MEMO

ARCADIS Design & Consultancy for natural and built assets

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From:

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Date:

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Arcadis Project No.:

30172204

Subject:

Infiltration Management and Generic LNAPL and PFAS Soil Management Plan - RACER Buick City

INTRODUCTION

In anticipation of the sale of the majority of the RACER Buick City Site (Site), a Materials Management Plan (MMP) is being prepared to address the management of impacted soils and groundwater on the property to be sold (Property) during construction and site development activities. As part of the RCRA Corrective Action process, Arcadis has defined restricted areas for soil impacts based on soil exposure pathways: direct contact (i.e. lead, arsenic, benzo(a)pyrene), particulate soil inhalation (i.e. manganese), and ambient air (various volatile organic compounds), plus the presence of PCBs (pursuant to Section 761 of CFR) and potential hazardous waste ("Areas of Contamination"), and former hazardous waste management units (WMUs). Specific regulatory and/or technical requirements apply based on concentrations of these constituents of concern (COCs). A Declaration of Restrictive Covenant – TSCA Issues (DRC-TSCA) will be prepared for PCB impacted soils on the Property and a Declaration of Restrictive Covenant for Part 111 and RCRA issues (DRC-RCRA) for other soil impacts on the Property. We have also defined restricted areas on the Property for per and polyfluoroalkyl substances (PFAS) and light non-aqueous phase liquid (LNAPL), which will be subject to restrictive covenants (RCs). Three RCs for PFAS have been established and are shown on **Figure 1**. Soil PFOS concentrations within these three areas are greater than 10,000 ng/kg. Twenty RCs have been established for LNAPL and are shown on **Figure 2**. Soils impacted with LNAPL at lesser levels may be encountered in other areas of the Property.

The potential risks for COCs other than PFAS and LNAPL are well defined, associated with the various RCs, and management of these soils is described in the MMP. The potential risks of PFAS and LNAPL impacted soils is discussed below, along with proposed restrictions on soil movement. The soil

management strategy considers changes in infiltration resulting from development of the property, which is also discussed below.

The RCs and the associated restrictions are predicated on several fundamental factors/site features. First, groundwater data, overall experience and site investigations have demonstrated that PCBs and lead do not leach and migrate in groundwater to a meaningful extent (changes in infiltration rates will not meaningfully impact PCBs or lead). Second, while LNAPL has historically reached the Flint River via stormwater discharges, the rerouting of main sewer trunk lines and disconnection or bulkheading of storm sewer laterals has terminated that pathway for the majority of the site. Third, terminating the storm sewer pathway for LNAPL has concurrently prevented PFAS migration in a substantial portion of the Property except for those areas identified as “Prohibited Zones” as discussed below. Confining PFAS and LNAPL to outside the prohibited zones is expected to minimize infiltration influence on PFAS and LNAPL. These principles, therefore, provide the underlying basis for the following discussion.

POTENTIAL LNAPL RISKS

Historically, LNAPL releases to the Flint River were a driving force in bulkheading multiple storm sewer lines to prevent LNAPL and other contaminants from leaking/infiltrating into the storm sewer system. As a result, the majority of storm water infiltrates through the existing surface of predominantly weathered former building slabs and other open areas of the Property. Redevelopment of the Property will involve the removal of former building slabs, parking lots, and other hard surfaces, in anticipation of the construction of new buildings. New construction will reduce the rate of infiltration and the leaching potential over the Property because these new features result in an increase in the percentage of essentially impermeable cover (i.e., roofs/slab on grade), and stormwater runoff from the construction of new buildings and parking lots will be discharged directly into existing storm sewers. Therefore, a long-term redevelopment strategy that incorporates new buildings and parking lots, service drives and access roadways will also produce a permanent long term environmental benefit by reducing overall infiltration rates and any potential leaching of any contaminants.

There are no regulatory established numerical criteria for the presence of LNAPL in soil. At the Buick City Property LNAPL represents only two potential environmental risks – generation of methane via natural degradation or migration to surface waters. A Declaration of Restrictive Covenant (DRC) requires any new construction to consider and address, as needed, the potential of vapor intrusion from methane gas. Cutting off the storm sewer pathway through bulkheading has essentially eliminated LNAPL migration to the river and the field work has demonstrated the LNAPL is stable[1].

POTENTIAL PFAS RISKS

PFAS has been found in various locations on the Site in soils at various depths. **Figure 3** shows the known range of PFAS concentration and depth on the Property. While Michigan Part 201 defines generic groundwater protection standards for PFAS compounds in soil, drinking water protection standards do not apply because drinking water use is prohibited on-Site by a DRC. Groundwater surface water interface protection (GSIP) criteria are only relevant where the soil is present near a surface water body (Flint River) or where storm sewers may represent a pathway to the river if groundwater were to potentially infiltrate the storm sewer. Terminating lateral storm sewers and installing sealed storm water lines has significantly

[1] Two locations are undergoing LNAPL removal of a limited amount of free LNAPL. Other portions of the larger Buick City Site (not addressed for the pending sale) require further work to compete LNAPL and related migration control (i.e., Outfall 005).

reduced potential infiltration and the redevelopment of the Property will produce long term reduction in the potential for infiltration/leaching of PFAS and migration via storm sewers or groundwater to the river. Controlled management of soil movement during construction under the Materials Management Plan will minimize any PFAS migration potential.

RESTRICTIONS ON MOVEMENT OF PFAS AND LNAPL-IMPACTED SOIL

Based on the above understanding of the potential risks of PFAS and LNAPL-impacted soils on the Property, movement of these soils must comply with the soil relocation requirements under Michigan Part 201 (20120c) pursuant to an RC. As indicated on **Figure 3** and discussed previously, PFAS impacts in soil are present at various locations on the Property, as is LNAPL-impacted soil. It is generally acknowledged that a significant percentage of the subsurface soils on the Property are impacted and as such, movement/relocation of PFAS and LNAPL-impacted soils make little relative difference within the Property. As such, relocation of soils outside the specific RC areas has a low potential to adversely impact the site if managed properly., with the following exceptions:

- Liquid LNAPL that is recovered must be characterized for off-Site disposal.
- LNAPL impacted soil that is present in PCB or lead-impacted soil RC areas must remain in these areas unless analytical testing indicates that concentrations of these COCs are less than regulatory levels prescribed in the MMP.
- Soil within the three PFAS RC areas (**Figure 1**) must remain within these areas and covered by soil or hard surface. These areas are characterized by elevated (greater than 10,000 ng/kg).
- Soil that is relocated within the Property cannot be placed in the prohibited zones, as shown on **Figure 4.** These areas are generally located at the property boundary (subject to potential surface runoff) and/or adjacent to currently active storm sewers[2].

It is also expected that after soil has been moved, it will be covered to reduce potential infiltration and contact.

INFILTRATION ASSESSMENT

Arcadis has performed a high-level assessment of the current and future infiltration potential at the Site and the likely impacts due to redevelopment of the Site. The prospective owner of the property, Ashley Capital (AC) has indicated that prior to construction of buildings on the Site, as a fundamental necessity the existing slabs will be removed, crushed, and recycled as part of redevelopment. The Michigan Department of Environment, Great Lakes, and Energy (EGLE) has requested a review of the potential for increased recharge following slab removal, suggesting that might subsequently cause enhanced migration of contaminants in the groundwater. AC has indicated that the first phase of the slab and pavement removal work will take place over the approximately 150 acres between Stewart Avenue and Leith Street. The infiltration at the Site can be broken down into three general categories, as follows:

- Current conditions – these include the following:
    - Approximately 300,000 sq ft of former basement area (~5% of the total area)

[2] Planned further rerouting of storm sewer 003 with new sealed storm water pipe would further reduce potential groundwater infiltration/migration in the central prohibited zone.

- Approximately 880,000 sq ft of grassed or otherwise landscaped area (approximately 13% of the total area)
- Approximately 5,320,000 sq ft of slab area (approximately 82% of the total area)

A map of the existing surface cover for this area is provided on **Figure 5.** The basement areas are filled in with granular material, thus infiltration is enhanced in these areas. Infiltration through the grassed or landscaped areas is somewhat predictable and likely to be similar to literature values for the area (approximately 5"/yr [Holtschlag, 1997]). Infiltration through the slab is less predictable but based on observations at the Site, the slab varies from fair to poor condition, with areas with more degradation allowing greater infiltration.

There are multiple lines of evidence to suggest that the current conditions **do not** provide an effective barrier to infiltration. First, based on observations over more than ten years, following heavy rains, water over most of the Site naturally dissipates within a day.

Second, experience at this Property and at all similar sites has demonstrated a change in groundwater conditions (increased elevations) following building demolition due to elimination of rapid transport of rain from roofs to storm sewers and off-site discharge. When the former General Motors Buildings were demolished in the Northend between 2010 and 2012, groundwater elevations rose considerably. **Figures 6, 7, and 8** present representative groundwater flow maps before and after these dates. The area north of Stewart Avenue provides the best example of the effect of the building demolition. The 2013 groundwater contours are generally 3 to 5 feet higher than the 2004 and 2010 groundwater contours. When the buildings were removed, the roof drains were disconnected, and rainfall no longer ran rapidly off the buildings. Furthermore, sumps and basements previously covered were exposed resulting in greater infiltration and subsequently higher groundwater elevations compared to the period prior to demolition.

Finally, the technical literature provides example of enhance recharge under urban conditions. Wakode et al. (2018) suggest that urban recharge can be as much as 10 times *greater* than natural recharge.

Thus, the final development of the site with new buildings and pavements will significantly reduce the infiltration rate at the site compared to the existing baseline conditions with weathered and cracked slabs and pavements. However, AC plans to remove the slabs and pavements and create an interim site condition that is "pad ready" to timely respond to market demand as expected by the State and local sourced funding for site preparation. Therefore, Arcadis evaluated the existing impacts for contaminant types or site conditions that could present a higher risk of complications if infiltration is not managed during this interim period and grouped the impacts into the following categories:

Areas where the risk of increased infiltration should be minimized:

- PFAS restricted areas.
- Soil areas with concentrations exceeding the ambient air criteria.
- Areas designated as "Areas Prohibited for Soil Importation" on **Figure 4**. These are areas near currently active storm sewers in which groundwater is likely to infiltrate.

Areas where the risk of increased infiltration is not expected to materially affect site conditions:

- PCB areas
- LNAPL areas
- Metals contamination
- SVOC contamination

Based on this analysis, RACER, Arcadis, and AC have collaborated on developing minimum soil cover requirements to mitigate risks associated with removing the slabs and pavements for the interim period before further construction and redevelopment. AC has committed to placing the following covers over select areas of the Property within nine months of removing the existing weathered and cracked concrete surface cover and prior to construction activities:

- 6" of soil with a permeability of no more than $1x10^{-7}$ cm/sec, overlain with 6" of clean cover material ((no concentrations above non-residential direct contact or particulate inhalation) to protect the clay material from weathering
  - PFAS restricted areas.
  - Soil areas with concentrations exceeding the ambient air criteria.
  - Areas designated as "Areas Prohibited for Soil Importation" on **Figure 4**. These are areas near active storm sewers in which groundwater is likely to for the interim period before further construction and redevelopment.
- 10" of soil with permeability of no more than $1x10^{-7}$ cm/sec in PCB areas that would require a TSCA cap consistent with 40 CFR 761.61 (a)(7) and (8).
- 12" of clean soil material (no concentrations above non-residential direct contact or particulate inhalation):
  - Other soil restricted areas (lead AOCs, other contamination above direct contact, or particulate inhalation).
  - LNAPL restricted areas

AC's interim soil cover plan is further described in their *Concrete Razing, Crushing, and Reuse Plan*. Based on the soil covers proposed and the timeframe that the cover materials will be placed after slab and pavement removal, the risk of the contamination worsening during the interim period (after slab removal and before construction activities) is expected to be minimal. However, to monitor the site conditions and confirm this assumption, Arcadis submitted A *Short-Term Construction Groundwater Monitoring Plan* to EGLE on April 7, 2023 to monitor before, during, and after slab removal to monitor the effects, if any, of slab removal on groundwater flow and quality. If there are any negative impacts, the monitoring program has been designed to allow for a remedial response. If based on the data, groundwater conditions materially change and construction of new buildings is delayed, remedial measures can be taken, such as placement of additional low permeability soil cover over a wider area.

Once redevelopment is complete with the new buildings and pavements, there will be a significant reduction in infiltration compared to current conditions, reducing the potential for leaching of impacted soils.

SUMMARY

This memo summarizes the plan for management of LNAPL and PFAS-impacted soils at the Buick City Site. In addition, an evaluation of infiltration under current and likely future conditions at the Site has been developed. Groundwater conditions are unlikely to materially change following slab removal, given the overall poor condition of the current slab. A groundwater monitoring plan will be implemented to track trends in groundwater head and quality to enable time for a remedial response if the data suggests that a response is necessary.

REFERENCES

Holtschlag, D.,1997. USGS Water Supply Paper 2437. 44 pages.

H. Wakode, K. Baier, R. Jha, and R. Azzam., 2018. Impact of Urbanization on Groundwater Recharge and urban water balance for the City of Hyderbad, India. International Soil and Water Conservation Research. 6(2018) 51-62.

Enclosures

Figure 1 – PFAS Restrictive Covenant Areas

Figure 2 – LNAPL Restrictive Covenant Areas

Figure 3 – Highest PFOS Concentration in Each Soil Boring

Figure 4 – Northend Areas Prohibited for Soil Importation

Figure 5 - Northend Surface Covers

Figure 6 – Groundwater Elevation Contour Map December 2004

Figure 7 – Groundwater Elevation Contour Map October 2010

Figure 8 – Groundwater Elevation Contour Map June 2013

NORTH END
SOUTH END

FIREFIGHTING TRAINING AREA

PAINTING AREA

FORMER WWTP AREA

FORMER CHROME PLATING OPERATION

PICKLING AND ENAMELING

PICKLING AND ENAMELING

ASSEMBLY AND PAINT

FLINT RIVER

NORTH END
SOUTH END

LEGEND:

- POTENTIAL PFAS SOURCE AREAS
- PFAS RESTRICTED AREA
- PROPERTY LINE
- FORMERLY OWNED RACER PROPERTIES
- SEWER LINE BELOW WATER TABLE (LIMITED DATA AVAILABLE)
- SEWER LINE ABOVE WATER TABLE
- SEWER LINE ABOVE WATER TABLE (LIMITED DATA AVAILABLE)
- SEALED STORM SEWER LINE
- INSUFFICIENT DATA AVAILABLE

0 400' 800'
APPROXIMATE SCALE IN FEET

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BUICK CITY
FLINT, MICHIGAN

PFAS RESTRICTED AREAS

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FIGURE
1

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BUICK CITY
FLINT, MICHIGAN

LNAPL RESTRICTIVE COVENANT AREAS

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FIGURE
2

NORTH END
SOUTH END

FLINT RIVER

LEGEND:

- PFOS <240 ng/kg
- PFOS >240 ng/kg
- PFOS >1,000 ng/kg
- PFOS >10,000 ng/kg
- PFOS >50,000 ng/kg
- PFOS >100,000 ng/kg
- AREAS WITH NO DIRECT DRAINAGE TO THE STORM SEWER
- PROPERTY LINE
- FORMERLY OWNED RACER PROPERTIES
- SEWER LINE BELOW WATER TABLE (LIMITED DATA AVAILABLE)
- SEWER LINE ABOVE WATER TABLE
- SEWER LINE ABOVE WATER TABLE (LIMITED DATA AVAILABLE)
- SEALED STORM SEWER LINE
- INSUFFICIENT DATA AVAILABLE

0 400' 800'
APPROXIMATE SCALE IN FEET

RACER TRUST
BUICK CITY
FLINT, MICHIGAN

HIGHEST PFOS CONCENTRATION IN EACH SOIL BORING

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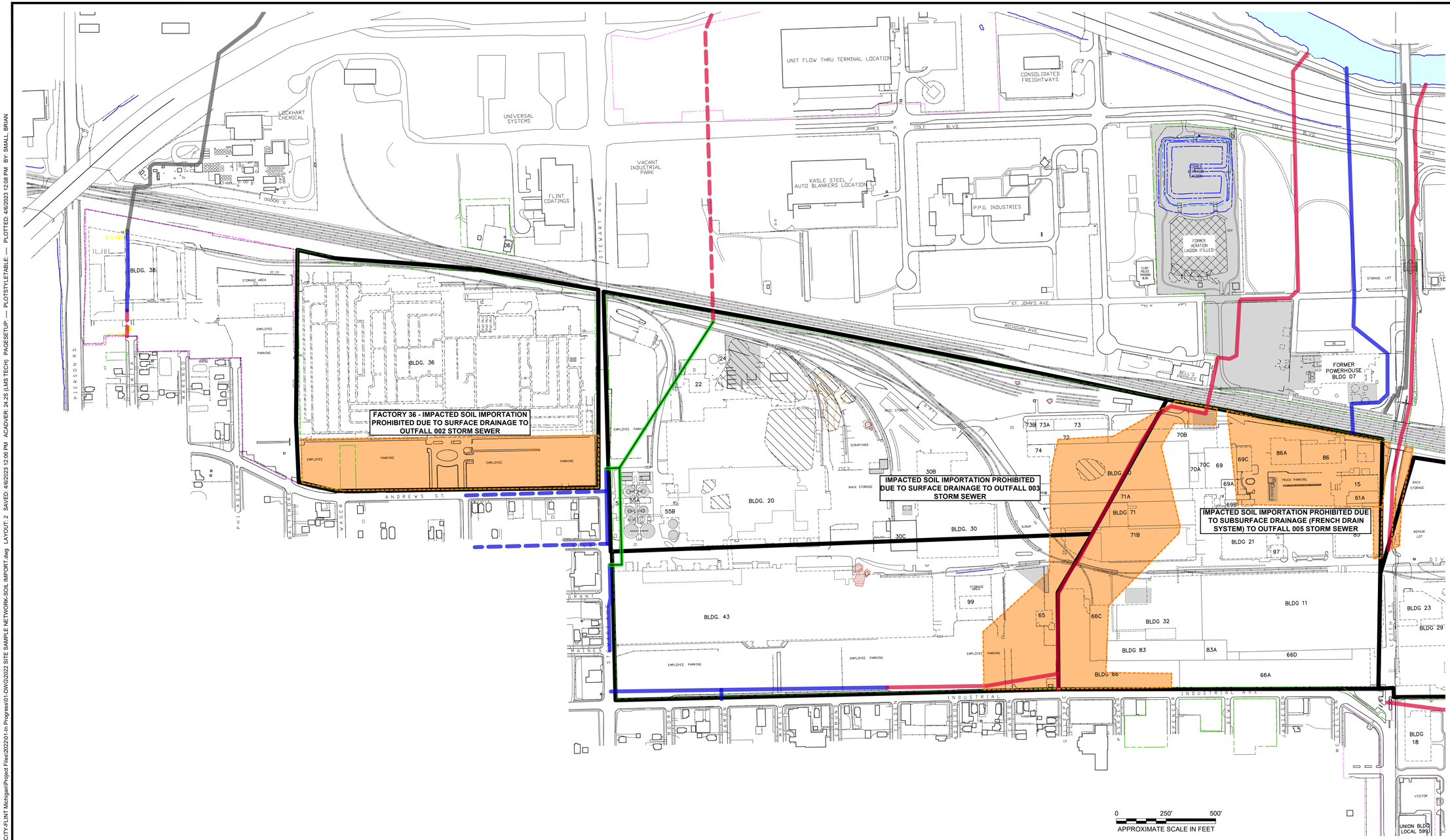
FIGURE
3



LEGEND:

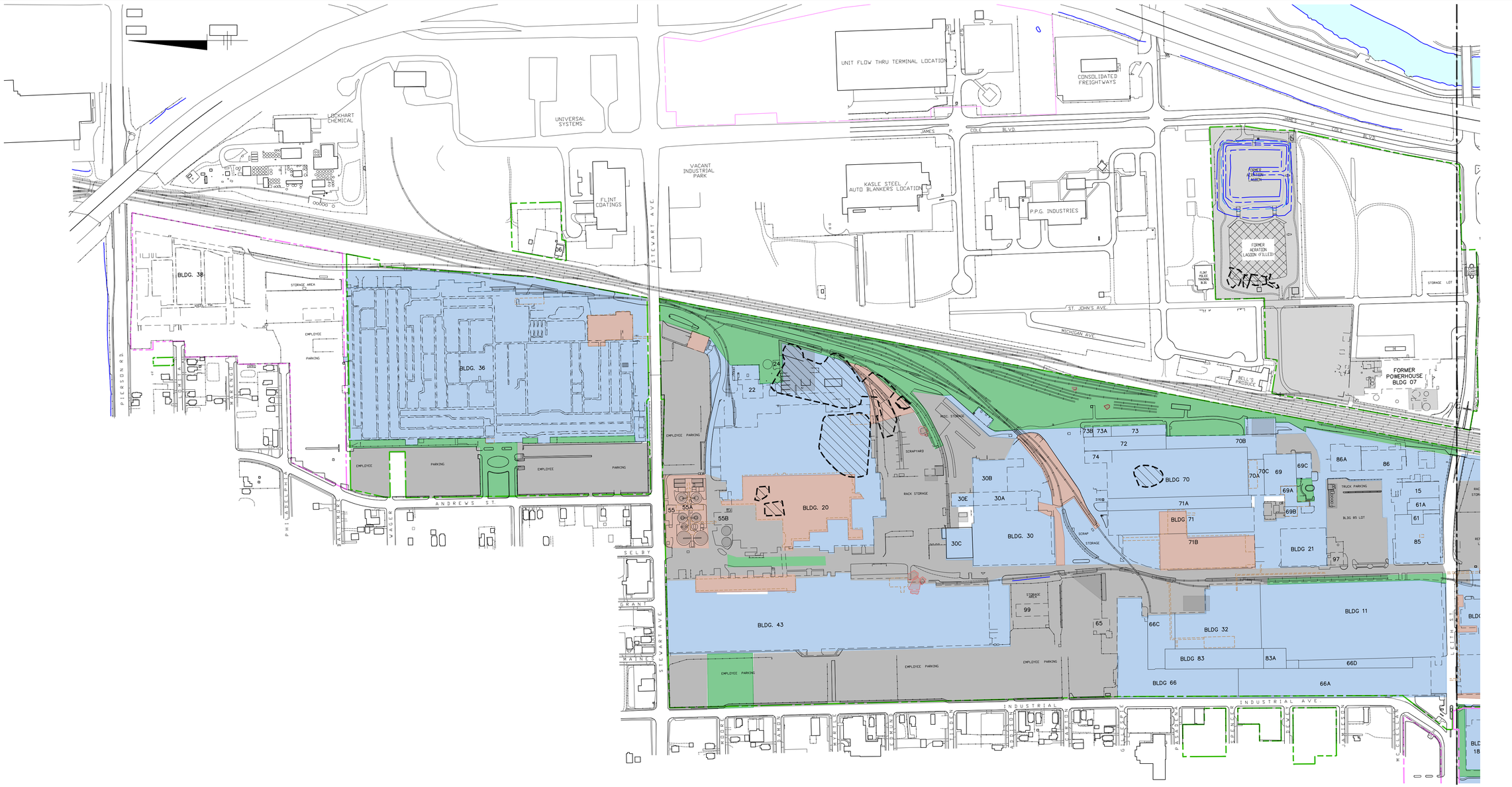
- PROPERTY BOUNDARY
- SEWER LINE BELOW WATER TABLE
- SEWER LINE BELOW WATER TABLE (LIMITED DATA AVAILABLE)
- SEWER LINE ABOVE WATER TABLE
- SEWER LINE ABOVE WATER TABLE (LIMITED DATA AVAILABLE)
- SEALED STORM SEWER LINE
- INSUFFICIENT DATA AVAILABLE
- AREA PROHIBITED FOR SOIL IMPORTATION

RACER TRUST
BUICK CITY
FLINT, MICHIGAN

NORTHEND AREAS PROHIBITED FOR SOIL IMPORTATION

ARCADIS

FIGURE 4



LEGEND:

- SOIL OR DEBRIS PILE
- RACER PROPERTY BOUNDARY
- PROPERTY PREVIOUSLY OWNED BY RACER
- CONCRETE BUILDING FOUNDATION
- GRAVEL
- MIXED/VEGETATION
- ASPHALT/CONCRETE – PARKING AND ROADWAY

NOTE:

1. BASE MAP INFORMATION FROM A SURVEY BY BMJ, INC. DATED APRIL 2001, AT A SCALE OF 1:100. AERIAL IMAGE FROM ARCGIS 10 ONLINE MAPPING, ACCESSED 6/12/2013.
2. BASED ON INFORMATION AVAILABLE AS OF 02/15/2016.

RACER TRUST
BUICK CITY
FLINT, MICHIGAN

NORTHEND SURFACE COVER

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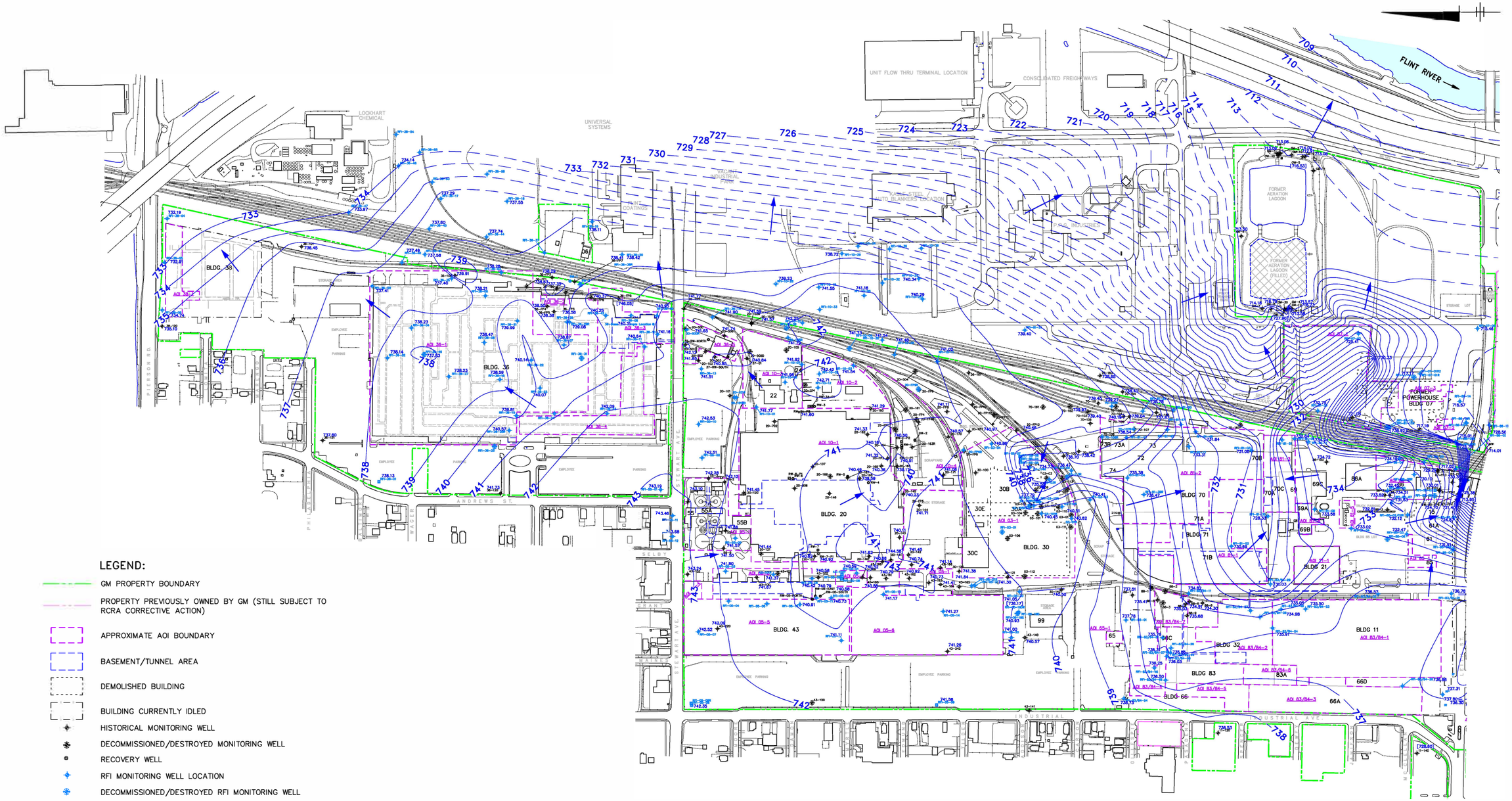
FIGURE 5



LEGEND:

- GM PROPERTY BOUNDARY
- PROPERTY PREVIOUSLY OWNED BY GM (STILL SUBJECT TO RCRA CORRECTIVE ACTION)
- APPROXIMATE AOI BOUNDARY
- BASEMENT/TUNNEL AREA
- DEMOLISHED BUILDING
- BUILDING CURRENTLY IDLED
- HISTORICAL MONITORING WELL
- DECOMMISSIONED/DESTROYED MONITORING WELL
- RECOVERY WELL
- RFI MONITORING WELL LOCATION
- DECOMMISSIONED/DESTROYED RFI MONITORING WELL
- RFI PIEZOMETER
- 715.54 — GROUNDWATER ELEVATION (IN FEET)
- 726 — GROUNDWATER ELEVATION CONTOUR (IN FEET)
- GENERALIZED FLOW DIRECTION (DASHED WHERE INFERRED)
- [728.37] — ANOMALOUS GROUNDWATER ELEVATION (IN FEET), NOT USED TO GENERATE GROUNDWATER ELEVATION CONTOURS

0 250' 500'
APPROXIMATE GRAPHIC SCALE

NOTES:

1. BASE MAP INFORMATION FROM A SURVEY BY BMJ, INC. DATED APRIL 2001, AT A SCALE OF 1:100.
2. ALL LOCATIONS ARE APPROXIMATE.

X: 64410X01, X02, X03, X24.DWG
L: ON=*, OFF=*REF*, [SHD-BUILDING, *]HIST_SB, *]NAPL_
P: PAGESET/SYR-DL
7/11/06 SYR-85-NES LAF GMS
64410112/RFI-06/64410W03.DWG

GENERAL MOTORS CORPORATION
NAO FLINT OPERATIONS SITE – FLINT, MICHIGAN
RFI PHASE II REPORT

GROUNDWATER ELEVATION CONTOUR MAP - DECEMBER 2004

JULY 2006

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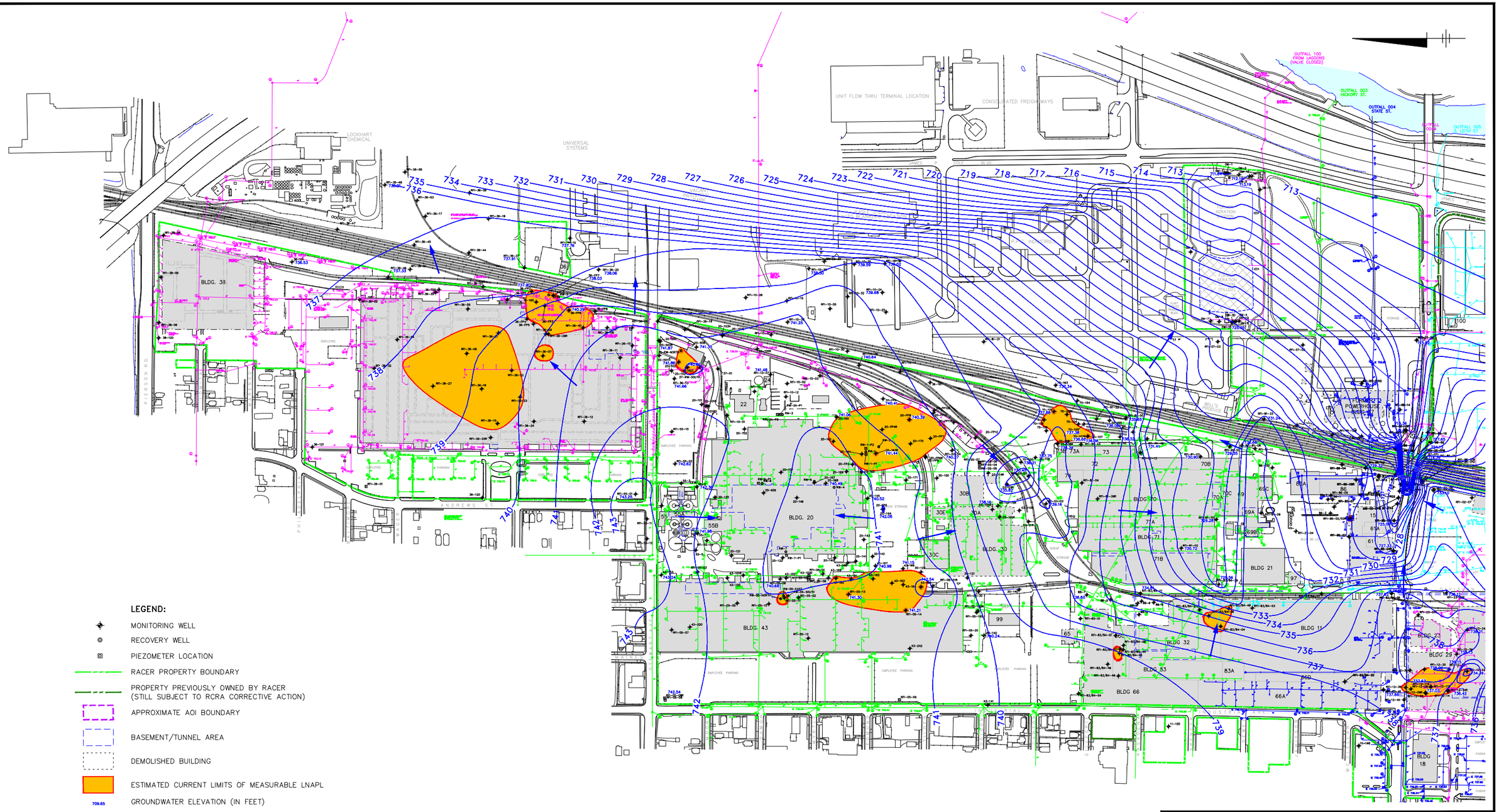
FIGURE 6



LEGEND:

- MONITORING WELL
- RECOVERY WELL
- PIEZOMETER LOCATION
- RACER PROPERTY BOUNDARY
- PROPERTY PREVIOUSLY OWNED BY RACER (STILL SUBJECT TO RCRA CORRECTIVE ACTION)
- APPROXIMATE AOI BOUNDARY
- BASEMENT/TUNNEL AREA
- DEMOLISHED BUILDING
- ESTIMATED CURRENT LIMITS OF MEASURABLE LNAPL
- 709.65 — GROUNDWATER ELEVATION (IN FEET)
- 726 — GROUNDWATER ELEVATION CONTOUR (IN FEET)
- GENERALIZED FLOW DIRECTION
- [709.55] — ANOMALOUS GROUNDWATER ELEVATION (IN FEET) NOT USED TO GENERATE GROUNDWATER ELEVATION CONTOURS
- LOCATION WHERE MEASURABLE LNAPL HAS BEEN DETECTED IN 2010

NOTES:

1. BASE MAP INFORMATION FROM A SURVEY BY BMJ INC., DATED APRIL 2001, AT A SCALE OF 1:100.
2. ALL LOCATIONS ARE APPROXIMATE.

0 250' 500'
GRAPHIC SCALE

REVITALIZING AUTO COMMUNITIES
ENVIRONMENTAL RESPONSE TRUST
NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN
CMI ANNUAL REPORT

GROUNDWATER ELEVATION CONTOUR MAP - OCTOBER 2010

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FIGURE 7

CITY: SYRACUSE DIV/GROUP: 141 DB: GMS PM:(Redgt) LYR: ON=*;OFF=*REF*;ISHD-BUILDING;;IHST_SB
G:\ENVCAD\SYRACUSE\ACTIB\06441\0\20111012\02\DWG\GW64410W01.DWG LAYOUT: 8 SAVED: 4/13/2011 5:13 PM ACADVER: 18.0S (LMS TECH) PAGESETUP: C:\LD2B-PDF-CONV PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 4/14/2011 4:53 PM BY: STOWELL, GARY
XREFS: IMAGES: PROJECTNAME: ---
64410X01
64410X7A
64410X00
64410X6A

LEGEND:

- RACER PROPERTY BOUNDARY
- FORMER BUILDING/FACTORY EXTENTS
- MONITORING WELL
- ABANDONED MONITORING WELL
- RFI SOIL BORING/GRAB
- APPROXIMATE KNOWN EXTENT OF MEASURABLE LNAPL (>0.1 FEET)
- STORM SEWER LINE
- COMPLETED BULKHEAD
- PROPOSED REROUTE
- PROPOSED REROUTE
- PROPOSED OUTFALL 004 BULKHEAD LOCATION (TO BE COMPLETED FOLLOWING REROUTE)
- 744.47 GROUNDWATER ELEVATION (IN FEET)
- 728 GROUNDWATER ELEVATION CONTOUR LINE (DASHED WHERE INFERRED)

NOTES:

1. BASE MAP INFORMATION FROM A SURVEY BY BMJ, INC. DATED APRIL 2001, AT A SCALE OF 1:100. AERIAL IMAGE FROM ARCGIS 10 ONLINE MAPPING, ACCESSED 6/12/2013.
2. BASED ON INFORMATION AVAILABLE AS OF MAY 2015.

RACER TRUST
BUICK CITY
FLINT, MICHIGAN

GROUNDWATER ELEVATION CONTOUR MAP JUNE 2013

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FIGURE
8

CITY: SYRACUSE DIV/GROUP: 141 DB: A.SANCHEZ LD: GMS PIC: C.S. PETERS PM: C.KIKER TM: C.KIKER LYR: ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACT\B0064410\2015\00701\B64410B01.dwg LAYOUT: 2 SAVED: 7/24/2015 2:43 PM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 7/24/2015 2:43 PM BY: SANCHEZ, ADRIAN
IMAGES: PROJECTNAME: ----