

**SITE INVESTIGATION WORK PLAN  
FORMER WABASH ALLOYS PROPERTY  
9100 South Fifth Avenue  
Oak Creek, Wisconsin**

*Prepared for:*

**Beazer**

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*Prepared by:*



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*September 22, 2011*

CERTIFICATION

“I, Michael R. Noel, hereby certify that I am a scientist as that term is defined in s. NR 712.03 (3), Wis. Adm. Code, and that, to the best of my knowledge, all of the information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code.”

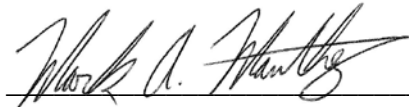


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Michael R. Noel, P.G.  
Vice President, Principal Hydrogeologist

September 22, 2011

Date

“I, Mark A. Manthey, hereby certify that I am a hydrogeologist as that term is defined in s. NR 712.03 (1), Wis. Adm. Code, and that, to the best of my knowledge, all of the information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code.”



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Mark A. Manthey, P.G.  
Senior Hydrogeologist

September 22, 2011

Date

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## **1.0 INTRODUCTION**

### **1.1 Purpose**

The purpose of this investigation is to evaluate the extent of soil and groundwater impacts at the former Wabash Alloys Facility owned by Connell Ltd Partnership, LLC in Oak Creek, Wisconsin associated with former coal tar distillation plant operations that took place on the property from 1935 to 1960 and the aluminum smelting and recycling operations that took place on the property from 1968 to 2007.

### **1.2 Location and Project Information**

#### **Site Address:**

9100 South Fifth Avenue  
Oak Creek, Wisconsin 53154

#### **Site Location:**

SW ¼ of the NW ¼, and the NW ¼ of the SW ¼  
Section 24, T5N, R22E  
Milwaukee County

#### **Potentially Responsible Parties:**

##### **Current Site Owner:**

Connell Ltd. Partnership, LLC  
Contact: John Curtin (in-house counsel)

##### **Former Site Owner:**

Vulcan Materials  
Contact: Tom McElligott (outside counsel)  
414-277-5531 (phone)

##### **Former Site Owner:**

Beazer East, Inc. (f/k/a Koppers Company, Inc.)  
Contact: Mike Slenska  
412-208-8867 (phone)

#### **Environmental Consultant:**

Mike Noel, P.G.  
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175 N Corporate Drive  
Brookfield, WI 53045  
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262-792-1310 (fax)

## **2.0 SITE BACKGROUND**

The former Wabash Alloys site is located at 9100 South Fifth Avenue in Oak Creek, Wisconsin (Figure 1).

### **2.1 Site History**

The site is located in an industrial area that has been used for manufacturing various products since the early 1900's. The chronology of site ownership and site use, as understood today, are provided below:

- 1917-1935 – American Tar Products – coal tar distillation;
- 1935-1960 – Koppers Tar Plant – coal tar distillation;
- 1960-1968 – Arthur A. Levin and Saul Padek – coal tar distillation, chemical manufacturing;
- 1968-1987 – Vulcan Materials – secondary aluminum smelting;
- 1987-1997 – Connell Limited Partnership – secondary aluminum smelting;
- 1997-2007 – Wabash Alloys – secondary aluminum smelting;
- 2007-present – Connell Aluminum Properties, LLC – discontinued operations

The site occupies approximately 21 acres of land. Approximately 12 acres form the western part of the site that includes the former smelting facility structures. The remaining eastern portion of the property contains no structures except for remaining segments of rail spurs.

The structures related to the coal tar distillation plant (Figure 2) were apparently removed during the Levin & Padek ownership period as only a few dilapidated structures remained when Vulcan purchased the property in 1968 and constructed the aluminum smelting plant. In the process of Vulcan's smelter construction activities, oily soil was excavated from the site and disposed of at an off-site landfill located at 3655 East American Avenue in Oak Creek.

The structures related to the discontinued smelting facility (Figure 3) remain at the site and are comprised of four contiguous buildings from west to east: 1) maintenance, office and ingot storage 2) furnace room, 3) crusher room and 4) scrap storage room.

## **2.2 Geology & Hydrogeology**

### **2.2.1 Regional Setting**

Native unconsolidated deposits in the vicinity of the site are comprised of glacial till, glaciolacustrine, and glacial outwash deposits of the Oak Creek Till. The total thickness of the unconsolidated deposits in the area varies from 100 to 200 feet, based on well logs from area wells. The uppermost bedrock unit is the Niagara Dolomite. Regional groundwater flow is to the east toward Lake Michigan.

### **2.2.2 Site Conditions**

Borings installed at the site in the vicinity of the underground storage tank (UST) areas indicate the native geology of the upper 20 feet (depth of investigation) is comprised of clayey silt to silty clay with silts and sands.

Groundwater has been observed in site wells at very shallow depths of 1 to 7 feet below ground surface (bgs). Previous investigations have observed a groundwater flow direction to the south or southeast. Hydraulic conductivity estimates range from  $4.24 \times 10^{-4}$  to  $5.14 \times 10^{-6}$  cm/sec with a geometric mean of  $5.44 \times 10^{-5}$  cm/sec based on bail-recovery tests conducted on 5 monitor wells. Based on a hydraulic gradient of 0.027 and an effective porosity of 15 percent for fractured clay, the linear groundwater flow velocity is estimated at approximately 10 ft/yr.

### **2.3 Previous Site Investigations and Remedial Actions**

The following is a chronological summary of the previous site investigation and remedial activities conducted at the site.

- 1968 – Vulcan had excavation work done in preparation for building the smelter plant. Oily soil that was removed was placed in an off-site landfill located at 3655 American Avenue (see Appendix A).
- 1980 – Vulcan installed a clay dam keyed into natural clay to prevent downhill seepage from a pond containing tar (Figure 2). The pond was drained and backfilled with compacted clay. A marshy swale was sealed with 1 to 2 feet of compacted clay to provide a sealed water course across this area to the city storm sewer (see Appendix A). The exact location of the cutoff wall is unknown. (see 1990 EPA SS1 Report)
- 1984 – WDNR performed a preliminary assessment (PA) of the site.
- 1985 – Vulcan reported a PCB leak from a transformer. This was subsequently cleaned up through soil excavation and closed by WDNR (see Appendix A).
- 1989 – EPA conducted a screening site inspection that included 6 subsurface soil samples (3 to 6 feet deep) in a saturated depression area on the east part of the site. These samples were collected in the area of the former pond and the samples were collected from a depth below the cap installed in 1980. Aromatics, phenols and polynuclear aromatic hydrocarbons (PAHs) were detected. The report concluded that there was a low potential for contaminant migration to groundwater or direct contact with the contaminants.
- 1989 – STS, through Quarles & Brady and on behalf of Wabash Alloys (a.k.a. Connell Limited Partnership) waste characterization and removal of 2922 cubic yards (2902 tons) of fill material from the southeast corner of the facility. The waste/fill was hauled to a BFI landfill. The excavation was backfilled with clay.
- 1990 – Wabash Alloys removed two USTs (1,000 gal gasoline and 1,000 gal diesel) from the north side of the property (Figure 2).
- 1991 – Sigma Environmental, on behalf of Wabash Alloys, conducted an investigation of the UST area including 7 soil borings and converting 3 to monitoring wells. Aromatic and PAH compounds were detected above NR 140 enforcement standards (ESs).
- 1992 – RMT, on behalf of Wabash Alloys, conducted further investigation of the UST area including 5 soil borings/monitoring wells. The results indicated that the extent of impacts associated with the UST were of limited extent (40 feet by 60 feet by 10 feet deep) and could be best remedied by excavation.
- 1993 – RMT, on behalf of Wabash Alloys, prepared a remedial action plan that evaluated options and recommended soil excavation as the preferred remedy with post-excavation monitoring of groundwater.

- 1993 – RMT, on behalf of Wabash Alloys, conducted 9 backhoe test pits to refine pre-excavation limits of impacted soils and to characterize soils for landfill disposal.
- 1993 – RMT, on behalf of Wabash Alloys, removed 1,875 tons of impacted soil (Figure 2) for off-site landfill disposal and 440 gallons of water for off-site recycling. Post-excavation groundwater monitoring was implemented.
- 1995 – RMT, on behalf of Wabash Alloys, sampled 4 post-excavation wells for volatile organic compounds (VOCs), PAHs, diesel range organics (DRO), and gasoline range organics (GRO). No groundwater exceedances except one PAH compound which was attributed to sample turbidity.
- 1996 – RMT, on behalf of Wabash Alloys, implemented corrective actions in response to the discovery of a black substance on two of three catch basins on the storm sewer line that drains the east area behind the buildings. The corrective actions included removal of a portion of a railway spur, using the soil from beneath the spur to regrade the land surface and promote sheet flow to the lowermost catch basin, and abandoning the two upper catch basins and interconnected culverts between the two by plugging with flowable fill (Figure 2).
- 1998 – RMT submitted a closure request for the UST area on behalf of Wabash Alloys and includes annual groundwater sampling results (1995-1997) from 4 wells. No VOCs or GRO were detected in the groundwater samples. Low levels of DRO were detected. One PAH compound (benzo (a) pyrene) was detected sporadically above the NR140 Enforcement Standard (ES).
- 1999 – WDNR granted closure of the two 1,000-gallon USTs area.
- 1999 – RMT, on behalf of Wabash Alloys, abandons all remaining monitoring wells as a condition of closure.
- 2002 – BT2, on behalf of Wabash Alloys, removed one 10,000 gallon diesel UST and associated product piping and pump from the north side of the property, east of the previous UST area (Figure 2). Soil samples from excavation sidewalls and test pits indicated DRO, PVOC and PAH concentrations above NR 720 RCLs.
- 2003 – BT2, on behalf of Wabash Alloys, conducted a site investigation that included installing 6 Geoprobe® boreholes and 6 monitoring wells. Soil samples indicated DRO, PVOC and PAH concentrations above NR 720 RCLs. Groundwater samples indicated PAH concentrations above NR140 ESs. A limited soil investigation was planned to remove petroleum-related impacts but not background PAH impacts attributed to non-petroleum UST operations.
- 2004 – RMT, on behalf of Wabash Alloys, excavated the soils in the vicinity of the UST to an average depth of 4.5 feet below ground surface (Figure 2).
- 2006 – ENSR/AECOM, on behalf of K2 Capital, conducted soil sampling at the site. Limited results were included in a Site Assessment Grant (SAG) application submitted by the City of Oak Creek. PAH compounds were detected at two sample locations (one in the east area which has been capped and one at the former 10,000-gallon UST area which has been granted closure) at concentrations above NR 720 RCLs. Photographs in the SAG application showed a couple of small areas of tar that had breached the asphalt and pooled (approximately 1-2 feet in diameter) on the asphalt surface (Figure 2).
- 2007 – WDNR granted closure of the one 10,000-gallon UST area.

- 2010 – Weston Solutions, Inc. on behalf of U.S. EPA and the City of Oak Creek conducted a Phase I Environmental Site Assessment (ESA) of the Connell Aluminum Site.
- 2010 – RMT, on behalf of Connell Ltd. Partnership, LLC, conducted a Phase II Site Investigation of the former Wabash Alloys Aluminum Recycling Facility to address Recognized Environmental Conditions (RECs) and recommendations in the Weston Phase I ESA. The interior of the building and exterior were investigated. The interior sampling included waste pile sampling (10 samples), concrete sampling (10 samples), wipe sampling (10 samples), pit/sump/drain/tank sampling (11 samples), and paint samples (3). Subsurface sampling (both inside and outside the building) consisted of 20 soil borings and 11 temporary monitoring well installations. PCBs were ubiquitous in interior floor, wipe, waste pile and sump/pit samples. Elevated concentrations of metals were identified in residual/waste pile, sump/pit and soil and groundwater samples. SVOCs and VOCs were identified at levels above regulatory standards in soil and groundwater samples. Select figures and tables from that report are included in Appendix B.
- 2010 – Bonestroo, on behalf of the City of Oak Creek, conducted a site investigation on the City utility property adjacent to the south property line of the Connell property. This work was performed to determine the extent and magnitude of soil and groundwater contamination identified during the installation of a raw-water line during 2008. PVOC and PAH compounds were detected in soil and groundwater samples. Select figures and tables from that report are included in Appendix C.

In summary the UST areas (two 1,000-gallon USTs and one 10,000-gallon UST) at the north end of the site have been investigated, remediated and granted closure (1999 and 2007). The PCB spill at the former transformer was cleaned up (1985). The former pond in the east area has been drained and capped and a clay cutoff wall installed at an unknown location (1980). A total of 2902 tons of fill was excavated from the southeast corner of the facility and disposed at an off-site landfill (1989). Catch basins and culverts in the area were sealed and the surface regraded to promote overland flow (1996). The Phase II site investigation found PCBs were ubiquitous in interior floor, wipe, waste pile and sump/pit samples; elevated concentrations of metals in residual/waste pile, sump/pit and soil and groundwater samples; and SVOCs and VOCs detected at levels above regulatory standards in soil and groundwater samples (2010).



### **3.0 FIELD INVESTIGATION**

The scope of work presented below will be implemented to determine the nature and extent of soil and groundwater impacts associated with the operations of the coal tar distillation plant and aluminum smelter and recycling plant. The field investigation activities will be performed by Tetra Tech GEO personnel with drilling/Geoprobe® and analytical laboratory subcontractors. Laboratory analyses will include VOCs, SVOCs/PAHs, RCRA metals and PCBs which are parameters associated with former coal tar plant and aluminum smelter products, byproducts and operations.

Historical aerial photographs and Sanborn Maps were used to place the former locations of the structures associated with the coal tar distillation plant on the former Wabash Alloys site. Figure 2 shows the former coal tar distillation plant structures in relation to the former smelter plant buildings, parking lots and driveways that currently exist on the property. As shown on Figure 2 the majority of the former coal tar distillation plant structures are located within the footprint of the former smelter plant buildings. Figure 3 shows the layout of the former aluminum smelter and recycling facility features.

A summary of the soil and groundwater sampling results from the Connell Phase II site investigation are provided in Figures 4, 5 and 6. Figure 4 shows soil sampling results for total benzene, toluene ethylbenzene, xylenes and trimethylbenzenes (BTEX & TM). Figure 5 shows soil sampling results for total PAH compounds. Figure 6 shows groundwater sampling results for benzene and naphthalene. Proposed sampling activities will be performed within and around the former smelter plant buildings to add to and expand on the sampling done during the previous Connell Phase II site investigation.

#### **3.1 Soil Investigation**

The proposed soil boring locations are shown on Figure 7. Shallow soil samples (0-2 feet bgs) will be collected at 43 locations for direct contact assessment. At 17 of those locations, deeper samples will be collected from 4-6 and 8-10 feet bgs. Actual locations may be adjusted in the field depending on underground utilities and above ground structures.

Soil samples will be collected using a Geoprobe® direct push soil core sampler (Appendix D). Borings inside building will be installed through a concrete core through the floor. Continuous soil samples will be collected to a depth of approximately 10 feet bgs at each proposed borehole location. The soil samples will be logged by a Tetra Tech GEO environmental technician according to the United Soil Classification System. Observations of tar staining and odor will be noted. Soil samples will be screened for the presence of ionizable VOCs at 2-foot intervals using a photoionization detector (PID) equipped with a 10.6 eV lamp. The soil samples collected for PID screening will be placed in 16-ounce glass canning jars. The jars will be half-filled with soil and the top of each jar will be sealed with aluminum foil and a canning jar screw-on metal retaining ring. The headspace in the jars will be allowed to equilibrate for a minimum of 10 minutes at an ambient temperature of at least 55 degrees Fahrenheit to allow any organic compounds to off-gas. The headspace of the container will then be measured for VOCs using the PID following Tetra Tech GEO's field PID measurement procedures (Appendix B). The PID screening results will be recorded on Tetra Tech GEO field PID data sheets. The PID will be

calibrated at the start of each work day by the Tetra Tech GEO environmental technician. The PID will be calibrated in accordance with manufacturer's calibration procedures using 100 parts per million isobutylene calibration gas. The PID calibration results will be recorded on a Tetra Tech GEO equipment calibration record form.

A total of 77 soil samples (43 from 0-2 feet bgs; 17 from 4-6 feet bgs; and 17 from 8-10 feet bgs) will be submitted for laboratory analyses of VOCs by EPA Method 8260, SVOCs or PAHs by EPA Method 8270, RCRA metals by Method 6010/7471 and PCBs by EPA Method 8082. For the SVOC/PAH analyses approximately 20 percent of the samples (19 total) will be analyzed for the full SVOC parameter list and 80 percent of the samples (58 total) will be analyzed for the PAH parameter list. Figure 7 shows all the sampling locations and which are selected for SVOC or PAH analyses.

The soil samples will be collected in sample containers provided by the laboratory subcontractor. The soil samples submitted for VOCs analysis will be preserved in the field with methanol provided by the laboratory subcontractor and will consist of approximately 25 grams of soil. The soil samples will be stored at a temperature of approximately 4 degrees Celsius and will be delivered to the laboratory following standard chain-of-custody procedures. Each sample container will have a self-adhesive label attached to it with the sample identification and date and time the sample was collected written on the label. The sample identification will consist of the borehole identification and sample depth. A methanol blank consisting of a sample container in which methanol is poured into will also be prepared in the field and will be submitted for laboratory analyses of VOCs for quality assurance/quality control (QA/QC) purposes.

The locations and elevations of the soil borings will be surveyed by a state licensed surveyor so they can be accurately placed on the site base map. The soil borings that will not be converted to permanent groundwater monitoring wells will be decommissioned in accordance with the procedures outlined in Chapter NR141 of the Wisconsin Administrative Code (WAC). For the interior borings, the concrete cores will be replaced in floor after borehole abandonment. WDNR borehole abandonment forms will be completed for each abandoned soil boring. Copies of the borehole abandonment forms will be included in an appendix of the site investigation report.

WDNR soil boring log information forms will be completed by Tetra Tech GEO personnel for each soil boring. Copies of the WDNR soil boring logs will be included in an appendix of the site investigation report.

### **3.2 Groundwater Investigation**

Fifteen water table monitor wells will be installed at the proposed locations shown on Figure 7 to document the hydrogeologic conditions and groundwater quality beneath the site. The wells will be installed to a depth of 15-20 feet bgs, depending on depth to water. The locations of these wells may be adjusted based on potential underground or above ground obstructions and site access. The monitoring wells are located around and across the site to assess background water quality, source areas and areas where off-site migration may be occurring. Two locations are located off-site on the City utility property to further assess off-site migration potential. Two wells may exist on the utility property from a previous investigation. These wells will be

incorporated into this plan and sampled if they still exist instead of installing a new well at that location.

At three locations, a deeper piezometer will be nested with a water table well to evaluate the vertical extent of groundwater contaminants. The proposed locations are shown on Figure 7. The depth of the piezometer will be 30 feet deeper than the water table well it is nested with.

The sonic method of drilling will be used to drill the boreholes in which the monitor wells will be installed. The sonic method of drilling was selected because it minimizes the amount of investigative waste produced and is a quicker drilling method in comparison to other drilling methods. The water table monitor wells will be constructed of 2-inch nominal diameter schedule 40 PVC well casing and stainless steel screen. The screen will have a slot size of 0.010-inches and a nominal length of 10 feet. The deeper piezometers will be constructed of 2-inch nominal diameter schedule 80 PVC well casing and PVC screen. The screen will have a slot size of 0.010-inches and a nominal length of 10 feet. Monitoring wells located inside the building or on paved surfaces will be completed with flush mounted protective covers. The flush mounted protective covers will comply with the specifications listed in NR141.13(4) WAC. The remaining wells will be completed above grade with protective casings.

Previous site investigation work conducted at the site indicates the water table occurs at a depth of 1 to 7 feet bgs; therefore, a variance to the sealing requirements specified in NR141.13 WAC is requested in order to place the well screens as close to the top of the water table as practical.

The locations, ground surface elevation, top of protective cover elevation, and top of well casing elevation of the monitor wells will be surveyed by a licensed surveyor in accordance with the specifications listed in NR141.065(2) WAC. WDNR monitoring well construction summary forms will be completed for each monitor well and will be included in an appendix of the site investigation report.

The monitor wells will be developed by Tetra Tech GEO personnel in accordance with the procedures described in NR141.21 WAC. PVC bailers will be used to surge and purge the monitor wells during development. If a monitor well does not bail dry, a portable submersible pump may be used to complete the development of the well. Tetra Tech GEO personnel will complete WDNR monitoring well development forms for each monitor well. The monitoring well development forms will be included in an appendix of the site investigation report.

Groundwater samples will be collected from the monitor wells after development of the wells is completed. The groundwater sampling round will be scheduled to occur a minimum of one week after the development of the monitor wells is completed to allow the zone disturbed during the drilling and development procedures to return to natural conditions. The groundwater samples will be submitted for laboratory analyses of VOCs by EPA Method 8260, SVOCs or PAHs by EPA Method 8270, RCRA metals by Methods 6010/7470 and PCBs by EPA Method 8082. For the SVOC/PAH analyses 5 samples will be analyzed for the full SVOC parameter list and 13 samples will be analyzed for the PAH parameter list. Figure 7 shows all the sampling locations and which are selected for SVOC or PAH analyses.

Sample containers provided by the laboratory subcontractor will be used to collect the groundwater samples. One duplicate groundwater sample will be collected from one of the monitor wells for QA/QC purposes. The duplicate sample will be submitted for laboratory analyses of VOCs and SVOCs. The groundwater samples will be stored at a temperature of approximately 4 degrees Celsius and will be delivered to the laboratory following standard chain-of-custody procedures. Each sample container will have a self-adhesive label attached to it with the sample identification and date and time the sample was collected written on the label. The sample identification will consist of the monitor well identification.

Because fine-grained sediment in groundwater samples can result in “false positive” detections of SVOCs/PAHs and metals, the low-flow purging and sampling method will be used to collect the groundwater samples from the monitor wells as the low-flow method is intended to prevent producing fines during the sampling process. A peristaltic pump and dedicated polyethylene sample tubing will be used to collect the groundwater samples. A description of the low-flow purging and sampling method is provided in Appendix D.

Slug tests will be performed on the site monitor wells after the wells are developed. The slug test data will be used to calculate hydraulic conductivity values of the saturated unconsolidated deposits beneath the site.

Depth to groundwater measurements will be collected from the monitor wells in conjunction with the groundwater sampling round. An electronic water level meter will be used to measure the water levels in the monitor wells to the nearest 0.01 foot. The water level measurements will be used to document the horizontal gradient and groundwater flow direction across the study area.

#### **4.0 DECONTAMINATION AND INVESTIGATIVE WASTE HANDLING**

The downhole sampling equipment used to collect the soil samples will be decontaminated between samples using a solution of trisodium phosphate (TSP) and potable water. A stiff bristle brush will be used to remove soil particles from the sampling equipment. The equipment will then be rinsed with potable water.

The bailers and portable pumps used to develop the monitor wells will be decontaminated between wells using a solution of TSP and potable water. The inner and outer surfaces of the bailers will be rinsed with the TSP and water solution. The bailers will then be rinsed with distilled water and dried before being used to develop another monitor well. If a portable pump is used to develop the wells, the pump will be decontaminated between wells by operating the pumping for several minutes in a 5-gallon bucket containing a solution of TSP and potable water. The pump will then be operated for several minutes in a 5-gallon bucket containing clean potable water and then rinsed with distilled water. The pump will be allowed to dry before being used in another monitor well.

The drilling/Geoprobe® subcontractor will be instructed to provide clean drill rods for the drilling of the boreholes in which the monitor wells will be installed. The drill rods used during the investigation will be cleaned using a pressure washer or a steam cleaner.

The soil cuttings produced during the installation of the soil borings and monitor wells will be contained in 55-gallon drums and temporarily stored on-site pending determination of appropriate disposal options for the soil. The drums will be labeled as containing soil cuttings. The date the soil cuttings were generated and the borehole identification from which the soil cuttings were collected will also be included on the drum labels. The analytical results from the soil investigation will be used to determine appropriate disposal options for the soil cuttings. If it is determined the drummed soil needs to be taken off-site for disposal, samples of the drummed soil would be collected and submitted for waste profile analysis.

Groundwater produced during the development and sampling of the monitor wells will be contained pending receipt of the analytical results from the groundwater sampling round. The vessels containing the groundwater will be labeled as containing groundwater. The monitor well identification from which the groundwater was purged and the date(s) the groundwater was purged from the monitor wells will also be noted on the labels. The analytical results from the groundwater sampling round will be used to determine appropriate disposal options for the contained groundwater. Additional sampling of the groundwater may be performed if it is determined that the contained groundwater needs to be disposed of off-site.

## 5.0 REPORT

Once all the tasks described above are completed, and if it is determined that soil and groundwater impacts have been adequately defined, a site investigation report in compliance with the requirements of Chapter NR716 WAC will be prepared by Tetra Tech GEO personnel presenting the findings of the site investigation. The report will include copies of the WDNR soil boring logs, monitor well construction summary forms, and monitor well development forms for the soil borings and monitor wells installed as part of this scope of work and copies of the soil and groundwater analytical results. Tables summarizing the soil and groundwater analytical results and figures showing the locations of the soil borings and monitor wells will also be included in the report. The analytical summary tables will include the detection limit for any parameter concentration below the limit of quantification. If it is determined that the soil or groundwater impacts have not been adequately defined, recommendations to implement another phase of site investigation work to address the data gaps will be prepared.

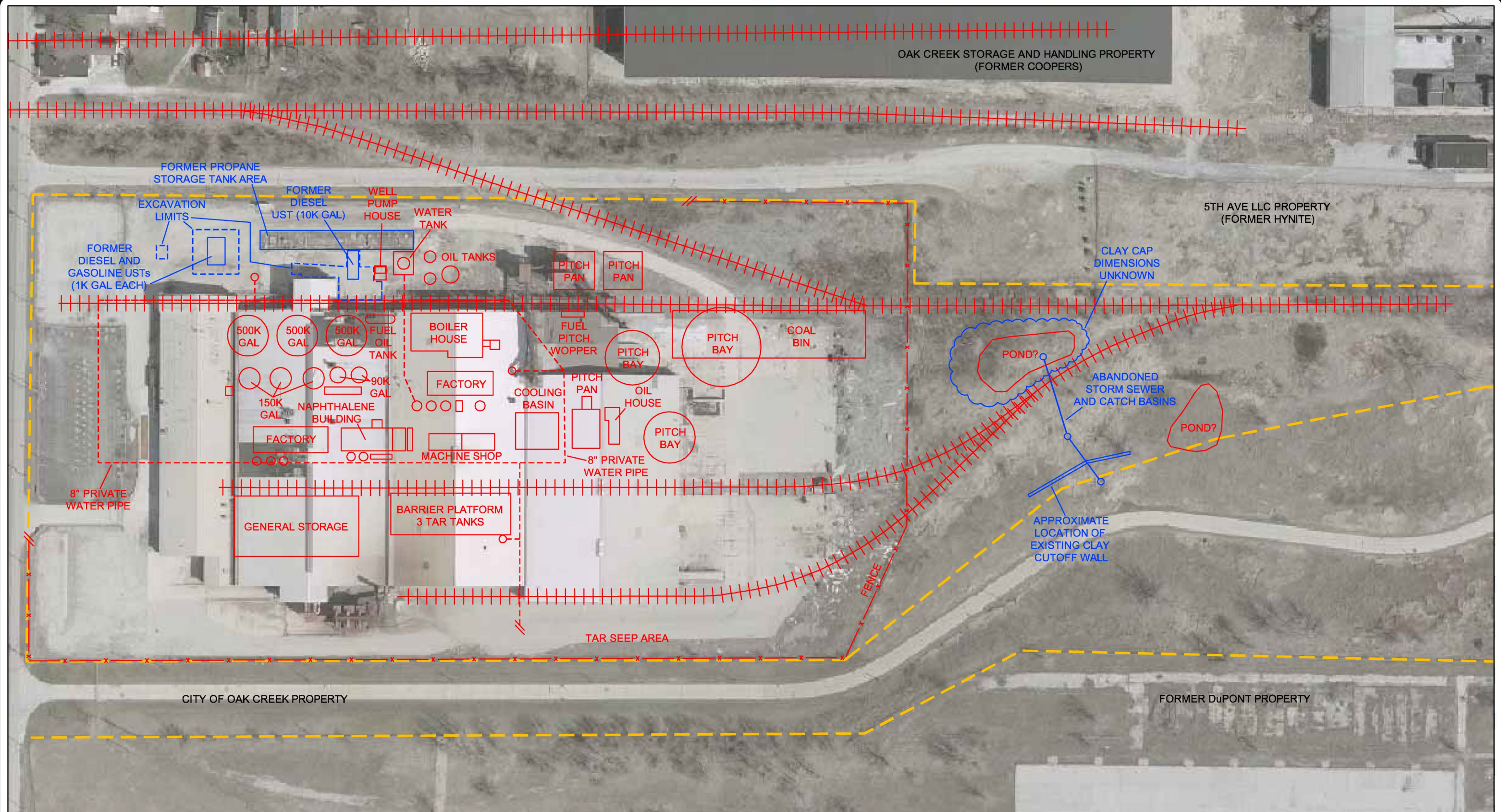
## **6.0 PROJECT SCHEDULE AND HEALTH AND SAFETY PLAN**

Site access agreements are being obtained with the property owners and subcontracts are being established for Geoprobe and drilling work. Boring locations will be marked in the field and utility clearance will be obtained. The site investigation activities are anticipated to begin in early October, subject to contractors' availability. The soil investigation and installation and development of the monitor wells should take two to three weeks to complete. As described above, the sampling of the monitor wells will be scheduled to take place at least one week after development of the monitor wells is completed.

GeoTrans personnel have prepared a health and safety plan. A copy of the health and safety plan is included as Appendix E.

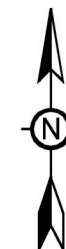
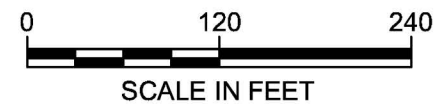
## FIGURES



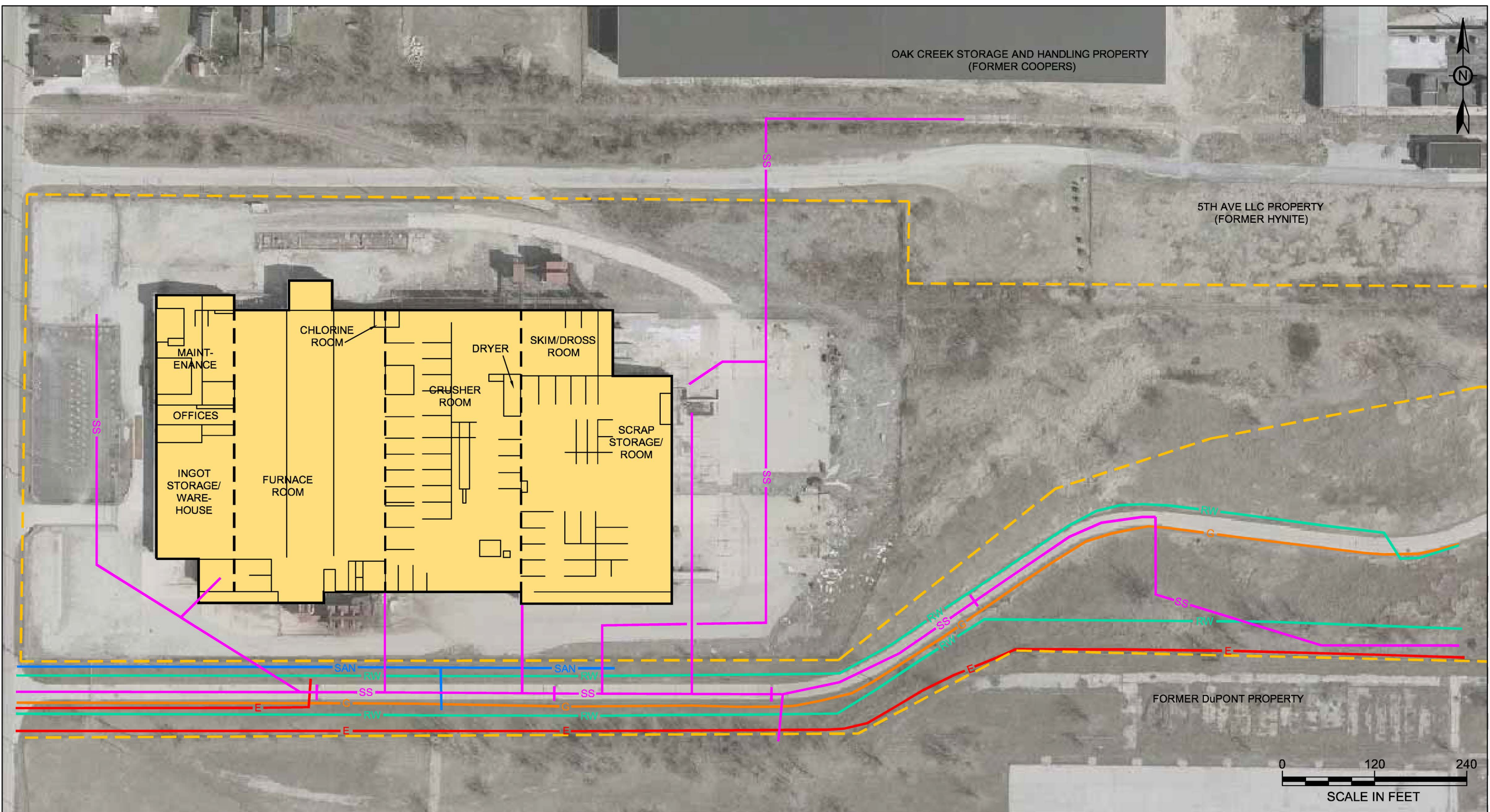


**EXPLANATION**

- FORMER TAR PLANT STRUCTURES
- PAST REMEDIAL ACTIVITIES
- APPROXIMATE PROPERTY BOUNDARY



TITLE: <b>CONNELL LLC PROPERTY SITE LAYOUT</b>			
LOCATION: <b>OAK CREEK, WISCONSIN</b>			
	CHECKED	MRN	FIGURE: <b>2</b>
	DRAFTED	HJW	
	PROJECT	117-2201220	
	DATE	7/16/10	



**EXPLANATION**

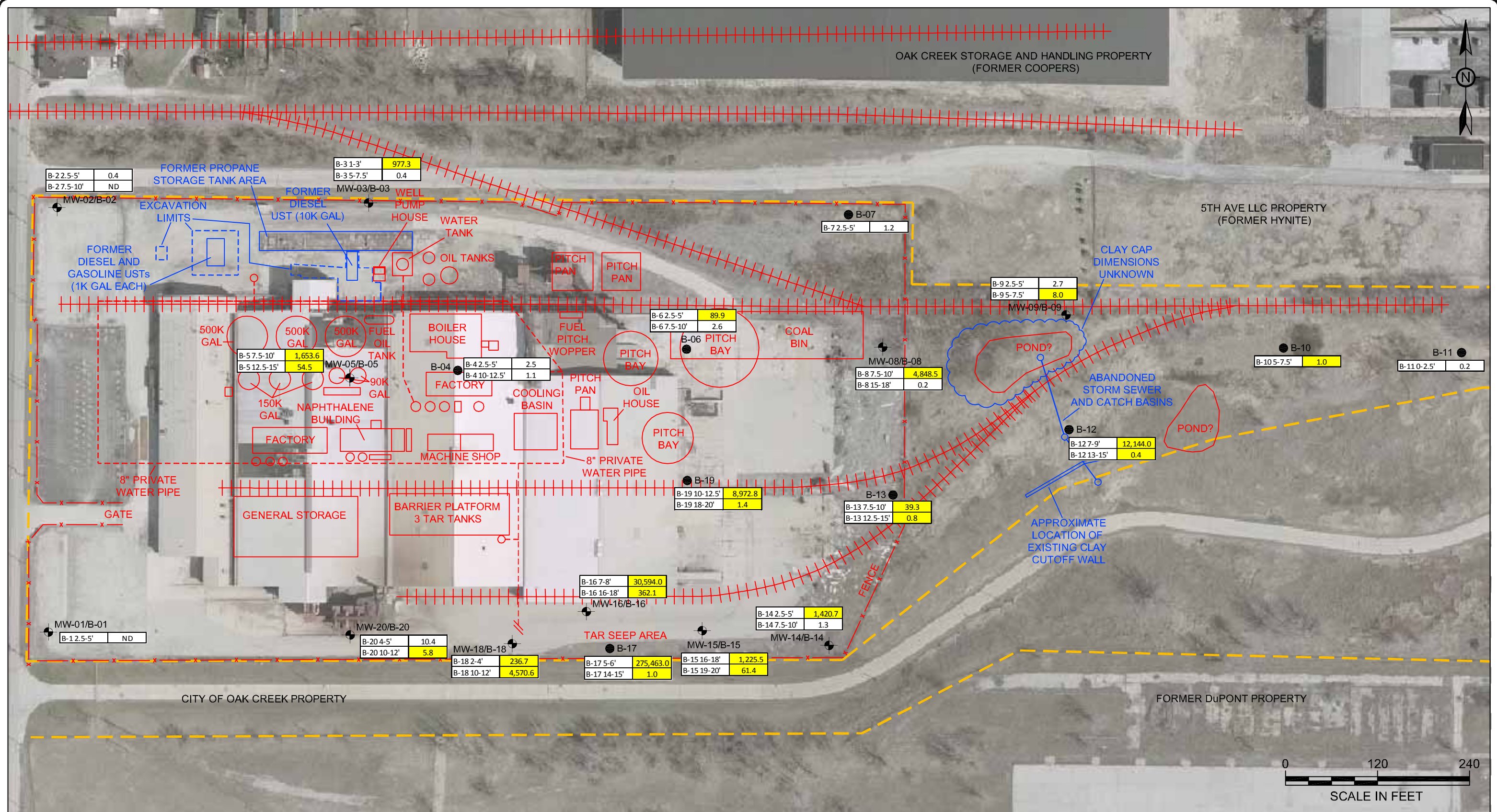
- APPROXIMATE PROPERTY BOUNDARY
- E— ELECTRICAL
- G— NATURAL GAS
- RW— RAW WATER
- SAN— SANITARY
- SS— STORM SEWER

**NOTES:**

1. Building layout and on-site utility locations from Connell Phase II report (RMT, 2010).
2. Utility locations on City Utility property from site investigation report (Bonestroo, 2010).

<b>TITLE:</b> CONNELL LLC PROPERTY			
INTERIOR BUILDING LAYOUT AND SUBSURFACE UTILITY LOCATIONS			
<b>LOCATION:</b> OAK CREEK, WISCONSIN			
	CHECKED	MRN	<b>FIGURE:</b>  <b>3</b>
	DRAFTED	HJW	
	PROJECT	117-2201220	
DATE	9/22/11		





**EXPLANATION**

- FORMER TAR PLANT STRUCTURES
- PAST REMEDIAL ACTIVITIES

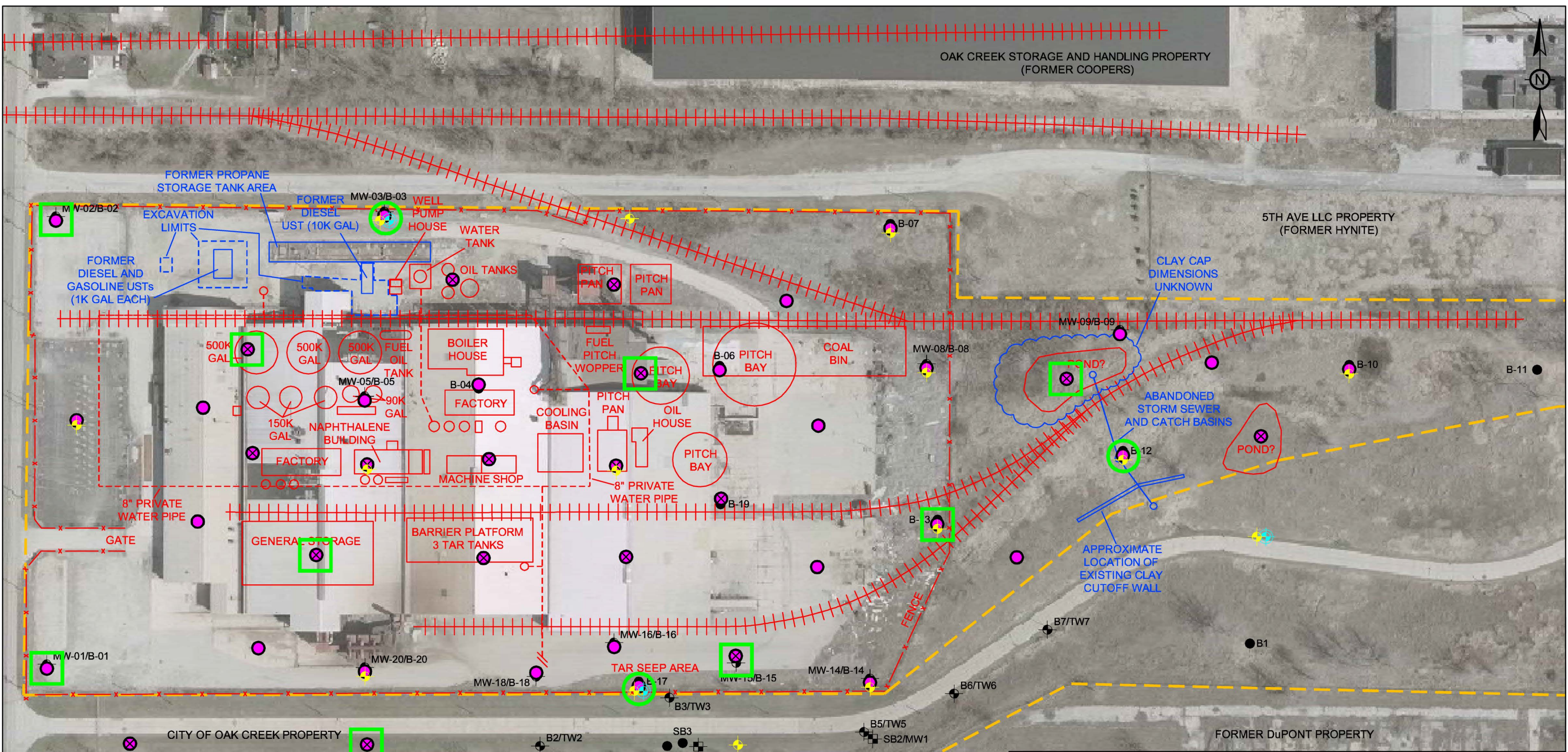
- APPROXIMATE PROPERTY BOUNDARY
- B-04 EXISTING SOIL BORING
- MW-01/B-01 TEMPORARY GROUNDWATER MONITORING WELL

TOTAL PAH CONCENTRATIONS IN SOIL (mg/Kg) AND SAMPLE DEPTH (HIGHLIGHTED VALUES INDICATE ONE OR MORE PARAMETERS EXCEEDS PROTECTION OF GROUNDWATER STANDARD)

**NOTE:** SAMPLING DATA FROM CONNELL PHASE II, AUGUST 2010

TITLE: CONNELL LLC PROPERTY TOTAL PAH CONCENTRATIONS IN SOIL			
LOCATION: OAK CREEK, WISCONSIN			
	CHECKED	MRN	FIGURE: <b>5</b>
	DRAFTED	HJW	
	PROJECT	117-2201220	
	DATE	3/31/11	





OAK CREEK STORAGE AND HANDLING PROPERTY  
(FORMER COOPERS)

5TH AVE LLC PROPERTY  
(FORMER HYNITE)

FORMER PROpane  
STORAGE TANK AREA

FORMER DIESEL  
UST (10K GAL)

WELL PUMP  
HOUSE

OIL TANKS

PITCH PAN

BOILER HOUSE

FUEL OIL TANK

COAL BIN

FUEL PITCH WOPPER

PITCH BAY

OIL HOUSE

NAPHTHALENE BUILDING

FACTORY

COOLING BASIN

PITCH PAN

PITCH BAY

BARRIER PLATFORM  
3 TAR TANKS

GENERAL STORAGE

TAR SEEP AREA



APPROXIMATE  
LOCATION OF  
EXISTING CLAY  
CUTOFF WALL

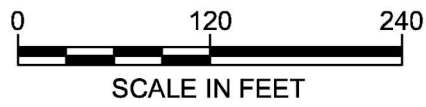
ABANDONED  
STORM SEWER  
AND CATCH BASINS

POND?




FORMER DuPONT PROPERTY






CITY OF OAK CREEK PROPERTY




-  GROUNDWATER SAMPLES FOR SVOC ANALYSIS (INSTEAD OF PAH)
-  SOIL SAMPLES FOR SVOC ANALYSIS (INSTEAD OF PAH)




**EXPLANATION**

-   FORMER TAR PLANT STRUCTURES
-  PAST REMEDIAL ACTIVITIES

-  B-04 EXISTING SOIL BORING
-  MW-01/B-01 TEMPORARY GROUNDWATER MONITORING WELL
-  SB1/MW23 PERMANENT GROUNDWATER MONITORING WELL
-  PROPOSED WATER TABLE WELL
-  PROPOSED NESTED PIEZOMETER

-  PROPOSED SOIL BORING - SAMPLING INTERVAL 0-2' ONLY VOCs, PAHs, PCBs, METALS
-  PROPOSED SOIL BORING - SAMPLING INTERVALS 0-2', 4-6' & 8-10' VOCs, PAHs, PCBs, METALS
-  APPROXIMATE PROPERTY BOUNDARY

TITLE: CONNELL LLC PROPERTY PROPOSED SOIL BORINGS AND MONITORING WELLS			
LOCATION: OAK CREEK, WISCONSIN			
	CHECKED	MRN	FIGURE: 7
	DRAFTED	HJW	
	PROJECT	117-2201220	
DATE	9/22/11		

**APPENDIX A**  
**VULCAN MATERIALS ACTIVITIES**

RECEIVED S.E.D.

**Vulcan Materials Company** Aug 15 4 07 PM '80

METALS DIVISION / 9100 SOUTH 5TH AVENUE • OAK CREEK, WISCONSIN 53154 • TELEPHONE 414 764-2200



August 14, 1980

Mr. Tim Krueger, Chief  
Solid Waste Department  
Wisconsin Department of Natural Resources  
9722 West Watertown Plank Road  
Milwaukee, Wisconsin

Dear Mr. Krueger,

Thank you for assisting us in evaluating the problem of the tars discarded many years ago on what is now our Oak Creek property.

As per our 8/8 inspection, discussion and agreement, we will take the necessary actions to properly contain this material in place at the center of our property and protect it from transient water.

The key parts of this plan include:

1. Install a sound clay dam keyed into the natural clay at the crest of the hill above the City's storm sewer manhole.
2. Drain the pond NW of the swale area (across the spur track). Backfill with compacted clay to minimize underground passage of water into the treated area.
3. Seal the top of the marshy swale with 1' to 2' of compacted clay, eliminate standing pools and provide paved watercourses to carry surface water across the sealed area to the storm sewer.

This work will be done expediently and we will keep you informed of our progress.

Please phone me if you have any questions.

VULCAN MATERIALS COMPANY  
Metals Division

L. C. Wichmann  
General Operations Manager

LCW/rjw



RECEIVED S.E.D.

**Vulcan Materials Company**

METALS DIVISION / 9100 SOUTH 5TH AVENUE • OAK CREEK, WISCONSIN 53154 • TELEPHONE 414 764-2200

OCT 15 10 41 AM '80



October 13, 1980

Mr. Tim Krueger, Chief  
Solid Waste Department  
Wisconsin Department of Natural Resources  
9722 W. Watertown Plank Road  
Milwaukee, WI 53226

Dear Mr. Krueger,

On August 14, 1980, I wrote you concerning the existence of soils, located at our Oak Creek, Wisconsin, plant, that were permeated with oily residues due to many years of prior manufacturing activities at our plant site by previous owners. This letter is to provide you with additional information concerning these soils.

Vulcan's Oak Creek Plant site property was purchased by Vulcan in 1968. At that time, Vulcan engaged Kramp Construction Company to perform excavation services for Vulcan preparatory to building the plant. The soil that was removed by Kramp from our Oak Creek plant property was deposited at a site located at 03655 East American Avenue, Oak Creek, Wisconsin. This landfill site was then owned by Kramp Construction Company. In June of 1980 Mr. John D. Huber bought this landfill site.

We have informed Mr. Huber of our intention to provide you with information concerning the existence of the excavated soil on Mr. Huber's property. Kramp Construction Company has also been so apprised.

We will be happy to discuss this matter with you further at your convenience.

Very truly yours,

L. C. Wichmann  
General Operations Manager

LCW/11b

Spoke w/ Mr. Wischmann on 1<sup>st</sup>-16-80 regarding  
October 13, 1980 letter sent to SED office.  
Wischmann was advised by Vulcan attorneys  
to advise DNR and Mr. John Huber that  
soil contaminated with oil/pitch substance was  
deposited at 3655 E. American Ave. Oak Creek  
in 1968.



# Notification of Hazardous Waste Site

United States Environmental Protection Agency Washington DC 20460

This initial notification information is required by Section 103(c) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 and must be mailed by June 9, 1981.

Please type or print in ink. If you need additional space, use separate sheets of paper. Indicate the letter of the item which applies.

810206

WI #19  
WIS-000-001-157

### A Person Required to Notify:

Enter the name and address of the person or organization required to notify.

Name Vulcan Materials Company  
Street 9100 South 5th Avenue  
City Oak Creek State WI Zip Code 53154

### B Site Location:

Enter the common name (if known) and actual location of the site.

Name of Site Vulcan Materials Company  
Street 9100 South 5th Avenue  
City Oak Creek County Milwaukee State WI Zip Code 53154

### C Person to Contact:

Enter the name, title (if applicable), and business telephone number of the person to contact regarding information submitted on this form.

Name (Last, First and Title) Wichmann, L.C. - General Operations Manager  
Phone 414-764-2200

### D Dates of Waste Handling:

Enter the years that you estimate waste treatment, storage, or disposal began and ended at the site.

From (Year) Early 1900's To (Year) Mid 1960's

### E Waste Type: Choose the option you prefer to complete

**Option 1:** Select general waste types and source categories. If you do not know the general waste types or sources, you are encouraged to describe the site in Item I—Description of Site.

#### General Type of Waste:

Place an X in the appropriate boxes. The categories listed overlap. Check each applicable category.

- 1.  Organics
- 2.  Inorganics
- 3.  Solvents
- 4.  Pesticides
- 5.  Heavy metals
- 6.  Acids
- 7.  Bases
- 8.  PCBs
- 9.  Mixed Municipal Waste
- 10.  Unknown
- 11.  Other (Specify)

#### Source of Waste:

Place an X in the appropriate boxes.

- 1.  Mining
- 2.  Construction
- 3.  Textiles
- 4.  Fertilizer
- 5.  Paper/Printing
- 6.  Leather Tanning
- 7.  Iron/Steel Foundry
- 8.  Chemical, General
- 9.  Plating/Polishing
- 10.  Military/Ammunition
- 11.  Electrical Conductors
- 12.  Transformers
- 13.  Utility Companies
- 14.  Sanitary/Refuse
- 15.  Photofinish
- 16.  Lab/Hospital
- 17.  Unknown
- 18.  Other (Specify)

Wood Treating

**Option 2:** This option is available to persons familiar with the Resource Conservation and Recovery Act (RCRA) Section 3001 regulations (40 CFR Part 261).

#### Specific Type of Waste:

EPA has assigned a four-digit number to each hazardous waste listed in the regulations under Section 3001 of RCRA. Enter the appropriate four-digit number in the boxes provided. A copy of the list of hazardous wastes and codes can be obtained by contacting the EPA Region serving the State in which the site is located.


000008 JUN-281

JUN 02 1981

Notification of Hazardous Waste Site

Side Two

F Waste Quantity:

Place an X in the appropriate boxes to indicate the facility types found at the site.

In the "total facility waste amount" space give the estimated combined quantity (volume) of hazardous wastes at the site using cubic feet or gallons.

In the "total facility area" space, give the estimated area size which the facilities occupy using square feet or acres.

Facility Type

- 1. Piles
2. Land Treatment
3. Landfill
4. Tanks
5. Impoundment
6. Underground Injection
7. Drums, Above Ground
8. Drums, Below Ground
9. Other (Specify) Soil contaminated in spots with oily residues.

Total Facility Waste Amount

cubic feet Unknown

gallons

Total Facility Area

square feet

acres approximately 2 A

G Known, Suspected or Likely Releases to the Environment:

Place an X in the appropriate boxes to indicate any known, suspected, or likely releases of wastes to the environment.

- Known Suspected Likely None

Note: Items Hand I are optional. Completing these items will assist EPA and State and local governments in locating and assessing hazardous waste sites.

H Sketch Map of Site Location: (Optional)

Sketch a map showing streets, highways, routes or other prominent landmarks near the site. Place an X on the map to indicate the site location. Draw an arrow showing the direction north. You may substitute a publishing map showing the site location.

See Map 1 and Map 2

I Description of Site: (Optional)

Describe the history and present conditions of the site. Give directions to the site and describe any nearby wells, springs, lakes, or housing. Include such information as how waste was disposed and where the waste came from. Provide any other information or comments which may help describe the site conditions.

In 1968 Vulcan Materials Company purchased a building site in Oak Creek, Wisconsin. We built a secondary aluminum smelter on the site and have operated the plant since then.

In 1980 we became aware of very small quantities of an oily material oozing from the soil in the eastern (unoccupied) part of our plant site. We subsequently determined that these residues were probably the result of a wood treating process by previous owners.

Vulcan then reported to the Wisconsin Department of Natural Resources (DNR) the existence of these oily residues, and after they were inspected, Vulcan proposed a plan to contain the residues at the site. DNR approved the plan, which has been implemented and is preventing seepage of the oily material.

Subsequent to informing DNR of the oily residues, Vulcan discovered that some soil containing oily residues was excavated from this plant site by a contractor and removed to a site nearby on American Avenue. This site is marked on Map #1 (enclosed). We notified the present owner of the site of this situation and also notified the DNR.

J Signature and Title:

The person or authorized representative (such as plant managers, superintendents, trustees or attorneys) of persons required to notify must sign the form and provide a mailing address (if different than address in item A). For other persons providing notification, the signature is optional. Check the boxes which best describe the relationship to the site of the person required to notify. If you are not required to notify check "Other"

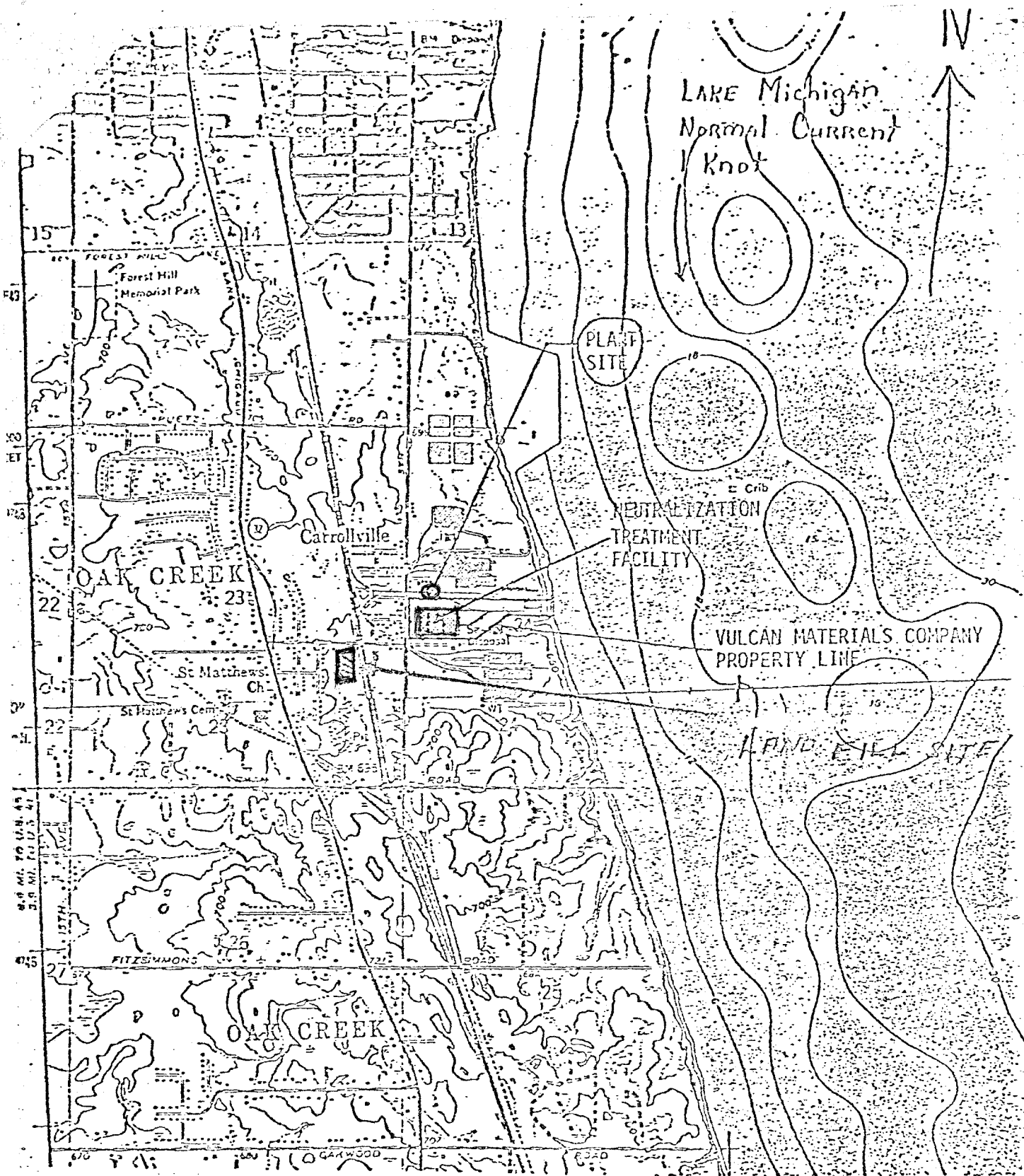
Name L. C. Wichmann

Street 9100 South 5th Avenue

City Oak Creek State WI Zip Code 53154

Signature [Signature] Date

- Owner, Present
Owner, Past
Transporter
Operator, Present
Operator, Past
Other



PLANT SITE LOCATION MAP - # 2  
 VULCAN MATERIALS COMPANY  
 OAK CREEK, WISC.

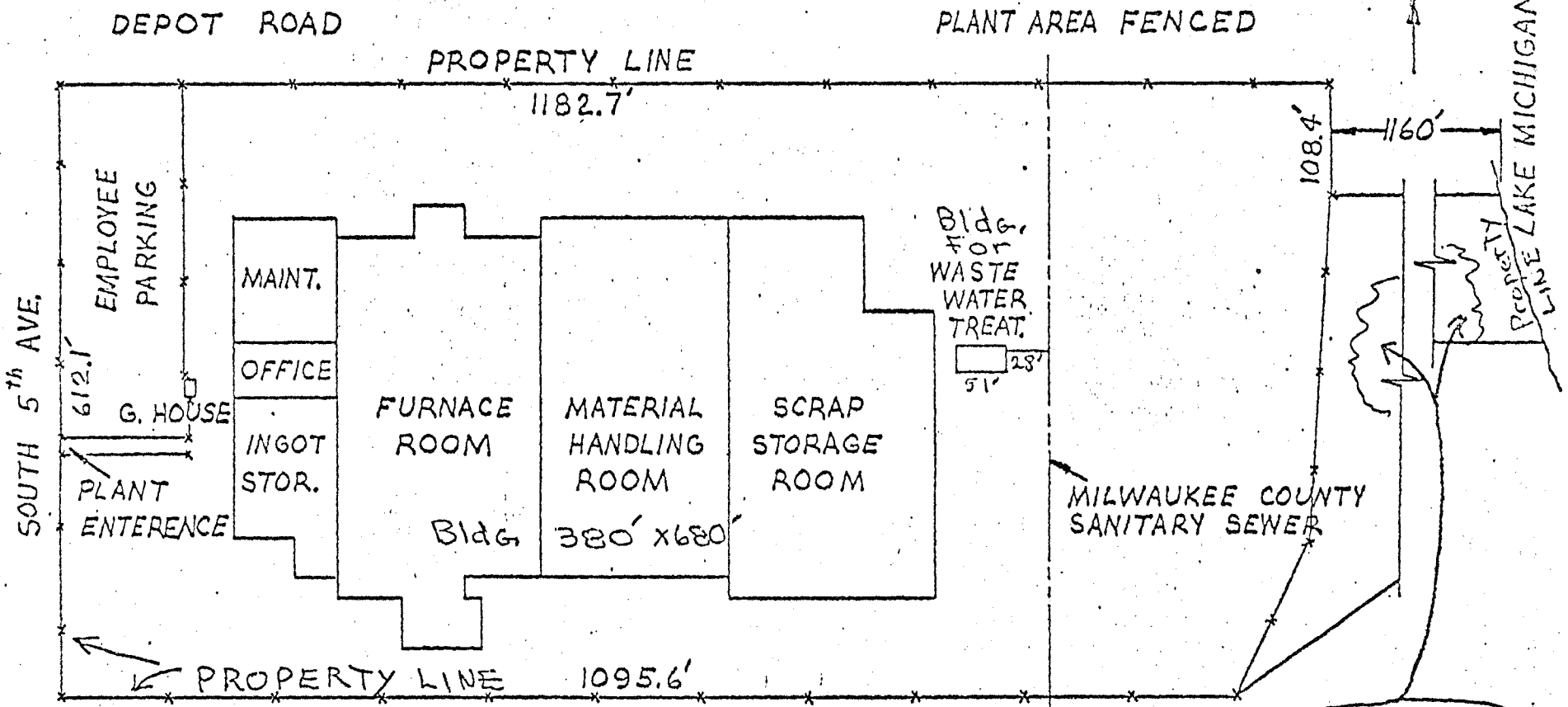
REF. USGS  
 SOUTH MILWAUKEE, WISC.  
 N4252.5-W8745/7.5  
 GREENDALE, WIS.  
 N4252.5-W8752.5/7.5  
 PACINE NORTH WIS.  
 N4245-W8745/7.5

Plant Location - Latitude 42° 52' 30"  
 Longitude 87° 52' 30"

SCALE - 1:24000

NOTE:

TOTAL PROCESSING PLANT AREA FENCED



MAP # 2  
 VULCAN MATERIALS COMPANY  
 OAK CREEK, WI PLANT  
 SCALE: 1"=150'  
 DATE: 10-29-80

Past landfill by previous owners. Exact dimensions and location of landfill material unknown. There are no structures of any kind in this unoccupied area.

Wabash  
Alloys

9100 South 5th Avenue  
Oak Creek, Wisconsin 53154  
414 764 2200

A Division of  
Cannell  
Limited  
Partnership

## Wabash

October 6, 1995

**Ms. Margaret M. Graefe  
Hydrogeologist  
Environmental Repair Program  
Department of Natural Resources  
4041 North Richards Avenue  
Milwaukee, WI 53212**

**Re: Storm Sewer**

**Dear Ms. Graefe:**

Recently, we noticed the presence of black viscous material in tow catch basins located an older storm sewer line that runs through our property. We believe the material may be entering through cracks or a deterioration of the storm sewer line. We have retained RMT, Inc. to investigate the matter and to assist us in evaluating and implementing appropriate repairs.

We anticipate having a more detailed understanding of the situation shortly. After receiving RMT Inc.'s recommendation, we will provide you with a status report and a time schedule for implementing the recommendations.

If you have any questions or would like any additional information, please call.

Very truly yours,



**Paul Lemke  
Plant Manager**

October 18, 1995

Ms. Margaret M. Graef  
Hydrogeologist  
Wisconsin Department of Natural Resources  
4041 N. Richards Street  
Milwaukee, WI 53212

RE: Storm Sewer at Wabash Alloys Facility in Oak Creek, Wisconsin

Dear Margaret:

This letter is a follow up to the October 6, 1995, letter sent by Paul Lemke, Plant Manager at the Wabash Facility in Oak Creek. RMT, Inc. (RMT), is assisting Wabash in investigating this situation. The results of this investigation and proposed solution are included in this letter.

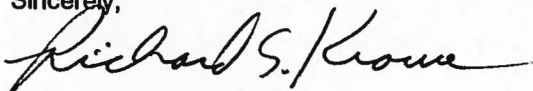
Wabash personnel recently noticed a material on the walls of two catch basins in a storm sewer line located on the eastern side of their property and have determined that there are cracks in this section of the pipe. They reported their observations to the Wisconsin Department of Natural Resources and pursued a focused review of site conditions. A floating sorbant pad has been place in the manhole to prevent any discharge of material from the manhole. This pad is monitored regularly and replaced when needed.

Wabash personnel have decided to repair the sewer line to prevent additional leaks. They determined that the quickest and most efficient way to do this is to install a new pipe inside the present one. Included with this letter is information on the Insituform process which we intend to use. This process will enable us to reconstruct the existing line by forming a new pipe inside the old one which will be compatible with the environment, self supporting, and permanent. We also plan to seal the catch basins to prevent releases around the new pipe or from the catch basins.

As part of this work, we will also observe the embankment south of the catch basins and sewer line to see if there are signs of other releases which may have occurred that would require other action.

We anticipate proceeding with this project as soon as actions can be coordinated with Insituform. If you have any questions, please call me at 414-879-1212.

Sincerely,



Richard S. Krouse, C.H.M.M.  
Manager, Milwaukee Office

Enclosures

cc: Paul Lemke - Wabash Alloys  
Ed Stolarz - Wabash Alloys  
John Curtin - Connell Limited Partnership



RMT, INC. — MILWAUKEE  
150 N. PATRICK BLVD.  
BROOKFIELD, WI - 53045  
414/879-1212 - 414/879-1220 FAX



April 25, 1997

Ms. Margaret M. Graef  
Hydrogeologist  
Wisconsin Department of Natural Resources  
4041 N. Richards Street  
Milwaukee, WI 53212

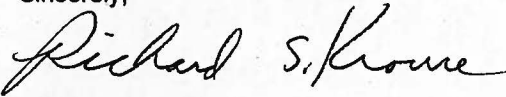
RE: Storm Drain at Wabash Alloys in Oak Creek, Wisconsin  
FID #241379050 *ERR/LUST  
ERP*

Dear Margaret:

This letter is a follow-up to our work in connection with the storm drainage system at the Wabash Alloys (Wabash) facility in Oak Creek. The work, completed in late 1996, included filling of the drain with controlled strength concrete (flowable fill) and importing soil material to regrade the ground surface, raise the low areas, and eliminate the need for the storm drain.

This work was completed and the documentation report for the project is enclosed with this letter. If you have any questions about the report or the project, please contact the undersigned or Paul Lemke at Wabash Alloys.

Sincerely,



Richard S. Krouse  
Project Manager

cmk

Enclosure

cc: John Curtin - Connell Ltd. Partnership  
Ed Stolarz - Wabash Alloys  
Paul Lemke - Wabash Alloys  
Leonard Lisciotto - Wabash Alloys  
Tom McElligott - Quarles and Brady



**RMT, INC. — MILWAUKEE**  
150 N. PATRICK BLVD.  
BROOKFIELD, WI - 53045  
414/879-1212 - 414/879-1220 FAX

**CONSTRUCTION DOCUMENTATION REPORT  
FOR  
WABASH ALLOYS  
STORM WATER DRAINAGE IMPROVEMENT**

**PREPARED FOR  
WABASH ALLOYS  
OAK CREEK, WISCONSIN**

**PREPARED BY  
RMT, INC.  
BROOKFIELD, WISCONSIN**




FID # 211379050  
ERR/LUST  
ERP


CONSTRUCTION DOCUMENTATION REPORT  
FOR  
WABASH ALLOYS  
STORM WATER DRAINAGE IMPROVEMENT


PREPARED FOR  
WABASH ALLOYS  
OAK CREEK, WISCONSIN

PREPARED BY  
RMT, INC.  
BROOKFIELD, WISCONSIN

MARCH 1997

  
\_\_\_\_\_  
Jeff Sasa  
Senior Engineering Technician

  
\_\_\_\_\_  
Michael J. Amstadt, P.E.  
Project Engineer

  
\_\_\_\_\_  
Richard Krouse, C.H.M.M.  
Project Manager



RMT, Inc. — MADISON, WI  
744 HEARTLAND TRAIL — 53717-1934  
P.O. Box 8923 — 53708-8923  
608/831-4444 — 608/831-3334 FAX

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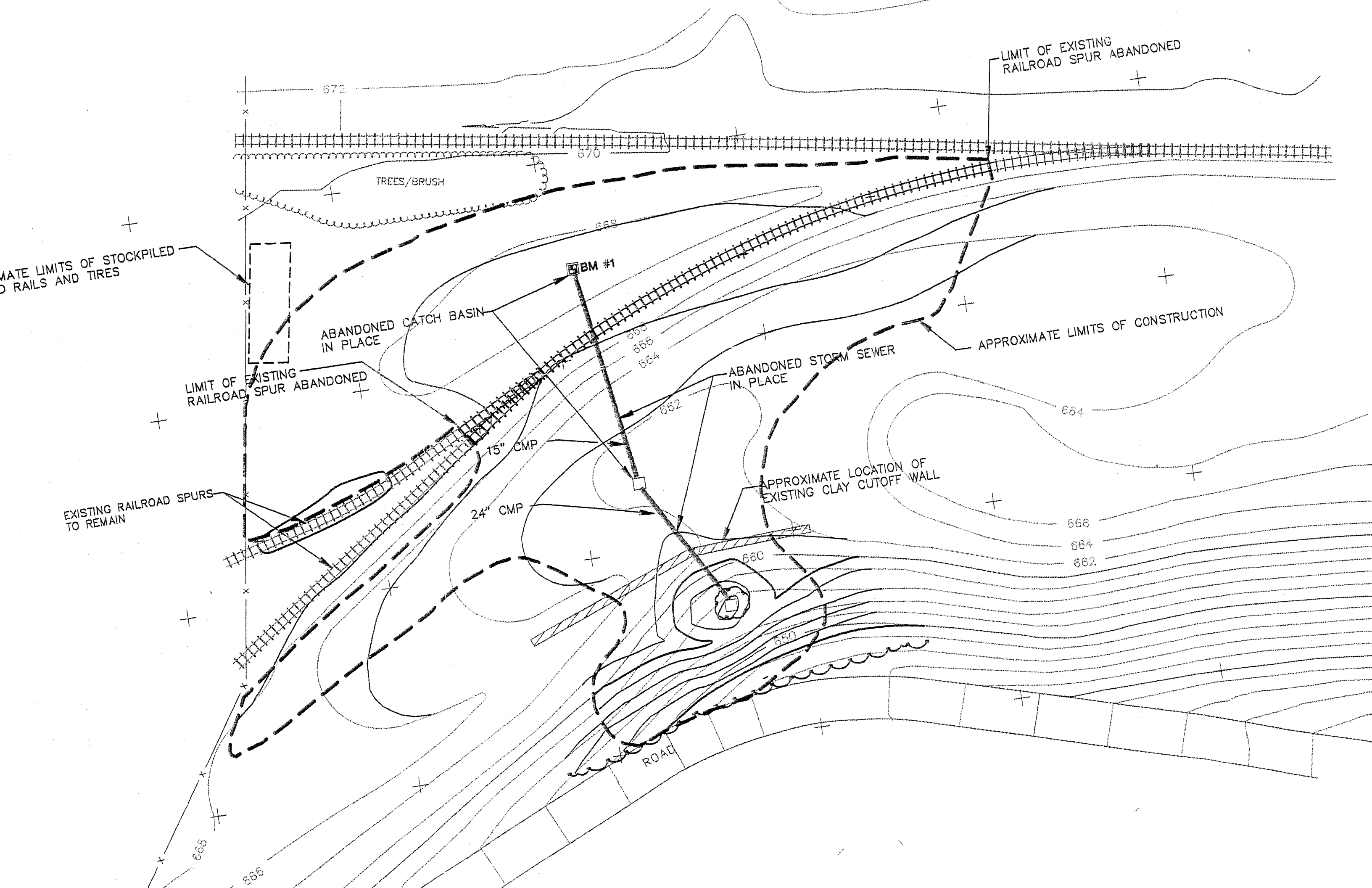
<u>Section</u>	<u>Page</u>
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1.1 Background.....	1
1.2 Purpose and Scope .....	2
<b>2. CONSTRUCTION DOCUMENTATION .....</b>	<b>3</b>
2.1 Railroad Spur Abandonment.....	3
2.2 Clearing.....	3
2.3 Catch Basin and Culvert Abandonment.....	3
2.4 Regrading .....	7
2.5 Topsoil Placement .....	7
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**List of Appendices**

Appendix A	Photographic Documentation
Appendix B	Laboratory Analysis Results
Appendix C	Waste Stream Profile and Accompanying Information

**List of Plan Sheets**

Plan Sheet 1	Existing Conditions
Plan Sheet 2	Final Grades



**APPENDIX B**  
**FIGURES AND TABLES FROM**  
**CONNELL PHASE II ESA (2010)**

**Table 1**  
**Summary of Samples and Locations**  
**Former Wabash Alloys Metal Recycling Facility**  
**Oak Creek, Wisconsin**

SAMPLE MEDIA	NUMBER OF SAMPLES	ANALYTES	LOCATIONS	COMMENTS
Water	10	VOCs, SVOCs, metals, cyanide	11 monitoring wells	Monitoring wells were installed to a depth of approximately 20 feet bgs. Well numbered as per their boring number, i.e., B-5 became MW-5.
Soil	36	VOCs, SVOCs, metals, cyanide	20 soil borings	Samples at surface and subsurface (above water table).
Water/Liquids	11	VOCs, SVOCs, metals, PCBs	Ladle Pits, Crusher Sump, floor drains (interior)	Samples were collected from the pits and sumps using a peristaltic pump.
Sludge	1	VOCs, SVOCs, metals, PCBs	Pit with hydraulic equipment in furnace room	Collected as a grab sample directly from the pit.
Waste Piles/Dust	11	PCBs, metals, TCLP metals and PCBs	2 from dross room, 2 from scrap storage room, 4 from crusher room, 2 from furnace room	Samples were collected from four different rooms in the building. One sample was composited for analysis for TCLP metals.
Concrete	10	PCBs	5 from crusher room, 3 from furnace room, 2 from scrap storage area	Concrete were drilled with a hammer drill at stained locations, the cuttings from the drill will be sampled. Multiple holes will be drilled within a sample location to obtain sufficient sample volume.
Wipe	10	PCBs	6 from crusher room, 2 from furnace room, 2 from scrap storage room	Wipe samples were collected from non porous surfaces such as metal beams and equipment.
Paint	3	Lead	One each from scrap storage, crusher, and furnace rooms	Samples were collected from three surfaces with chipping or peeling paint.
QA/QC	5	VOCs, SVOCs, RCRA Metals, PCBs as appropriate	Varied	One duplicate and one matrix spike/matrix spike duplicate was collected from each sample media (except paint and sludge), and analyzed for the same parameters as the parent sample. Inadvertently, no duplicate collected of subsurface soil.
<b>Total number of samples</b>	<b>97</b>			

Prepared by: N. Keller  
Checked by: L. Bakken

Table 2  
**Summary of Concrete Floor Sample Results**  
**Former Wabash Alloys Facility**  
**Oak Creek, Wisconsin**

SAMPLE ID	LOCATION	TOTAL PCB CONCENTRATION (mg/kg)
CRF-1	Crusher room	2.16
CRF-2	Crusher room	17.6
CRF-3	Crusher room	6.44
CRF-4	Crusher room	16.3
CRF-DUP	Crusher room	22.3
CRF-5	Crusher room	2.65
FRF-1	Furnace room	2.97
FRF-2	Furnace room	5.65
FRF-3	Furnace room	26.4
SRF-1	Scrap storage room	0.695
SRF-2	Scrap storage room	0.733

Note:

CRF-DUP collected from CRF-4 location.

Prepared by: N. Keller

Checked by: L. Bakken



Table 3  
 Summary of Wipe Sample Results  
 Former Wabash Alloys Facility  
 Oak Creek, Wisconsin

SAMPLE ID	SAMPLE LOCATION	PCB, TOTAL (Total ug)		
SSW-1	Steel reinforcement wall - south end	2.6		
SSW-2	Dryer cyclone/afterburner - north end	0.30	J	
CRW-1	Exit conveyor from crusher pit	4.6		
CRW-2	Incoming conveyor to crusher pit	3.2		
CRW-3	Crusher baghouse	1.5		
CRW-4	Crusher pit equipment	18.3		
CRW-5	Scrap dryer	<	0.22	U
CRW-6	Lunch room scale	0.53 J		
FRW-1	Furnace #4	<	0.22	U
FRW-1 DUP	Furnace #4	<	0.22	U
FRW-2	Electric control box - south end	0.26 J		

Qualifiers:

J - Estimated concentration above the adjusted detection limit and below the adjusted reporting limit.

U - Indicates the compound was analyzed for but not detected

Prepared by: N. Keller

Checked by: L. Bakken

Table 4  
 Summary of Waste Pile Analytical Results  
 May 20, 2010  
 Former Wabash Alloys Facility  
 Oak Creek, Wisconsin

PARAMETER	SCREENING VALUE	UNITS	WP-DR1	WP-DR2	WP-CR1	WP-CR2	WP-CR3	WP-CR4	WP-FR1	WP-FR2	WP-SS1	WP-SS2	WP-DUP	WP-COMP. <sup>(1)</sup>
Arsenic	100	mg/kg	13.4 JD3	< 1.2 UD3	1.9 JD3	< 1.1 UD3	9.0 JD3	1.6 JD3	1.8 J	< 1.3 UD3	< 1.1 UD3	< 1.1 UD3	< 1 UD3	< 0.0028 U
Barium	2000	mg/kg	93.7	317	1970	254	859	<b>4090</b>	60.9	367	1150	51.4	9.0	9.6
Cadmium	20	mg/kg	3.8 JD3	35.9	18.9	<b>21.4</b>	<b>152</b>	<b>67.6</b>	2.5	4.7 JD3	5.0 JD3	5.1	4.5 JD3	0.10 J
Chromium	100	mg/kg	<b>1250</b>	<b>419</b>	<b>376</b>	<b>3350</b>	<b>325</b>	<b>426</b>	32.1	<b>275</b>	<b>466</b>	<b>246</b>	<b>975</b>	0.0062 J
Lead	100	mg/kg	<b>359</b>	<b>1310</b>	<b>2500</b>	<b>1550</b>	<b>1890</b>	<b>2970</b>	<b>206</b>	<b>485</b>	<b>1180</b>	<b>448</b>	<b>945</b>	0.37 J
Mercury	4	mg/kg	0.16	2.0	0.10	0.29	<b>12.9</b>	1.9	0.098	0.70	0.037	0.062	0.026	< 0.1 U
PCB, Total	50	mg/kg	0.55	12.8	0.67	11.20	<b>148</b>	26.70	8.27	0.279	0.069.2 J	0.720	0.232	7.12
Selenium	20	mg/kg	6.9 JB, D3	8.9 JB, D3	10.2 JB, D3	7.8 JB, D3	19.2 JB, D3	13.6 JB, D3	1.6 JB	7.1 JB, D3	6.8 JB, D3	5.7 JB, D3	5.9 JB, D3	< 0.011 U
Silver	100	mg/kg	3.3 JD3	7.7 JD3	18.0	6.9 JD3	9.2 JD3	14.9	0.42 J	7.5 JD3	12.7	3.0 JD3	3.4 JD3	< 0.0023 U

Qualifiers:

J - Estimated concentration above the adjusted detection limit and below the adjusted reporting limit.

D3 - Sample was diluted due to the presence of high levels of non-target analytes or other matrix interference.

U - Indicates the compound was analyzed for but not detected

B- Analyte was detected in the associated method blank.

Notes:

1 - The Waste Pile Composite sample was analyzed for TCLP metals. Results for this analysis are in mg/L with the exception of total PCB, these results are in µg/kg.

Prepared by: N. Keller

Checked by: L. Bakken

Table 5  
 Summary of Liquids Sampling Analytical Results  
 Former Wabash Alloys Facility  
 Oak Creek, Wisconsin

PARAMETER	UNITS	HAZ. WASTE STANDARD	CRL-1	FRL-1	FRL-2	FRL-3	FRL-4	FRL-7	FRL-8	FRL-5	FRL-6	FRL-9	FRL-9 DUP	MRL-1	FRSL-1
3&4-Methylphenol(m&p Cresol)	ug/L		3.7 J	< 5670	< 92.1	< 0.77	< 0.89	< 0.77	< 0.78	< 0.78	< 0.79	< 0.78	< 0.79	< 0.78	
4-Chloro-3-methylphenol	ug/L		16.0	< 7450	< 121	< 1	< 1.2	< 1	< 1	< 1	< 1	< 1	< 1	< 1	
Arsenic	ug/L	5000	< 0.55	< 2.8	47.4 J	2.9 J	21.0	1.1 J	< 0.55	< 0.55	2.5 J	< 0.55	0.62 J	5.0 J	1100J
Barium	ug/L	100000	24.2	148	2720	877	125	66.3	53.0	32.0	21.2	49.2	48.4	79.2	13800
Benzo(a)pyrene	ug/L		< 0.97	< 7150	< 116	< 0.97	1.1 J	< 0.97	< 0.99	< 0.99	< 1	< 0.99	< 1	< 0.99	
Benzo(g,h,i)perylene	ug/L		< 0.77	< 5690	< 92.4	< 0.77	2.6 J	0.94 J	< 0.79	< 0.79	< 0.79	< 0.79	< 0.79	< 0.79	
Benzene	ug/L	500	< 0.41	< 0.41	1.6	< 0.41	< 0.41	< 0.41	< 0.41	< 0.41	< 0.41	< 0.41	< 0.41	< 0.41	
bis(2-Ethylhexyl)phthalate	ug/L		5.0	< 19200	< 312	< 2.6	< 3	< 2.6	< 2.7	< 2.7	< 2.7	< 2.7	< 2.7	< 2.7	
Cadmium	ug/L	1000	4.2 J	7.6 J	351	21.6	27.5	15.1	1.1 J	1.1 J	2.6 J	5.7	5.7	0.87 J	2500
Chloromethane	ug/L		< 0.24	< 0.24	< 0.24	0.24 J	< 0.24	< 0.24	< 0.24	< 0.24	< 0.24	< 0.24	< 0.24	< 0.24	
Chromium	ug/L	5000	0.62 J	5.5 JB	1140	72.0	53.3	11.2	1.8 J	9.0	0.91 J	1.6 J	1.6 J	0.73 J	5400
Dibenz(a,h)anthracene	ug/L		< 1.4	< 10200	< 166	< 1.4	2.2 J	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	
Indeno(1,2,3-cd)pyrene	ug/L		< 0.67	< 4940	< 80.2	< 0.67	2.0 J	< 0.67	< 0.68	< 0.68	< 0.69	< 0.68	< 0.69	< 0.68	
Lead	ug/L	5000	1.8 J	59.8	6200	556	53.6	55.2	1.8 J	17.4	6.5 J	4.8 J	5.1 J	<1.4	6000
Mercury	ug/L	200	1.6	< 0.2 D3	5.5	0.20	0.39	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	8.1J
Methylene Chloride	ug/L		< 0.43	0.79 JZ3	0.61 JZ3	0.92 JZ3	< 0.43	< 0.43	< 0.43	< 0.43	< 0.43	0.44 JZ3	< 0.43	0.93 JZ3	
PCB, Total	ug/L		4.7	211 J	30.5 J	0.70 J	8.5	< 0.32	< 0.32	< 0.3	< 0.3	< 0.32	< 0.32	<0.33	
PCB-1242 (Aroclor 1242)	ug/L		2.4	120 J											
PCB-1254 (Aroclor 1254)	ug/L		2.3	90.1 J	30.5 J	0.70 J	8.5								
Selenium	ug/L	1000	< 2.1	11.4 J	48.8 J	2.3 J	17.2 J	6.9 J	< 2.1	< 2.1	< 2.1	2.9 J	2.7 J	<2.1	300JB
Silver	ug/L	5000	<0.46	< 2.3	21.0 J	1.3 J	1.2 J	<0.46	<0.46	<0.46	<0.46	<0.46	<0.46	<0.46	<40

Qualifiers:  
 J - Estimated concentration above the adjusted detection limit and below the adjusted reporting limit.  
 B - Analyte was detected in the associated method blank.  
 Z3 - Methylene chloride is a common laboratory contaminant. Results of this analyte should be considered estimated unless the amount found in the sample is 3 to 5 times higher than that found in the blank.  
 D3 - Sample was diluted due to the presence of high levels of non-target analytes or other matrix interference.

Note:  
 FSRL sample results are in ug/kg.

Prepared by: N. Keller  
 Checked by: L. Bakken

Table 6  
 Paint Sample Analytical Results  
 Former Wabash Alloys Facility  
 Oak Creek, Wisconsin

SAMPLE ID	DESCRIPTION	LEAD CONCENTRATION (mg/kg)
SSPT-1	Safety yellow paint off bumper guards in scrap storage room	69200
CRPT-1	Grey paint and some yellow paint peeling off walls of lunch room in crusher room	516
FRPT-1	Grey paint that resembles above but taken in adjacent furnace room	35600

Prepared by: N. Keller  
 Checked by: L. Bakken

**Table 7**  
**Summary of Soil Analytical Results**  
**Former Wabash Alloys Facility**  
**Oak Creek, Wisconsin**

PARAMETER	UNITS	STANDARDS <sup>(1)</sup>	B-1	B-2	B-2	B-3	B-3	B-4	B-4	B-5	B-5	B-6	B-6	B-7	B-8	B-8	B-9	B-9	B-10	B-11	B-12
			2.5-5	2.5-5	7.5-10	1-3	5-7.5	2.5-5	10-12.5	7.5-10	12.5-15	2.5-5	7.5-10	2.5-5	7.5-10	15-18	2.5-5	5-7.5	5-7.5	0-2.5	7-9
1,2,4-Trimethylbenzene	ug/kg					126		109		51400	1420	116									145000
1,3,5-Trimethylbenzene	ug/kg					126				45800	1100										132000
2,4-Dimethylphenol	ug/kg									10400 J											
2-Methylnaphthalene	ug/kg	600000		55.1 J		3310 J				86900	469 J	237 J		23.2 J	674000	27.4 J		655	73.7 J		635000
2-Methylphenol(o-Cresol)	ug/kg									11100 J											
3&4-Methylphenol(m&p Cresol)	ug/kg									27400	3950										32.0 J
Acenaphthene	ug/kg	900000					J			49600		604 J			280000						635
Acenaphthylene	ug/kg	18000					2470 J								142000 J						321000 J
Anthracene	ug/kg	5000000					46900			35600		1590			179000						790
Arsenic	mg/kg	1.6	4.0	6.3	2.2 J	4.1	3.0	5.3	6.1	6.7	3.5	5.6	9.1	3.5	5.1	5.3	2.4	6.3	5.3	7.5	7.1
Barium	mg/kg		67.4	63.3	54.8	65.7	66.1	66.7	67.0	62.2	52.7	66.6	74.7	52.6	10.9	35.4	37.2	64.2	45.9	58.6	45.7
Benzene	ug/kg	5.5				80.2					1910				49000						34100 J
Benzo(a)anthracene	ug/kg	88		36.5 J		82300	51.5 J	211	118 J	13300 J		7220	237	107 J	161000		254	234	32.2 J		176000 J
Benzo(a)pyrene	ug/kg	8.8				81600	56.9 J	250	152 J	6850 J		9910	292	120 J	136000 J		409	206 J			145000 J
Benzo(b)fluoranthene	ug/kg	88		24.2 J		62000	52.3 J	213	127 J	6250 J		9220	320	111 J	133000 J		356	223	26.1 J		120000 J
Benzo(g,h,i)perylene	ug/kg	1800				55900		147 J				7470	191 J				250				
Benzo(k)fluoranthene	ug/kg	880				86600	69.2 J	278	164 J	6610 J		9300	277	116 J	112000 J		342	235			193000 J
bis(2-Ethylhexyl)phthalate	ug/kg																				
Cadmium	mg/kg	510	0.27 J	0.41 J	0.19 J	0.27 J	0.19 J	0.44 J	0.30 J	0.22 J	0.31 J	0.30 J	0.21 J	0.22 J	0.10 J	0.20 J	0.12 J	0.21 J	0.20 J	0.28 J	0.32 J
Chromium	mg/kg	200	23.1	22.1	19.4	23.6	23.8	22.7	25.2	20.1	16.5	24.6	30.7	19.4	6.8	16.0	15.4	34.4	19.4	29.7	14.6
Chrysene	ug/kg	8800		35.7 J		85800	49.5 J	258	139 J	14500 J		9100	303	122 J	142000 J		334	302	48.8 J		278000 J
Cyanide	mg/kg					0.54 J															0.52
Dibenz(a,h)anthracene	ug/kg	8.8				14200 J						1730	47.9 J								844
Dibenzofuran	ug/kg									48900					318000						364000 J
Ethylbenzene	ug/kg	2900									833				43300						
Fluoranthene	ug/kg	600000		55.5 J		157000	85.5 J	407	240	72800		7900	287	169 J	544000		252	721	92.3 J		763000
Fluorene	ug/kg	600000				14500 J				50500		725 J		22.5 J	318000						824
Indeno(1,2,3-cd)pyrene	ug/kg	88				55000		127 J				6990	153 J	47.5 J	57000 J		198 J	112 J			419000 J
Lead	mg/kg	500	10.5	22.3	9.2	16.2	5.8	14.0	12.8	7.8	6.7	10.6	11.5	5.7	3.3	7.3	9.0	10.4	7.1	12.4	7.0
m&p-Xylene	ug/kg	4100 <sup>(2)</sup>									2650				180000						103000 J
Mercury	mg/kg		0.014	0.025	0.026	0.45	0.014	0.019	0.023	0.019	0.012	0.034	0.021	0.0090 J	0.036	0.0089 J	0.038 1q	0.035 1q	0.0075 J1q	0.047 1q	0.037 1q
Naphthalene <sup>(3)</sup>	ug/kg	20000		32.8 J		2210		33.6 J	131	444000	14600	4390	181	388	2930000	280	129	1570	453	42.4 J	8730000
Naphthalene <sup>(4)</sup>	ug/kg	20000				10900 J		133		1000000	48700	2760	83.3 J	119	2410000	157			444	179	6320000
o-Xylene	ug/kg	4100 <sup>(2)</sup>									1010				63800						72300 J
Phenanthrene	ug/kg	18000		113 J		78800		190 J		144000		4420	163 J	111 J	952000			1690	148 J		1250000
Phenol	ug/kg									14200 J	1360 J										
Pyrene	ug/kg	500000		75.7 J		140000	72.0 J	320	197	54700		10700	286	130 J	411000		264	502	67.0 J		541000 J
Selenium	mg/kg		0.36 J	0.40 J		0.60 J	0.46 J	0.37 J	0.35 J		0.22 J	0.43 J			0.31 J	0.23 J	0.26 J	0.63 J	0.36 J	0.27 J	0.68 J
Silver	mg/kg		0.22 J	0.70 J	0.31 J	0.089 J	0.13 J	0.090 J	0.11 J	0.24 J	0.14 J	0.14 J	0.17 J	0.13 J	0.12 J	0.12 J		0.11 J	0.14 J	0.14 J	0.12 J
Styrene	ug/kg														48500						101000
Toluene	ug/kg	1500				61.0 J					2060				125000						83800

**Qualifiers**

- J - Estimated concentration above the adjusted detection limit and below the adjusted reporting limit.
- MO - Matrix spike recovery and/or matrix spike duplicate recovery was outside laboratory control limits.
- R1 - RPD value was outside control limits.
- 1q - Analyte had a negative detect in the associated method blank at -0.0055 mg/kg.

**Notes**

- This table lists detections only. Blank cells mean the constituent was not detected.
- 1 - Soil standards are compiled from NR720 Table 1, and PAH standards are the suggested non-industrial generic soil cleanup levels provided in the 1997 WDNR Document, "Soil Cleanup Levels for Polycyclic Aromatic Hydrocarbons (PAHs) Interim Guidance".
- 2 - Standard is for total xylenes.
- 3 - Analyzed using Method 8260
- 4 - Analyzed using Method 8270

Prepared by: N. Keller  
Checked by: L. Bakken

Table 7 (continued)  
 Summary of Soil Analytical Results  
 Former Wabash Alloys Facility  
 Oak Creek, Wisconsin

PARAMETER	UNITS	STANDARDS <sup>(1)</sup>	B-12 13-15	B-13 7.5-10	B-13 12.5-15	B-14 2.5-5	B-14 7.5-10	B-15 16-18	B-15 19-20	B-16 7-8	B-16 16-18	B-17 5-6	B-17 14-15	B-18 2-4	B-18 10-12	B-19 10-12.5	B-19 18-20	B-20 4-5	B-20 10-12
1,2,4-Trimethylbenzene	ug/kg			907	1670			65000	4280		3540	509000	105	114	10900	64900	110		
1,3,5-Trimethylbenzene	ug/kg			753	1540			42600	2900		2900	409000			8650	49000			
2,4-Dimethylphenol	ug/kg			1020 J									103 J						
2-Methylnaphthalene	ug/kg	600000	103 J	2900	61.0 J		157 J	88700	5750	876000 J	31000	12900000 J	58.0 J	849 J	209000	1050000	149 J		160 J
2-Methylphenol(o-Cresol)	ug/kg																		
3&4-Methylphenol(m&p Cresol)	ug/kg			172 J															
Acenaphthene	ug/kg	900000		1430 J				98.8 J	35700	1820	1520000	31900		2570 J	509000	332000 J			
Acenaphthylene	ug/kg	18000							178 J							90100 J			
Anthracene	ug/kg	5000000		784 J		61900	104 J	28000		3590000	9550			12000	160000	285000 J		169 J	
Arsenic	mg/kg	1.6	3.8	3.6	3.9	4.0	8.1	11.5	4.5	8.3	3.4	17.3	4.5	6.9	2.0 J	3.7	3.8	3.7	3.6
Barium	mg/kg		68.8	20.5	37.2	85.2	49.8	44.8	30.5	61.7	34.6	117	54.2	72.4	18.3	86.3	43.7	55.8	38.3
Benzene	ug/kg	5.5		212 J	442 J							286000	596			40400			
Benzo(a)anthracene	ug/kg	88		870 J		129000	56.4 J	12600 J	105 J	1240000	8540	2330000 J		17700	101000	153000 J		865 R1	129 J
Benzo(a)pyrene	ug/kg	8.8		921 J		89100	29.5 J	6950 J		905000 J	4280 J			21500	60100 J	107000 J		1140 M0, R1	69.2 J
Benzo(b)fluoranthene	ug/kg	88		984 J		70600	30.6 J	7300 J		846000 J	3400 J			18900	59800 J	96700 J		1010 R1	60.7 J
Benzo(g,h,i)perylene	ug/kg	1800				41100 J								16000				816 M0, R1	
Benzo(k)fluoranthene	ug/kg	880		1110 J		102000	36.3 J	6110 J		714000 J	5520 J			19400	63800 J	110000 J		991 R1	70.2 J
bis(2-Ethylhexyl)phthalate	ug/kg			7050															
Cadmium	mg/kg	510	0.23 J	0.21 J	0.25 J	0.33 J	0.25 J	0.19 J	0.19 J	0.62	0.28 J	3.1	0.17 J	0.33 J	0.17 J	0.17 J	0.18 J	0.24 J	0.22 J
Chromium	mg/kg	200	20.4	13.4	18.8	31.0	16.4	14.6	13.2	22.9	21.8	33.4	20.5	27.5	6.1	35.0	14.4	18.5	14.6
Chrysene	ug/kg	8800		1100 J		108000	87.0 J	19700		1320000	7590			20900	103000	227000 J		1080 M0, R1	93.5 J
Cyanide	mg/kg									0.41 J		84.2							
Dibenz(a,h)anthracene	ug/kg	8.8				11600 J								3340 J				189 J	
Dibenzofuran	ug/kg			1030 J				29400	1560	1570000	24600				376000	339000 J			
Ethylbenzene	ug/kg	2900		340 J	1130			10900	643		1290 J	297000				32200			
Fluoranthene	ug/kg	600000	36.8 J	2450		270000	165 J	41600	355 J	3640000	32600	7000000 J	57.9 J	31400	476000	502000 J	75.8 J	1240 M0, R1	506
Fluorene	ug/kg	600000	31.8 J	917 J		30400 J	100 J	32100	1280	2280000	27600	4150000 J	28.9 J	2980 J	448000	343000 J	55.3 J	74.5 J	234 J
Indeno(1,2,3-cd)pyrene	ug/kg	88		631 J		48000				443000 J	1880 J			14700	23900 J			753 R1	
Lead	mg/kg	500	6.3	6.5	6.1	14.1	8.8	7.8	6.2	24.7	8.1	155	6.5	12.2	3.5	11.1	5.6	7.2	6.1
m&p-Xylene	ug/kg	4100 <sup>(2)</sup>		1150	961 J			45600	3330			834000				140000			
Mercury	mg/kg		0.0090 J1q	0.0083 J1q	0.0053 J1q	0.048	0.0083 J	0.010 J	0.0097 J	0.44	0.0096 J	84.4	0.012	0.11	0.010 J	0.077	0.010 J	0.032	0.045
Naphthalene <sup>(3)</sup>	ug/kg	20000	905	28300	36400	173	201	128000	7520	782000	176000	17200000	1210	3550	423000	2650000	558	71.3 J	2880
Naphthalene <sup>(4)</sup>	ug/kg	20000	187	11400	721 M0			812000	47800	1810000	84500	231000000	668	2870 J	557000	4060000	885	139	245
o-Xylene	ug/kg	4100 <sup>(2)</sup>		515	1140			18100	1100		1330 J	349000		49.5 J		43700			
Phenanthrene	ug/kg	18000		2970		199000	287	77600	1530	7190000	69800	13000000 J	110 J	22400	1100000	926000	147 J	559 M0, R1	827
Phenol	ug/kg																		
Pyrene	ug/kg	500000		1540		260000	112 J	27700	230 J	2650000	19300	4800000 J		29200	324000	352000 J	49.3 J	1370 M0, R1	303 J
Selenium	mg/kg		0.20 J	0.21 J	0.33 J	0.54 J	0.42 J	0.56 J		1.3 J	0.18 J	3.7	0.40 J		0.17 J	0.49 J	0.24 J	0.19 J	0.38 J
Silver	mg/kg		0.13 J	0.10 J	0.092 J	0.25 J	0.18 J	0.15 J		0.13 J	0.12 J	0.55 J	0.17 J	0.16 J		0.31 J	0.083 J	0.067 J	0.098 J
Styrene	ug/kg							768				283000							
Toluene	ug/kg	1500			533 J				458 J			775000				85600			

Qualifiers

J - Estimated concentration above the adjusted detection limit and below the adjusted reporting limit.

M0 - Matrix spike recovery and/or matrix spike duplicate recovery was outside laboratory control limits.

1q - Analyte had a negative detect in the associated method blank at -0.0055 mg/Kg.

Notes

This table lists detections only. Blank cells mean the constituent was not detected.

1 - Soil standards are compiled from NR720 Table 1, and PAH standards are the suggested non-industrial generic soil cleanup levels provided in the 1997 WDNR Document, "Soil Cleanup Levels for Polycyclic Aromatic Hydrocarbons (PAHs) Interim Guidance".

2 - Standard is for total xylenes.

3 - Analyzed using Method 8260

4 - Analyzed using Method 8270

Prepared by: N. Keller

Checked by: L. Bakken

Table 8  
Summary of Groundwater Analytical Results  
Former Wabash Alloys Facility  
Oak Creek, Wisconsin

PARAMETER	UNITS	NR 140 ES	NR 140 PAL	MW-1	MW-2	MW-5	MW-8	GW DUP-01 <sup>(1)</sup>	MW-9	MW-14	MW-15	MW-16	MW-18	MW-20
1,2,4-Trimethylbenzene	ug/L	480 <sup>(2)</sup>	96 <sup>(2)</sup>			10.5	289	296			66.7		19.4	
1,3,5-Trimethylbenzene	ug/L	480 <sup>(2)</sup>	96 <sup>(2)</sup>				163	163			29.1			
2,4-Dimethylphenol	ug/L			18.8		69.2 J	19200	19800				157 J		
2-Methylnaphthalene	ug/L			1.8 J		71.3 J	2020 J	1350 J			57.0 J	732	274	6.6 J
2-Methylphenol(o-Cresol)	ug/L			13.3		70.1 J	13900	16400						
3&4-Methylphenol(m&p Cresol)	ug/L			29.0	0.92 J	147 J	28300	32100			33.9 J			
Acenaphthene	ug/L										36.3 J	376 J	609	6.0 J
Anthracene	ug/L	3000	600								13.8 J		136	8.9 J
Arsenic, Dissolved	ug/L	10	1		3.2 J	4.6 JB	24.4	24.7	3.9 JB	3.6 JB	7.7 JB	5.3 JB	3.2 JB	4.6 JB
Barium, Dissolved	ug/L	2000	400	41.8	64.3	293	109	106	44.4	142	120	97.2	98.8	178
Benzene	ug/L	5	0.5			49.2	13500	13600			24.6 J	71.7		
Benzo(a)anthracene	ug/L												102	2.0 J
Benzo(a)pyrene	ug/L	0.2	0.02										52.5 J	
Benzo(b)fluoranthene	ug/L	0.2	0.02										47.6 J	
Benzo(k)fluoranthene	ug/L												55.1 J	
Cadmium, Dissolved	ug/L	5	0.5		0.29 J	1.5 J	0.34 J	0.29 J	0.48 J				0.32 J	
Carbazole	ug/L										31.6 J	245 J	22.8 J	13.6
Chromium, Dissolved	ug/L	100	10	0.79 JB	0.56 J	0.73 JB	0.86 J	0.71 JB	23.8	0.64 JB	0.98 JB	0.74 JB	0.63 J	0.73 JB
Chrysene	ug/L	0.2	0.02										88.3	4.0 J
Cyanide	ug/L	200	40				0.0075 J							
Dibenzofuran	ug/L										28.2 J	198 J	458	4.3 J
Ethylbenzene	ug/L	700	140			10.8	644	651			42.4	109	16.7	
Fluoranthene	ug/L	400	80	1.1 J									503	8.8 J
Fluorene	ug/L	400	80								33.8 J	179 J	514	6.3 J
Indeno(1,2,3-cd)pyrene	ug/L												21.2 J	
Isopropylbenzene (Cumene)	ug/L												9.5 J	
Lead, Dissolved	ug/L	15	1.5		1.5 J		1.4 J	2.6 J	2.8 J	1.7 J		2.6 J		
m&p-Xylene	ug/L	10000	1000			44.4	2620	2700			121			
Naphthalene	ug/L	100	10	11.7		1660	16400	16000			1220	9640	2520	109
Naphthalene	ug/L	100	10			943	19700	18000			551	8140	859	298
o-Xylene	ug/L	10000	1000			15.4	879	894			51.6			
Phenanthrene	ug/L			1.5 J			1440 J	628 J			47.0 J	104 J	1130	16.1
Phenol	ug/L	6000	1200	8.2		48.9 J	8370	9970						
Pyrene	ug/L	250	50			< 70.6							299	5.0 J
Selenium, Dissolved	ug/L	50	10	3.1 J		2.4 J	2.8 J	3.7 J		3.2 J		3.1 J	3.9 JB	4.6 J
Styrene	ug/L	100	10				468	479						
Toluene	ug/L	1000	200			64.2	7290	7240			29.1	34.5 J		

Qualifiers

J - Estimated concentration above the adjusted detection limit and below the adjusted reporting limit.

B - Analyte was detected in the associated method blank.

Notes

1 - GW-DUP01 was collected from the MW-8 location

2 - Standards for 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene are for total trimethylbenzenes

*italic* values indicate exceedences of NR140 Preventative Action Limits (PALs)

**Bold** values indicate exceedences of NR 140 Enforcement Standards (ES)

Prepared by: N. Keller

Checked by: L. Bakken

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 PAPEZ J Date Printed: 11/9/2007



**LEGEND**

- MONITORING WELL LOCATION
- SOIL BORING LOCATION
- OBSERVED SEEP LOCATION
- PROPERTY BOUNDARY LINE

**NOTES**

- BASE MAP IMAGERY AND PARCEL LINES FROM MILWAUKEE COUNTY ARCGIS WEB MAP SERVICE, 2007.
- MAP PROJECTION AND GRID COORDINATES ARE NAD27 STATE PLANE WISCONSIN SOUTH, US SURVEY FEET.

1" = 200'  
 1:2,400

0 200 400  
 SCALE IN FEET

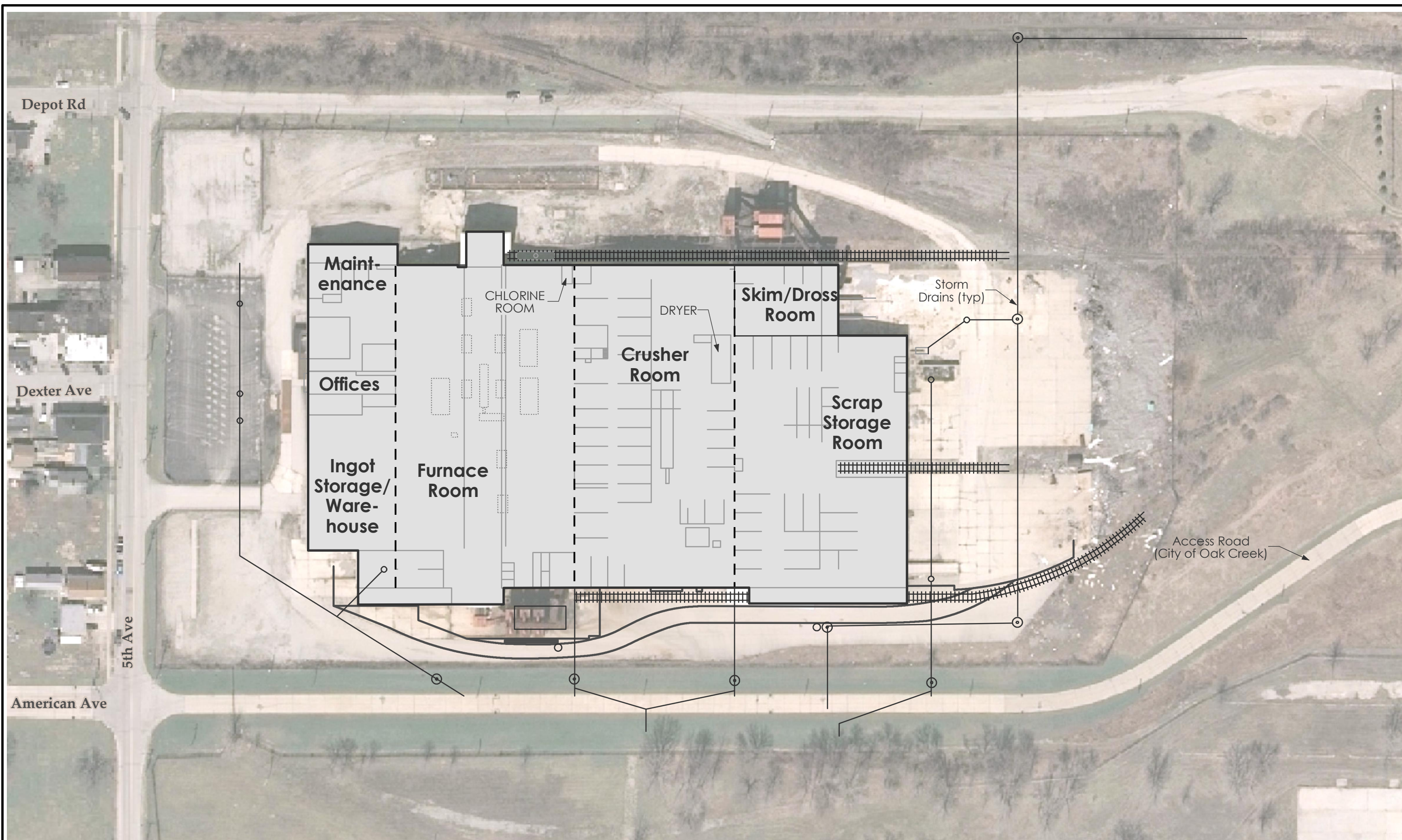
DRAWN BY:	PAPEZ J
CHECKED BY:	KELLER N
APPROVED BY:	WEDEKIND J
DATE:	AUGUST 2010



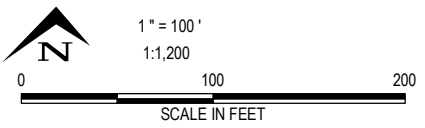
744 Heartland Trail  
 Madison, WI 53717-1934  
 P.O. Box 8923 53708-8923  
 Phone: 608-831-4444  
 Fax: 608-831-3334

CONNELL LP		OAK CREEK, WISCONSIN	
<b>SITE LAYOUT AND MONITORING WELL AND BORING LOCATIONS</b>			
8/2/2010	PROJ. NO. 06139.01.002	DWG. NAME 061390101.mxd	SHT. NO. FIGURE 1
SCALE: AS NOTED			





Drawing Name / Location: D:\061390101\MXD\061390108.mxd 8/2/2010 09:41:32  
 Cartographer: PAPEZ J Date Printed: 11/9/2007



**NOTES**  
 1. BASE MAP IMAGERY FROM MILWAUKEE COUNTY ACRGIS WEB MAP SERVICE, 2007.

DRAWN BY:	PAPEZ J
CHECKED BY:	KELLER N
APPROVED BY:	WEDEKIND J
DATE:	AUGUST 2010

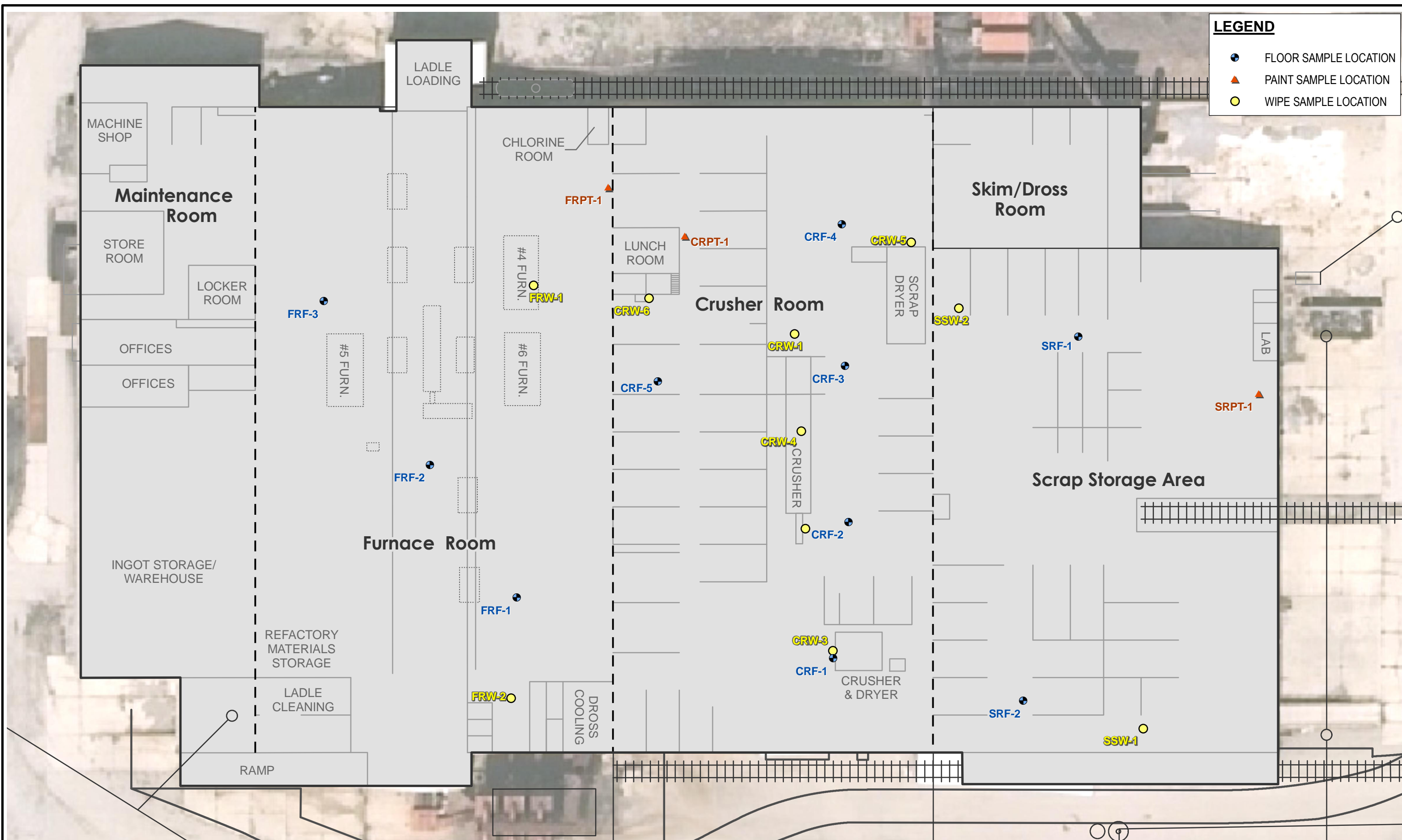
**RMT**

744 Heartland Trail  
 Madison, WI 53717-1934  
 P.O. Box 8923 53708-8923  
 Phone: 608-831-4444  
 Fax: 608-831-3334

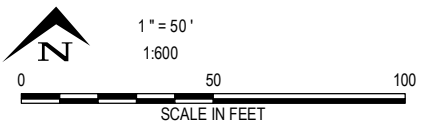
CONNELL LP		OAK CREEK, WISCONSIN	
<b>INTERIOR BUILDING LAYOUT</b>			
8/2/2010	PROJ. NO.	DWG. NAME	SHT. NO.
SCALE: AS NOTED	06139.01.002	061390108.mxd	FIGURE 2

**LEGEND**

- FLOOR SAMPLE LOCATION
- ▲ PAINT SAMPLE LOCATION
- WIPE SAMPLE LOCATION



Drawing Name / Location: D:\061390110\061390110.mxd 8/2/2010 09:41:15  
 Cartographer: PAPEZ J  
 Date Printed: 11/9/2007



**NOTES**  
 1. BASE MAP IMAGERY FROM MILWAUKEE COUNTY ACRGIS WEB MAP SERVICE, 2007.

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CHECKED BY:	KELLER N
APPROVED BY:	WEDEKIND J
DATE:	AUGUST 2010

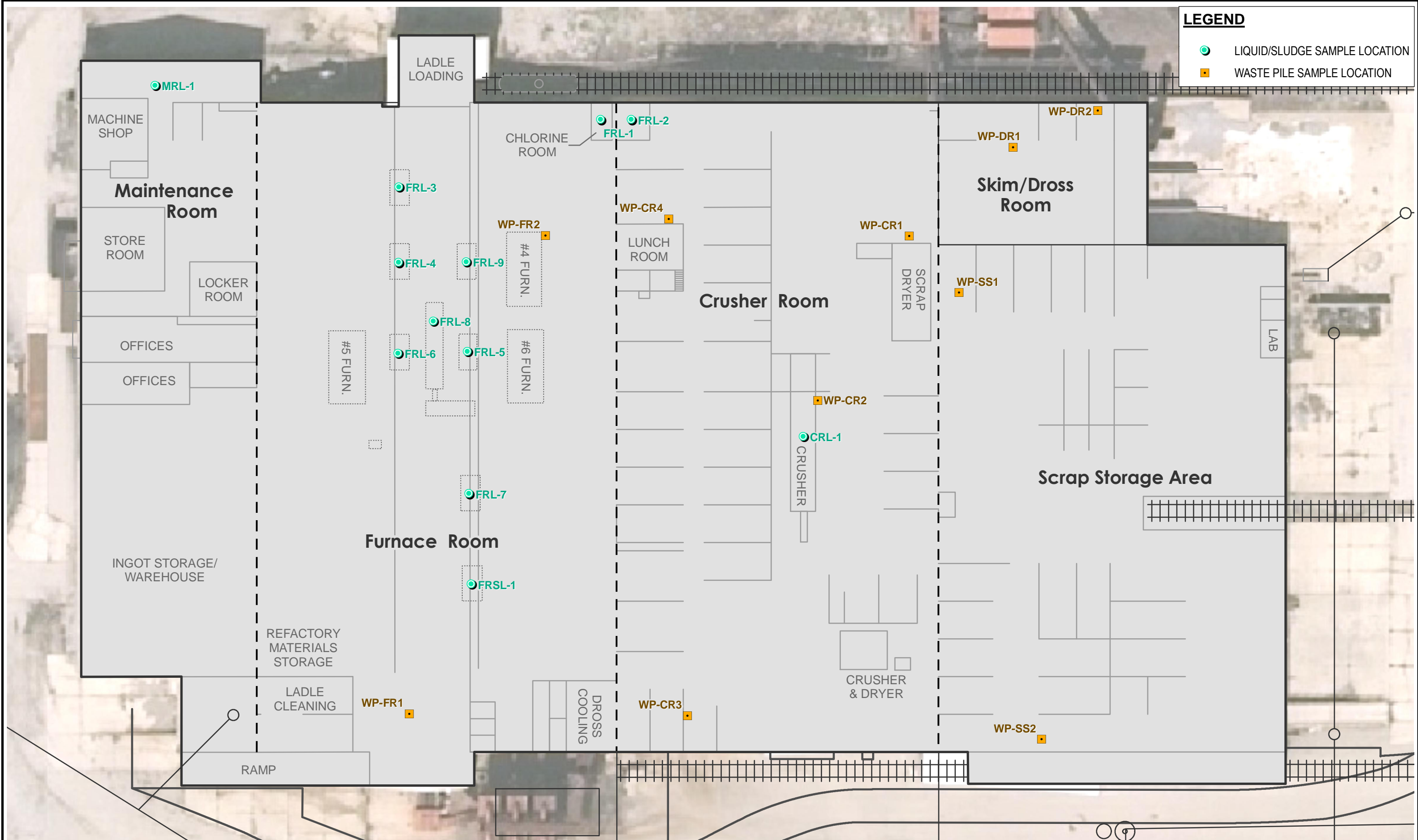


744 Heartland Trail  
 Madison, WI 53717-1934  
 P.O. Box 8923 53708-8923  
 Phone: 608-831-4444  
 Fax: 608-831-3334

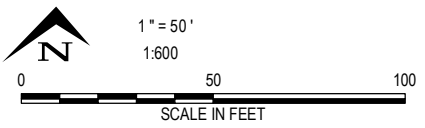
CONNELL LP		OAK CREEK, WISCONSIN	
<b>INTERIOR FLOOR, PAINT, AND WIPE SAMPLING</b>			
8/2/2010	PROJ. NO.	DWG. NAME	SHT. NO.
SCALE: AS NOTED	06139.01.002	061390110.mxd	FIGURE 4

**LEGEND**

- LIQUID/SLUDGE SAMPLE LOCATION
- WASTE PILE SAMPLE LOCATION



Drawing Name / Location: D:\061390101\MXD\061390109.mxd 8/2/2010 09:41:24  
 Date Printed: 11/9/2007  
 Cartographer: PAPEZ J



**NOTES**  
 1. BASE MAP IMAGERY FROM MILWAUKEE COUNTY ACRGIS WEB MAP SERVICE, 2007.

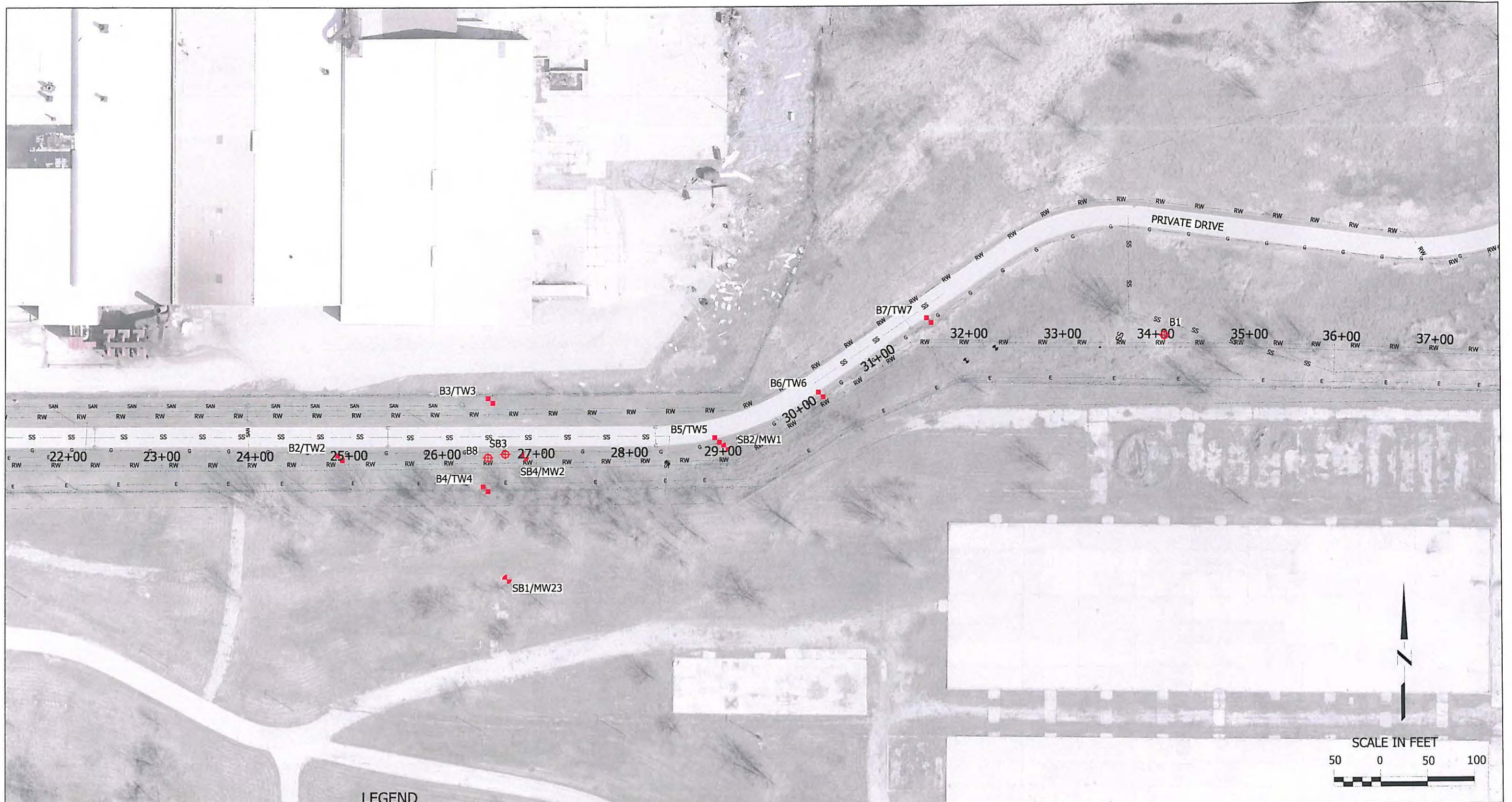
DRAWN BY:	PAPEZ J
CHECKED BY:	KELLER N
APPROVED BY:	WEDEKIND J
DATE:	AUGUST 2010



744 Heartland Trail  
 Madison, WI 53717-1934  
 P.O. Box 8923 53708-8923  
 Phone: 608-831-4444  
 Fax: 608-831-3334

CONNELL LP		OAK CREEK, WISCONSIN	
<b>INTERIOR LIQUID AND WASTE PILE SAMPLING</b>			
8/2/2010	PROJ. NO.	DWG. NAME	SHT. NO.
SCALE: AS NOTED	06139.01.002	061390109.mxd	FIGURE 5

**APPENDIX C**  
**FIGURES AND TABLES FROM**  
**CITY UTILITY PROPERTY INVESTIGATION (2010)**



**LEGEND**

- |                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li><span style="color: red;">■</span> B3/TW3 TEMPORARY MONITORING POINT LOCATION AND IDENTIFICATION</li> <li><span style="color: red;">⊕</span> B1 BORE HOLE LOCATION AND IDENTIFICATION</li> <li><span style="color: red;">■</span> SB2/MW1 MONITORING WELL LOCATION AND IDENTIFICATION</li> </ul> | <ul style="list-style-type: none"> <li>--- SAN --- SAN --- SANITARY</li> <li>--- E --- E --- ELECTRICAL</li> <li>--- G --- G --- NATURAL GAS</li> <li>--- RW --- RW --- RAW WATER</li> <li>--- SAN --- SAN --- PROPERTY BOUNDARY</li> <li>--- SS --- SS --- STORM SEWER</li> <li>--- CHAINLINK --- CHAINLINK FENCE</li> <li>26+00 STATION LOCATION AND IDENTIFICATION</li> </ul> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

NOTE:  
2005 AERIAL FROM MILWAUKEE COUNTY LAND INFORMATION OFFICE.

12075 N CORPORATE PKWY, STE. 200  
MEQUON, WISCONSIN 53092  
P: 262-241-4466 F: 262-241-4901

THIS DRAWING AND ALL INFORMATION CONTAINED THEREON IS THE PROPERTY OF BONESTROO AND SHALL NOT BE REPRODUCED OR USED EXCEPT FOR THE PURPOSE FOR WHICH IS IT EXPRESSLY FURNISHED.

DATE: 03/18/09	DRAWN BY: WDG	REVISED: 10/21/10 MSM	PROJECT: 000850-10001-0
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**BOREHOLE/MONITORING WELL  
LOCATION MAP**

LOW LIFT PROPERTY  
OAK CREEK, WISCONSIN

FIGURE: 3
-----------

**Table 1 Water Level Data, Low-Lift Property, Oak Creek, Wisconsin**

Well ID	Date	Ground Surface Elevation (feet)	Top of Casing Elevation (feet)	Depth to Water (Feet Below Casing)	Water Table Elevation (feet)
TW2	02/23/09 09/14/10	668.22	670.31	11.89 12.44	658.42 657.87
TW3	02/23/09 09/14/10	664.17	666.88	7.89 7.40	658.99 659.48
TW4	02/23/09 09/14/10	664.05	666.99	6.23 7.03	660.76 659.96
TW5	02/23/09 09/14/10	661.90	664.54	Dry Dry	- -
TW6	02/23/09 09/14/10	660.40	662.09	9.17 9.47	652.92 652.62
TW7	02/23/09 09/14/10	657.78	659.31	4.01 4.37	655.30 654.94
MW1	09/14/10	663.65	665.62	15.95	649.67
MW2	09/14/10	663.19	665.40	12.46	652.94
MW23	09/14/10	670.50	672.42	10.55	661.87

**Note:**

Elevation derived using benchmart BM-1 (elevation = 672.82) chiseled into concrete slab on former DuPont property.

Table 2 Soil Sample Field Screening and Volatile Organic Compounds Laboratory Results, Low-Lift Property, Oak Creek, Wisconsin

Borehole Number	Sample Number	Date Sampled	Sample Depth (feet)	PID Response (iui)	Detected Volatile Organic Compounds Analytical Results (micrograms per kilogram)					
					Benzene	Ethylbenzene	Toluene	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	Total Xylenes
Calculated Site-Specific Soil Screening Level for Groundwater Protection					NA	NA	NA	28,000	13,000	NA
Calculated Site-Specific Soil Screening Level for Ingestion Risk (applied to upper 4 feet)					52,000	102,000,000	81,800,000	51,100,000	51,100,000	204,000,000
Section NR 720.09, Wis. Adm. Code RCL for Groundwater Protection					5.5	2900	1500	NE	NE	4100
B1	S101	01/08/09	0-2	0	-	-	-	-	-	-
	S102	01/08/09	2-4	0	-	-	-	-	-	-
	S103	01/08/09	4-6	0	-	-	-	-	-	-
	S104	01/08/09	6-8	5	<25	146	153	287	160	512
	S105	01/08/09	8-10	3	-	-	-	-	-	-
	S106	01/08/09	10-12	1	-	-	-	-	-	-
B2	S201	01/08/09	0-2	3	-	-	-	-	-	-
	S202	01/08/09	2-4	2	-	-	-	-	-	-
	S203	01/08/09	4-6	2	-	-	-	-	-	-
	S204	01/08/09	6-8	1	<25	<25	<25	<25	<25	<75
	S205	01/08/09	8-10	3	<25	<25	<25	<25	<25	<75
	S206	01/08/09	10-12	1	-	-	-	-	-	-
	S207	01/08/09	12-14	1	-	-	-	-	-	-
	S208	01/08/09	14-16	1	-	-	-	-	-	-
B3	S301	01/09/09	0-2	0	<b>31.6</b>	<25	48	<25	28.1	52
	S302	01/09/09	2-4	426	-	-	-	-	-	-
	S303	01/09/09	4-6	70	-	-	-	-	-	-
	S304	01/09/09	6-8	191	-	-	-	-	-	-
	S305	01/09/09	8-10	152	-	-	-	-	-	-
	S306	01/09/09	10-12	45	-	-	-	-	-	-
	S307	01/09/09	12-14	163	-	-	-	-	-	-
	S308	01/09/09	14-16	193	-	-	-	-	-	-
	S309	01/09/09	16-18	24	<25	<25	<25	<25	<25	<75
B4	S401	01/09/09	0-2	0	-	-	-	-	-	-
	S402	01/09/09	2-4	0	<25	59	88	58	59	163
	S403	01/09/09	4-6	4	-	-	-	-	-	-
	S404	01/09/09	6-8	22	-	-	-	-	-	-
	S405	01/09/09	8-10	44	-	-	-	-	-	-
	S406	01/09/09	10-12	12	<b>4000</b>	<b>7700</b>	<b>7100</b>	18,300	11,400	<b>42,400</b>
B5	S501	01/09/09	0-2	0	-	-	-	-	-	-
	S502	01/09/09	2-4	0	-	-	-	-	-	-
	S503	01/09/09	4-6	2	<25	<25	42	<25	<25	<75
	S504	01/09/09	6-8	0	<25	<25	<25	<25	<25	<75
	S505	01/09/09	8-10	0	-	-	-	-	-	-
	S506	01/09/09	10-12	0	-	-	-	-	-	-
	S507	01/09/09	12-14	0	-	-	-	-	-	-
	S508	01/09/09	14-16	0	-	-	-	-	-	-
B6	S601	01/09/09	0-2	0	<25	34	57	52	61	125
	S602	01/09/09	2-4	2	-	-	-	-	-	-
	S603	01/09/09	4-6	3	-	-	-	-	-	-
	S604	01/09/09	6-8	2	-	-	-	-	-	-
	S605	01/09/09	8-10	3	-	-	-	-	-	-
	S606	01/09/09	10-12	12	<25	<25	<25	<25	<25	<75
	S607	01/09/09	12-14	2	-	-	-	-	-	-
	S608	01/09/09	14-16	1	<25	<25	<25	<25	<25	<75
B7	S701	01/09/09	0-2	0	<25	<25	<25	<25	<25	<75
	S702	01/09/09	2-4	2	-	-	-	-	-	-
	S703	01/09/09	4-6	2	-	-	-	-	-	-
	S704	01/09/09	6-8	1	<25	<25	<25	<25	<25	<75
	S705	01/09/09	8-10	1	-	-	-	-	-	-
	S706	01/09/09	10-12	1	-	-	-	-	-	-
B8	S801	01/09/09	0-2	1	<b>205</b>	94	360	150	132	471
	S802	01/09/09	2-4	3	-	-	-	-	-	-
	S803	01/09/09	4-6	392	<b>4700</b>	<b>13,800</b>	<b>25,200</b>	<b>28,300</b>	<b>17,100</b>	<b>65,900</b>
	S804	01/09/09	6-8	224	-	-	-	-	-	-
SB1	SB101	08/06/10	0-2.5	0.3	-	-	-	-	-	-
	SB102	08/06/10	2.5-5	0.5	-	-	-	-	-	-
	SB103	08/06/10	5-7.5	0.1	-	-	-	-	-	-
	SB104	08/06/10	7.5-10	0.1	<25	<25	<25	<25	<25	<75
	SB105	08/06/10	10-12.5	0.3	-	-	-	-	-	-
	SB106	08/06/10	12.5-15	0.6	-	-	-	-	-	-
	SB107	08/06/10	15-17.5	0.3	-	-	-	-	-	-
	SB108	08/06/10	17.5-20	0.3	-	-	-	-	-	-
SB2	SB201	08/06/10	0-2.5	0.3	-	-	-	-	-	-
	SB202	08/06/10	2.5-5	1.1	-	-	-	-	-	-
	SB203	08/06/10	5-7.5	1.3	-	-	-	-	-	-
	SB204	08/06/10	7.5-10	3.0	-	-	-	-	-	-
	SB205	08/06/10	10-12.5	1.5	-	-	-	-	-	-
	SB206	08/06/10	12.5-15	1.3	-	-	-	-	-	-
SB3	S801	08/06/10	0-2.5	1.3	-	-	-	-	-	-
	S802	08/06/10	2.5-5	68.5	-	-	-	-	-	-
	S803	08/06/10	5-7.5	73.3	-	-	-	-	-	-
	S804	08/06/10	7.5-10	8.3	-	-	-	-	-	-
	S805	08/06/10	10-12.5	272	-	-	-	-	-	-
SB4	SB401	08/06/10	0-2.5	50.7	-	-	-	-	-	-
	SB402	08/06/10	2.5-5	80.0	-	-	-	-	-	-
	SB403	08/06/10	5-7.5	60.2	<2500	<b>6600</b>	<2500	12,300	7400	<b>26,000</b>
	SB404	08/06/10	7.5-10	73.0	-	-	-	-	-	-
	SB405	08/06/10	10-12.5	19.0	-	-	-	-	-	-
	SB406	08/06/10	12.5-15	3.0	-	-	-	-	-	-

Note:

- PID = photoionization detector
- iui = instrument units as isobutylene
- NA = not applicable since s. NR 720.09 Wis. Adm. Code residual contaminant levels exist
- NE = not established by Wisconsin Administrative Code (Wis. Adm. Code)
- <x = compound not detected to a detection limit of x
- = not laboratory analyzed
- "J" = analyte detected between the limit of detection and the limit of quantitation
- XXX** = exceeds calculated site-specific soil screening level for groundwater protection
- XXX** = exceeds Section NR 720.09, Wis. Adm. Code RCL for groundwater protection

**Table 3 Soil Sample Field Screening and Metals and Polynuclear Aromatic Hydrocarbons Laboratory Results, Low-Lift Property, Oak Creek, Wisconsin**

Borehole Number	Sample Number	Date Sampled	Depth (feet)	Relevant and Significant Polynuclear Aromatic Hydrocarbon Analytical Results (micrograms per kilogram)																		
				Acenaphthalene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g, h, i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenzo(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	1-Methylnaphthalene	2-Methylnaphthalene	Naphthalene	Phenanthrene	Pyrene	
WDNR Suggested RCL for Groundwater Protection				38,000	700	3.0E+06	17,000	48,000	360,000	6,800,000	870,000	37,000	38,000	500,000	100,000	680,000	23,000	20,000	400	1800	8.7E+06	
WDNR Suggested RCL for Protection from Direct-Contact Risk (applied to upper 4 feet)			Industrial	6.0E+07	3.6E+05	3.0E+08	390	3900	3900	39,000	39,000	390,000	390	4.0E+07	4.0E+07	3900	7.0E+07	4.0E+07	1.1E+05	390,000	3.0E+07	
B1	S101	01/08/09	0-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S102	01/08/09	2-4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S103	01/08/09	4-6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S104	01/08/09	6-8	166	76	146	620	890	1200	680	360	790	169	1010	88	550	410	950	8400	450	860	
	S105	01/08/09	8-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	S106	01/08/09	10-12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B2	S201	01/08/09	0-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S202	01/08/09	2-4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S203	01/08/09	4-6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S204	01/08/09	6-8	<13	<14	<8.8	<15	<7.7	<11	<12	<11	<6.8	<9.7	<11	<12	<9.9	<12	<9.4	<12	<9.4	<9.9	
	S205	01/08/09	8-10	<13	<14	<8.8	<15	<7.7	<11	<12	<11	7.7 "J"	<9.7	<11	<12	<9.9	<12	<9.4	<12	15.4 "J"	<9.9	
	S206	01/08/09	10-12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S207	01/08/09	12-14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S208	01/08/09	14-16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
B3	S301	01/09/09	0-2	660	4800	5400	9100	21,100	28,200	30,900	8200	16,400	5600	12,600	480	17,600	410	520	3200	3300	11,200	
	S302	01/09/09	2-4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S303	01/09/09	4-6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S304	01/09/09	6-8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S305	01/09/09	8-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S306	01/09/09	10-12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S307	01/09/09	12-14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S308	01/09/09	14-16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S309	01/09/09	16-18	25.9 "J"	21.4 "J"	36	25.1 "J"	22.4 "J"	29.1 "J"	25.6 "J"	<11	29.7 "J"	<9.7	53	24.5 "J"	<9.9	17 "J"	40	120	93	38	
B4	S401	01/09/09	0-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S402	01/09/09	2-4	650	7300	4900	14,800	29,500	40,000	18,800	11,200	17,900	6400	8000	580	17300	620	790	1630	2040	7100	
	S403	01/09/09	4-6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S404	01/09/09	6-8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S405	01/09/09	8-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S406	01/09/09	10-12	15,900	2300	10,700	5000	2330	3600	960	1380	3300	360 "J"	22,300	16,200	940	22,400	53,000	142,000	43,000	14,700	
B5	S501	01/09/09	0-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S502	01/09/09	2-4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S503	01/09/09	4-6	49	45	128	261	530	760	500	199	390	116	430	46	390	44	84	257	272	360	
	S504	01/09/09	6-8	16.2 "J"	15.2 "J"	15.7 "J"	23.7 "J"	16 "J"	25.2 "J"	13.4 "J"	<11	15.9 "J"	<9.7	30.3 "J"	15.8 "J"	<9.9	12.5 "J"	16.7 "J"	50	48	23.8 "J"	
	S505	01/09/09	8-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S506	01/09/09	10-12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S507	01/09/09	12-14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S508	01/09/09	14-16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
B6	S601	01/09/09	0-2	4700	760	19,800	5600	4000	5900	2350	1820	6000	650	18,500	700	2040	1680	450	2890	22,900	13,200	
	S602	01/09/09	2-4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S603	01/09/09	4-6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S604	01/09/09	6-8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S605	01/09/09	8-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S606	01/09/09	10-12	11,300	530	6200	6400	3300	4900	1470	1540	4600	400	31,400	12,400	1330	245	62 "J"	420	17,100	21,000	
	S607	01/09/09	12-14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S608	01/09/09	14-16	42	<14	40	43 "J"	21.3 "J"	29.1 "J"	<12	11.3 "J"	35	<9.7	174	45	<9.9	<12	<9.4	<12	144	117	



**Table 3 Soil Sample Field Screening and Metals and Polynuclear Aromatic Hydrocarbons Laboratory Results, Low-Lift Property, Oak Creek, Wisconsin**

Borehole Number	Sample Number	Date Sampled	Depth (feet)	Relevant and Significant Polynuclear Aromatic Hydrocarbon Analytical Results (micrograms per kilogram)																	
				Acenaphthalene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g, h, i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenzo(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	1-Methylnaphthalene	2-Methylnaphthalene	Naphthalene	Phenanthrene	Pyrene
WDNR Suggested RCL for Groundwater Protection				38,000	700	3.0E+06	17,000	48,000	360,000	6,800,000	870,000	37,000	38,000	500,000	100,000	680,000	23,000	20,000	400	1800	8.7E+06
WDNR Suggested RCL for Protection from Direct-Contact Risk (applied to upper 4 feet)			Industrial	6.0E+07	3.6E+05	3.0E+08	390	3900	3900	39,000	39,000	390,000	390	4.0E+07	4.0E+07	3900	7.0E+07	4.0E+07	1.1E+05	390,000	3.0E+07
B7	S701	01/09/09	0-2	26.1 "J"	80	134	550	770	1170	520	340	660	139	890	24.2 "J"	450	<12	10.7 "J"	37 "J"	300	800
	S702	01/09/09	2-4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	S703	01/09/09	4-6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	S704	01/09/09	6-8	<13	<14	12.4 "J"	17 "J"	9.7 "J"	15 "J"	<12	<11	13.3 "J"	<9.7	18.7 "J"	<12	<9.9	<12	<9.4	<12	19.7 "J"	17.3 "J"
	S705	01/09/09	8-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	S706	01/09/09	10-12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B8	S801	01/09/09	0-2	3700	15,400	74,000	32,000	66,000	86,000	47,000	28,500	85,000	14,500	38,000	2560	42,000	1320	2060	5000	10,600	36,000
	S802	01/09/09	2-4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	S803	01/09/09	4-6	31,200	10,200 "J"	66,000	10,100 "J"	3300 "J"	5800 "J"	<3000	<2750	15,500	<2425	48,000	39,000	<2475	58,000	12,300	1,490,000	109,000	30,700
	S804	01/09/09	6-8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SB1	SB101	08/06/10	0-2.5	<15.2	<5.1	<6.4	<12.9	<4.7	<6.5	<7.7	<9.8	<8.9	<5.5	<9.2	<5.6	<7.8	<15	<9.7	<16.2	<10.6	<7.7
	SB102	08/06/10	2.5-5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SB103	08/06/10	5-7.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SB104	08/06/10	7.5-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SB105	08/06/10	10-12.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SB106	08/06/10	12.5-15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SB107	08/06/10	15-17.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SB108	08/06/10	17.5-20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SB4	SB401	08/06/10	0-2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SB402	08/06/10	2.5-5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SB403	08/06/10	5-7.5	39,000	39,000	78,000	41,000	33,000	49,000	19,800	19,400	57,000	5000	128,000	41,000	16,600	50,000	110,000	620,000	109,000	11,800
	SB404	08/06/10	7.5-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SB405	08/06/10	10-12.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SB406	08/06/10	12.5-15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note: Suggested generic RCLs obtained from Wisconsin Department of Natural Resources Guidance Publication RR-519-97 (Corrected), April 1997

<x = compound not detected to a detection limit of x

- = not laboratory analyzed

"J" = analyte detected between the limit of detection and the limit of quantitation

XXX = exceeds calculated site-specific soil screening level for groundwater protection

XXX = exceeds WDNR suggested RCL for protection of groundwater

XXX = exceeds WDNR suggested RCL for protection from direct-contact risk for industrial land use

**Table 4 Soil Sample Metals Laboratory Results, Low-Lift Property, Oak Creek, Wisconsin**

Borehole Number	Sample Number	Date Sampled	Depth (feet)	Detected Metals (milligrams per kilogram)					
				Arsenic	Barium	Cadmium	Chromium	Lead	Mercury
Chapter NR 720, Wisconsin Administrative Code Residual Contaminant Levels				0.039	NE	8	14	50	NE
Calculated Site-Specific Soil Screening Level for Groundwater Protection			Industrial	0.580	330	2	NC	NC	0.21
Calculated Site-Specific Soil Screening Level for Ingestion Risk (applied to upper 4 feet)			Industrial	NA	204,000	NA	NC	NC	NR
B1	S101	01/08/09	0-2	-	-	-	-	-	-
	S102	01/08/09	2-4	-	-	-	-	-	-
	S103	01/08/09	4-6	-	-	-	-	-	-
	S104	01/08/09	6-8	-	-	-	-	-	-
	S105	01/08/09	8-10	<b>6.92</b>	172	1.18	<b>27.4</b>	<b>1700</b>	6.86
	S106	01/08/09	10-12	-	-	-	-	-	-

Note: Suggested generic RCLs obtained from Wisconsin Department of Natural Resources Guidance Publication RR-519-97 (Corrected), April 1997

NC = not calculated and/or compound not listed in Environmental Protection Agency list of parameters

NA = not applicable since s. NR 720.11 Wisconsin Administrative Code (Wis. Adm. Code) residual contaminant levels (RCLs) exist

NE = not established by Wis. Adm. Code

- = not laboratory analyzed

**XXX** = exceeds calculated site-specific soil screening level for groundwater protection

**XXX** = exceeds Chapter NR 720, Wisconsin Administrative Code residual contaminant levels

**Table 5 Volatile Organic Compounds Groundwater Laboratory Results, Low-Lift Property, Oak Creek, Wisconsin**

Sample Number	Date Collected	Detected Volatile Organic Compounds Analytes (micrograms per liter)							
		Benzene	Chloro-benzene	Ethyl-benzene	Isopropyl-benzene	Naphthalene	Toluene	Trimethyl-benzenes	Total Xylenes
NR 140, Wis. Adm. Code PAL		0.5	NE	140	NE	10	200	96	1000
NR 140, Wis. Adm. Code ES		5	NE	700	NE	100	1000	480	10,000
TW2	02/23/09	<0.24	<0.39	<0.35	<0.6	<1.8	<0.39	<0.74	<1.67
TW3	02/23/09	<b>910</b>	<39	<b>890</b>	105 "J"	<b>20,400</b>	<b>1040</b>	<b>1010</b>	<b>1300</b>
TW4	02/23/09	<b>1000</b>	<39	<b>510</b>	<60	<b>14,800</b>	<b>540</b>	<b>950</b>	<b>2710</b>
TW6	02/23/09	<0.24	4.2	4.1	1.07 "J"	6.8	<0.39	2.44 "J"	1.26 "J"
TW7	02/23/09	<0.24	<0.39	<0.35	<0.6	<1.8	<0.39	<0.74	<1.67
MW1	09/14/10	<0.38	<0.91	<0.55	<0.71	<2.4	<0.72	<1.20	<1.62
MW2	09/14/10	<b>105</b>	<45.5	86 "J"	<35.5	<b>4900</b>	48 "J"	<b>132 "J"</b>	141 "J"
MW23	09/14/10	<0.38	<0.91	<0.55	<0.71	<2.4	<0.72	<1.20	<1.62

Note:

NE = not established by Wisconsin Administrative Code

<x = compound not detected to a detection limit of x

- = not laboratory analyzed

**XXX** = exceeds Chapter NR 140, Wisconsin Administrative Code (NR 140, Wis. Adm. Code) preventive action limit (PAL)

**XXX** = exceeds NR 140, Wis. Adm. Code enforcement standard (ES)

**Table 6 Polynuclear Aromatic Hydrocarbons Groundwater Laboratory Results, Low-Lift Property, Oak Creek, Wisconsin**

Borehole Number	Date Sampled	Detected Polynuclear Aromatic Hydrocarbon Analytical Results (micrograms per liter)																	
		Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g, h, i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenzo(g, h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	1-Methylnaphthalene	2-Methylnaphthalene	Naphthalene	Phenanthrene	Pyrene
NR 140, Wis. Adm. Code PAL		NE	NE	600	NE	0.02	0.02	NE	NE	0.02	NE	80	80	NE	NE	NE	10	NE	50
NR 140, Wis. Adm. Code ES		NE	NE	3000	NE	0.2	0.2	NE	NE	0.2	NE	400	400	NE	NE	NE	100	NE	250
TW2	09/14/10	<0.017	<0.016	<0.018	0.018 "J"	<0.016	<0.017	<0.017	<0.029	<0.017	<0.016	0.029 "J"	<0.018	<0.016	<0.016	<0.017	0.107	0.032 "J"	0.020 "J"
TW3	02/23/09	268	33 "J"	39 "J"	<17	<16	<10	<20	<23	<20	<12	31.4 "J"	<b>152</b>	<13	470	850	<b>9500</b>	159	21.2 "J"
TW4	02/23/09	189	15.9 "J"	26.4 "J"	<17	<16	<10	<20	<23	<20	<12	17 "J"	<b>84</b>	<13	360	320	<b>5900</b>	85	<16
TW6	09/14/10	59	0.69	4.2	1.97	<b>0.37 "J"</b>	<b>0.57</b>	<0.17	0.306 "J"	<b>0.94</b>	<0.16	43	38	<0.16	0.258 "J"	<0.17	0.9	2.75	25.9
TW7	02/23/09	0.167	0.023 "J"	0.19	0.101	<b>0.079</b>	<b>0.144</b>	0.064	0.048 "J"	<b>0.103</b>	0.014 "J"	0.288	0.15	0.053	0.066	0.079	0.306	0.255	0.22
MW1	09/14/10	<0.017	<0.016	<0.018	<0.017	<0.016	<0.017	<0.017	<0.029	<0.017	<0.016	0.029 "J"	<0.018	<0.016	<0.016	<0.017	0.019 "J"	0.019 "J"	0.023 "J"
MW2	09/14/10	274	32	50	19.2 "J"	<b>8 "J"</b>	<b>14.4 "J"</b>	<8.5	<14.5	<b>19.4 "J"</b>	<8	<b>91</b>	<b>180</b>	<8	470	900	<b>6000</b>	228	<b>59</b>
MW23	09/14/10	<0.017	<0.016	<0.018	<0.017	<0.016	<0.017	<0.017	<0.029	<0.017	<0.016	<0.019	<0.018	<0.016	<0.016	<0.017	0.173	<0.019	<0.02

Note: Suggested generic RCLS based on Wisconsin Department of Natural Resources Guidance Publication *RR-519-97* (Corrected), April 1997

NE = not established by Wisconsin Administrative Code (Wis. Adm. Code)

<x = compound not detected to a detection limit of x

J = analyte detected between the limit of detection and the limit of quantitation

**XXX** = exceeds Chapter NR 140, Wisconsin Administrative Code (NR 140, Wis. Adm. Code) prevention action limit (PAL)

**XXX** = exceeds NR 140, Wis. Adm. Code enforcement standard (ES)

**APPENDIX D**  
**STANDARD OPERATING PROCEDURES**

## **GEOPROBE® SAMPLING SYSTEM**

Geoprobe® brand Dual Tube Sampling Systems are efficient methods of collecting continuous soil cores with the added benefit of a cased hole. Dual tube sampling uses two sets of probe rods to collect continuous soil cores. One set of rods is driven into the ground as an outer casing. These rods receive the driving force from the hammer and provide a sealed hole from which soil samples may be recovered without the threat of cross contamination. The second, smaller set of rods are placed inside the outer casing. The smaller rods hold a sample liner in place as the outer casing is driven one sampling interval. The small rods are then retracted to retrieve the filled liner.

The DT325's unique combination of cutting shoe, sheath, and sample retainer allows efficient recovery of samples in formations ranging from plastic clays to saturated sands. The DT325 is designed to quickly recover samples well below the water table. Problems with liner failure or lodging are virtually eliminated with this system.

Liners for the DT325 system are clear PVC with an integral core catcher fused to one end. This configuration maximizes sample recovery while minimizing entrance losses. It's also proven to be very robust in use. The DT325 Liner Cutter, designed specifically for DT325 liners, permits safe, simple, and quick cutting of the liners for sample logging. The DT325 Soil Sampling System is robust and durable under the Geoprobe® GH62 Hammer. A Liner Retainer, with threads identical to the Sheath Drive Head, is stronger and prevents the retainer from fusing to the Sample Sheath. The thread pattern on the Liner Retainer also made it possible to put the same thread on both ends of the Sample Sheath which allows for more even thread wear when the sheath is turned end-for-end during use. The standard DT325 Cutting Shoe used with the Liner Retainer greatly improves sampling in plastic clays and saturated sands. The Expendable Cutting Shoe with O-ring and Holder are designed for a tight fit to eliminate the possibility of losing the cutting shoe during sampling.

Problems with stuck liners in the DT325 system has been significantly reduced due to a more efficient liner retainer design, and a specially designed cutting shoe that has proven to help reduce the overfilling of a soil liner when sampling. Plastic clays are always a challenge to sample. In extreme conditions, it is recommended to increase the length of the sampler being used. For example, if plastic clays are encountered with a 48-in. sampler, then switch to a 60-in. sampler. Using a 60-in. sampler when collecting 48-in. samples will give the user an additional 12-in. buffer for the overall sample volume. This has been proven to significantly reduce problems when sampling in plastic clays.

The Macro-Core® Soil Sampling system is a 1.5-inch diameter, piston-operated sampler which features a positive release system that eliminates the uncertainty of continuous sampling! When the stop-pin is released, the user retracts the extension rod string which carries the released stop-pin and the piston-rod right into the operator's hand. Other benefits of this system are numerous. With a lightweight piston tip assembly, sample compression is minimized during retrieval. An O-ring on the tip ensures that the sampler remains sealed until the desired sampling depth is reached. Other features include increased durability, user friendly, easy to decontaminate, and easy to maintain.

The Macro-Core® system is also versatile. While sampling loose, difficult-to-sample soils, use the MC stop-pin coupler. The piston rod and stop-pin are removed in this process which enhances sample recovery. The stop-pin coupler usually is not necessary when sampling in stronger, more consolidated formations, where sample recovery is not a problem.

- Positive release system eliminates the uncertainty of continuous sampling.
- Sample compression is limited due to the lightweight piston tip.
- Stop-pin coupler is available for sampling loose soils.
- 1.5-in. diameter.
- Available for 4-, 3-, and 2-foot Macro-Core® sample tube lengths.
- Few parts to decon. Few parts to maintain.

## **PID MEASUREMENT PROCEDURES**

Semi-quantitative measurements of total volatile organic compounds (VOCs) in soil and groundwater can be determined using a photoionization detector (PID) by monitoring the headspace within a sample jar. The PID reads concentrations in parts per million (ppm). In order for the PID to give an accurate concentration for a specific compound it would have to be calibrated for that specific compound. Because the samples being screened typically may contain more than one compound as potential contaminants, the PID is usually calibrated using 100 ppm isobutylene gas. Therefore the PID provides an approximate concentration of the VOCs in the sample. Because of this, the PID concentrations are recorded as instruments units (IUs) instead of ppm. The procedure to be used for measuring sample headspace is as follows:

1) Record the background ambient air concentration on the field PID form. Typical background values are zero to 3.0 IUs, or higher depending on the measurement location. Locations with ambient PID readings greater than 3.0 IUs should not be utilized for field screening measurements.

2) Half-fill a clean 16-ounce glass canning jar with the sample to be analyzed. Quickly cover the top with two sheets of clean aluminum foil and apply a screw cap to tightly seal the jar.

3) Allow headspace development of VOCs for at least ten minutes in ambient temperatures greater than 55°F. Vigorously shake or swirl the jar for 15 seconds both at the beginning and end of the headspace development period. Where ambient temperatures are below 55°F, headspace development should occur within a heated vehicle or building.

4) Subsequent to headspace development, quickly puncture foil seal with the PID sampling probe to a point about one-half of the headspace depth. Exercise care to avoid uptake of water droplets or soil particles.

5) Record the maximum meter response observed within 15 seconds on the field PID data form as the jar headspace concentration. Maximum response should occur between two and five seconds. Erratic meter response may occur at high organic vapor concentrations or conditions of elevated headspace moisture, in which case notation should be made of the suspected cause of the erratic reading. Record sample identification information.

6) All PID readings for soil will be followed by the symbol "d" (dry), "m" (moist) or "w" (wet) to aid in data interpretation. The symbol "w" will be used when there is substantial accumulation of water droplets in the bag or jar to the extent that readings are probably being affected by the humidity. Erratic meter response may occur at high organic vapor concentrations or conditions of elevated headspace moisture, in which case headspace data should be discounted.



## **QUALITY ASSURANCE**

### **Replicates**

If sufficient sample is available, headspace analysis of samples should be performed in duplicate. True duplicate samples of soil are not possible to collect due to matrix heterogeneity; however, to minimize the matrix effects, duplicate samples for VOCs should be collected by dividing the sample in half perpendicular to any noted bedding or layering. This is performed to include all layers of the sample in both replicates as one layer may be more permeable thereby concentrating contaminants within one area of the sample. If duplicate samples are collected, the headspace screening data from both jar samples should be recorded and compared. Generally, replicate values should be consistent to plus or minus 20%. Duplicate samples should be screened on one out of every 10 samples collected, or less.

### **Blanks**

Blank samples will be measured to determine if any contamination is being introduced as part of the measurement procedure. One PID blank sample will be performed for each 11 samples measured, inclusive of duplicates, which represents one jar for each case of canning jars used. The measurement procedure for field PID blanks is given below:

### **Water**

Distilled water should be substituted for sample water, and the same headspace measurement procedure as outlined above should be followed.

### **Soil**

The headspace measurement procedure outlined above should be followed, but no sample should be placed in the canning jar, as no universal soil blank has been accepted. A headspace reading of the jar should be taken after the jar has been opened, resealed, and allowed to sit for ten minutes.

### **Data Recording**

PID data should be recorded in the field notebook and clearly marked "PID reading (IUs)" if field notebooks are required for the project. The data should also be recorded on applicable field forms, such as field PID data forms, soil borehole logs, and water quality sampling and analysis forms. In addition to data records, maintenance records and calibration records will be generated and maintained on appropriate forms or in the site field notebook. Records of the instrument user, dates of uses, instrument identification number, and project identification should also be maintained.

## **LOW-FLOW PURGING AND SAMPLING METHOD**

The low-flow purging and sampling method, which is taken from the December 1995 U.S. Environmental Protection Agency (EPA) paper entitled "EPA Groundwater Issue, Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures" by Robert W. Puls and Michael J. Barcelona, is described below:

*Low-flow purging, whether using portable or dedicated systems, should be done using the pump intake located in the middle or slightly above the middle of the screened interval. Placement of the pump too close to the bottom of the well will cause increased entrainment of solids which have collected in the well over time. These particles are present as a result of well development, prior purging and sampling events, and natural colloidal transport and deposition. Therefore, placement of the pump in the middle or toward the top of the screened interval is suggested.*

*Low-flow refers to the velocity with which water enters the pump intake and that is imparted to the formation pore water in the immediate vicinity of the well screen. It does not necessarily refer to the flow rate of water discharged at the surface which can be affected by flow regulators or restrictions. Water level drawdown provides the best indication of the stress imparted by a given flow-rate for a given hydrological situation. The objective is to pump in a manner that minimizes stress (drawdown) to the system to the extent practical taking into account established site sampling objectives. Typically flow rates on the order of 0.1 - 0.5 L/min are used, however this is dependent on site-specific hydrogeology. Some extremely coarse-textured formations have been successfully sampled in this manner at flow rates to 1 L/min. The effectiveness of using low-flow purging is intimately linked with proper screen location, screen length, and well construction and development techniques. The reestablishment of natural flow paths in both the vertical and horizontal directions are important for correct interpretation of the data. For high resolution sampling needs, screens less than 1 m should be used. Most of the need for purging has been found to be due to passing the sampling device through the overlying casing water which causes mixing of these stagnant waters and the dynamic waters within the screened interval. Additionally, there is disturbance to suspended sediment collected in the bottom of the casing and the displacement of water out into the formation immediately adjacent to the well screen. These disturbances and impacts can be avoided using dedicated sampling equipment, which precludes the need to insert the sampling device prior to purging and sampling.*

*Isolation of the screened interval water from the overlying stagnant casing water may be accomplished using low-flow minimal drawdown techniques. If the pump intake is located within the screened interval most of the water pumped will be drawn in directly from the formation with little mixing of casing water or disturbance to the sampling zone. It is recommended that water quality indicator parameters be used to determine purging needs prior to sample collection in each well. Stabilization of parameters such as pH, specific conductance, dissolved oxygen, oxidation-reduction potential, temperature and turbidity should be used to determine when formation water is accessed during purging. In general the order of stabilization is pH, temperature, and specific conductance,*

*followed by oxidation-reduction potential, dissolved oxygen and turbidity. Temperature and pH, while commonly used as purging indicators, are actually quite insensitive in distinguishing between formation water and stagnant casing water; nevertheless, these are important parameters for data interpretation purposes and should also be measured. Performance criteria for determination of stabilization should be based on water-level drawdown, pumping rate and equipment specifications for measuring indicator parameters. Instruments are available which utilize in-line flow cells to continuously measure the above parameters.*

*It is important to establish specific well stabilization criteria and then consistently follow the same methods thereafter, particularly with respect to drawdown, flow rate and sampling device. Generally the time or purge volume required for parameter stabilization is independent of well depth or well volumes. Dependent variables are well diameter, sampling device, hydrogeochemistry, pump flow rate, and whether the devices are used in a portable or dedicated manner.*

*If parameter stabilization criteria are too stringent, then minor oscillations in indicator parameters may cause purging operations to become unnecessarily protracted. It should also be noted that turbidity is a very conservative parameter in terms of stabilization. Turbidity is always the last parameter to stabilize. Excessive purge times are invariably related to the establishment of too stringent turbidity stabilization criteria. It should be noted that natural turbidity levels in ground water may exceed 10 nephelometric turbidity units (NTU).*

An in-line flow cell containing measurement probes for temperature, pH, electrical conductance, oxidation-reduction potential (ORP) and dissolved oxygen (DO) and a digital display screen will be used during the low-flow purging process to determine when stabilization of the groundwater quality indicator parameters has occurred. An electronic water level meter will be used to measure the drawdown in the monitor wells during the purging process. The low-flow purging and sampling procedures are presented below:

1. Open the monitor well and measure the depth to groundwater from the top of the well casing. Record the depth to groundwater (static water level) on the low-flow sampling field water quality sampling and analysis form.
2. Lower the dedicated polyethylene sample tubing into the well so that its inlet is near the midpoint of the well screen. Connect the sample tubing to the peristaltic pump and the flow cell.
3. Set the pump controls about half-way between the minimum and maximum settings. Note the time that purging was started (start purge time) on the low-flow sampling field water quality sampling and analysis form.
4. Monitor the drawdown in the monitor well using the electronic water level meter. Drawdown in the monitor well should be kept between 0.1 and 0.3 feet, if

- possible. Adjust the flow-rate using the pump controls to keep drawdown within this range and record any adjustments to the pumping rate in the field notebook. The groundwater purged from the monitor well should be discharged to a graduated container (bucket or measuring cup) so the volume of groundwater purged from the well and purge rate can be documented.
5. Continue to purge groundwater from the monitor well and periodically check the drawdown in the monitor well until the groundwater quality indicator parameters have stabilized. Also measure the purge rate during the purging process using a graduated bucket and record the value in the field notebook. The groundwater quality indicator parameters will be considered stabilized when three successive readings taken between one and three minutes apart are within the following ranges: 0.1 for pH, 3% for electrical conductance, 10 mv for ORP and 10% for DO. The time between indicator parameter readings will be dependent on the purging rate used for the monitor well. Stabilized indicator parameter trends are generally obvious and follow either an exponential or asymptotic change to stable values during purging. DO usually requires the longest time for stabilization. The stabilization criteria may be adjusted as additional site-specific experience is gained from subsequent sampling events.
  6. Record the time between readings and the stabilized groundwater quality indicator parameter readings on the low-flow sampling field water quality sampling and analysis form. Also record the time when stabilization of the indicator parameters occurred (end purge time), and the volume of groundwater purged from the monitor well on the low-flow sampling field water quality sampling and analysis form.
  7. Disconnect the sample tubing from the flow cell and adjust the flow rate using the pump controls to between 0.1 and 0.2 L/min if sampling for VOCs or between 0.1 and 0.5 L/min if sampling for other parameters and fill the sample container(s). Fill the sample containers.
  8. Turn off the pump and remove the sample tubing from the monitor well. Record the date and time that the groundwater sample was collected on the low-flow sampling field water quality sampling and analysis form. Also record the color, odor and clarity of the groundwater sample on the low-flow sampling field water quality sampling and analysis form.
  9. Close the well.

**APPENDIX E**  
**SITE HEALTH & SAFETY PLAN**

