in the vicinity of the B-26 Coolant Pit are the source of the sewer sample TEH exceedances, but that proper operation of the oil recovery system should prevent further problems.

Tank No. 11 Area

LNAPL detections in this area have not previously been reported to NYSDEC. H&A observed LNAPL in monitoring well MW-103 four months after it was installed. During installation of monitoring well MW-103, H&A collected two samples for analysis for VOC, SVOC, PCBs, and TPH. All detected concentrations were below TAGM #4046 Soil Cleanup Values (Tables 3 and 4). Furthermore, VOC and SVOC concentrations in a groundwater sample collected from monitoring well MW-103 were BDL (SVOCs) or below STARS TCLP extraction values (VOCs).

BBL personnel observed 2.14 feet of LNAPL in MW-103 in July 1996. Therefore, in October 1997, BBL installed monitoring wells MW-300, MW-301, MW-302, and MW-303 to define the extent of LNAPL. Soil samples were collected at 2-foot intervals from soil boring locations SB-3-1 (in the location of MW-300), SB-3-2 (MW-301), SB-3-3 (MW-302), and SB-3-4 (MW-303) and screened for LNAPL using Sudan IV hydrophobic dye. Because LNAPL, if present, cannot penetrate the clay, and groundwater is not always encountered in the surficial soils beneath the building, wells were installed to 2 feet into the clay, regardless of whether groundwater was encountered.

During installation of monitoring well MW-302 north of MW-103, oily soil was observed at a depth of 6 feet BLS, which is the base of the fill unit. During installation of monitoring well MW-300 west of MW-103, hydrocarbons were detected with the Sudan IV dye in soil from 4 feet BLS, also near the base of the fill unit. Oily soils were not observed, and the presence of hydrocarbons was not detected by the Sudan

IV dye during installation of monitoring wells MW-301 and MW-303. The Sudan IV screening data are summarized in Table 5. Groundwater accumulated in three of the four newly-installed wells after several days. However, LNAPL was never observed in these wells.

CONCLUSIONS AND RECOMMENDATIONS

Based on both BBL's field investigations and H&A's 1994 investigation, the following conclusions and recommendations are provided for each area of concern.

Former Knuckle Job Area
The presence of LNAPL was indicated in soil at the Former Knuckle Job Area by the hydrophobic dye. However, LNAPL was not observed visually, and LNAPL did not accumulate in monitoring well MW-304. Also, SVOC concentrations in two soil samples collected at this area of concern were below the Exposure Assessment Value. Therefore, the Knuckle Job Area is no longer considered an area of concern.

Maintenance Garage Area
Concentrations of SVOC were not detected above the Exposure Assessment Value in soil samples collected from the Maintenance Garage Area in July 1996. LNAPL did not accumulate in monitoring well MW-205 installed in this area. Therefore, the Maintenance Garage Area is no longer considered a Area of concern.

Fire Loop Repair Area (West)
LNAPL did not accumulate in monitoring well MW-200 installed in this area. Therefore, the Fire Loop Repair Area (West) is no longer considered an area of concern.

Former UST Fill Station
Concentrations of SVOC were not detected above the Exposure Assessment Value in a soil sample collected from the Fill Station Area in July 1996 (Table 3). Also, LNAPL did not accumulate in monitoring well MW-204 installed in this area. Therefore, the Former UST Fill Station is no longer considered an area of concern.

Fire Loop Repair Excavation (East)
This area was investigated due to oily soils encountered by AAM. However, LNAPL was not present in monitoring wells MW-408 and MW-409 installed in this area. SVOC concentrations were BDL in groundwater samples collected from these wells in 1998. Therefore, no further action is required.

Railroad Gondola Car Scale Area
This area was investigated due to oily soils encountered by AAM. However, LNAPL was not present in monitoring wells MW-104 and MW-502. MW-502 is screened across the base of the fill unit/top of the clay, where oily soils were observed by AAM. SVOC concentrations were BDL in a groundwater sample collected from MW-502 in 1998. Therefore, no further action is required.

Truck Scale Pit
LNAPL was not present in monitoring well MW-501 installed in the area where oily soils were encountered during AAM construction activities.

Former Tank No. 11 Area
The extent of LNAPL observed in the shallow portion of the subsurface in the Former Tank No. 11 Area has been defined.

BSA Sewer Tunnel
Minute quantities of oil were present in the groundwater in MW-404 adjacent to the BSA Sewer Tunnel. This oil may represent LNAPL that has migrated along the sewer tunnel. Further investigation is warranted to confirm this assumption.

Tank No. 5 Area, Gleason Machine Area, and B-26 Coolant Pit
SVOC concentrations in soil were above the Exposure Assessment Value in three soil samples in this area. Inhalation of vapors from the soils is unlikely due to the low volatility of SVOCs. However, because some SVOCs are dermal carcinogens, a Health and Safety Plan should be developed to ensure that construction workers utilize the appropriate personal protection if construction activities occur in the affected area.

Shallow and deep LNAPL plumes are present in this area:

Deep Oil Plume
Although over 2 feet of LNAPL is present at MW-305, the current Coolant Pit recovery system, which is downgradient from MW-305, appears to intercept most of the LNAPL in this area. Monitoring wells MW-307 and MW-400, which are downgradient from the Coolant Pit recovery system, contain only a thin layer of product, less than one inch thick. This further supports the premise that the Coolant Pit recovery system is collecting most of the LNAPL in this area.

AAM will continue operation and maintenance of the B-26 Oil Recovery System and submit the required annual report for Spill No. 9104671 to NYSDEC.

Shallow Oil Plume
The LNAPL at the top of the clay/base of the fill in the Gleason Machine Area is not a human health risk for the following reasons:

- The site is an industrial facility;
- The plume is contained beneath the building;
- The only potentially complete exposure pathway is through direct contact by construction workers;
- Groundwater has not been impacted;
- The plume is not moving; and
- The oils involved do not pose a flammable risk.

Dermal contact, particle ingestion, and inhalation of particles and vapors from SVOC-impacted soil by a construction worker receptor is the only potentially complete exposure pathway at this site. Engineering controls to limit exposure during construction activities should be implemented.

Therefore, BBL recommends:

- A Due Care Plan should be prepared and implemented to protect construction workers from exposure in areas with impacted soil;
- Continue operation of the B-26 Recovery system under Spill 9104671;
- Monitor MW-404 for LNAPL under Spill 9104671;
- Investigate potential releases to stormwater in the BSA sewer tunnel;
- Evaluate the extent of LNAPL observed in monitoring well MW-406; and
- Inactivate Spill 9400483 once these activities are complete.

Sincerely,

BLASLAND, BOUCK & LEE, INC.

Barbara A. Sullivan

Barbara A. Sullivan, P.G.
Senior Project Geologist

BAS/fbd

Cc: C. Bernd, AAM
A. Glieco, AAM
K. Malinowski, CRA
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Att:

Figure 1	Site Plan
Figure 2	Extent of Shallow LNAPL Plume
Figure 3	Extent of Deep LNAPL Plume
Table 2	Summary of Soil Criteria from Exposure Assessment
Table 3	Summary of Semi-Volatile Organic Compounds in Soil
Table 4	Summary of Volatile Organic Compounds, Total Petroleum Hydrocarbons, and PCBs in Soil
Table 5	Summary of Sudan IV Soil Screening
Table 6	Summary of Semi-Volatile Organic Compounds in Groundwater

Table 2
Summary of Soil Criteria from Exposure Assessment

NYSDEC Spill No. 9400483

American Axle & Manufacturing, Inc. Buffalo Plant
Buffalo, New York

Chemical	Relevant Exposure Pathway				
		Pathway 3 [1]			Pure Product
	Groundwater Protection	Carcinogenic Effects	Non-Carcinogenic Effects	Indoor Volatilization [2]	Saturation
Acenaphthene	5.74E+06	NA	8.03E+06	4.11E+06	7.89E+04
Anthracene	4.39E+07	NA	2.37E+08	6.13E+06	3.18E+03
Benzo(a)anthracene	1.72E+05	4.40E+05	2.30E+08	4.63E+10	4.62E+04
Benzo(a)pyrene	4.81E+04	4.28E+04	2.32E+08	9.54E+10	2.33E+03
Benzo(b)fluoranthene	6.80E+04	4.40E+05	2.07E+08	2.35E+09	3.85E+04
Benzo(g,h,i)perylene	4.91E+08	NA	2.35E+08	3.19E+11	5.55E+03
Benzo(k)fluoranthene	6.80E+04	4.40E+06	1.89E+08	7.42E+08	1.18E+06
Chrysene	2.50E+04	4.40E+07	2.20E+08	7.79E+09	1.80E+03
Dibenzo(a,h)anthracene	1.30E+10	4.40E+04	2.36E+08	6.57E+11	8.25E+03
Fluoranthene	NV	NV	NV	NV	NV
Fluorene	2.26E+07	NA	6.95E+07	5.23E+06	6.13E+04
Indeno(1,2,3-cd)pyrene	1.99E+05	4.40E+05	2.35E+08	3.67E+11	4.20E+03
Naphthalene	8.06E+05	NA	1.38E+06	1.56E+05	7.07E+04
Phenanthrene	4.39E+07	NA	5.21E+07	3.92E+06	7.07E+04
Pyrene	1.18E+08	NA	1.73E+08	3.51E+08	2.51E+04

Notes:
All values are in micrograms per kilogram
NA - Not applicable.
NV - No values provided by NYSDEC to perform Exposure Assessment
[1] Inhalation of vapors and particulates, dermal contact, and ingestion of chemicals
Construction worker receptor used
[2] Commercial worker receptor

Table 3
Summary of Semi-Volatile Organic Compounds in Soil

NYSDEC Spill No. 9400483

American Axle & Manufacturing, Inc. Buffalo Plant
Buffalo, New York

Exploration Number	Soil	Exposure	Knuckle Job Area		Maintenance Garage			Tank No. 11 Area			Fire Loop Repair	
			SB-103		SB-107	SB-2-1[2]		MW-103			SB-116	
Sample Depth	Cleanup[1]	Assessment	4'-6'	6'-8'	6'-8'	6'-8'	8'-10'	2'-4'	2'-4'D	6'-8'	2'-4'	2'-4-D
Acenaphthene	50.0	78.9	1.500J	1.300J	ND	ND	ND	ND	0.010J	ND	ND	ND
Acenaphthylene	41	49.4	ND	ND	ND	ND	ND	ND	0.008J	ND	ND	ND
Anthracene	50	3.18	2.000J	2.200J	ND	ND	ND	0.014J	ND	ND	ND	ND
Benzo(a)anthracene	0.224/MDL	46.2	**1.300J**	**1.100J**	ND	ND	ND	ND	ND	ND	0.042J	ND
Benzo(a)pyrene	0.061/MDL	2.33	**0.540J**	**0.440J**	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	1.100	38.5	0.810J	0.600J	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	50	5.55	0.420J	0.300J	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	1.100	1,180	0.660J	0.500J	ND	ND	ND	ND	ND	ND	ND	ND
Benzoic acid	2.7	NS	ND	ND	ND	ND	ND	0.110JB	0.130JB	0.025JB	ND	ND
Bis(2-Ethylhexyl)phthalate	50.0	NS	1.400JB	0.600JB	ND	ND	ND	ND	0.62	0.310J	0.330J	0.260J
Chrysene	0.4	1.8	**1.400J**	**1.1**	ND	ND	ND	ND	ND	ND	0.082J	ND
Di-n-butylphthalate	8.1	NS	ND	ND	ND	ND	1.8	ND	0.050JB	0.047JB	0.160J	ND
Dibenzofuran	6.2	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diethylphthalate	7.1	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	50	NC	ND	3.4	ND	ND	ND	ND	ND	ND	0.068J	ND
Fluorene	50	61.3	1.600J	1.300J	ND	ND	ND	ND	ND	0.010J	ND	ND
Indeno(1,2,3-cd)pyrene	3.2	4.2	0.500J	0.400J	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	36.4	NS	0.310J	0.700J	ND	ND	ND	0.063J	0.042J	ND	0.056J	ND
3+4 Methylphenol	0.9[3]	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	13.0	70.7	0.430J	1.3	ND	ND	ND	0.0108J	0.019J	ND	ND	ND
Phenanthrene	50	70.7	6.5	7	ND	ND	ND	0.073J	ND	ND	0.140J	0.073J
Phenol	0.03	NS	ND	ND	ND	ND	ND	ND	ND	ND	**0.130J**	0.030J
Pyrene	50	25.1	2.000J	ND	ND	ND	ND	ND	ND	ND	0.080J	ND
2,4,6-Trichlorophenol	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total SVOC	500	NS	19.97	21.64	ND	ND	1.8	0.1608	0.699	0.32	1.088	0.363

Notes:
All values are in millograms per kilogram
B - Also detected in an associated laboratory blank sample.
J - Estimated value outside the calibrated concentration range.
TAGM - Technical and Administrative Guidance Memorandum
D - Indicates duplicate sample
NA - Not analyzed
NC - Not calculated (no default values provided by NYSDEC)
TCLP - Toxicity Characteristic Leaching Procedure
ND - Not detected
NS - No standard
Bold values exceed TAGM #4046 values.
[1] - From TAGM #4046, New York Department of Environmental Conservation, January 24, 1994.
[2] Key to sample identification on laboratory reports: PAOC2-B1 = SB-2-1; PAOC6-B1 = SB-6-1
[3] - Value is for 4-methylphenol

Table 3
Summary of Semi-Volatile Organic Compounds in Soil

NYSDEC Spill No. 9400483

American Axle & Manufacturing, Inc. Buffalo Plant
Buffalo, New York

Exploration Number	Soil	Exposure	Fill Station		Tank No. 5		Gleason Machine Area				
			SB-117	SB-6-1[2]	MW-101		SB-104			SB-105	
Sample Depth	Cleanup[1]	Assessment	0'-2'	6'-8'	4'-6'	6'-6.4'	1'-2'	1'-2'D	8'-9'	2'-4'	4'-6'
Acenaphthene	50.0	78.9	0.053J	ND	0.650J	3.2	ND	7.9	1.700J	1.500J	3.500J
Acenaphthylene	41	49.4	ND	ND	ND	ND	3.100J	ND	ND	ND	ND
Anthracene	50	3.18	0.230J	ND	0.850J	2.8	ND	ND	1.400J	1.900J	5
Benzo(a)anthracene	0.224/MDL	46.2	0.730	ND	ND	**3.6**	**2.700J**	ND	ND	**2.4**	**5.6**
Benzo(a)pyrene	0.061/MDL	2.33	0.800	ND	ND	**2.4**	**1.500J**	**2.100J**	**0.610J**	**5.7**	**4.5**
Benzo(b)fluoranthene	1.100	38.5	0.780	ND	ND	**3.8**	ND	**2.900J**	0.890J	**12**	NS
Benzo(g,h,i)perylene	50	5.55	0.061J	ND	ND	ND	0.600J	1.400J	ND	4	1.500J
Benzo(k)fluoranthene	1.100	1,180	0.670	ND	ND	**2.6**	ND	**3.000J**	1.000J	**5.6**	NS
Benzoic acid	2.7	NS	0.083J	ND	ND	ND	0.860J	0.650J	ND	ND	ND
Bis(2-Ethylhexyl)phthalate	50.0	NS	0.210	ND	ND	ND	ND	ND	1.000JB	3.900B	ND
Chrysene	0.4	1.8	0.790	ND	ND	**4.2**	**3.000J**	ND	0.980J	**3.8**	NS
Di-n-butylphthalate	8.1	NS	0.033JB	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a)anthracene	0.014/MDL	8.25	ND	ND	ND	ND	ND	ND	ND	**1.7**	ND
Dibenzofuran	6.2	NS	ND	ND	0.420J	2	2.500J	**6.9**	1.200J	ND	ND
Diethylphthalate	7.1	NS	0.019JB	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	50	NR	1.600	ND	ND	6	ND	ND	3.2	7	13
Fluorene	50	61.3	0.077J	ND	ND	3.1	3.500J	6.8	1.900J	1.600J	3.800J
Indeno(1,2,3-cd)pyrene	3.2	4.2	0.320J	ND	ND	ND	0.650J	1.300J	ND	**4.2**	1.900J
2-Methylnaphthalene	36.4	NS	0.043J	ND	0.250J	1.600J	1.200J	3.400J	0.630J	0.690J	2.400J
3+4 Methylphenol	0.9[3]	NS	ND	ND	ND	ND	ND	**1.300J**	ND	ND	ND
Naphthalene	13.0	70.7	0.036J	ND	ND	0.490J	1.300J	3.400J	ND	0.600J	2.100J
Phenanthrene	50	70.7	0.860	ND	3.1	15	16	34	6.6	6.6	16
Phenol	0.03	NS	ND	ND	ND	ND	**2.300J**	**8.5**	ND	**0.540J**	**0.570J**
Pyrene	50	25.1	0.970	ND	ND	6	3.000J	ND	4.3	4	9.7
2,4,6-Trichlorophenol	NS	NS	ND	ND	ND	ND	ND	0.400J	ND	ND	ND
Total SVOC	500	NS	8.313	ND	5.27	56.79	42.21	83.95	24.41	63.83	69.57

Notes:
All values are in millograms per kilogram
B - Also detected in an associated laboratory blank sample.
J - Estimated value outside the calibrated concentration range.
TAGM - Technical and Administrative Guidance Memorandum
D - Indicates duplicate sample
NA - Not analyzed
NC - Not calculated (no default values provided by NYSDEC)
TCLP - Toxicity Characteristic Leaching Procedure
ND - Not detected
NS - No standard
Bold values exceed TAGM #4046 values.
[1] - From TAGM #4046, New York Department of Environmental Conservation, January 24, 1994.
[2] Key to sample identification on laboratory reports: PAOC2-B1 = SB-2-1; PAOC6-B1 = SB-6-1
[3] - Value is for 4-methylphenol

Table 4
Summary of Volatile Organic Compounds, Total Petroleum Hydrocarbons, and PCBs in Soil

NYSDEC Spill No. 9400483

American Axle & Manufacturing, Inc. Buffalo Plant
Buffalo, New York

Exploration Number	Soil	Knuckle Job Area		Maintenance Garage			Tank No. 11 Area		
		SB-103		SB-107			MW-103		
Sample Depth	Cleanup[1]	4'-6'	6'-8'	6'-8'	6'-8'	8'-10'	2'-4'	2'-4'D	6'-8'
Volatile Organic Compounds									
2-Butanone	0.3	NA	NA	NA	NA	NA	0.02	0.004J	0.007
Acetone	0.2	NA	NA	NA	NA	NA	0.086B	0.013B	0.033B
Benzene	0.06	NA	NA	NA	NA	NA	0.001J	ND	ND
Carbon disulfide	2.7	NA	NA	NA	NA	NA	ND	0.0007J	ND
Chloroform	0.3	NA	NA	NA	NA	NA	0.0009J	ND	ND
Ethylbenzene	5.5	NA	NA	NA	NA	NA	0.002J	ND	ND
Methylene Chloride	0.1	NA	NA	NA	NA	NA	0.016	0.105	0.013
Tetrachloroethene	1.4	NA	NA	NA	NA	NA	0.001J	ND	0.007
Toluene	1.5	NA	NA	NA	NA	NA	0.004J	0.004J	0.003J
Xylenes	1.2	NA	NA	NA	NA	NA	0.007	0.003J	0.002J
Styrene	NS	NA	NA	NA	NA	NA	0.001J	0.001J	0.002J
Polychlorinated Biphenyls									
	1.0	NA	NA	NA	NA	NA	ND	ND	ND
Total Petroleum Hydrocarbons									
Method 418.1	NS	25,000	17,000	NA	NA	NA	NA	NA	NA
as Motor Oil (Method 8015)	NS	ND	NA	62,000	32,000	27,000	4,400	7,600	9,400
as Diesel/No.2 Fuel Oil (Method 8015)	NS	2500	NA	NA	NA	NA	NA	NA	NA

Notes:
All values are in milligrams per kilogram
B - Also detected in an associated laboratory blank sample.
J - Estimated value outside the calibrated concentration range.
TAGM - Technical and Administrative Guidance Memorandum
D - Indicates duplicate sample
NA - Not analyzed
NC - Not calculated (no default values provided by NYSDEC)
ND - Not detected
Bold values exceed STARS TCLP Extraction Values.
[1] - From TAGM #4046, New York Department of Environmental Conservation, January 24, 1994.

Table 4
Summary of Volatile Organic Compounds, Total Petroleum Hydrocarbons, and PCBs in Soil

NYSDEC Spill No. 9400483

American Axle & Manufacturing, Inc. Buffalo Plant
Buffalo, New York

Exploration Number	Soil	Fire Loop Repair		Fill Station	Tank No. 5		Gleason Machine Area	
		SB-116		SB-117	MW-101		SB-105	
Sample Depth	Cleanup[1]	2'-4'	2'-4'D	0'-2'	4'-6'	6'-6.4'	2'-4'	4'-6'
Volatile Organic Compounds				8020				
Benzene	0.06	0.0004J	0.0004J	NA	ND	ND	NA	NA
Ethylbenzene	5.5	ND	ND	NA	0.016	0.36	NA	NA
Isopropylbenzene	5	ND	ND	NA	0.0056	0.16	NA	NA
p-Isopropyltoluene	11	ND	ND	NA	ND	0.11	NA	NA
Naphthalene	13	ND	ND	NA	0.0035	0.17	NA	NA
n-propylbenzene	14	ND	ND	NA	0.0069	0.21	NA	NA
1,2,4-Trimethylbenzene	11	ND	ND	NA	0.01	0.25	NA	NA
1,3,5-Trimethylbenzene	3.3	ND	ND	NA	0.0059	0.19	NA	NA
Toluene	1.5	0.0005JB	0.0006JB	NA	0.013	0.096	NA	NA
Xylenes	1.2	ND	ND	NA	0.028	0.88	NA	NA
Polychlorinated Biphenyls								
	NS	ND	ND	ND	NA	NA	NA	NA
Total Petroleum Hydrocarbons								
Method 418.1	NS	NA	NA	NA	34,000	55,000	36,000	180,000
as Motor Oil (Method 8015)	NS	118	NA	226	NA	NA	NA	NA
as Diesel/No.2 Fuel Oil (Method 8015)	NS	NA	NA	NA	NA	NA	NA	NA

Notes:
All values are in milligrams per kilogram
B - Also detected in an associated laboratory blank sample.
J - Estimated value outside the calibrated concentration range.
TAGM - Technical and Administrative Guidance Memorandum
D - Indicates duplicate sample
NA - Not analyzed
NC - Not calculated (no default values provided by NYSDEC)
ND - Not detected
Bold values exceed STARS TCLP Extraction Values.
[1] - From TAGM #4046, New York Department of Environmental Conservation, January 24, 1994.

Table 5
Summary of Sudan IV Soil Screening

NYSDEC Spill No. 9400483

American Axle & Manufacturing, Inc. Buffalo Plant
Buffalo, New York

Monitoring Well	Sample Identification	Visual Examination	Sudan IV Results
MW-304	SB-1-1 (0-1')	Concrete	Test not performed
	SB-1-1 (1-2')	No oil observed	No reaction
	SB-1-1 (2-4')	No oil observed	No reaction
	SB-1-1 (4-6')	Slightly oily	Oil show at 5 feet
	SB-1-1 (6-7.5')	No oil observed	No reaction
MW-300	SB-3-1 (0-1')	Concrete	Test not performed
	SB-3-1 (1-2')	No oil observed	No reaction
	SB-3-1 (2-4')	No oil observed	No reaction
	SB-3-1 (4-6')	Slight odor	Slight dye reaction
	SB-3-1 (6-8')	No oil observed	No reaction
MW-301	SB-3-2 (0-1')	Concrete	Test not performed
	SB-3-2 (1-2')	No oil observed	No reaction
	SB-3-2 (2-4')	No oil observed	No reaction
	SB-3-2 (4-6')	No oil observed	No reaction
	SB-3-2 (6-8')	No oil observed	No reaction
MW-302	SB-3-3 (0-1')	Concrete	Test not performed
	SB-3-3 (1-2')	No oil observed	No reaction
	SB-3-3 (2-4')	No oil observed	No reaction
	SB-3-3 (4-6')	No oil observed	No reaction
	SB-3-3 (6-8')	Oil at 6 feet	Test not necessary
MW-303	SB-3-4 (0-1')	Concrete	Test not performed
	SB-3-4 (1-2')	No oil observed	No reaction
	SB-3-4 (2-4')	No oil observed	No reaction
	SB-3-4 (4-6')	No oil observed	No reaction
	SB-3-4 (6-8')	No oil observed	No reaction
MW-305	SB-7-1 (0-1')	Concrete	Test not performed
	SB-7-1 (1-2')	No oil observed	No reaction
	SB-7-1 (2-4')	No oil observed	No reaction
	SB-7-1 (4-6')	Odor in soil	Dye reaction at 5 feet
	SB-7-1 (6-8')	No oil observed	No reaction
	SB-7-1 (8-10')	No oil observed	No reaction
	SB-7-1 (10-12')	No oil observed	Dye reaction at 10.5 feet in sand stringer
	SB-7-1 (12-14')	No oil observed	No reaction
	SB-7-1 (14-16')	No oil observed	No reaction
	SB-7-1 (16-17.1')	No oil observed	No reaction
MW-306 (completed as a shallow well)	SB-8-1 (0-2')	No oil observed	No reaction
	SB-8-1 (2-4')	No oil observed	Dye reaction at 3.5 feet
	SB-8-1 (4-6')	No oil observed	No reaction
	SB-8-1 (6-8')	No oil observed	No reaction
	SB-8-1 (10-12')	No oil observed	No reaction
	SB-8-1 (12-12.5')	Oil visible on spoon, not in soil	Test not performed

Table 5
Summary of Sudan IV Soil Screening

NYSDEC Spill No. 9400483

American Axle & Manufacturing, Inc.Buffalo Plant
Buffalo, New York

Monitoring Well	Sample Identification	Visual Examination	Sudan IV Results
MW-309	SB-8-2 (0-2')	No oil observed	No reaction
	SB-8-2 (2-4')	No oil observed	No reaction
	SB-8-2 (4-6')	No oil observed	No reaction
	SB-8-2 (6-8')	Oily soils	Test not performed
MW-307	SB-9-1 (0-1')	Concrete	Test not performed
	SB-9-1 (1-2')	No oil observed	No reaction
	SB-9-1 (2-4')	No oil observed	No reaction
	SB-9-1 (4-6')	No oil observed	No reaction
	SB-9-1 (6-9')	No oil observed	No reaction
	SB-9-1 (8-10')	No oil observed	No reaction
	SB-9-1 (10-12')	No oil observed	No reaction
	SB-9-1 (12-14')	No oil observed	No reaction
	SB-9-1 (14-16')	No oil observed	No reaction
	SB-9-1 (16-18.5')	No oil observed	Dye reaction at 17 feet
MW-308	SB-9-2 (0-3.8')	Concrete	Test not performed
	SB-9-2 (3.8-5.8')	No oil observed	No reaction
	SB-9-2 (5.8-7.8')	No oil observed	No reaction
	SB-9-2 (7.8-9.8')	No oil observed	No reaction
	SB-9-2 (9.8-11.8')	No oil observed	No reaction
	SB-9-2 (11.8-13.8')	No oil observed	No reaction
	SB-9-2 (13.8-17.5')	No oil observed	No reaction
MW-400	SB-9-3 (0-1')	Concrete	Test not performed
	SB-9-3 (1-3')	No oil observed	No reaction
	SB-9-3 (2.7-4.5')	No oil observed	No reaction
	SB-9-3 (4.5-6.5')	No oil observed	No reaction
	SB-9-3 (6.5-8.5')	Odor in soil, staining	Dye reaction
	SB-9-3 (8.5-10.5')	No oil observed	Dye reaction
	SB-9-3 (10.5-12.5')	No oil observed	Dye reaction
	SB-9-3 (12.5-14.5')	No oil observed	No reaction
	SB-9-3 (14.5-16.5')	No oil observed	No reaction
	SB-9-3 (16.5-18.5')	No oil observed	Dye reaction
MW-402	SB-9-4 (0-1')	Concrete	Test not performed
	SB-9-4 (1-2.2')	No oil observed	No reaction
	SB-9-4 (2.2-4')	Concrete	No reaction
	SB-9-4 (4-6')	No oil observed	No reaction
	SB-9-4 (6-8')	No oil observed	Dye reaction
	SB-9-4 (8-10')	No oil observed	No reaction
	SB-9-4 (10-12')	No oil observed	No reaction
	SB-9-4 (12-14')	No oil observed	No reaction
	SB-9-4 (14-14.5')	No oil observed	Dye reaction

Table 5
Summary of Sudan IV Soil Screening

NYSDEC Spill No. 9400483

American Axle & Manufacturing, Inc.Buffalo Plant
Buffalo, New York

Monitoring Well	Sample Identification	Visual Examination	Sudan IV Results
MW-404	SB-9-5 (0-1')	Concrete	Test not performed
	SB-9-5 (1-2')	No oil observed	No reaction
	SB-9-5 (2-4')	No oil observed	No reaction
	SB-9-5 (4-6')	No oil observed	No reaction
	SB-9-5 (6-8')	No oil observed	No reaction
	SB-9-5 (8-10')	No oil observed	No reaction
	SB-9-5 (10-12')	No oil observed	No reaction
	SB-9-5 (12-14')	No oil observed	No reaction
	SB-9-5 (14-16')	No oil observed	No reaction
	SB-9-5 (16-16.3')	Odor in soil	Dye reaction
MW-406	SB-9-6 (0-1')	Concrete	Test not performed
	SB-9-6 (1-2')	No oil observed	No reaction
	SB-9-6 (2-3.5')	Concrete	Test not performed
	SB-9-6 (3.5-5.5')	No oil observed	No reaction
	SB-9-6 (5.5-7.5')	No oil observed	No reaction
	SB-9-6 (9.5-11.5')	No oil observed	No reaction
	SB-9-6 (11.5-13.5')	No oil observed	No reaction
	SB-9-6 (13.5-15.5')	No oil observed	No reaction
	SB-9-6 (15.5-17.5')	No oil observed	No reaction
	SB-9-6 (17.5-17.6')	No oil observed	No reaction
MW-408	SB-9-7 (0-1')	Concrete	Test not performed
	SB-9-7 (1-3')	No oil observed	No reaction
	SB-9-7 (3-5')	No oil observed	No reaction
	SB-9-7 (5-7')	No oil observed	No reaction
	SB-9-7 (7-9')	No oil observed	No reaction
	SB-9-7 (9-11')	No oil observed	No reaction
	SB-9-7 (11-12.1')	No oil observed	No reaction
MW-500	SB-9-8 (0-2')	Concrete	Test not performed
	SB-9-8 (2-4')	No oil observed	No reaction
	SB-9-8 (4-6')	No oil observed	No reaction
	SB-9-8 (6-8')	No oil observed	No reaction
	SB-9-8 (8-10')	No oil observed	No reaction
	SB-9-8 (10-12')	No oil observed	No reaction
	SB-9-8 (12-14')	No oil observed	No reaction
	SB-9-8 (14-16')	No oil observed	No reaction
	SB-9-8 (16-18')	No oil observed	No reaction
	SB-9-8 (18-18.5')	No oil observed	No reaction

Table 6
Summary of Semi-Volatile Organic Compounds in Groundwater

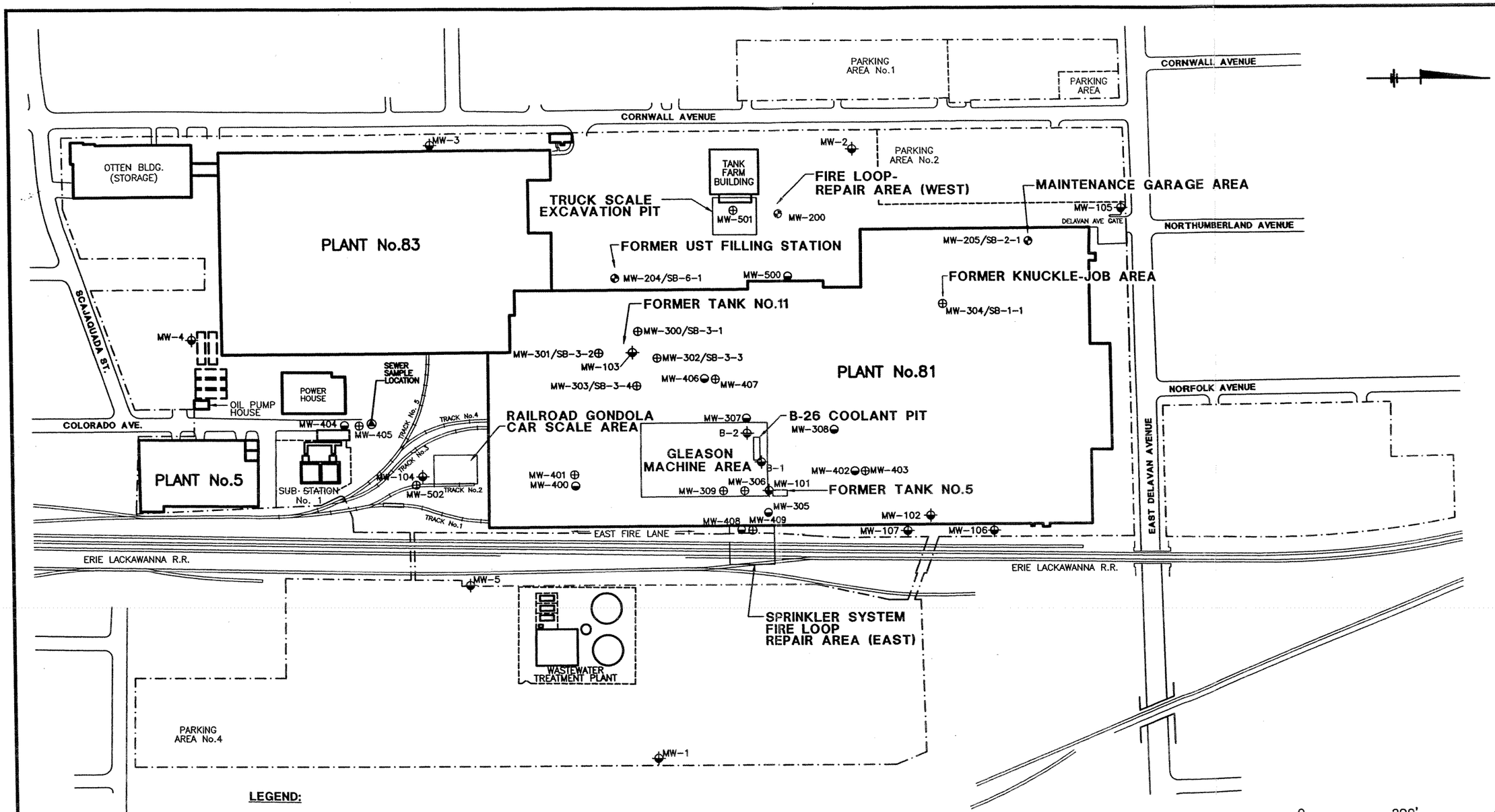
NYSDEC Spill No. 9400483

American Axle & Manufacturing, Inc. Buffalo Plant
Buffalo, New York

Parameter Detected	Sample Identification							STARS TCLP Extraction Value
	MW-103[1]	MW-404[2]	MW-405[2]	MW-408[2]	MW-409[2]	MW-500[3]	MW-502[3]	
Volatile Organic Compounds								
Toluene	0.7JB	NA	NA	NA	NA	NA	NA	5
Xylenes	0.8JB	NA	NA	NA	NA	NA	NA	5
Methylene Chloride	6B	NA	NA	NA	NA	NA	NA	NS
Acetone	6J	NA	NA	NA	NA	NA	NA	NS
Semi-Volatile Organic Compounds								
Acenaphthene	<50	**49**	<5	<5	<5	<5	<5	20
Benzo (a) pyrene	<50	**33**	<5	<5	<5	<5	<5	0.002
Fluoranthene	<50	**93**	<5	<5	<5	<5	<5	50
Fluorene	<50	**58**	<5	<5	<5	<5	<5	50
Indeno (1,2,3-cd) Pyrene	<50	**14**	<5	<5	<5	<5	<5	0.002
Phenanthrene	<50	34	<5	<5	<5	<5	<5	50
Pyrene	<50	**110**	<5	<5	<5	<5	<5	50

Notes:
All concentrations are in micrograms per liter
NA = Not analyzed.
NS = No standard
J = Estimated value outside the calibrated concentration range.
B = Also detected in an associated laboratory blank sample.
STARS - Spill Remediation and Technology Series
TCLP - Toxicity Characteristic Leachate Procedure
STARS TCLP values from STARTS Memo #1, Petroleum Contaminated Soil Guidance Policy, New York State Department of Environmental Conservation, August 1992

[1] Samples were collected on April 29, 1994
[2] Samples were collected on May 18, 1998.
[3] Samples were collected on June 17, 1998.



LEGEND:

MW-204/SB-6-1	APPROXIMATE LOCATION OF SOIL BORING/MONITORING WELL INSTALLED BY BBL
MW-300	APPROXIMATE LOCATION OF SHALLOW MONITORING WELL INSTALLED BY BBL
MW-500	APPROXIMATE LOCATION OF SOIL BORING/DEEP MONITORING WELL INSTALLED BY BBL
MW-1	APPROXIMATE LOCATION OF MONITORING WELL INSTALLED BY OTHERS
SB-4-1	SOIL BORING LOCATION

SOIL BORING SB-7-1 IS IN LOCATION OF MW-305
SOIL BORING SB-8-1 IS IN LOCATION OF MW-306
SOIL BORING SB-8-2 IS IN LOCATION OF MW-309
SOIL BORING SB-9-1 IS IN LOCATION OF MW-307
SOIL BORING SB-9-2 IS IN LOCATION OF MW-308
SOIL BORING SB-9-3 IS IN LOCATION OF MW-400
SOIL BORING SB-9-4 IS IN LOCATION OF MW-402
SOIL BORING SB-9-5 IS IN LOCATION OF MW-404
SOIL BORING SB-9-6 IS IN LOCATION OF MW-406
SOIL BORING SB-9-7 IS IN LOCATION OF MW-408
SOIL BORING SB-9-8 IS IN LOCATION OF MW-500

0 200' 400'

APPROXIMATE SCALE: 1"=200'

NOTES:

1. ALL LOCATIONS ARE APPROXIMATE.
2. REFERENCE: HALEY & ALDRICH DRAWING BUFFEXPL.DWG, FILE NO. 70464-051. APPROXIMATE LOCATIONS OF SITE FEATURES WERE ADDED BASED ON OBSERVATIONS MADE BY HALEY & ALDRICH, INC.

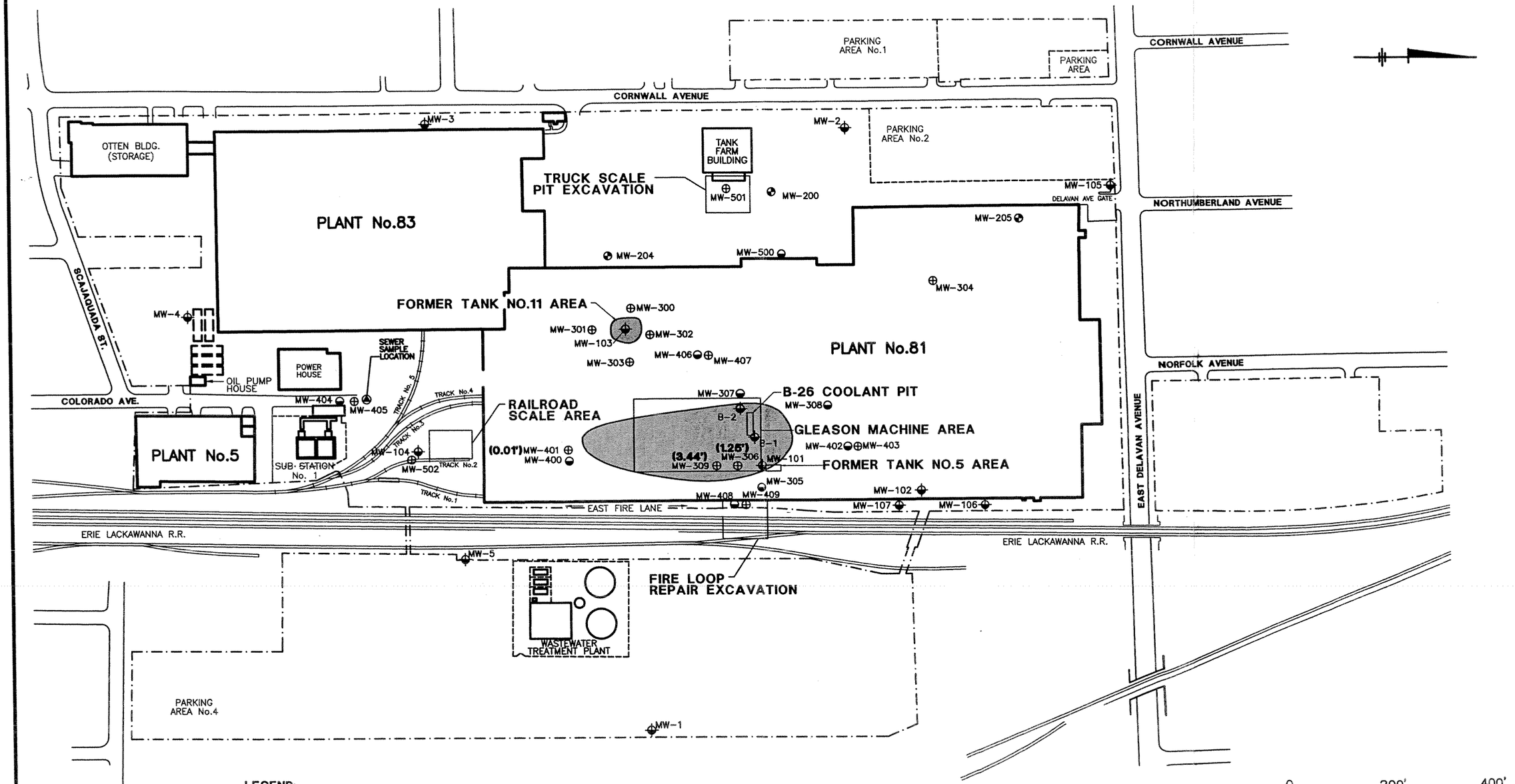
GENERAL MOTORS CORPORATION
AMERICAN AXLE & MANUFACTURING, INC. BUFFALO PLANT
SPILL #9400483

SITE PLAN

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 1

3/21/01 BOC-54 MJS
86977040/spill_9400483/86977009.DWG



LEGEND:

MW-204 ⊕	APPROXIMATE LOCATION OF MONITORING WELL INSTALLED BY BBL
MW-300 ⊕	APPROXIMATE LOCATION OF SHALLOW MONITORING WELL INSTALLED BY BBL (AVERAGE TOTAL DEPTH OF 7' BLS)
MW-500 ⊖	APPROXIMATE LOCATION OF DEEP MONITORING WELL INSTALLED BY BBL (AVERAGE TOTAL DEPTH OF 17' BLS)
MW-1 ⊕	APPROXIMATE LOCATION OF MONITORING WELL INSTALLED BY OTHERS
	EXTENT OF SHALLOW PLUME
(0.05')	LNAPL THICKNESS (FEET)
BLS	BELOW LAND SURFACE
LNAPL	LIGHT NON-AQUOUS PHASE LIQUID

NOTES:

1. ALL LOCATIONS ARE APPROXIMATE.
2. REFERENCE: HALEY & ALDRICH DRAWING BUFFEXPL.DWG, FILE NO. 70464-051. APPROXIMATE LOCATIONS OF SITE FEATURES WERE ADDED BASED ON OBSERVATIONS MADE BY HALEY & ALDRICH, INC.

GENERAL MOTORS CORPORATION
AMERICAN AXLE & MANUFACTURING, INC. BUFFALO PLANT

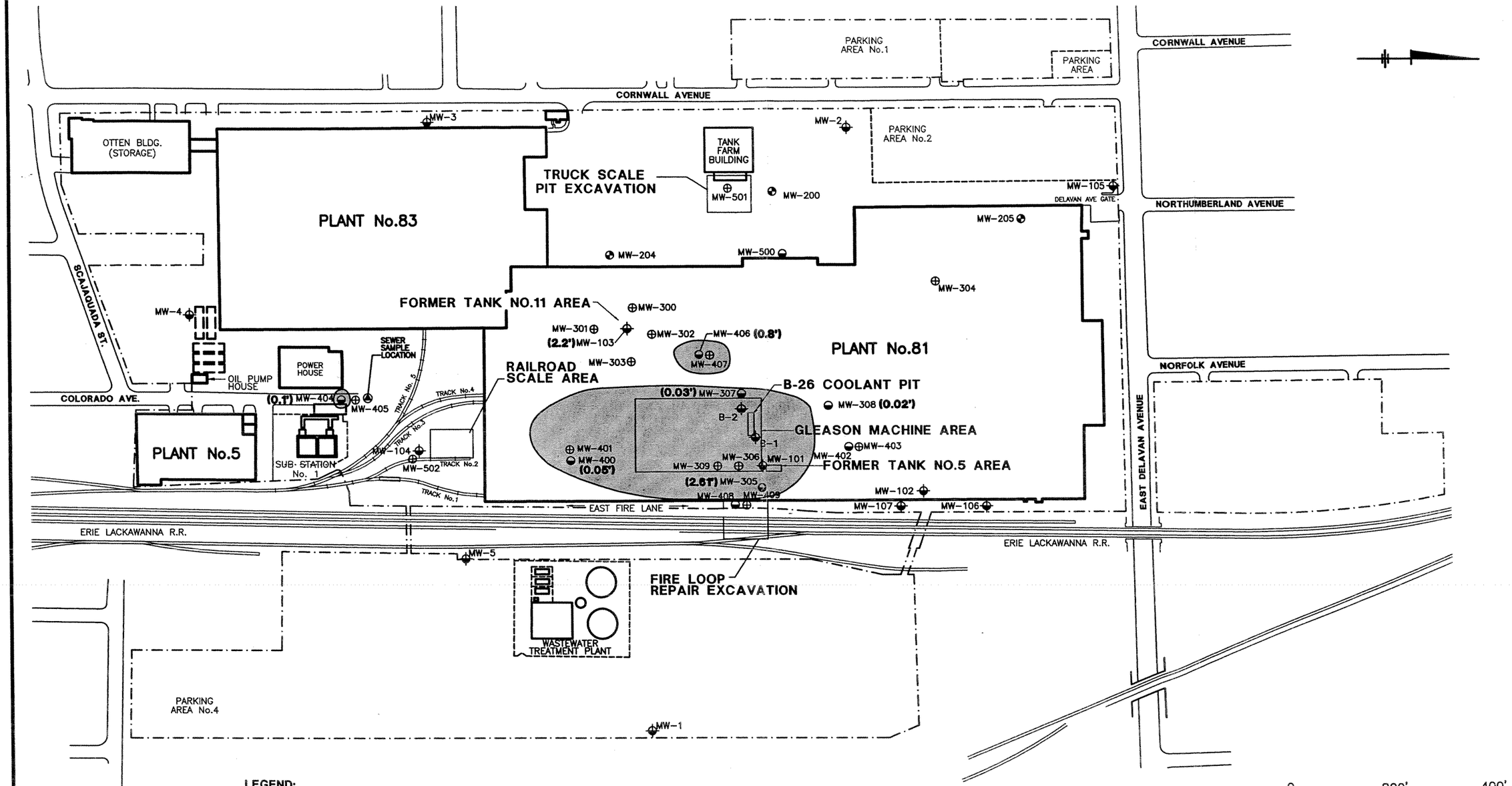
SPILL #9400483

EXTENT OF SHALLOW LNAPL PLUME

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 2

3/21/01 BOC-54 MJS
86977040\SPILL_9400483\86977010.DWG



LEGEND:

MW-204 ⊕	APPROXIMATE LOCATION OF MONITORING WELL INSTALLED BY BBL		EXTENT OF DEEP PLUME
MW-300 ⊕	APPROXIMATE LOCATION OF SHALLOW MONITORING WELL INSTALLED BY BBL (AVERAGE TOTAL DEPTH OF 7' BLS)	(0.05')	LNAPL THICKNESS (FEET)
		BLS	BELOW LAND SURFACE
MW-500 ⊕	APPROXIMATE LOCATION OF DEEP MONITORING WELL INSTALLED BY BBL (AVERAGE TOTAL DEPTH OF 17' BLS)	LNAPL	LIGHT NON-AQUEOUS PHASE LIQUID
MW-1 ⊕	APPROXIMATE LOCATION OF MONITORING WELL INSTALLED BY OTHERS		

0 200' 400'

APPROXIMATE SCALE: 1"=200'

NOTES:

1. ALL LOCATIONS ARE APPROXIMATE.
2. REFERENCE: HALEY & ALDRICH DRAWING BUFFEXPL.DWG, FILE NO. 70464-051. APPROXIMATE LOCATIONS OF SITE FEATURES WERE ADDED BASED ON OBSERVATIONS MADE BY HALEY & ALDRICH, INC.

GENERAL MOTORS CORPORATION
AMERICAN AXLE & MANUFACTURING, INC. BUFFALO PLANT

SPILL #9400483

EXTENT OF DEEP LNAPL PLUME

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 3

3/21/01 BOC-54 MJS
86977040/SPILL_9400483/86977011.DWG