CITY OF HOUSTON

PUBLIC WORKS AND ENGINEERING
PLANNING & DEVELOPMENT DIVISION

EXECUTIVE SUMMARY

Project Overview

InControl Technologies, Inc. was retained by Malcolm Pirnie on behalf of Metro Solutions (the current property owner), to provide environmental consulting services at the North Route MSD No. 1 property located near the confluence of Interstate 10 and Interstate 45 north of downtown Houston, Harris County, Texas. The subject property consists of approximately 16.37-acres of land located northwest of downtown Houston, Harris County, Texas (**Figure B1**). The subject property is developed with a mixture of commercial and light industrial properties, parking lots, warehouses and office space.

The subject property is located within the White Oak Bayou Watershed (**Figure B2**). According to the Flood Insurance Rate Map (**Figure B3**), the subject property is located outside the 0.2% annual chance (500 year) floodplain. Approximately 85% of the subject property is covered with parking spaces, walkways, roadways, railroad and buildings. The remaining 15% is covered by grassy areas (**Figure C1**).

The subject property currently has several groundwater Protective Concentration Level Exceedance (PCLE) zones which are depicted on **Figure B4**.

Historical Environmental Condition

To date, Metro Solutions has undertaken site investigation activities designed to define the nature and extent of the environmental impact from historical releases at the subject property. The subject property (North Route MSD No. 1) is subdivided into sixteen Parcels (IT_003, NR_803, NR_803A, IT_004, NR_804, IT_005, IT_007D, IT_011, IT_016, NR_816, IT_018, IT_031, NR_830, NR_809B, NR_809C and NR_808G). All of the Parcels are currently developed with commercial or light industrial uses. Historic property uses include warehousing (Parcel IT_005), bulk fuel terminal (Parcels IT_031 and NR_830) and rail yard operations (Parcel IT_016 and NR_816). As part of the environmental due diligence, a Phase I Environmental Site Assessment (ESA) was completed for each Parcel. Phase II ESAs were conducted for METRO on select parcels (IT_003/NR_803/NR_803A, IT_004/NR_804, IT_005, IT_016/NR_816, IT_018, and IT_031/NR_830) based on recognized environmental conditions reported in the Phase I ESAs. Phase II ESAs were conducted independently of METRO at select parcels (IT_007D, IT_011, and IT_016/NR_816). Soil and groundwater samples were collected to determine if historic operations associated with the Parcel or surrounding Parcels had affected soil and/ or shallow groundwater. The results were compared to the most conservative Tier 1 Protective Concentration Levels (PCLs) (**Table F1** and **Table F2**) under the Texas Risk Reduction Program (TRRP). **Figure B5** depicts the locations of the

soil sampling points and **Figure B6** depicts the groundwater sampling points within the proposed MSD boundary.

The lateral extent of affected groundwater has been horizontally delineated in all directions (**Figure B4**). A comparison of the sampling results available for the investigation areas indicates that the affected area has remained stable over time. Compound specific PCLE zones are depicted in **Figure B8-1** through **Figure B8-3**. Based on information collected from the various reports available for each Parcel within the proposed MSD boundary, the overall direction of groundwater flow is to the southwest (i.e. toward White Oak Bayou) (**Figure B7**). Because all the groundwater elevation data are not tied to a common reference point, a groundwater gradient across the proposed MSD boundary could not be calculated.

Twenty-three water wells were identified within a ½-mile radius of the proposed MSD boundary. None of the identified water wells within a ½-mile radius are listed as domestic or public supply wells. All identified wells within the ½-mile radius are listed as industrial, de-watering or unused. Three of the identified wells are within the proposed MSD boundary. One well is located on the edge of parcel IT_016 (well ID 65-14-733) and is drilled to a depth of greater than 1,000-ft below ground surface (bgs). The remaining two wells identified on the MSD boundary are located cross-gradient of the subject property. All other identified wells within ½-mile radius of the site are cross-gradient or downgradient. The depths of the identified wells range from 70-ft bgs to greater than 1,000-ft bgs. The wells that are completed at depths of 70-ft bgs are located cross-gradient and upgradient of the proposed MSD boundary and are unlikely to be in contact with the area of affected groundwater associated with the subject site. In general, the completion zones for the identified water wells are typically deeper than the limit of the affected groundwater associated with the proposed MSD area.

White Oak Bayou is located approximately 680-feet downgradient of the proposed MSD boundary. Numerous soil and groundwater samples have been collected between the downgradient edge of the area of affected groundwater and White Oak Bayou to confirm that surface water at the bayou is not threatened by affected groundwater (**Figure B4**).

Appendix B – Site Maps

The figures in this section provide information required under **Item 2**. The maps depict the property location and topography with proposed MSD boundary, the area of affected groundwater, the location of all soil sampling points and groundwater monitoring wells, the groundwater gradient, and the soil and groundwater PCLE zones.

The following is a listing of figures included in **Appendix B**.

Figure B1 – Site location and topographic Map
Figure B2 – Watershed Map
Figure B3 – Floodplain Map
Figure B4 – Groundwater PCLE zones
Figure B5 – Soil sampling locations
Figure B6 – Groundwater sampling locations
Figure B7 – Groundwater Gradient Map
Figure B8-1 – Groundwater PCL Exceedance zone map (VOCs)
Figure B8-2 – Groundwater PCL Exceedance zone map (SVOCs)
Figure B8-3 – Groundwater PCL Exceedance zone map (RCRA metals)
Figure B8-4 – Groundwater PCL Exceedance zone map (TPH)

The subject property is located within the White Oak Bayou watershed (**Figure B2**) and is not located within the 100-year floodplain (**Figure B3**).

Figure B4 depicts all of the groundwater PCLE zones within the proposed MSD boundary. These zones were developed based on several environmental samples collected from both soil and groundwater. **Figure B5** shows the locations of the soil samples and **Figure B6** depicts the locations of the groundwater samples. Groundwater in this area tends to flow towards White Oak Bayou and Buffalo Bayou (**Figure B7**). The primary chemicals of concern (COCs) can be divided into four different groups; volatile organic compounds (VOCs, **Figure B-1**), semi volatile organic compounds (SVOCs, **Figure B8-2**), RCRA Metals (**Figure B8-3**) and Total Petroleum Hydrocarbons (TPH, **Figure B8-4**).

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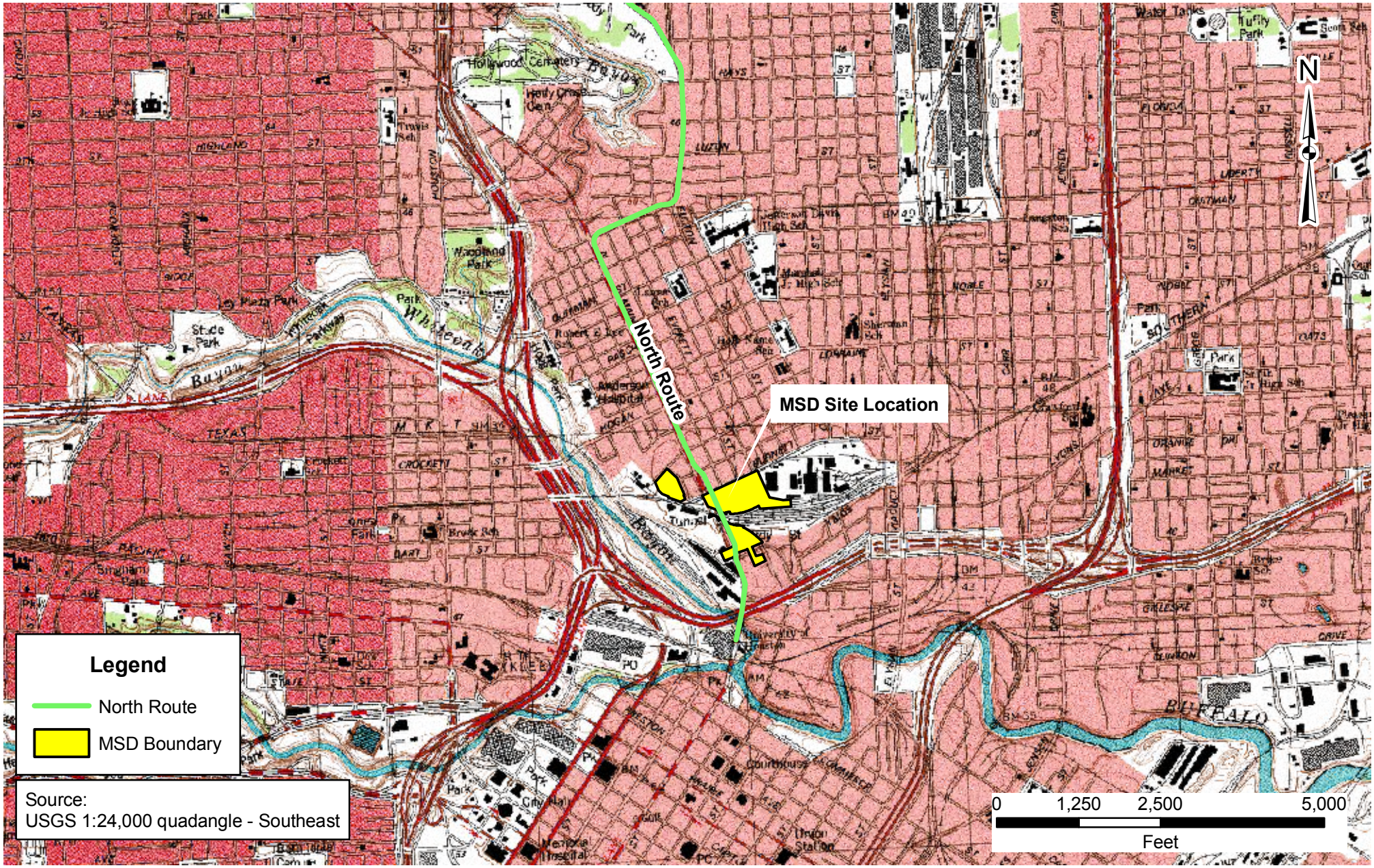

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METRO SOLUTIONS - NORTH ROUTE MSD NO. 1

CITY OF HOUSTON - MSD APPLICATION
SITE LOCATION MAP
TOPOGRAPHIC QUADANGLE

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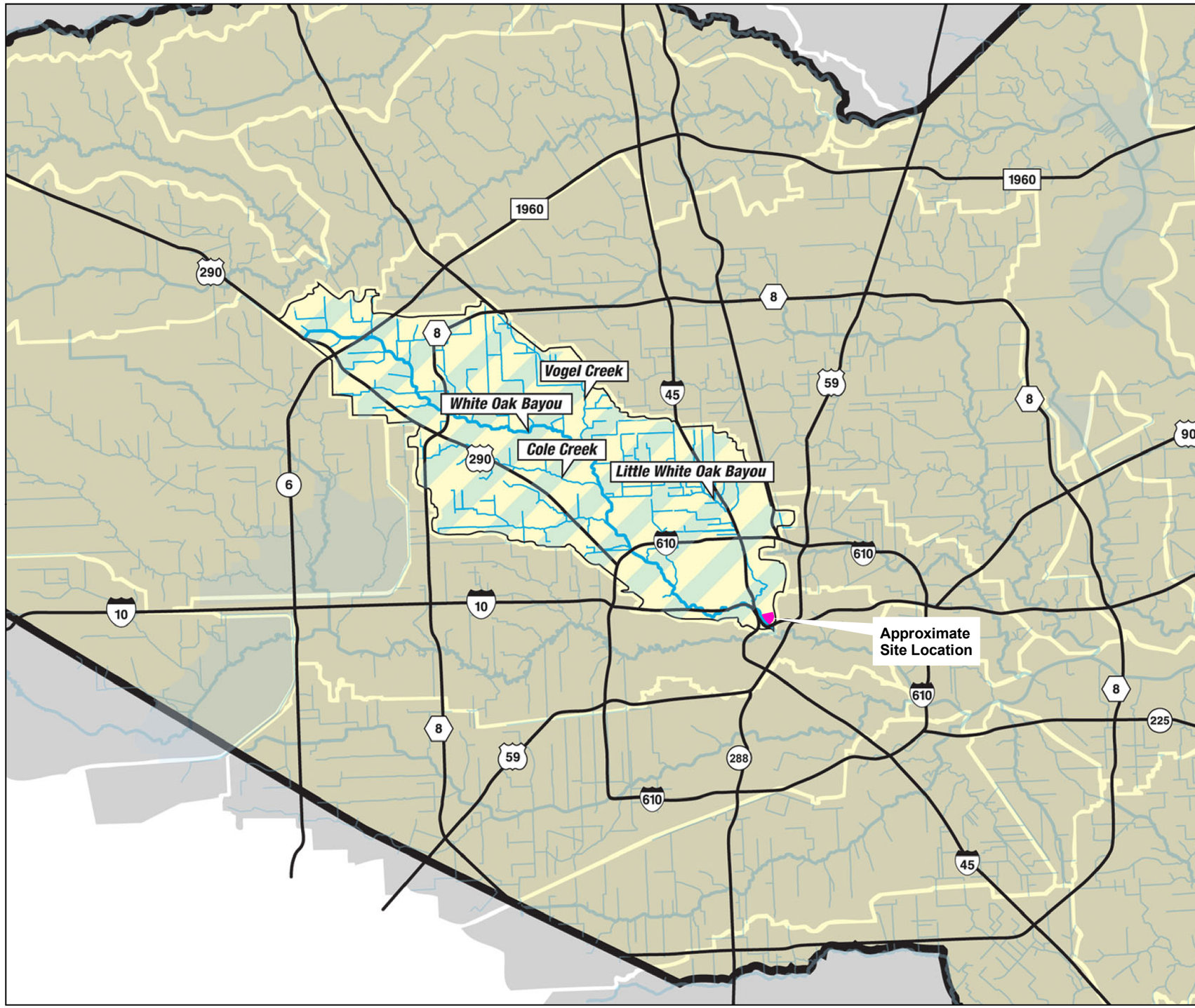
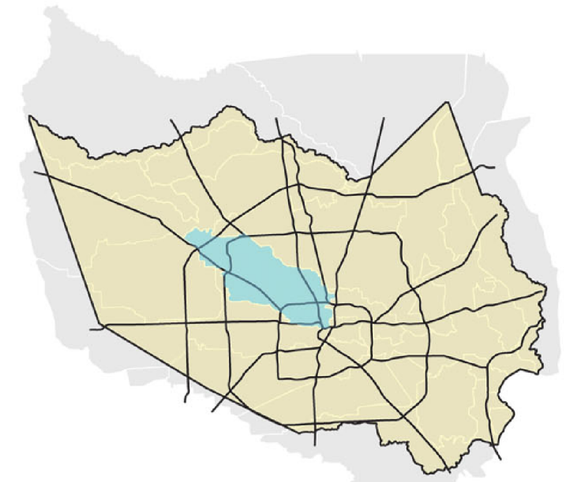
FIGURE B1





111 Sq. Miles

Watershed Population:
416,067

Open Stream Miles:
151 Miles

Primary Streams:
White Oak Bayou
Little White Oak Bayou
Cole Creek

N

Legend

Approximate Site Location

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Watershed Map
White Oak Bayou Watershed

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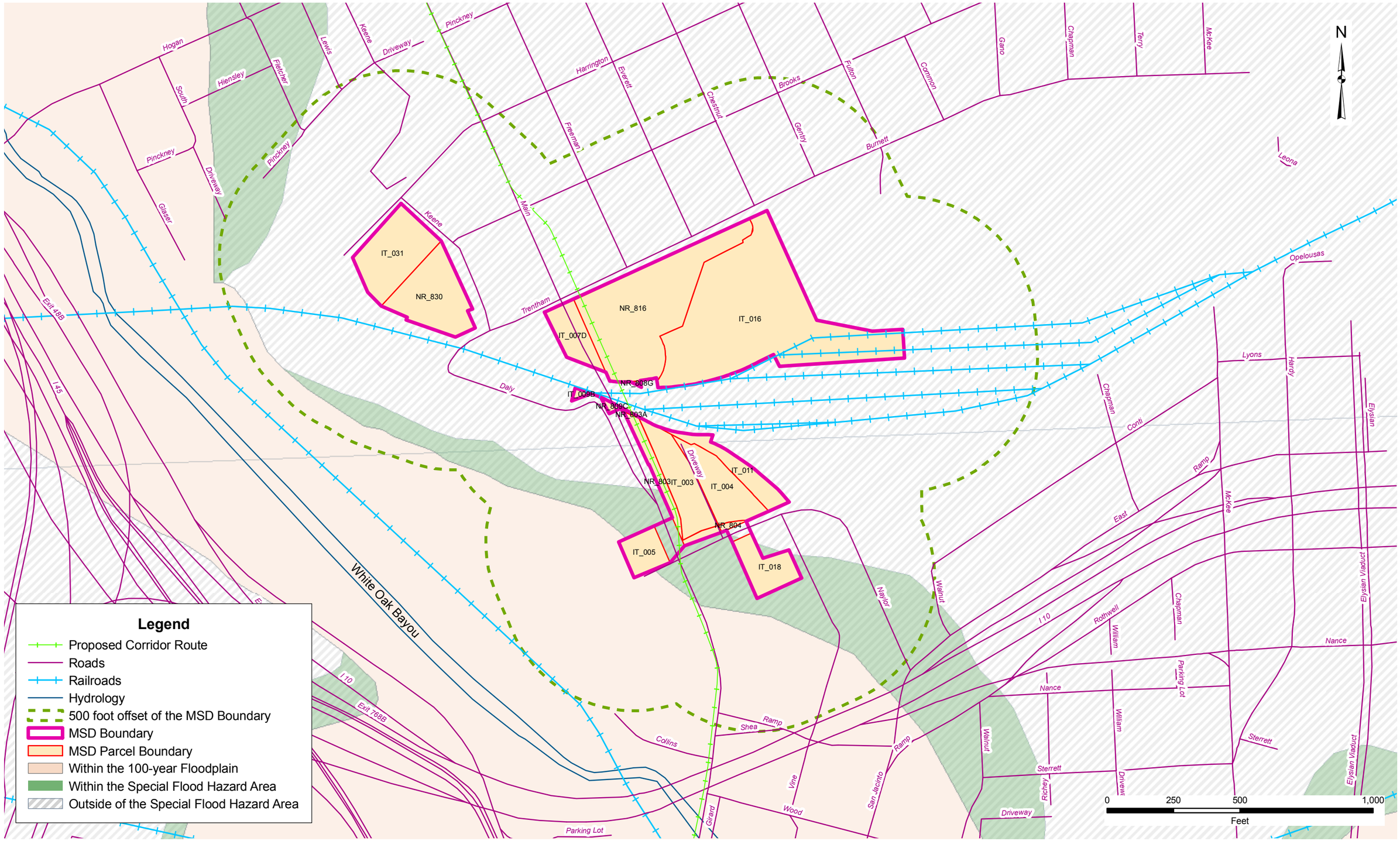
FIGURE B2



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FEMA FLOODPLAIN AND PARCEL LOCATION MAP

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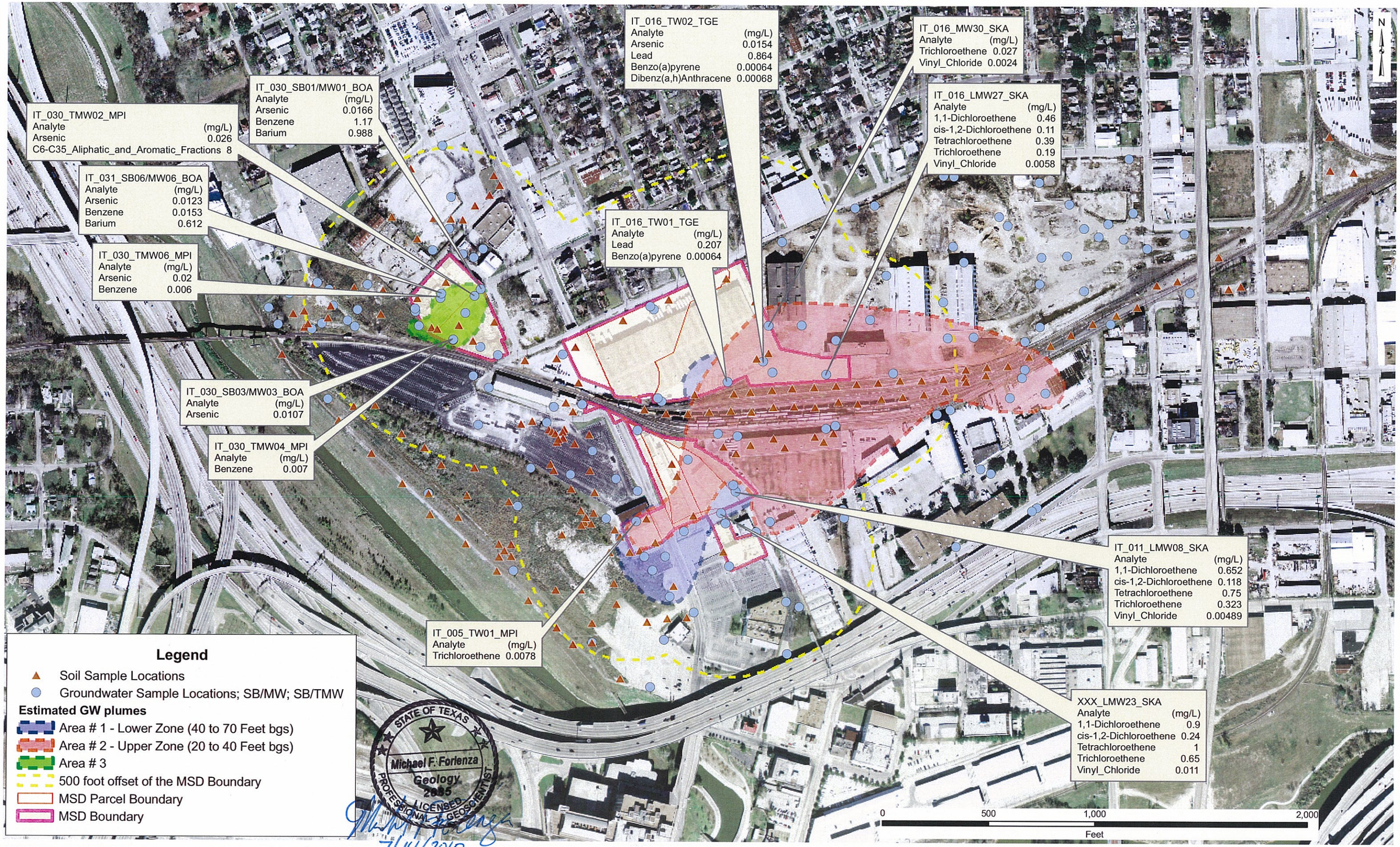
FIGURE B3



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DETECTED AREA OF AFFECTED GROUNDWATER

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FIGURE - B4

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SOIL SAMPLE LOCATIONS

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FIGURE B5

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METRO SOLUTIONS - NORTH ROUTE MSD NO. 1

GROUNDWATER SAMPLE LOCATIONS

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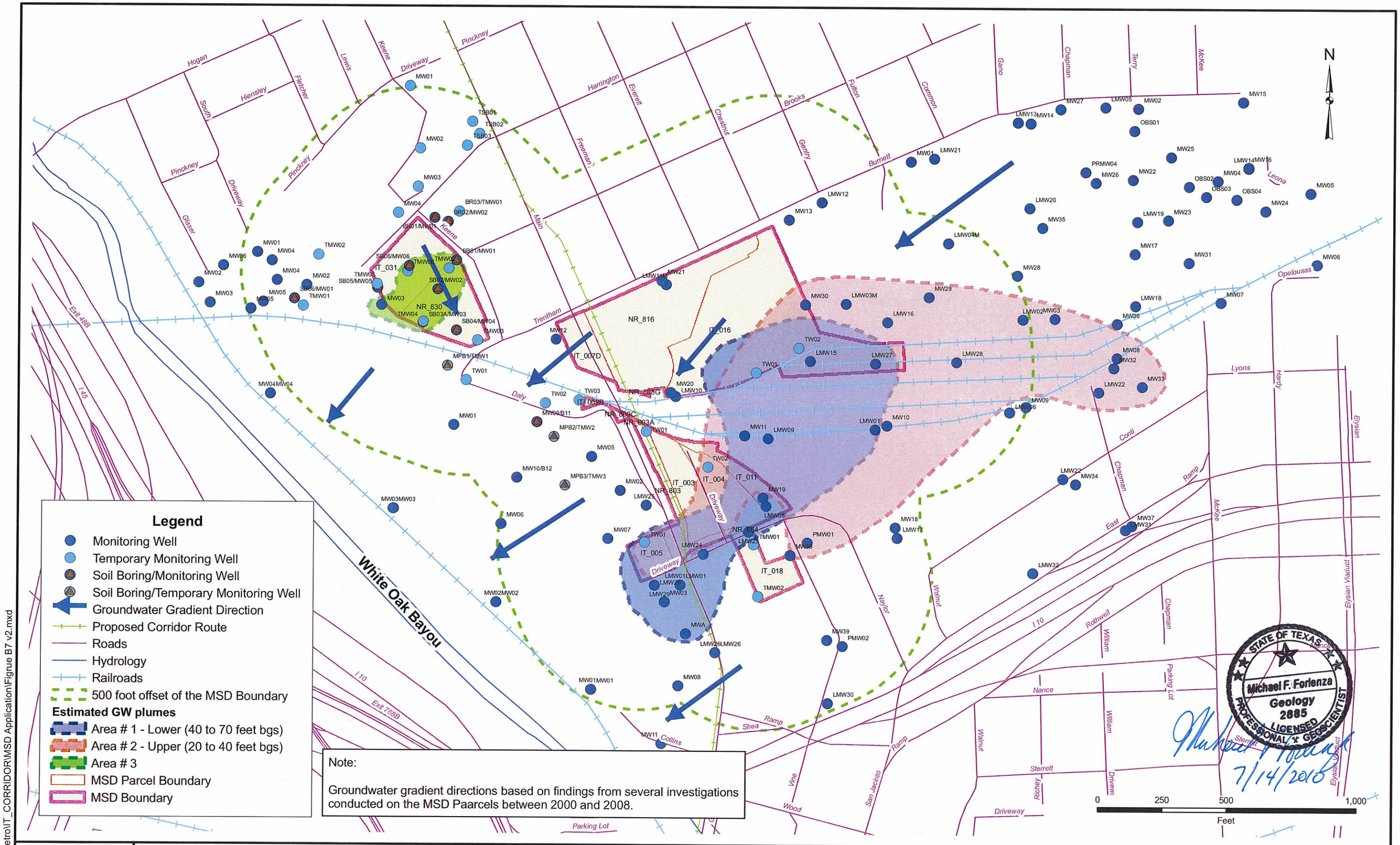
FIGURE B6



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GROUNDWATER GRADIENT MAP

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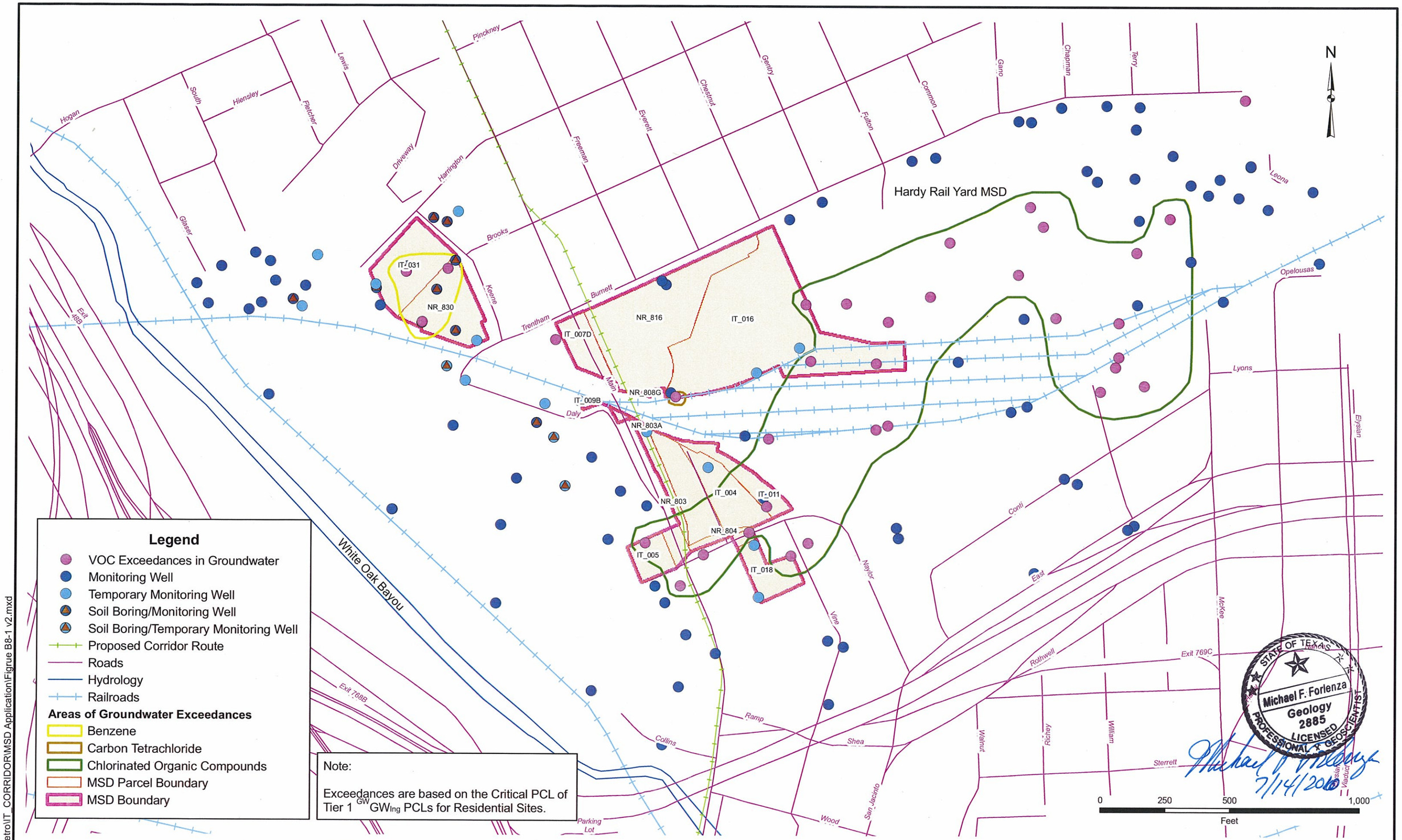
FIGURE B7



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INGESTION PROTECTIVE CONCENTRATION LEVEL EXCEEDANCE ZONE
VOC EXCEEDANCES IN GROUNDWATER

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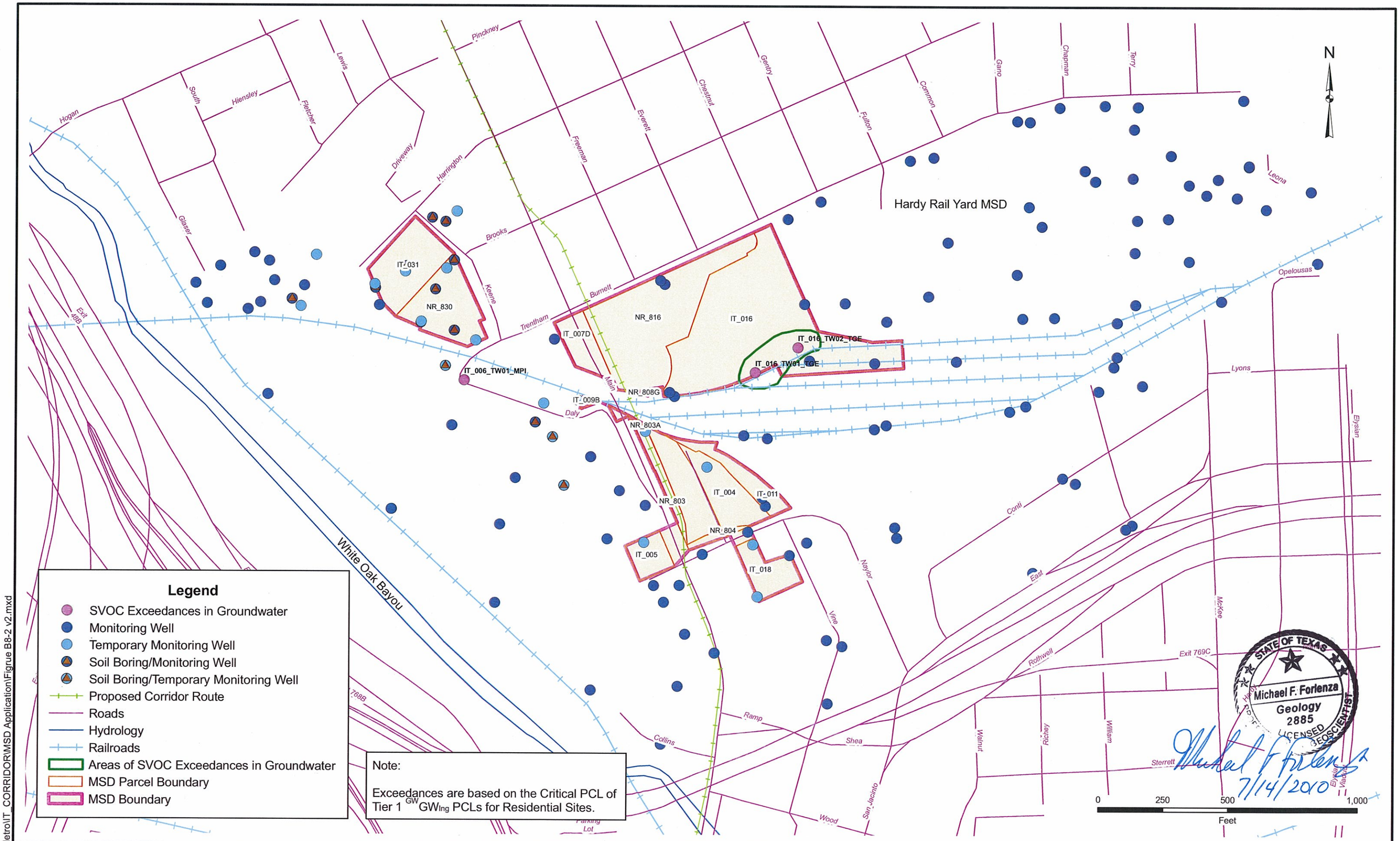
FIGURE B8-1



Legend

- SVOC Exceedances in Groundwater
- Monitoring Well
- Temporary Monitoring Well
- Soil Boring/Monitoring Well
- Soil Boring/Temporary Monitoring Well
- Proposed Corridor Route
- Roads
- Hydrology
- Railroads
- Areas of SVOC Exceedances in Groundwater
- MSD Parcel Boundary
- MSD Boundary

Note:

Exceedances are based on the Critical PCL of Tier 1 $^{GW}GW_{Ing}$ PCLs for Residential Sites.

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METRO SOLUTIONS - NORTH ROUTE MSD NO. 1

INGESTION PROTECTIVE CONCENTRATION LEVEL EXCEEDANCE ZONE
SVOC EXCEEDANCES IN GROUNDWATER

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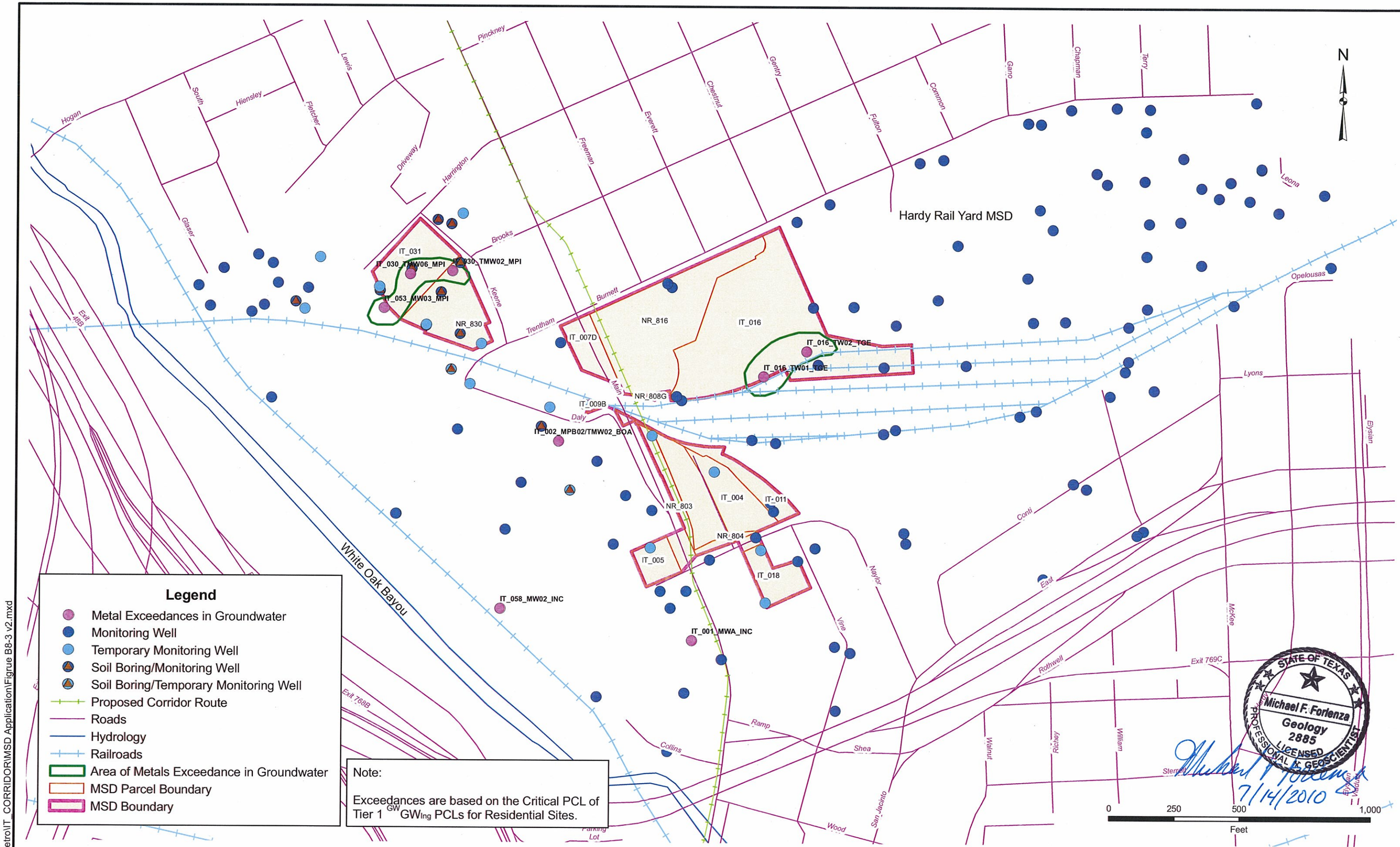
FIGURE B8-2



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METRO SOLUTIONS - NORTH ROUTE MSD NO. 1

INGESTION PROTECTIVE CONCENTRATION LEVEL EXCEEDANCE ZONE
METAL EXCEEDANCES IN GROUNDWATER

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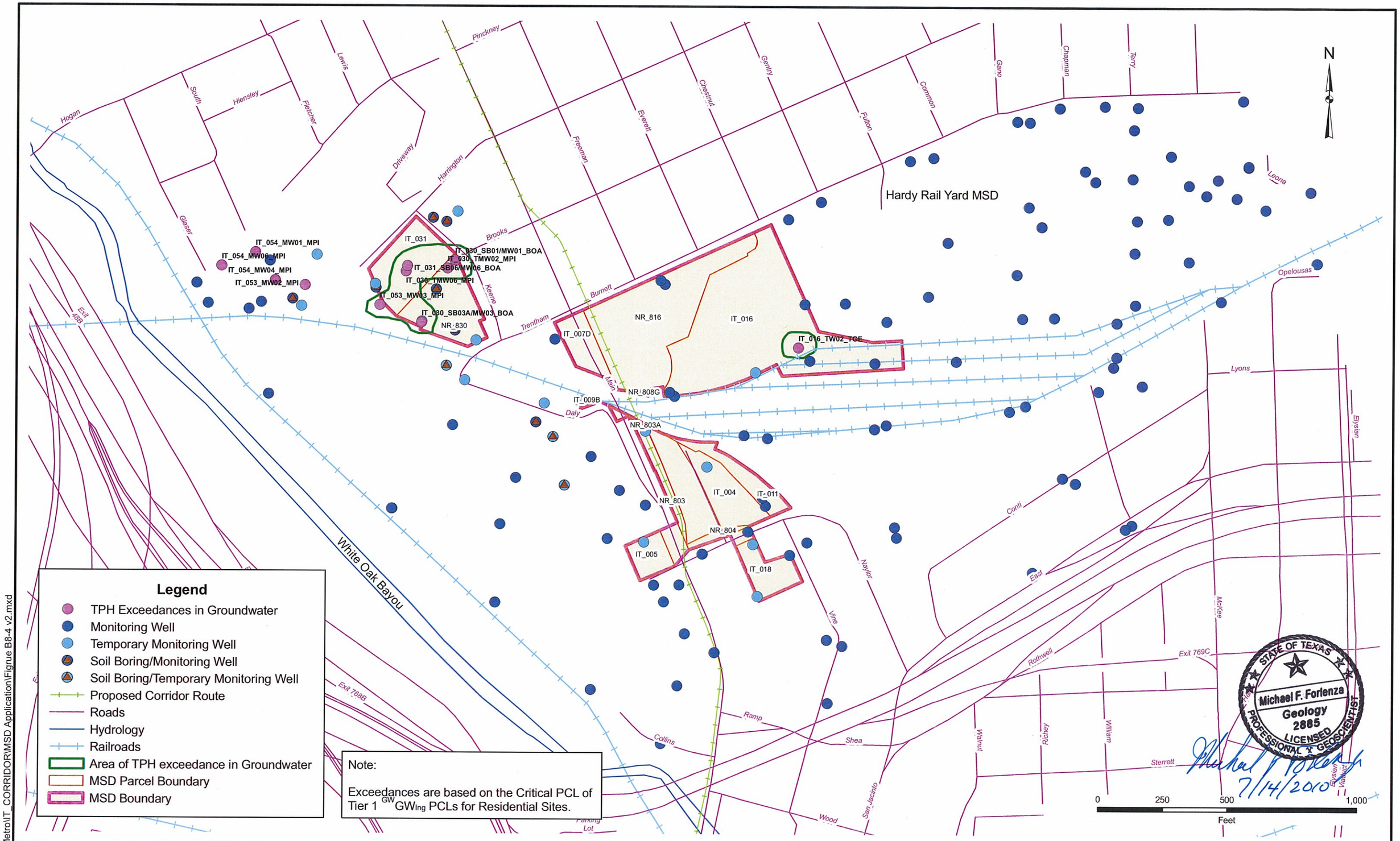
FIGURE B8-3



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METRO SOLUTIONS - NORTH ROUTE MSD NO. 1

INGESTION PROTECTIVE CONCENTRATION LEVEL EXCEEDANCE ZONE
TPH EXCEEDANCES IN GROUNDWATER

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FIGURE B8-4

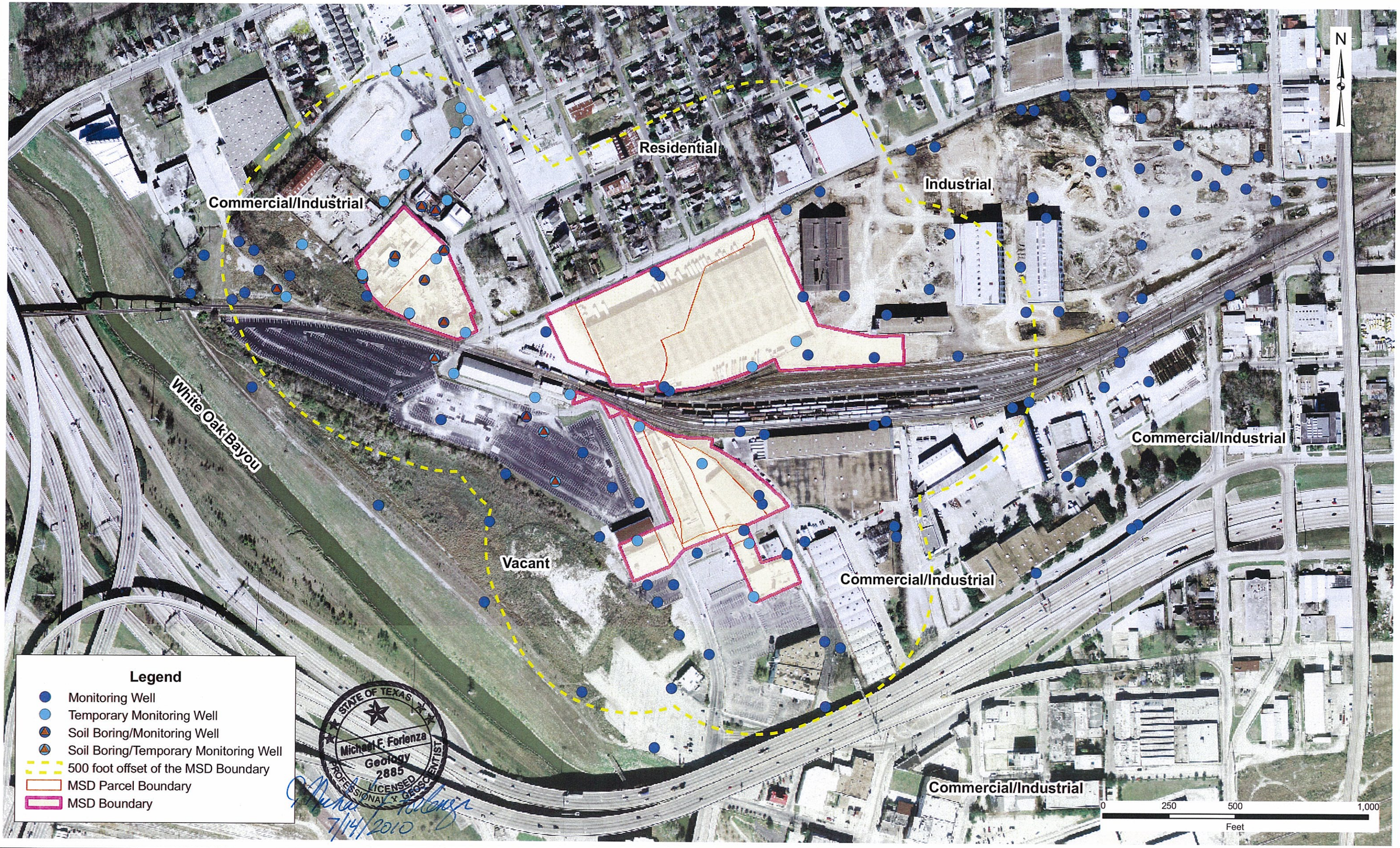
Appendix C – Property Use

The subject property consists of approximately 16.37-acres of land located northeast of downtown Houston, Harris County, Texas. The affected property is located in a mixture of residential, commercial and light industrial development (**Figure C1**). The subject property has been occupied since at least late 1800s by various commercial and industrial users. Historic property uses include warehousing (Parcel IT_005), bulk fuel terminal (Parcels IT_031 and NR_830) and rail yard operations (Parcel IT_016 and NR_816). Current property uses include parking lots, warehouses and residential. The anticipated use of the property will be the future METRO light rail transit.

Approximately 85% of the subject property is developed with parking lots, walkways, roadways and buildings (**Figure C1**). The remaining 15% is covered by grassy areas. Future use of the subject property is to be redeveloped for public transportation and commercial uses.

Figure C1 (found in **Appendix C**) provides a description of the surrounding land use within 500-feet of the proposed MSD boundary:

- North – Primarily residential development.
- East – Railroad and industrial development. The properties to the east are included in the CR V Hardy Yards L.P. MSD (City Ordinance 2008-1323).
- South – Commercial/ industrial development followed by Interstate 10.
- West – Parking lot followed by vacant property followed by White Oak Bayou.



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METRO SOLUTIONS - NORTH ROUTE MSD NO. 1

CURRENT LAND USE MAP
MSD 500-FOOT BOUNDARY

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FIGURE C1

Appendix D – PCLE Zone Discussion

A) A review of recent sampling data indicates that COCs in groundwater currently exceed the Tier 1 $^{GW}GW_{Ing}$ PCLs for residential properties. These COCs are related to the long history of use of the properties within the proposed MSD boundary by commercial/ industrial users. PCLE zones for VOCs, SVOCs, metals and TPH are depicted on **Figure B8-1** through **Figure B8-4** respectively and are discussed in more detail below. The areas of affected groundwater are delineated in all directions (**Figure B4**).

Volatile Organic Compounds (VOCs)

A review of recent groundwater sampling data indicates that the VOCs that currently exceed the Tier 1 $^{GW}GW_{Ing}$ PCLs are 1,1-dichloroethene (1,1-DCE), tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), vinyl chloride, benzene and methyl tert-butyl ether (MTBE). There are several small VOC PCLE zones within the proposed MSD boundary. A benzene plume appears to be limited to Parcels NR_830 and IT_031 located on the northwestern portion of the proposed MSD boundary. One large VOC PCLE zone extends from the adjacent Hardy Rail Yard MSD site to the northeast across the subject property. This plume has a shallow and deep component and is the responsibility of CR V Hardy Yards L.P. The VOC PCLE zones are depicted on **Figure B8-1**.

Semi Volatile Organic Compounds (SVOCs)

A review of recent groundwater sampling data indicates that the SVOCs that currently exceed the Tier 1 $^{GW}GW_{Ing}$ PCLs are benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene and indeno(1,2,3-c,d)pyrene. The PCLE zone is located on the southern portion of Parcel IT_016 and is wholly contained within the proposed MSD boundary (**Figure B8-2**).

RCRA Metals

A review of recent groundwater sampling data indicates that the following RCRA metals currently exceed the Tier 1 $^{GW}GW_{Ing}$ PCLs: lead and arsenic. There are two small PCLE zones within the proposed MSD boundary. One PCLE zone is located on the southern portion of Parcel IT_016 extending onto the northern portion of Parcel IT_008_D (not included in the MSD boundary). This PCLE zone is fully delineated. A second metals PCLE zone is located primarily on Parcel IT_031 extending onto the northern corner of Parcel NR_830. Groundwater samples collected from sampling points on the adjacent Parcel IT_053 (not included in MSD boundary) provide complete delineation of this second metals PCLE zone. Both PCLE zones are depicted on **Figure B8-3**.

Total Petroleum Hydrocarbons (TPH)

A review of recent groundwater sampling data indicates that total petroleum hydrocarbons (TPH) currently exceed the Tier 1 $^{GW}GW_{Ing}$ PCLs. There are two small PCLE zones located within the proposed MSD boundary (**Figure B8-4**). One PCLE zone is located on the southern portion of Parcel IT_016 and centered on sample location IT_016_TW02. A PCLE zone is found on Parcels NR_830 and IT_031. Both PCLE zones are wholly contained within the proposed MSD boundary.

A comparison of the groundwater sampling results with applicable non-ingestion protective concentration levels ($^{Air}GW_{Inh-V}$) indicates that none of the groundwater samples had a COC concentration above the Tier 1 $^{Air}GW_{Inh-V}$ PCL. Based on the recent groundwater monitoring results, there is no non-ingestion protective concentration level exceedance zone within the proposed MSD boundary.

Based on a review of boring logs, the shallow groundwater on the subject property is first encountered at a depth of approximately 16 to 27 feet bgs. The bottom of the shallow groundwater bearing unit (GWBU) is estimated at approximately 35 to 40 ft bgs. A deeper affected groundwater bearing unit is observed in the northeastern portion of the proposed MSD boundary. The COCs in the deeper affected GWBU are related to releases at the neighboring CR V Hardy Yards LP MSD/VCP No. 857 site. The deeper affected GWBU lies between approximately 40 and 70 ft bgs. The area of affected groundwater in the deeper GWBU has been completely delineated. The GWBU is underlain by a thick clay unit.

B) The following table represents the groundwater ingestion PCL exceedances that were reported from the most recent monitoring event for each Parcel:

Table D1 – Groundwater Ingestion PCL Exceedances in Groundwater Bearing Unit

Parcel Number	COC Class	Analyte	CAS	Sample Date	Tier 1 $^{GW}GW_{Ing}$ Residential	Tier 1 $^{Air}GW_{Inh-V}$ Residential	Sample ID	Result (mg/L)	Qualifier
IT_005	VOCs	Trichloroethene	79-01-6	10/30/07	5.0E-03	1.2E+02	TW01	0.0078	
IT_011	VOCs	1,1-Dichloroethene	75-35-4	12/14/06	7.0E-03	1.7E+03	LMW08	0.652	
IT_011	VOCs	cis-1,2-Dichloroethylene	156-59-2	12/14/06	7.0E-02	1.6E+04	LMW08	0.118	
IT_011	VOCs	Tetrachloroethene	127-18-4	12/14/06	5.0E-03	5.0E+02	LMW08	0.75	
IT_011	VOCs	Trichloroethene	79-01-6	12/14/06	5.0E-03	1.2E+02	LMW08	0.323	
IT_011	VOCs	Vinyl Chloride	75-01-4	12/14/06	2.0E-03	3.8E+00	LMW08	0.00489	
IT_016	VOCs	Tetrachloroethene	127-18-4	12/15/06	5.0E-03	5.0E+02	LMW27	0.39	
IT_016	VOCs	Trichloroethene	79-01-6	01/03/07	5.0E-03	1.2E+02	MW30	0.027	
IT_016	VOCs	1,1-Dichloroethene	75-35-4	12/15/06	7.0E-03	1.7E+03	LMW27	0.46	
IT_016	VOCs	cis-1,2-Dichloroethylene	156-59-2	12/15/06	7.0E-02	1.6E+04	LMW27	0.11	
IT_016	VOCs	Vinyl Chloride	75-01-4	01/03/07	2.0E-03	3.8E+00	MW30	0.0024	
IT_016	VOCs	Methyl_tert-butyl_ether	1634-04-4	12/18/06	3.6E-01	4.0E+03	LMW15	0.61	
IT_016	SVOCs	Benzo(a)pyrene	50-32-8	11/20/07	2.0E-04	3.9E+02	TW01	0.00064	J
IT_016	SVOCs	Benzo(a)pyrene	50-32-8	11/20/07	2.0E-04	3.9E+02	TW02	0.00064	J
IT_016	SVOCs	Benzo(b)fluoranthene	205-99-2	11/20/07	1.2E-04	1.6E+03	TW01	0.00056	J
IT_016	SVOCs	Benzo(b)fluoranthene	205-99-2	11/20/07	1.2E-04	1.6E+03	TW02	0.00092	
IT_016	SVOCs	Dibenz(a,h)Anthracene	53-70-3	11/20/07	1.2E-05	1.0E+03	TW02	0.00068	J
IT_016	SVOCs	Indeno(1,2,3-c,d)Pyrene	193-39-5	11/20/07	1.2E-04	9.4E+03	TW01	0.0006	J
IT_016	SVOCs	Indeno(1,2,3-c,d)Pyrene	193-39-5	11/20/07	1.2E-04	9.4E+03	TW02	0.0006	J
IT_016	Metals	Arsenic	7440-38-2	11/20/07	1.0E-02	--	TW02	0.0154	
IT_016	Metals	Lead	7439-92-1	11/20/07	1.5E-02	--	TW01	0.207	
IT_016	Metals	Lead	7439-92-1	11/20/07	1.5E-02	--	TW02	0.864	
IT_016	TX1005	TPH_fraction_C12-C28	TPH-1005-2	11/20/07	9.8E-01	7.5E+03	TW02	3.28	

Parcel Number	COC Class	Analyte	CAS	Sample Date	Tier 1 $^{GW}GW_{Ing}$	Tier 1 $^{Air}GW_{Inh-V}$	Sample ID	Result (mg/L)	Qualifier
IT_018	VOCs	Trichloroethene	79-01-6	05/04/07	5.0E-03	1.2E+02	MW38	0.0059	
NR_830	VOCs	Benzene	71-43-2	9/4/08	5.0E-03	1.8E+02	MW01	1.17	
NR_830	Metals	Arsenic	7440-38-2	9/4/08	1.0E-02	--	MW01	0.0166	
NR_830	Metals	Barium	7440-39-3	9/4/08	2.0E-01	--	MW01	0.988	
NR_830	Metals	Arsenic	7440-38-2	9/4/08	5.0E-03	--	MW03	0.0107	
NR_830	VOCs	Benzene	71-43-2	9/4/08	5.0E-03	1.8E+02	MW06	0.0153	
NR_830	Metals	Arsenic	7440-38-2	9/4/08	1.0E-02	--	MW06	0.00123	
NR_830	Metals	Barium	7440-39-3	9/4/08	2.0E-01	--	MW06	0.612	
NR_830	TX1005	TPH_fraction_C6-C12	TPH-1005-1	11/07/07	9.8E-01	1.8E+03	TMW02	9.11	
NR_830	TX1005	TPH_fraction_C6-C12	TPH-1005-1	09/05/08	9.8E-01	1.8E+03	SB01/MW01	5	
NR_830	TX1005	TPH_fraction_C12-C28	TPH-1005-2	09/05/08	9.8E-01	7.5E+03	SB01/MW01	1.13	J
NR_830	TX1006	Aliphatics_>C6-8	TPH-1006-2	11/07/07	1.5E+00	2.1E+01	TMW02	2.87	
NR_830	TX1006	Aromatics_>C21-35	TPH-1006-13	11/07/07	7.3E-01	--	TMW02	1.51	
NR_830	TX1006	Aromatics_>C8-10	TPH-1006-9	11/07/07	9.8E-01	6.6E+01	TMW02	2.28	J
IT_031	TX1005	TPH_fraction_C6-C12	TPH-1005-1	09/05/08	9.8E-01	1.8E+03	SB06/MW06	3.48	
IT_031	TX1005	TPH_fraction_C12-C28	TPH-1005-2	09/05/08	9.8E-01	7.5E+03	SB06/MW06	1.83	J
IT_031	TX1005	TPH_fraction_C28-C35	TPH-1005-4	09/05/08	9.8E-01	7.5E+03	SB06/MW06	1.47	J

Note:
J – Analyte detected below quantitation limit

Groundwater COC concentrations tabulated above are less than the Tier 1 $^{Air}GW_{Inh-V}$ non-ingestion PCL. Therefore, based on the groundwater data, there is no non-ingestion PCLE zone on the subject property.

C) The COCs detected in groundwater samples (1,1-DCE, PCE, TCE, cis-1,2-DCE, vinyl chloride, benzene, MTBE, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-c,d)pyrene, lead, arsenic and TPH) are associated with the historic operations at the various parcels included in the MSD boundary.

Chlorinated solvents are characterized by their high volatilities, high densities, low viscosities, low interfacial tension, low absolute solubilities, high relative solubilities, low portioning to soil materials and low degradability. Chlorinated solvents will dissolve in water at low concentrations but once the groundwater has reached the saturation limit for that compound, the chlorinated solvent will form a separate phase in equilibrium with the water. Because chlorinated solvents have higher densities relative to water, the separate phase will "sink". These compounds are referred to as "dense non-aqueous phase liquids" (DNAPLs). In high concentrations DNAPLs will be able to penetrate the water table and form "pools" on the top of less permeable layers. Historically, DNAPL has not been identified in any of the monitoring wells within the proposed MSD boundary and is not expected to be present given the relatively low concentration of chlorinated solvents detected in groundwater.

Metals are relatively immobile in the subsurface as the result of precipitation and adsorption reactions. A variety of reactions may occur which influence the speciation and mobility of metals including acid/base, precipitation/dissolution, oxidation/ reduction, sorption or ion exchange. Precipitation, sorption, and ion exchange reactions can retard the movement of metals in groundwater. The rate and extent of these reactions will depend on factors such as pH, Eh, complexation with other dissolved constituents, sorption and ion exchange capacity of the geological materials, and organic matter content. Groundwater flow characteristics also influence the transport of metals.

Hydrocarbons will dissolve in water at low concentrations but once the groundwater has reached the saturation point for that compound, a separate phase will form in equilibrium with the water. Because hydrocarbons have lower densities relative to the groundwater, the separate phase will "float". These compounds are referred to as "light non-aqueous phase liquids" (LNAPLs). Historically, LNAPL has not been identified in any of the monitoring wells within the proposed MSD boundary and is not expected to be present given the relatively low concentrations of benzene and TPH detected in groundwater.

Based on the field observations and laboratory results, it appears that the groundwater COCs on the subject property are primarily dissolved in the shallow groundwater. A review of the off-site groundwater sampling results indicates that the majority of the dissolved phase VOCs originate off-site in the northwestern direction on the Hardy Rail Yard MSD site (**Figure B4, Figure B8-1**).

Appendix E – COCs in Designated Groundwater Discussion

A) Refer to **Appendix D** for a discussion of the chemicals of concern (COC) in the ingestion PCLE zone. Current groundwater sampling results indicate that there are several identified COCs (1,1-DCE, PCE, TCE, cis-1,2-DCE, vinyl chloride, benzene, MTBE, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-c,d)pyrene, lead, arsenic and TPH) that exceed the Tier 1 $^{GW}GW_{Ing}$ PCLs for residential properties on the subject property in the shallow groundwater bearing unit. **Figure B8-1** through **Figure B8-4** depicts the PCLE zones for each category of COCs.

B) Refer to **Table D1** for a tabulated comparison of COC concentrations with the respective TRRP PCLs.

C) Refer to **Appendix D** for a discussion of the basic geochemical properties of the COCs in the ingestion PCLE zone.

Appendix F – Summary of Soil and Groundwater Concentration Data

Appendix F contains tables summarizing the concentration levels for the primary COCs in soil and groundwater. The tables include the concentration level, the residential ingestion protective concentration limits (Tier 1 ${}^{GW}Soil_{Ing}$ PCLs for soil and Tier 1 ${}^{GW}GW_{Ing}$ PCLs for groundwater), the residential non-ingestion protective concentration limits for soil (Tier 1 ${}^{Tot}Soil_{Comb}$ and ${}^{Air}Soil_{Inh\text{-}V}$ PCLs) and groundwater (Tier 1 ${}^{Air}GW_{Inh\text{-}V}$ PCLs), the critical residential protective concentration limits assuming no MSD is in place (Tier 1 ${}^{GW}Soil_{Ing}$ PCLs for soil and Tier 1${}^{GW}Soil_{Ing}$ PCLs for groundwater), and the critical residential PCLs assuming that an MSD is in place (Tier 1 ${}^{Tot}Soil_{Comb}$ PCLs for soil and Tier 1 ${}^{Air}GW_{Inh\text{-}V}$ PCLs for groundwater).

Table F1 – Summary of Chemicals of Concern in Soil by Parcel

Parcel Number	CAS	COC Class	Analyte	Sample Date	Tier 1 $^{GW}Soil_{Ing}$ Critical PCL without MSD (Residential)	Tier 1 $^{Tot}Soil_{Comb}$ Critical PCL with MSD (Residential)	Tier 1 $^{Air}Soil_{Inh-V}$ Critical PCL with MSD (Residential)	Sample ID	Sample Depth (ft)	Result (mg/kg)	Qualifier
IT_004	7440-39-3	Metals	Barium	7/1/2008	4.4E+02	8.0E+03	--	TW02	14-16	683	
IT_004	TPH-1006-8	TX1006	Aromatics_>C7-8	7/1/2008	2.0E+01	4.8E+03	1.5E+04	TW02	32-34	36.2	
IT_007D	50-32-8	SVOCs	Benzo(a)pyrene	7/14/2006	7.6E+00	5.6E-01	8.5E+02	MSB03	0-2	0.2	
IT_016	50-32-8	SVOCs	Benzo(a)pyrene	11/20/2007	7.6E+00	5.6E-01	8.5E+02	SB01	0-5	0.207	
IT_016	53-70-3	SVOCs	Dibenz(a,h)Anthracene	11/20/2007	1.5E+01	5.5E-01	2.0E+03	SB01	0-5	0.207	
IT_016	50-32-8	SVOCs	Benzo(a)pyrene	11/20/2007	7.6E+00	5.6E-01	8.5E+02	TW02	0-5	0.437	
IT_016	7440-38-2	Metals	Arsenic	11/20/2007	5.0E+00	2.4E+01	--	TW02	0-5	24.4	
IT_016	7440-38-2	Metals	Arsenic	11/20/2007	5.0E+00	2.4E+01	--	TW02	37-38	20.4	
IT_016	7782-49-2	Metals	Selenium	11/20/2007	2.3E+00	3.1E+02	--	SB02	16-17	2.49	
IT_016	TPH-1005-2	TX1005	TPH_fraction_C12-C28	11/20/2007	2.0E+02	2.3E+03	1.5E+04	SB01	0-5	369	
NR_816	50-32-8	SVOCs	Benzo(a)pyrene	11/20/2007	7.6E+00	5.6E-01	8.5E+02	SB03	0-5	0.131	
NR_816	50-32-8	SVOCs	Benzo(a)pyrene	11/20/2007	7.6E+00	5.6E-01	8.5E+02	SB05	0-5	0.116	
NR_816	50-32-8	SVOCs	Benzo(a)pyrene	11/18/2009	7.6E+00	5.6E-01	8.5E+02	FS17	2-4	0.19	
NR_816	7440-39-3	Metals	Barium	11/18/2009	4.4E+02	8.0E+03	--	FS11	0-4	615	
NR_816	7439-92-1	Metals	Lead	11/18/2009	3.0E+00	5.0E+02	--	FS11	0-4	1,390	
NR_816	7782-49-2	Metals	Selenium	11/18/2009	2.3E+00	3.1E+02	--	FS11	0-4	5.42	
IT_018	7782-49-2	Metals	Selenium	9/6/2007	2.3E+00	3.1E+02	--	TMW02	28-30	4.1	
NR_830	7440-38-2	Metals	Arsenic	8/28/2008	5.0E+00	2.4E+01	--	SB01/MW01	0-2	22.1	
NR_830	7440-38-2	Metals	Arsenic	9/3/2008	5.0E+00	2.4E+01	--	SB04/MW04	0-2	14.8	
NR_830	7440-39-3	Metals	Barium	11/6/2007	4.4E+02	8.0E+03	--	TMW05	2-4	1640	
NR_830	7440-39-3	Metals	Barium	11/6/2007	4.4E+02	8.0E+03	--	TMW05	24-26	1140	
NR_830	TPH-1005-1	TX1005	TPH_fraction_C6-C12	8/28/2008	6.5E+01	1.6E+03	3.1E+03	SB01/MW01	32.5-35	82.3	
NR_830	TPH-1005-1	TX1005	TPH_fraction_C6-C12	11/5/2007	6.5E+01	1.6E+03	3.1E+03	TMW02	36-38	411	
NR_830	TPH-1005-1	TX1005	TPH_fraction_C6-C12	11/6/2007	6.5E+01	1.6E+03	3.1E+03	TMW06	0-2	268	
NR_830	TPH-1005-2	TX1005	TPH_fraction_C12-C28	8/27/2008	2.0E+02	2.3E+03	1.5E+04	SB03A/MW03	10	908	
NR_830	TPH-1005-2	TX1005	TPH_fraction_C12-C28	11/6/2007	2.0E+02	2.3E+03	1.5E+04	TMW06	0-2	377	

Parcel Number	CAS	COC Class	Analyte	Sample Date	Tier 1 $^{GW}Soil_{Ing}$ Critical PCL without MSD (Residential)	Tier 1 $^{Tot}Soil_{Comb}$ Critical PCL with MSD (Residential)	Tier 1 $^{Air}Soil_{Inh-V}$ Critical PCL with MSD (Residential)	Sample ID	Sample Depth (ft)	Result (mg/kg)	Qualifier
IT_031	7440-39-3	Metals	Barium	8/28/2008	4.4E+02	8.0E+03	--	SB03	0-2	6790	
IT_031	7440-39-3	Metals	Barium	8/28/2008	4.4E+02	8.0E+03	--	SB05/MW05	0-2.5	4160	
IT_031	7440-39-3	Metals	Barium	8/28/2008	4.4E+02	8.0E+03	--	SB06/MW06	35-37.5	508	
IT_031	TPH-1005-1	TX1005	TPH_fraction_C6-C12	8/28/2008	6.5E+01	1.6E+03	3.1E+03	SB03	12.5-15	107	
IT_031	TPH-1005-1	TX1005	TPH_fraction_C6-C12	8/28/2008	6.5E+01	1.6E+03	3.1E+03	SB03	35-37.5	277	
IT_031	TPH-1005-1	TX1005	TPH_fraction_C6-C12	11/7/2007	6.5E+01	1.6E+03	3.1E+03	SB05	24-26	188	
IT_031	TPH-1005-1	TX1005	TPH_fraction_C6-C12	11/7/2007	6.5E+01	1.6E+03	3.1E+03	SB06	36-38	81.3	
IT_031	TPH-1005-1	TX1005	TPH_fraction_C6-C12	8/28/2008	6.5E+01	1.6E+03	3.1E+03	SB06/MW06	27.5-30	83.1	
IT_031	TPH-1005-2	TX1005	TPH_fraction_C12-C28	8/28/2008	2.0E+02	2.3E+03	1.5E+04	SB03	12.5-15	328	
IT_031	TPH-1005-2	TX1005	TPH_fraction_C12-C28	8/28/2008	2.0E+02	2.3E+03	1.5E+04	SB03	35-37.5	446	
IT_031	TPH-1005-2	TX1005	TPH_fraction_C12-C28	11/7/2007	2.0E+02	2.3E+03	1.5E+04	SB05	24-26	329	

Notes:
J – Analyte detected below quantitation limit.

Table F2 – Summary of Chemicals of Concern in Groundwater by Parcel

Parcel Number	COC Class	Analyte	CAS	Sample Date	Tier 1 $^{GW}GW_{Ing}$ Critical PCL without MSD (Residential)	Tier 1 $^{Air}GW_{Inh-V}$ Critical PCL with MSD (Residential)	Sample ID	Result (mg/L)	Qualifier
IT_005	VOCs	Trichloroethene	79-01-6	10/30/07	5.0E-03	1.2E+02	TW01	0.0078	
IT_011	VOCs	Tetrachloroethene	127-18-4	12/14/06	5.0E-03	5.0E+02	LMW08	0.75	
IT_011	VOCs	Trichloroethene	79-01-6	12/14/06	5.0E-03	1.2E+02	LMW08	0.323	
IT_011	VOCs	1,1-Dichloroethene	75-35-4	12/14/06	7.0E-03	1.7E+03	LMW08	0.652	
IT_011	VOCs	cis-1,2-Dichloroethylene	156-59-2	12/14/06	7.0E-02	1.6E+04	LMW08	0.118	
IT_011	VOCs	Vinyl Chloride	75-01-4	12/14/06	2.0E-03	3.8E+00	LMW08	0.00489	
IT_016	VOCs	Tetrachloroethene	127-18-4	12/18/06	5.0E-03	5.0E+02	LMW15	0.18	
IT_016	VOCs	Tetrachloroethene	127-18-4	12/15/06	5.0E-03	5.0E+02	LMW27	0.39	
IT_016	VOCs	Trichloroethene	79-01-6	12/18/06	5.0E-03	1.2E+02	LMW15	0.19	
IT_016	VOCs	Trichloroethene	79-01-6	12/15/06	5.0E-03	1.2E+02	LMW27	0.19	
IT_016	VOCs	Trichloroethene	79-01-6	01/03/07	5.0E-03	1.2E+02	MW30	0.027	
IT_016	VOCs	1,1-Dichloroethene	75-35-4	12/18/06	7.0E-03	1.7E+03	LMW15	0.34	
IT_016	VOCs	1,1-Dichloroethene	75-35-4	12/15/06	7.0E-03	1.7E+03	LMW27	0.46	
IT_016	VOCs	cis-1,2-Dichloroethylene	156-59-2	12/15/06	7.0E-02	1.6E+04	LMW27	0.11	
IT_016	VOCs	Vinyl Chloride	75-01-4	12/15/06	2.0E-03	3.8E+00	LMW27	0.0058	
IT_016	VOCs	Vinyl Chloride	75-01-4	01/03/07	2.0E-03	3.8E+00	MW30	0.0024	
IT_016	VOCs	Methyl_tert-butyl_ether	1634-04-4	12/18/06	3.6E-01	4.0E+03	LMW15	0.61	
IT_016	SVOCs	Benzo(a)pyrene	50-32-8	11/20/07	2.0E-04	3.9E+02	TW01	0.00064	J
IT_016	SVOCs	Benzo(a)pyrene	50-32-8	11/20/07	2.0E-04	3.9E+02	TW02	0.00064	J
IT_016	SVOCs	Benzo(b)fluoranthene	205-99-2	11/20/07	1.2E-04	1.6E+03	TW01	0.000560	J
IT_016	SVOCs	Benzo(b)fluoranthene	205-99-2	11/20/07	1.2E-04	1.6E+03	TW02	0.00092	
IT_016	SVOCs	Dibenz(a,h)Anthracene	53-70-3	11/20/07	1.2E-05	1.0E+03	TW02	0.00068	J
IT_016	SVOCs	Indeno(1,2,3-c,d)Pyrene	193-39-5	11/20/07	1.2E-04	9.4E+03	TW01	0.0006	J
IT_016	SVOCs	Indeno(1,2,3-c,d)Pyrene	193-39-5	11/20/07	1.2E-04	9.4E+03	TW02	0.00064	J
IT_016	Metals	Arsenic	7440-38-2	11/20/07	1.0E-02	--	TW02	0.0154	
IT_016	Metals	Lead	7439-92-1	11/20/07	1.5E-02	--	TW01	0.207	
IT_016	Metals	Lead	7439-92-1	11/20/07	1.5E-02	--	TW02	0.864	
IT_016	TX1005	TPH_fraction_C12-C28	TPH-1005-2	11/20/07	9.8E-01	7.5E+03	TW02	3.28	
IT_018	VOCs	Trichloroethene	79-01-6	05/04/07	5.0E-03	1.2E+02	MW38	0.0059	
NR_830	VOCs	Benzene	71-43-2	11/07/07	5.0E-03	1.8E+02	TMW02	2.91	D
NR_830	VOCs	Benzene	71-43-2	11/07/07	5.0E-03	1.8E+02	TMW04	0.007	
NR_830	VOCs	Benzene	71-43-2	11/08/07	5.0E-03	1.8E+02	TMW06	0.006	

Parcel Number	COC Class	Analyte	CAS	Sample Date	Tier 1 $^{GW}GW_{Ing}$ Critical PCL without MSD (Residential)	Tier 1 $^{Air}GW_{Inh-V}$ Critical PCL with MSD (Residential)	Sample ID	Result (mg/L)	Qualifier
NR_830	VOCs	Benzene	71-43-2	09/04/08	5.0E-03	1.8E+02	MW01	1.17	
NR_830	Metals	Arsenic	7440-38-2	11/07/07	1.0E-02	--	TMW02	0.026	
NR_830	Metals	Arsenic	7440-38-2	11/08/07	1.0E-02	--	TMW06	0.02	
NR_830	Metals	Arsenic	7440-38-2	09/04/08	1.0E-02	--	MW01	0.0166	
NR_830	Metals	Arsenic	7440-38-2	09/04/08	1.0E-02	--	MW03	0.0107	
NR_830	Metals	Barium	7440-39-3	9/4/08	2.0E-01	--	MW01	0.988	
NR_830	TX1005	TPH_fraction_C6-C12	TPH-1005-1	11/07/07	9.8E-01	1.8E+03	TMW02	9.11	
NR_830	TX1005	TPH_fraction_C6-C12	TPH-1005-1	11/08/07	9.8E-01	1.8E+03	TMW06	1.64	J
NR_830	TX1005	TPH_fraction_C6-C12	TPH-1005-1	09/05/08	9.8E-01	1.8E+03	SB03A/MW03	4.02	
NR_830	TX1005	TPH_fraction_C6-C12	TPH-1005-1	09/05/08	9.8E-01	1.8E+03	SB01/MW01	5	
NR_830	TX1005	TPH_fraction_C12-C28	TPH-1005-2	09/05/08	9.8E-01	7.5E+03	SB01/MW01	1.13	J
NR_830	TX1006	Aliphatics_>C6-8	TPH-1006-2	11/07/07	1.5E+00	2.1E+01	TMW02	2.87	
NR_830	TX1006	Aromatics_>C8-10	TPH-1006-9	11/07/07	9.8E-01	6.6E+01	TMW02	2.28	J
NR_830	TX1006	Aromatics_>C21-35	TPH-1006-13	11/07/07	7.3E-01	--	TMW02	1.51	
IT_031	TX1005	TPH_fraction_C6-C12	TPH-1005-1	09/05/08	9.8E-01	1.8E+03	SB06/MW06	3.48	
IT_031	TX1005	TPH_fraction_C12-C28	TPH-1005-2	09/05/08	9.8E-01	7.5E+03	SB06/MW06	1.83	J
IT_031	TX1005	TPH_fraction_C28-C35	TPH-1005-4	09/05/08	9.8E-01	7.5E+03	SB06/MW06	1.47	J
IT_031	VOCs	Benzene	71-43-2	09/04/08	5.0E-03	1.8E+02	MW06	0.0153	
IT_031	Metals	Arsenic	7440-38-2	09/04/08	1.0E-02	--	MW06	0.0123	
IT_031	Metals	Barium	7440-39-3	9/4/08	2.0E-01	--	MW06	0.612	

Notes:
J – Analyte detected below quantitation limit.

D – Result is from a diluted sample.

Appendix G – Plume Stability

The Parcels included in the MSD have been affected by dissolved phase COCs (one or more of 1,1-DCE, PCE, TCE, cis-1,2-DCE, vinyl chloride, benzene, MTBE, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-c,d)pyrene, lead, arsenic and TPH) in the soil and groundwater. These COCs are associated with the historic operations conducted on the various parcels within the proposed MSD boundary.

The lateral extent of affected groundwater in the shallow groundwater bearing unit has been delineated in all directions. VOCs in the shallow groundwater bearing unit have been delineated in the upgradient direction by groundwater sampling events conducted at monitoring wells LMW12, MW01, LMW21, LMW13, MW14, LMW05, MW02 and MW16 located on the adjacent property (Hardy Rail Yards). Several monitoring points on the adjacent property south of the MSD boundary (Parcel IT_001) delineate the downgradient boundary of dissolved phase VOCs. The small VOC plume on Parcels NR_830 and IT_031 is delineated in all directions by several monitoring points. **Figure B4** depicts the delineated COC plumes in shallow groundwater.

Several monitoring wells have been installed to determine the offsite extent of affected groundwater. Based on the results available to date it appears that a dissolved phase chlorinated hydrocarbon plume extends from the adjacent north property (Hardy Rail Yards MSD/ VCP) onto the subject property (Parcel IT_016) and migrates off-site in the downgradient direction onto Parcels IT_010 and IT_023 which are not included in the MSD boundary (**Figure B8-1**). The area of impacted groundwater is not expanding and is the result of historic releases associated with past operations on the Parcels contained within the subject property.