



THE **UNDERGROUND** UTILITIES EVENT

Underground Construction Technology | Jan. 29-31, 2019 | Fort Worth, TX

# *Clean Water* Challenge on Sanitary Sewer Project

David Ellett, BRH-Garver





# The Project



## LIFT STATION RENEWAL/REPLACEMENT PROJECT

CONSOLIDATION OF NORTH POST OAK LANE (FN 546),  
STALBE WOOD (FN 127), AND BUCKINGHAM (FN 028) LIFT  
STATIONS

WBS NO. R-000267-109A-4



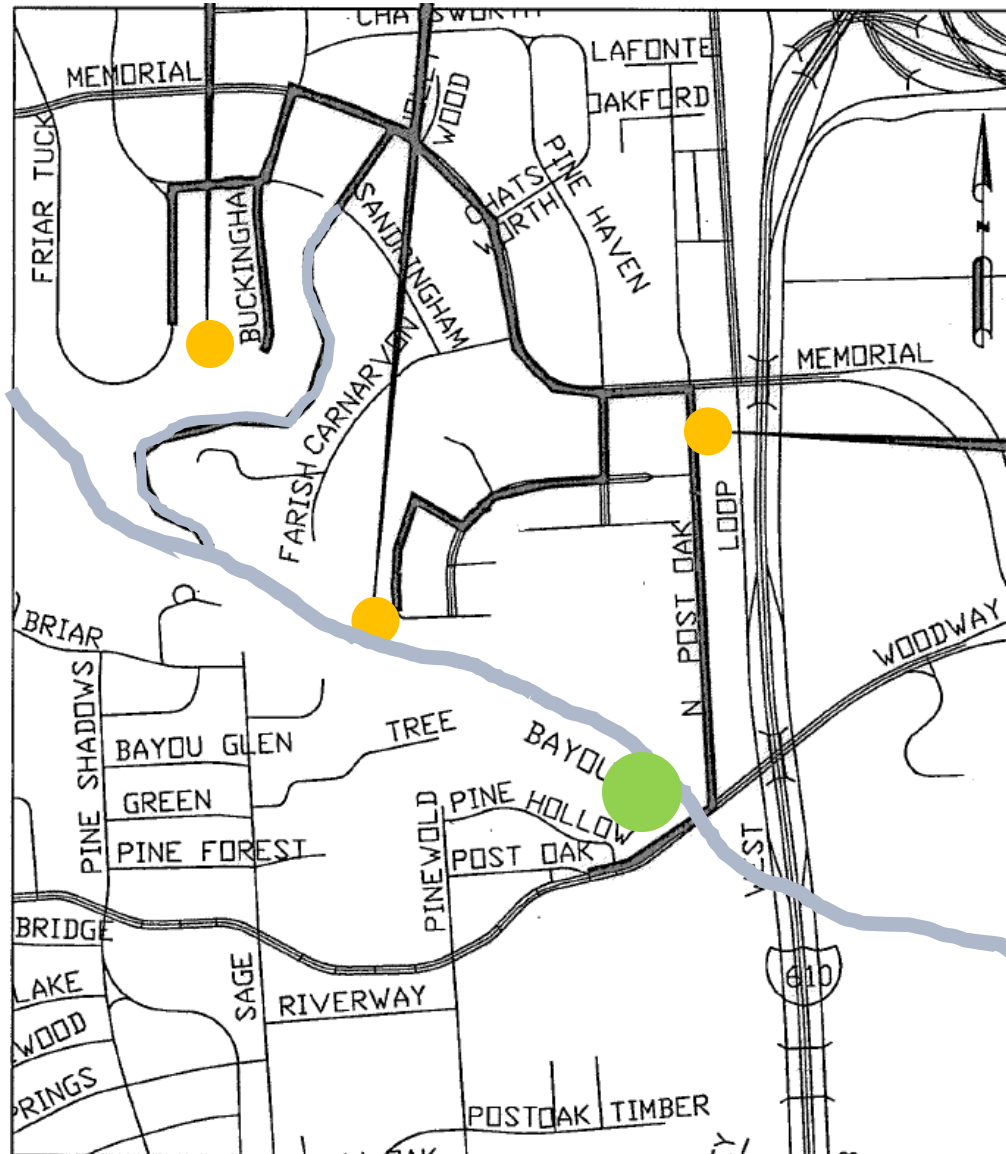
# The “N. Post Oak” Project

- Bid Date: May 21, 2015
- Estimate: \$12,700,000
- Duration: 495 Calendar Days

## Why is this a *Clean Water* project?

- Scope: “Work of the Contract is for the consolidation of the service areas of the North Post Oak Lane, Stable Wood, and Buckingham Lift Stations by construction of gravity sanitary sewers and demolition of the North Post Oak Lane, Stable Wood, and Buckingham Lift Stations, ...”

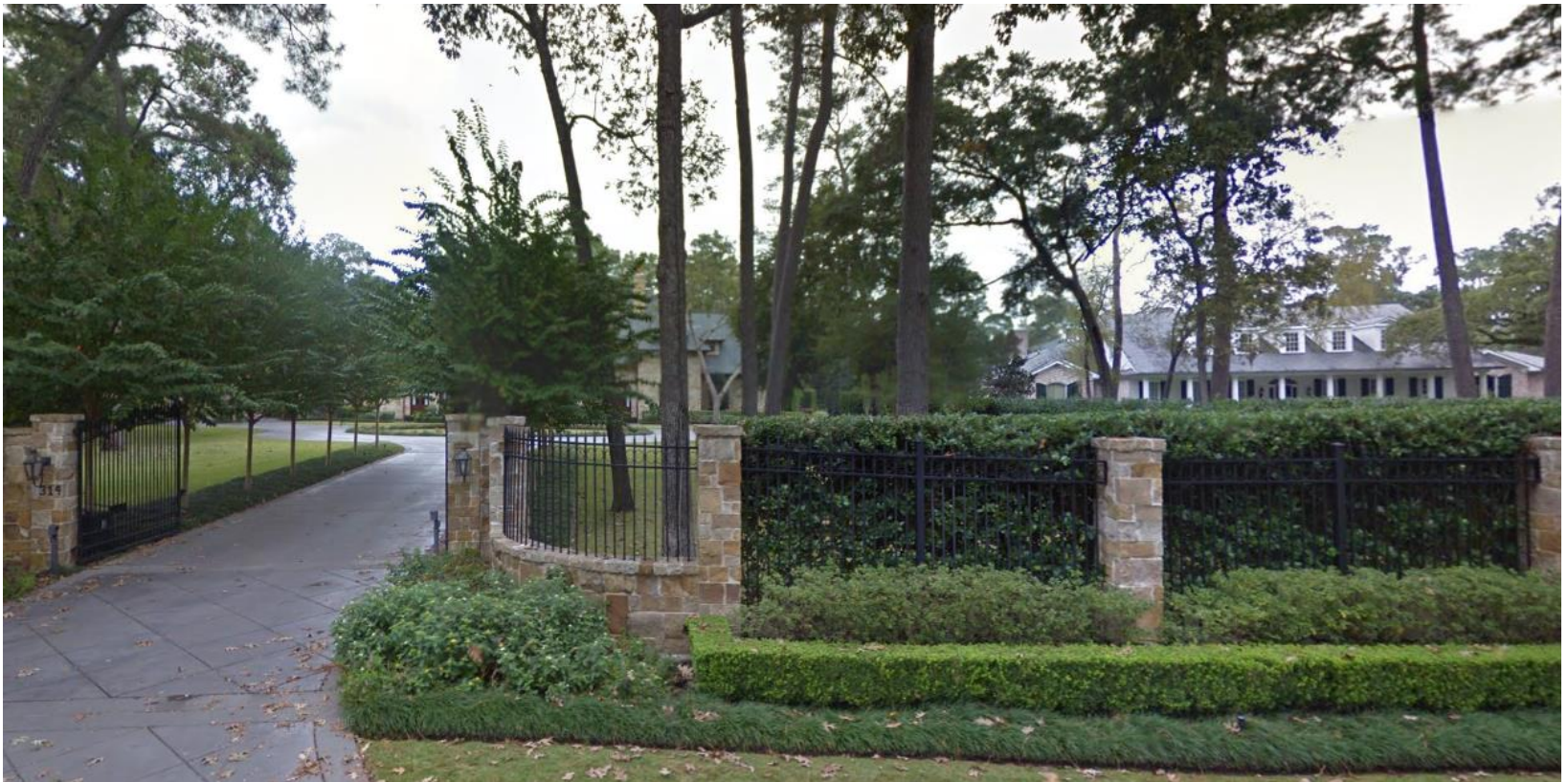
# *Clean Water* in Design



- Buckingham LS
- Stablewood LS
- N. Post Oak LS
- Woodway LS

# *Clean Water* in Design

Buckingham LS



# *Clean Water* in Design

## Stablewood Lift Station



# *Clean Water* in Design

North Post Oak LS

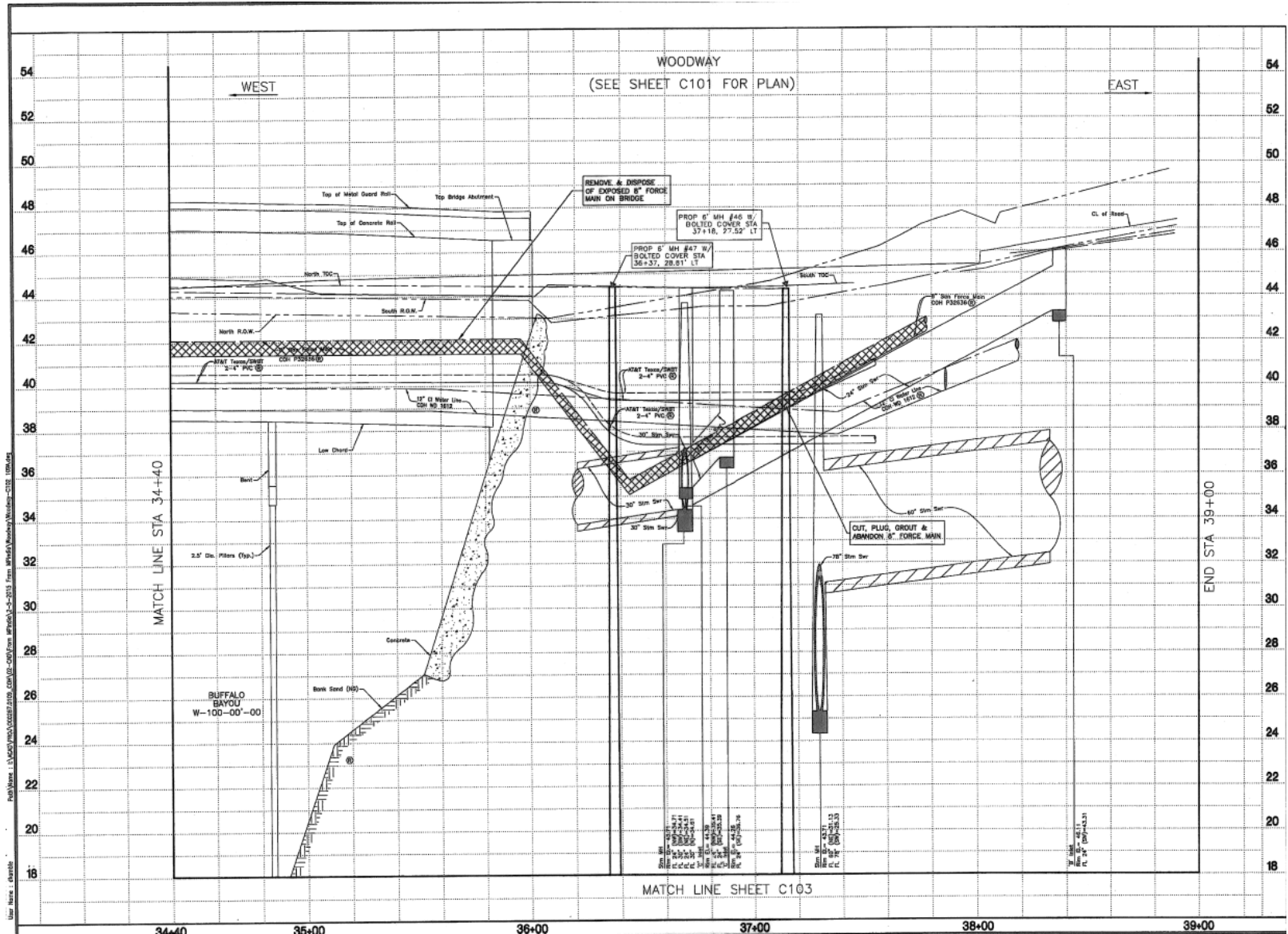


# *Clean Water* in Design

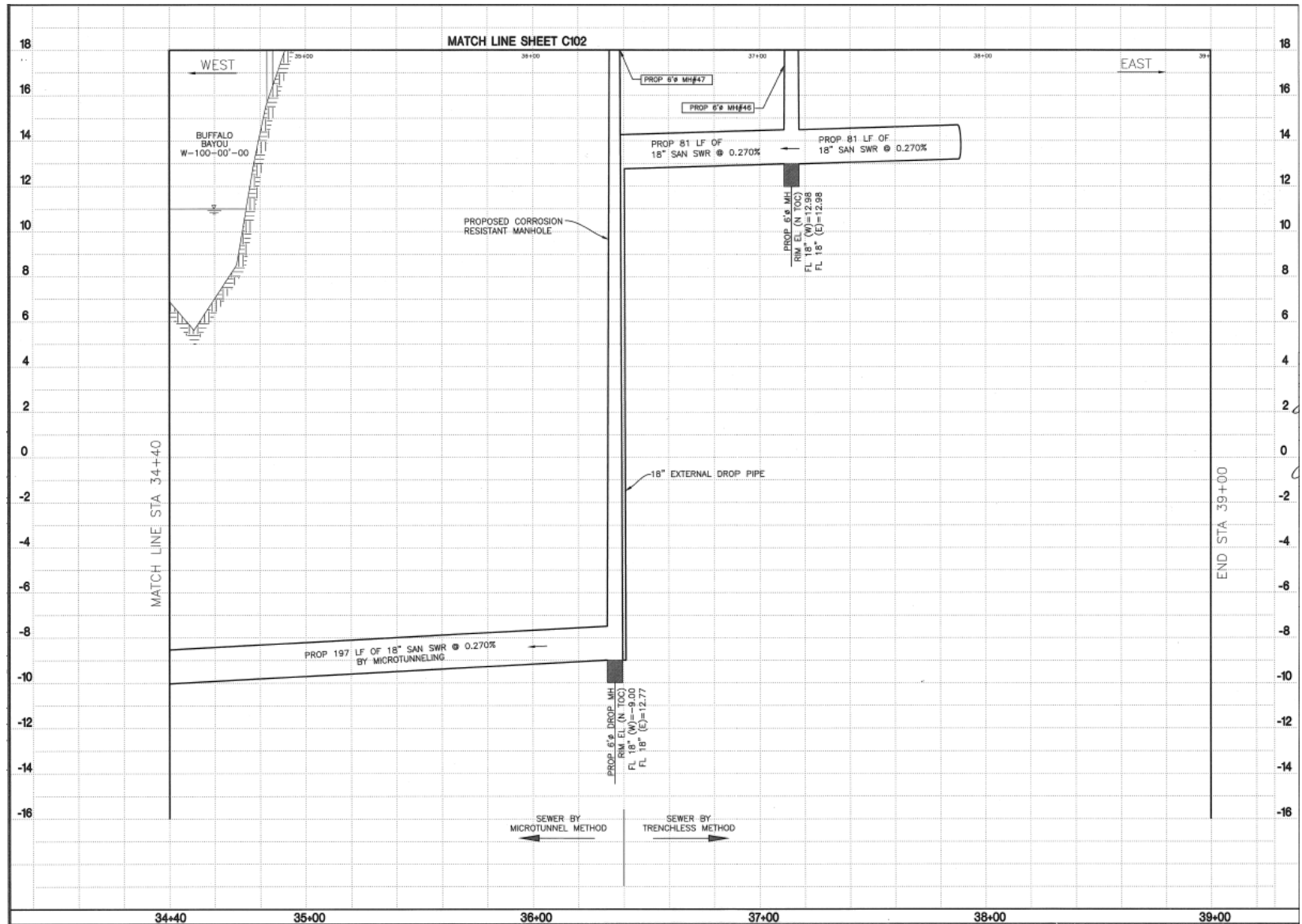
## Buffalo Bayou



# Clean Water in Design



# Clean Water in Design



# *Clean Water* in Design

North Post Oak; 35ft deep



# *Clean Water* in Design

Memorial Drive; 28ft deep



# *Clean Water* in Design

Sandringham Drive; 26ft deep



# *Clean Water* in Design

PHASE I ENVIRONMENTAL SITE ASSESSMENT  
CITY OF HOUSTON LIFT STATION  
RENEWAL/REPLACEMENT  
GALLERIA AREA LIFT STATIONS  
WBS NO. R-000267-0109-3  
HOUSTON, TEXAS

*Reported to:*

ARCADIS U.S., INC.

*Submitted by:*

GEOTEST ENGINEERING, INC.

Houston, Texas

REPORT NO. 1130016601

May 7, 2013

Key Map No. 497 G, H & M

Phase I ESA; 5/7/13

PHASE II ENVIRONMENTAL SITE ASSESSMENT  
LIFT STATION RENEWAL/ REPLACEMENT  
GALLERIA AREA LIFT STATIONS  
WBS NO. S-000267-0109-3  
HOUSTON, TEXAS

*Reported to:*

ARCADIS U.S., INC.

Houston, Texas

*Submitted by:*

GEOTEST ENGINEERING, INC.

Houston, Texas

REPORT NO. 1130018301, dated July 23, 2014

Key Map Nos. 497 G, H & M

Phase II ESA; 7/23/14

# *Clean Water* in Design

- Phase I Findings

- Based on the information from Environmental Data Resources, Inc. the following sites were identified within City of Houston search distance criteria.
  - Five (5) Leaking Petroleum Storage Tank (LPST) sites;
  - Five (5) Underground Storage Tank (UST) sites;
  - Two (2) Resource Conservation and Recovery Act – Conditionally Exempt Small Quantity Generator (RCRA-CESQG) sites;
  - Three (3) Resource Conservation and Recovery Act – NonGenerator (RCRA-Nongen) sites;
  - Ten (10) Facility Index System (FINDS) sites;
  - Five (5) Industrial Hazardous Waste Sites
  - One (1) Innocent Owner or Operator (IOP) site;
  - One (1) FTTS site; and
  - Two (2) Dry Cleaners sites.

# Clean Water in Design

- Phase I Findings

A review of the FINDS list, as provided by EDR, and dated 10/23/2011 has revealed that there are 17 FINDS sites within the searched area.

| <u>Site</u>                    | <u>Address</u>          | <u>Map ID</u> | <u>Page</u> |
|--------------------------------|-------------------------|---------------|-------------|
| AMERICAN PORCELAIN ENAMELING   | 1130 SIDCO ROAD         | 1             | 3           |
| CAMERON INTERNATIONAL CORPORAT | 1000 SILBER RD K FR     | 2             | 6           |
| AMERICAN RESIDENTIAL SERVICES  | 7715 KATY FWY           | 4             | 32          |
| EXXON MOBIL CORPORATION        | 8605 MEMORIAL DR        | 7             | 44          |
| US DEPARTMENT OF JUSTICE       | 333 W LOOP N STE 300    | 8             | 88          |
| BASF                           | 5 POST OAK PK #900      | 9             | 92          |
| ENVIRONMENTAL SERVICES II INC  | ONE W LOOP S STE 100    | 10            | 93          |
| APACHE CORP                    | 100 POST OAK BLVD., STE | 11            | 95          |
| EXXON MOBIL CORPORATION        | 2521 S POST OAK         | 11            | 95          |
| PINEHOLLOW CONDOMINIUMS        | 4950 WOODWAY DR         | 13            | 99          |
| MOTIVA ENTERPRISE              | 5121 WOODWAY DRIVE      | 14            | 100         |
| WOODWAY MOBIL                  | 5139 WOODWAY DR         | 14            | 133         |
| EXXON MOBIL CORPORATION        | 5139 WOODWAY            | 14            | 136         |
| RIVER OAKS CLEANERS            | 5128 WOODWAY DR         | 14            | 140         |
| OMNI HOTEL                     | 4 RIVERWAY              | 15            | 140         |
| THE BORDEAUX APT               | 5010 WOODWAY AVE        | 16            | 146         |
| MOBIL RETAIL GASOLINE STATION  | 5010 WOODWAY DR         | 16            | 147         |

# *Clean Water* in Design

- Phase I Recommendations

This assessment has revealed six (6) recognizable environmental conditions in the project area; hence a Phase II environmental site investigation is warranted at this time. The Phase II ESA may include a total of sixteen (16) environmental borings to a depth of at least 15 feet at the LPST sites. The details are given below:

| LPST Site               | Address             | No. of Borings |
|-------------------------|---------------------|----------------|
| Exxon Mobil             | 8605 Memorial Drive | 4              |
| TPG 577 07              | 8602 Memorial Drive |                |
| Texaco                  | 5121 Woodway Drive  | 3              |
| Former Mobil 12 WDY     | 5010 Woodway Drive  | 3              |
| Pinehollow Condominiums | 4950 Woodway Drive  | 3              |
| Woodway Mobil           | 5139 Woodway Drive  | 3              |

# *Clean Water* in Design

- Phase II Findings

## 6.2 Impact on Planned Construction

Based on the analytical test results, the COCs were detected in borings EB-3 and EB-7 and the measured organic vapors were higher than 25 ppm in borings EB-2, EB-3 and EB-5 through EB-8, hence the following areas are identified as potentially petroleum contaminated area (PPCA).

- **Area from Station 28+50 to 31+00 along N Post Oak Lane.**

# *Clean Water* in Design

- Addressing the Issues

|    |                             |                                                                                                                                                                                                                                                                                                                                                                                                |    |   |
|----|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|---|
| 36 | 02220,<br>Div 01,<br>02, 16 | Buckingham LS – Salvage & Demolition of Existing Lift Station. Salvage Pumps, Piping, Valves, Electrical and Instrumentation Devices; Demolition for all site structures, and backfill site to grade including existing Wet Well and Valve Vault structures; cut, plug, and abandon or grout (as applicable) existing 8" Force Main; and Demolish existing 4' Wrought Iron Fence and Gate      | LS | 1 |
| 37 | 02220,<br>Div 01,<br>02, 16 | N. Post Oak Lane LS – Salvage & Demolition of Existing Lift Station. Salvage Pumps, Piping, Valves, Electrical and Instrumentation Devices; Demolition of all site structures and back fill site to grade including existing Wet Well and Valve Vault structures, cut , plug & abandon existing 8" force main. Cut & remove above-ground segment of 8" force main from bridge @ Buffalo Bayou. | LS | 1 |

# *Clean Water* in Design

- Addressing the Issues

|    |                 |                                                                                      |    |       |
|----|-----------------|--------------------------------------------------------------------------------------|----|-------|
| 33 | 02105           | Preparatory work for Sampling and Analysis in PPCA                                   | LS | 1     |
| 34 | 02120           | Transportation and Disposal of Contaminated Ground Water From PPCA                   | LS | 1     |
| 35 | 02120           | Transportation and Disposal of soil in PPCA, Class I and Class II Soils,             | CY | 2,000 |
| 51 | 02441<br>02448  | 15-inch diameter sanitary sewer, by trenchless method in PPCA,                       | LF | 263   |
| 53 | 02441,<br>02448 | 18-inch diameter sanitary sewer, by trenchless construction method, within PPCA area | LF | 14    |

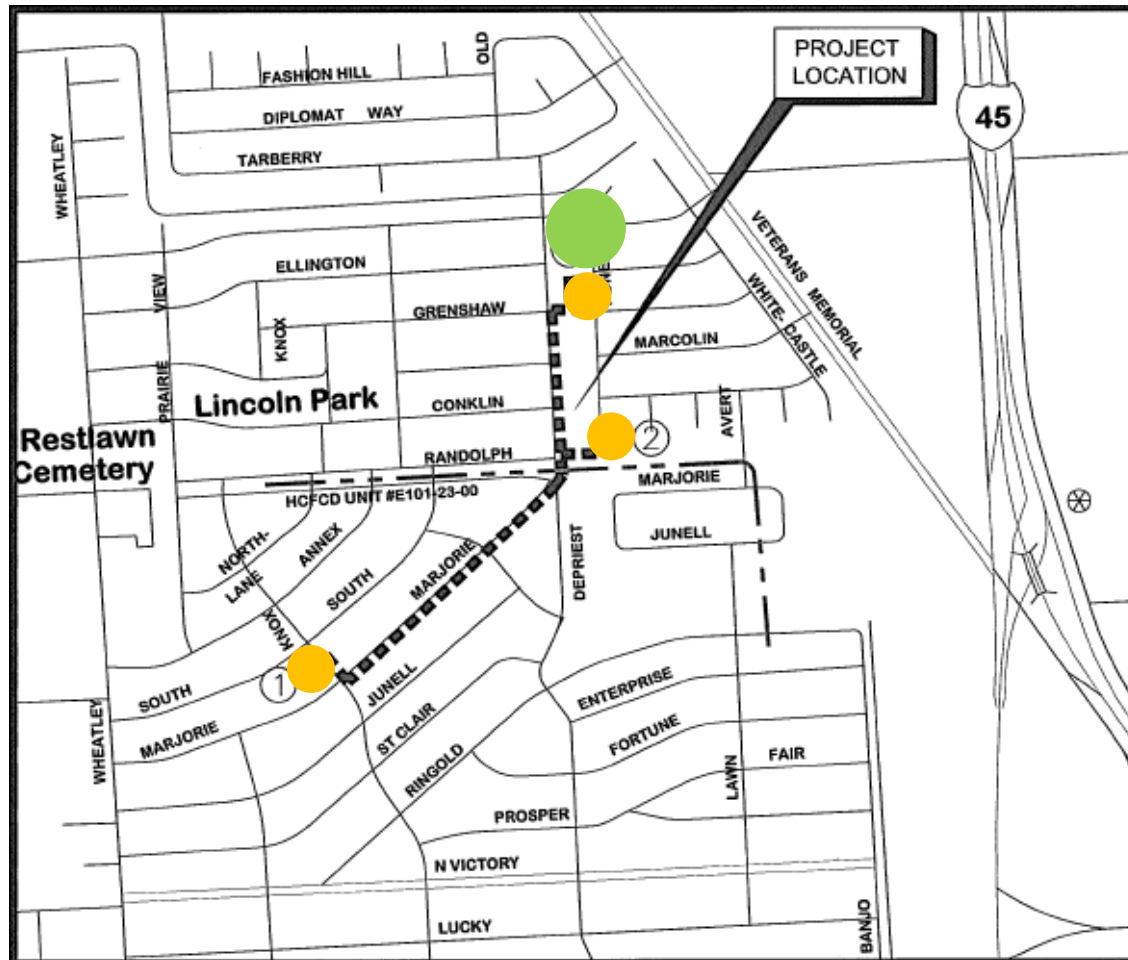
# *Clean Water* in Design

- Addressing the Issues

|    |                 |                                                                    |    |       |
|----|-----------------|--------------------------------------------------------------------|----|-------|
| 46 | 02441           | 18-inch diameter sanitary sewer, by microtunneling method          | LF | 875   |
| 47 | 02448<br>02441  | 8-inch diameter sanitary sewer, by trenchless construction method  | LF | 91    |
| 48 | 02441,<br>02448 | 10-inch diameter sanitary sewer, by trenchless construction method | LF | 2,956 |
| 49 | 02441,<br>02448 | 12-inch diameter sanitary sewer, by trenchless construction method | LF | 7,108 |
| 50 | 02441,<br>02448 | 15-inch diameter sanitary sewer, by trenchless construction method | LF | 540   |
| 52 | 02441,<br>02448 | 18-inch diameter sanitary sewer, by trenchless construction method | LF | 2830  |

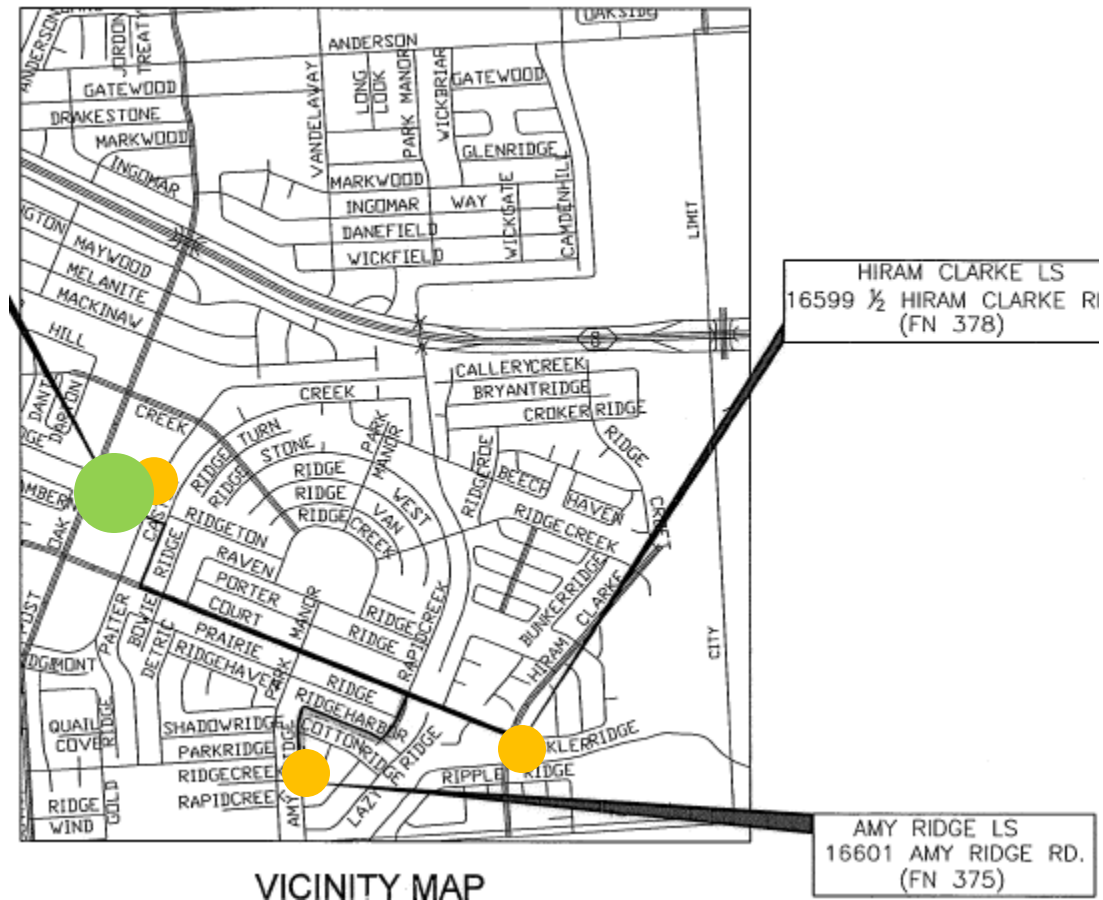
# Similar *Clean Water* Work

Knox, Randolph & Grenshaw (2014)



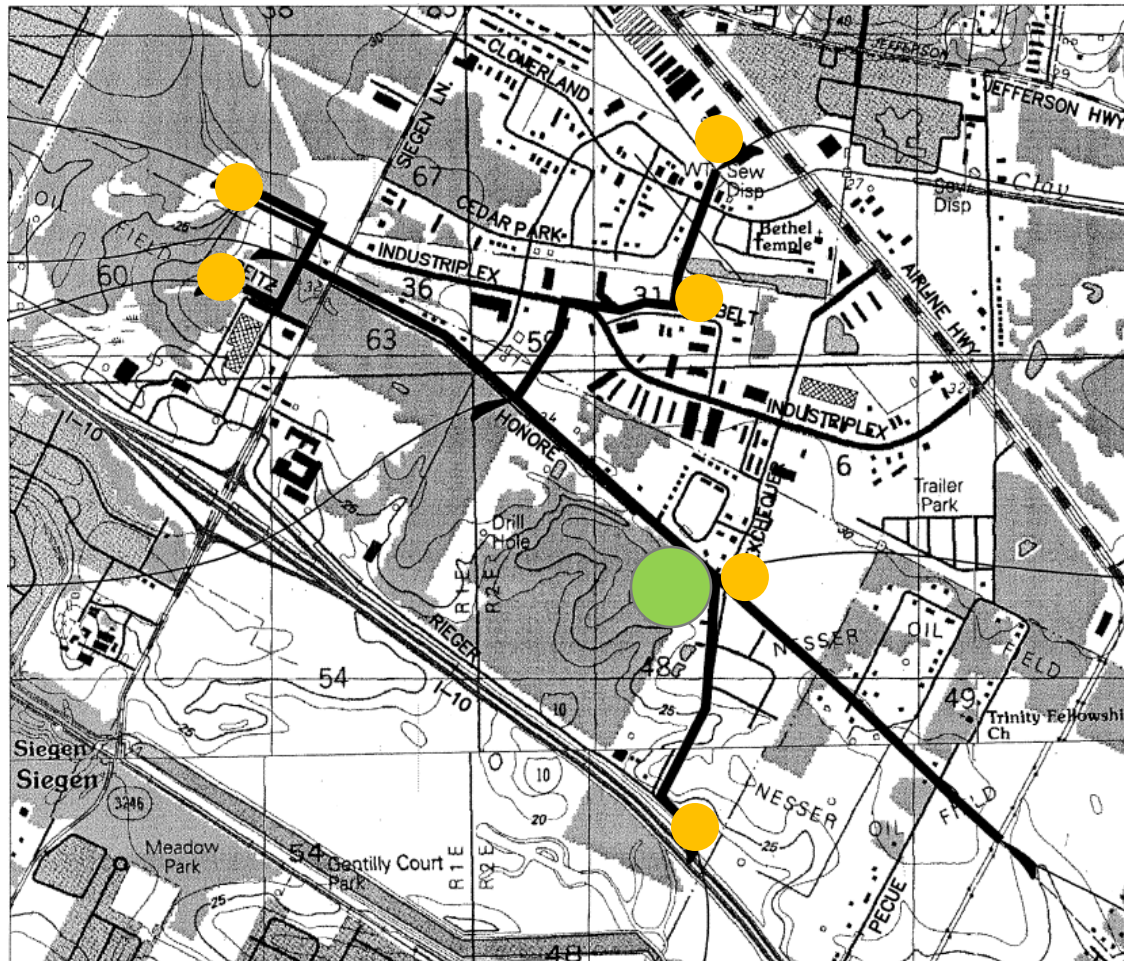
## Similar *Clean Water* Work

# Amy Ridge & Hiram Clark (2013)



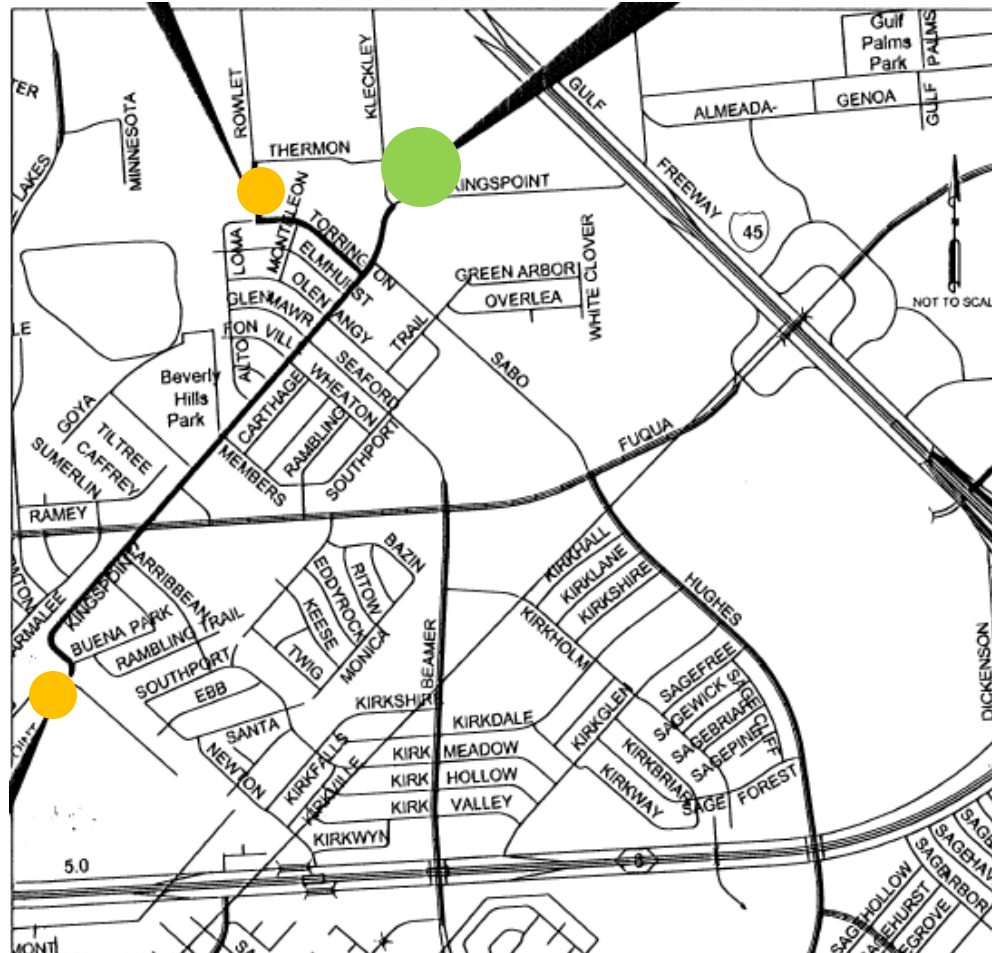
# Similar *Clean Water* Work

## Industriplex Area WWF Upgrades (2009)



# Similar *Clean Water* Work

## Kingspoint and Torrington Lift Stations (2008)



# *Clean Water* in Construction

- Bid Date: May 21, 2015
- Estimate: \$12,700,000
- Duration: 495 Calendar Days
  
- Low Bid: \$14,594,955.72
- Pre-Con Meeting: February 16, 2016
- NTP: March 14, 2016

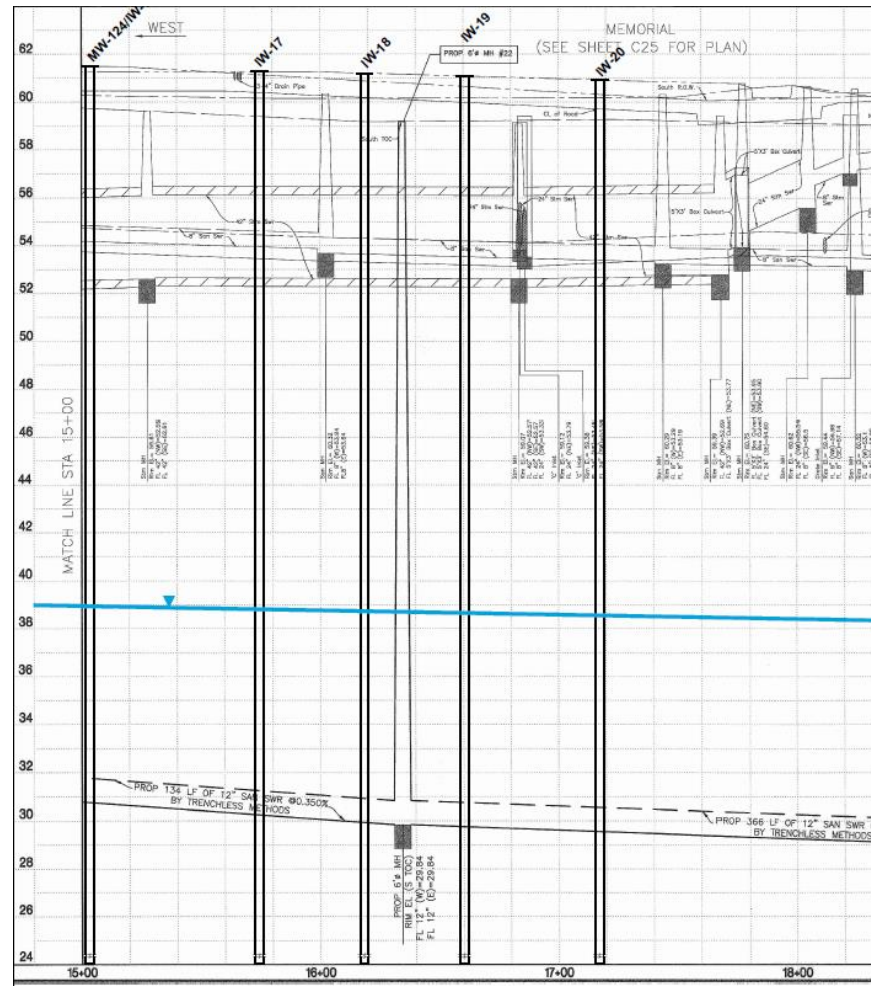
# *Clean Water* in Construction

- Pre-Con Meeting: February 16, 2016

- Geotechnical /ESA Issues

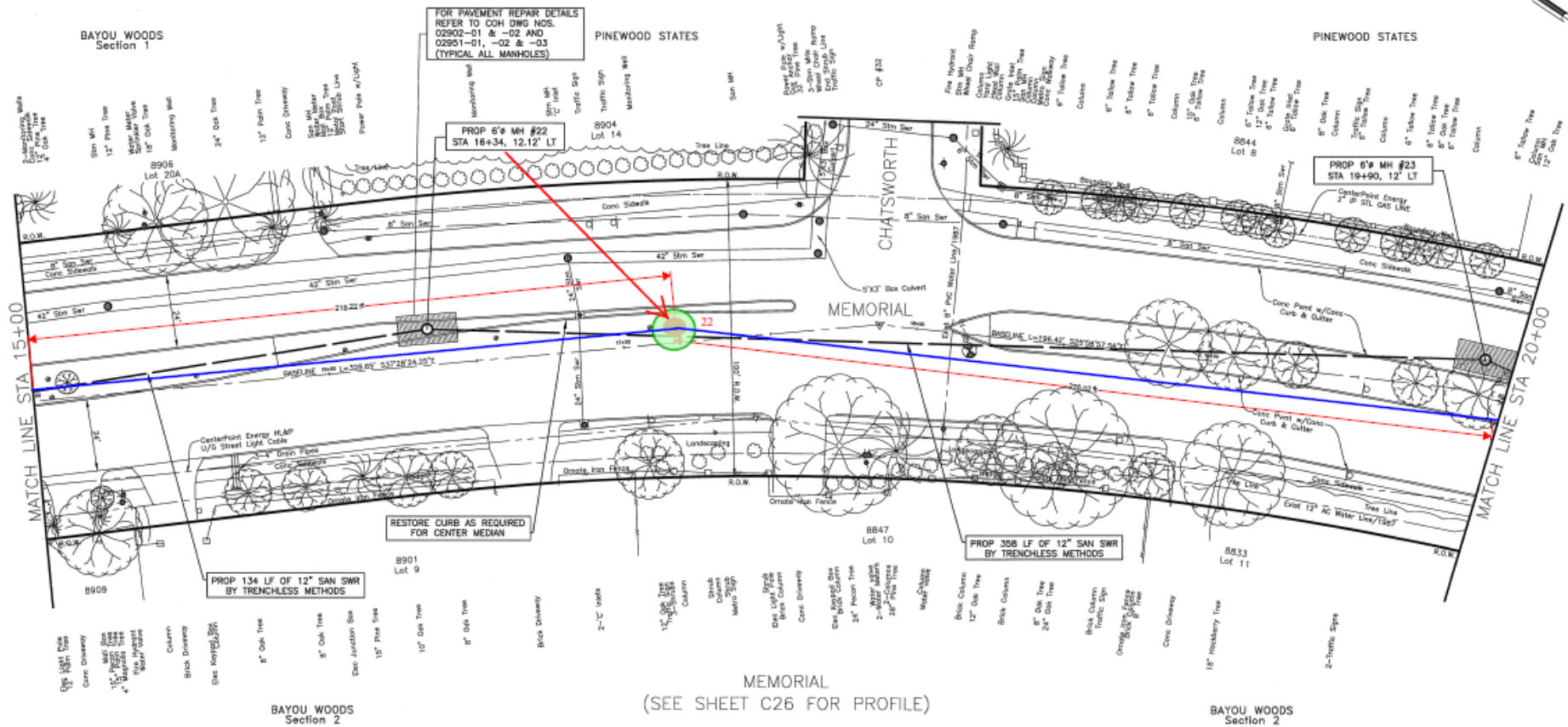
- a. PPCA detected between STA 28+50 to 31+00 along N. Post Oak Lane and STA 13+50 to 19+50 along Woodway Drive. It is recommended that OSHA 29 CFR 1926 and COH Guide Specifications 02105 and 02120 should be followed for workers safety during excavations and handling of the site soils in these areas.
- b. Environmental Resources Management – Monitoring and Injection wells on project site – Rob Jaros - 832-730-2345
  - i. ***CM to coordinate meeting***

-



# Clean Water in Construction

- Work Layout



# *Clean Water* in Construction



# *Clean Water* in Construction



# *Clean Water* in Construction



# *Clean Water* in Construction



# Unknown *Clean Water* Challenge

- August 1, 2016



# Unknown *Clean Water* Challenge

- August 1, 2016

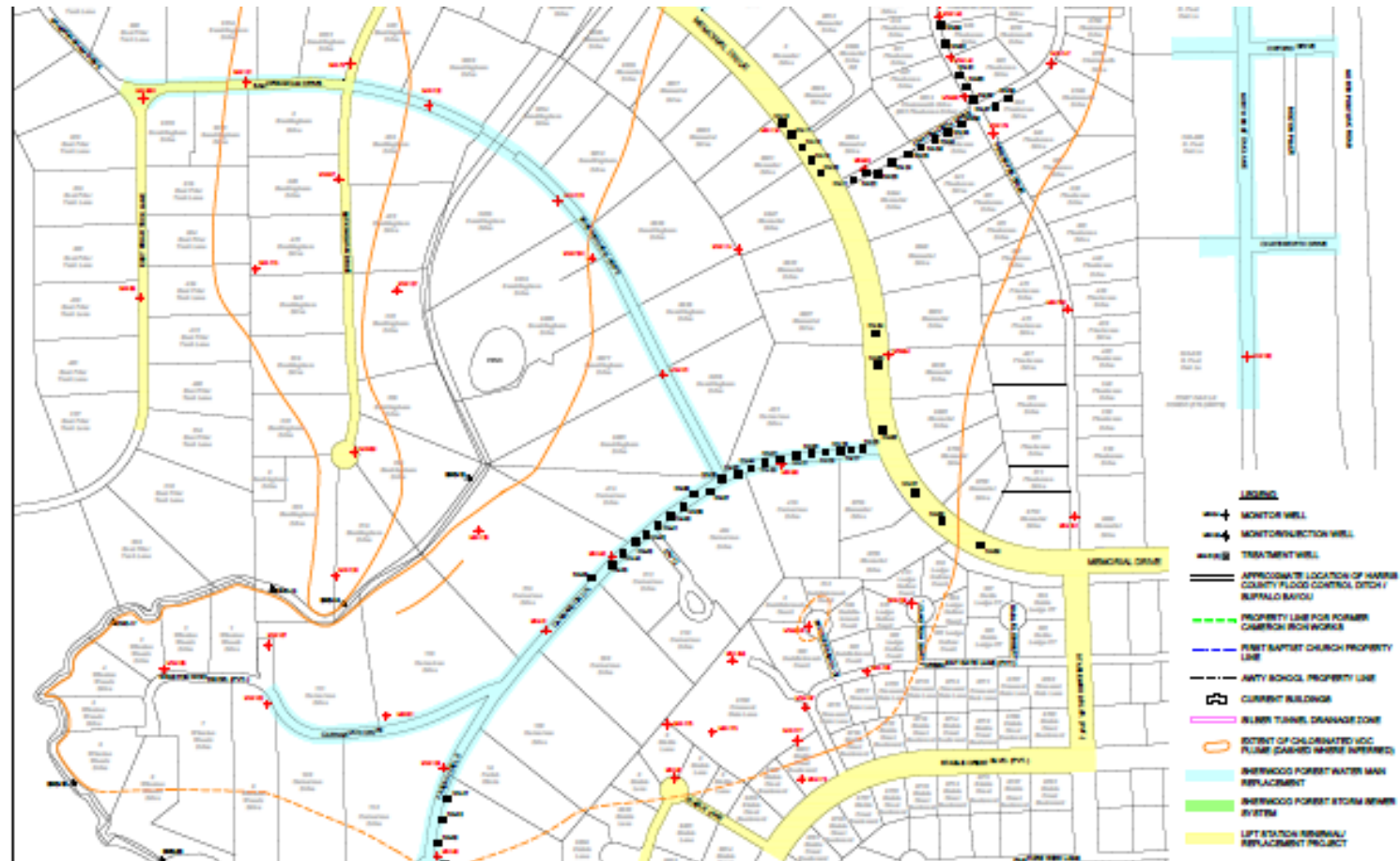


# Unknown *Clean Water* Challenge

- August 1, 2016

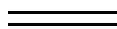
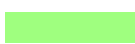
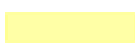


# Unknown *Clean Water* Challenge

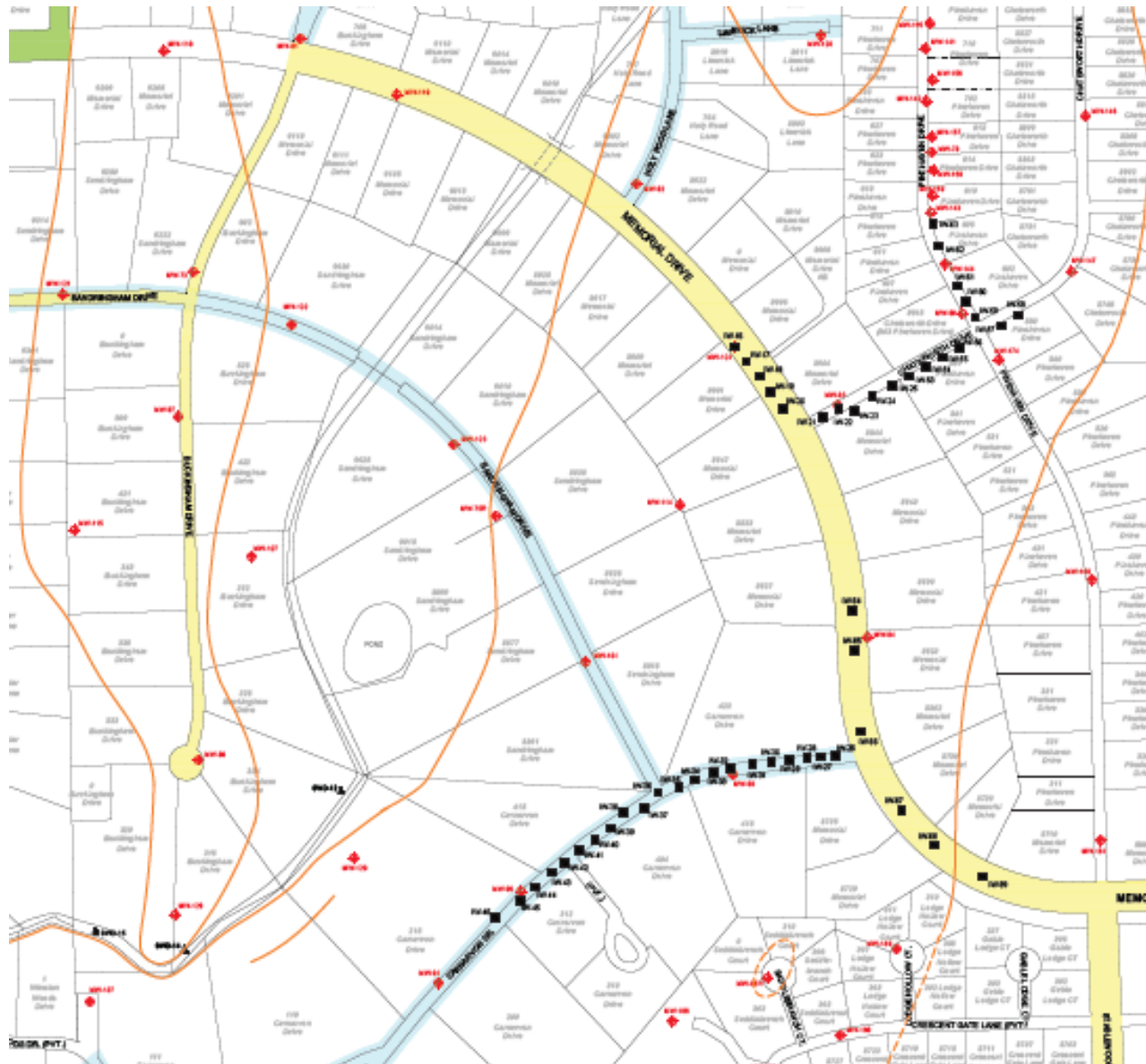


# Unknown *Clean Water* Challenge

## LEGEND

|                                                                                     |                                                                           |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
|    | MONITOR WELL                                                              |
|    | MONITOR/INJECTION WELL                                                    |
|    | TREATMENT WELL                                                            |
|    | APPROXIMATE LOCATION OF HARRIS COUNTY FLOOD CONTROL DITCH / BUFFALO BAYOU |
|    | PROPERTY LINE FOR FORMER CAMERON IRON WORKS                               |
|    | FIRST BAPTIST CHURCH PROPERTY LINE                                        |
|    | AWTY SCHOOL PROPERTY LINE                                                 |
|    | CURRENT BUILDINGS                                                         |
|    | SILBER TUNNEL DRAINAGE ZONE                                               |
|   | EXTENT OF CHLORINATED VOC PLUME (DASHED WHERE INFERRED)                   |
|  | SHERWOOD FOREST WATER MAIN REPLACEMENT                                    |
|  | SHERWOOD FOREST STORM SEWER SYSTEM                                        |
|  | LIFT STATION RENEWAL/ REPLACEMENT PROJECT                                 |

# Unknown *Clean Water* Challenge



# Identified *Clean Water* Challenge

The laboratory analytical results reported the presence of chlorinated VOCs (primarily 1,1-Dichloroethane, 1,1-Dichloroethylene, 1,2-Dichloroethane, cis-1,2-Dichloroethylene, Tetrachloroethylene, Trichloroethylene, Trichlorofluoromethane, Tetrachloroethylene) at concentrations exceeding allowable groundwater discharge requirements in both of the sampling locations. A copy of the laboratory analytical report is included in **Appendix A**.

## CONCLUSIONS

Based upon laboratory analytical testing results and the review of the existing literature, it is apparent that the VOC release and in-situ groundwater treatment associated with the Cameron Iron Works Site has affected the City of Houston's construction activities along Memorial Drive. Concentrations of VOCs detected in groundwater produced from dewatering activities exceed regulatory stormwater and sanitary sewer discharge limits.

# Identified *Clean Water* Challenge

Cameron International Corporation

2014 Annual Ground Water  
Monitoring Report and Field  
Activities Summary

*Former Cameron Iron Works  
Facility, Houston, Texas*

July 14, 2015

Project No. 0260324

## 2.3

### ***SODIUM PERMANGANATE INJECTION***

An assessment of residual oxidant concentrations was conducted on October 14 and 15, 2014. The levels of Oxidation-Reduction Potential (ORP) in ground water were measured over 60 locations throughout the injection gallery network. Based on the results of this assessment, the treatment of affected ground water appears to be continuing throughout the treatment areas as evidenced by color observed and/or elevated ORP measurements except along Pinehaven and Chatsworth Drives where no significant color or elevated ORP readings were observed.

The levels of ORP throughout the treatment areas will continue to be monitored periodically for the presence of permanganate.

# Addressing *Clean Water* Challenge

- Aug 1 – 1<sup>st</sup> encounter; Shaft 23
- Aug 2 – 2<sup>nd</sup> encounter; Shaft 24
- Aug 3 – Identification by Operator
- Aug 5 – Plan of Action development starts
- Aug 9 – Preliminary Investigation Complete
- Aug 10-15 – Equipment recovery & cleaning

# Addressing *Clean Water* Challenge

- Aug 15-Oct 18



# Addressing *Clean Water* Challenge

- Aug 1 – 1<sup>st</sup> encounter; Shaft 23
- Aug 2 – 2<sup>nd</sup> encounter; Shaft 24
- Aug 3 – Identification by Operator
- Aug 5 – Plan of Action development starts
- Aug 9 – Preliminary Investigation Complete
- Aug 10-15 – Equipment recovery & cleaning
- Oct 18-28; Develop and Submit Environmental Sampling and Monitoring Plan

# Addressing *Clean Water* Challenge



## **ENVIRONMENTAL SAMPLING AND MONITORING PLAN**

### **LIFT STATION RENEWAL/REPLACEMENT PROJECT**

**WBS No. R000267-109A-4**

### **N. POST OAK, STABLEWOOD & BUCKINGHAM PROJECT**

**FOR**

### **CAMERON IRON WORKS – POTENTIAL CONTAMINANT AREA**

DATE: OCTOBER 28, 2016

PROJECT: 15-0418

DOC NO.: TN-16-0418-001 REV 1

PREPARED FOR:

BRH Garver Construction, L.P.

and

The City of Houston

# Addressing *Clean Water* Challenge

- Aug 1 – 1<sup>st</sup> encounter; Shaft 23
- Aug 2 – 2<sup>nd</sup> encounter; Shaft 24
- Aug 3 – Identification by Operator
- Aug 5 – Plan of Action development starts
- Aug 9 – Preliminary Investigation Complete
- Aug 10-15 – Equipment recovery & cleaning
- Oct 18-28; Develop and Submit Environmental Sampling and Monitoring Plan
- Nov 1-15 – Install monitoring wells and discharge piping

# Addressing *Clean Water* Challenge



# Addressing *Clean Water* Challenge



# Addressing *Clean Water* Challenge



# Addressing *Clean Water* Challenge



# Addressing *Clean Water* Challenge



# Addressing *Clean Water* Challenge

- Aug 1 – 1<sup>st</sup> encounter; Shaft 23
- Aug 2 – 2<sup>nd</sup> encounter; Shaft 24
- Aug 3 – Identification by Operator
- Aug 5 – Plan of Action development starts
- Aug 9 – Preliminary Investigation Complete
- Aug 10-15 – Equipment recovery & cleaning
- Oct 18-28; Develop and Submit Environmental Sampling and Monitoring Plan
- Nov 1-15 – Install monitoring wells and discharge piping
- Dec 16 – Receive COH Sanitary Discharge Permit

# Addressing *Clean Water* Challenge

City of Houston

Industrial Waste Permit Number: 11017

Department of Public Works and Engineering

**Industrial Wastewater Service**

10500 Bellaire Blvd.

Houston, Texas 77072

Phone: 832- 395-5800

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BRH Garver Construction, L.P. and Cameron International Corporation

is hereby authorized to discharge into the City's collection system raw liquid waste in accordance with the terms of Houston's Industrial Waste Program, Chapter 47, Article V of the Code of Ordinances, Houston, Texas, and in accordance with the effluent limitations, monitoring requirements and other conditions set forth in this permit at the following location:

8900 Memorial Drive  
Houston, TX 77024

Significant Industrial User: No

Categorical Discharge Limits Applicable: No

Facility Operates a Pretreatment System: Yes

Category: **GROUNDWATER RECOVERY EXCAVATION**

Product/Service: **Discharge of contaminated groundwater from dewatering at the City construction site on Memorial Drive from the intersection of Buckingham Drive to North Post Oak Lane and on Buckingham Drive from the intersection of Sandringham Drive to Memorial Drive.**

# Addressing *Clean Water* Challenge

| Activity/Sample Type    | Sample Method | Sample ID         | Date      | Results                                                                                                                                                      |
|-------------------------|---------------|-------------------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Gauging                 | N/A           | N/A               | 1/3/2017  | No samples are taken during gauging.                                                                                                                         |
| Discharge Stream Sample | 624           | Pit 26D           | 1/5/2017  | Does not exceed total discharge limit.                                                                                                                       |
| Gauging                 | N/A           | N/A               | 1/9/2017  | No samples are taken during gauging.                                                                                                                         |
| Monitor Well Sampling   | 8260          | MW-S16            | 1/9/2017  | PCL exceedance for Dichloroethene                                                                                                                            |
|                         |               | MW-S20            |           | Clean                                                                                                                                                        |
|                         |               | MW-S22            | 1/10/2017 | PCL exceedance for Dichloroethene, Tetrachloroethylene, Trichloroethylene, and Vinyl Chloride                                                                |
|                         |               | MW-S23            |           | PCL exceedance for Dichloroethene, Tetrachloroethylene, and Trichloroethylene                                                                                |
|                         |               | MW-S25            |           | PCL exceedance for Dichloroethene, Tetrachloroethylene, Trichloroethylene, and Vinyl Chloride                                                                |
|                         |               | MW-S26            | 1/9/2017  | PCL exceedance for Dichloroethene, Tetrachloroethylene, and Vinyl Chloride                                                                                   |
|                         |               | MW-S27            |           | PCL exceedance for Dichloroethene                                                                                                                            |
|                         |               | MW-S38            | 1/10/2017 | Clean                                                                                                                                                        |
|                         |               | MW-S39            |           | Clean                                                                                                                                                        |
|                         |               | MW-73             | 1/9/2017  | PCL exceedance for Dichloroethene                                                                                                                            |
|                         |               | MW-82             | 1/10/2017 | PCL exceedance for Dichloroethene, Tetrachloroethylene, Trichloroethylene, and Vinyl Chloride                                                                |
|                         |               | MW-84             |           | PCL exceedance for Tetrachloroethylene                                                                                                                       |
|                         |               | MW-85R            | 1/9/2017  | Clean                                                                                                                                                        |
|                         |               | MW-86             | 1/10/2017 | Clean                                                                                                                                                        |
|                         |               | MW-87             |           | PCL exceedance for Dichloroethene                                                                                                                            |
|                         |               | MW-118            | 1/9/2017  | PCL exceedance for Dichloroethene                                                                                                                            |
|                         |               | MW-119            | 1/10/2017 | Clean                                                                                                                                                        |
|                         |               | MW-121            | 1/9/2017  | Clean                                                                                                                                                        |
|                         |               | MW-124            | 1/10/2017 | PCL exceedance for Tetrachloroethylene and Trichloroethylene                                                                                                 |
| Tunnel Spoil Sample     | 8260          | Pit 25/26T        | 1/16/2017 | Clean                                                                                                                                                        |
| Discharge Stream Sample | 624           | Pit 25D           | 1/19/2017 | Does not exceed total discharge limit.                                                                                                                       |
| Gauging                 | N/A           | N/A               | 1/23/2017 | No samples are taken during gauging.                                                                                                                         |
| Shaft GW Sample         | 8260          | Pit 18_013117     | 1/31/2017 | Clean                                                                                                                                                        |
|                         |               | Pit 20_013117     |           | Clean                                                                                                                                                        |
| Tunnel Spoil Sample     | 8260          | Pit 27/28T        | 1/31/2017 | Clean                                                                                                                                                        |
| Monitor Well Sampling   | 8260          | MW-S16            | 2/6/2017  | PCL exceedance for Dichloroethene                                                                                                                            |
|                         |               | MW-S20            |           | Clean                                                                                                                                                        |
|                         |               | MW-S22            |           | PCL exceedance for Dichloroethene, Tetrachloroethylene, Trichloroethylene, and Vinyl Chloride                                                                |
|                         |               | MW-S23            |           | PCL exceedance for Dichloroethene, Tetrachloroethylene, and Trichloroethylene                                                                                |
|                         |               | MW-S25            |           | PCL exceedance for Dichloroethene, Tetrachloroethylene, and Trichloroethylene                                                                                |
|                         |               | MW-S26            |           | PCL exceedance for Dichloroethene and Tetrachloroethylene                                                                                                    |
|                         |               | MW-S27            |           | PCL exceedance for Dichloroethene, Xylenes, and Vinyl Chloride                                                                                               |
|                         |               | MW-82             |           | PCL exceedance for Dichloroethene, Tetrachloroethylene, Trichloroethylene, and Vinyl Chloride                                                                |
|                         |               | MW-121            |           | Clean                                                                                                                                                        |
| Gauging                 | N/A           | N/A               | 2/6/2017  | No samples are taken during gauging.                                                                                                                         |
| Discharge Stream Sample | 624           | Pit 25/26D_021017 | 2/10/2017 | Does not exceed total discharge limit.                                                                                                                       |
| Discharge Stream Sample | 624           | Pit 25/26D_021617 | 2/16/2017 | Does not exceed total discharge limit.                                                                                                                       |
| Shaft GW Sample         | 8260          | Pit 18_021617     | 2/16/2017 | PCL exceedance for Dichloroethylene, Tetrachloroethylene, and Trichloroethylene; Not representative of GW due to high turbidity and suspended solids content |
|                         |               | Pit 19_021617     |           | Clean                                                                                                                                                        |
| Tunnel Spoil Sample     | 8260          | Pit 25/26T        | 2/17/2017 | Clean                                                                                                                                                        |
| Gauging                 | N/A           | N/A               | 2/24/2017 | No samples are taken during gauging.                                                                                                                         |
| Discharge Stream Sample | 624           | Pit 25D_030717    | 3/7/2017  | Does not exceed total discharge limit.                                                                                                                       |
| Monitor Well Sampling   | 8260          | MW-82             | 3/8/2017  | PCL exceedance for Dichloroethene, Tetrachloroethylene, Trichloroethylene, and Vinyl Chloride                                                                |
|                         |               | MW-121            |           | Clean                                                                                                                                                        |
|                         |               | MW-S16            |           | PCL exceedance for Dichloroethene                                                                                                                            |
|                         |               | MW-S20            |           | Clean                                                                                                                                                        |
|                         |               | MW-S22            |           | PCL exceedance for Dichloroethene, Tetrachloroethylene, Trichloroethylene, and Vinyl Chloride                                                                |
|                         |               | MW-S23            |           | PCL exceedance for Dichloroethene, Tetrachloroethylene, and Trichloroethylene                                                                                |
|                         |               | MW-S25            |           | PCL exceedance for Dichloroethene, Tetrachloroethylene, Trichloroethylene, and Vinyl Chloride                                                                |
|                         |               | MW-S27            |           | PCL exceedance for Dichloroethene and Vinyl Chloride                                                                                                         |
| Gauging                 | N/A           | N/A               | 3/8/2017  | No samples are taken during gauging.                                                                                                                         |
| Discharge Stream Sample | 624           | Pit 24D_031517    | 3/15/2017 | Does not exceed total discharge limit.                                                                                                                       |
| Gauging                 | N/A           | N/A               | 3/20/2017 | No samples are taken during gauging.                                                                                                                         |

# Cost of Unknown *Clean Water* Challenge

|                                    |                     |
|------------------------------------|---------------------|
| • Original Proposal                | \$2,167,015.62      |
| • Revised Cost-Plus Proposal       | \$1,041,684.85      |
| • Reimbursements of Cost (to date) |                     |
| • WCD 1 – Plan                     | \$30,000.00         |
| • WCD 2 – Sampling & Monitoring    | \$200,000.00        |
| • WCD 3 – Sampling & Monitoring    | \$220,000.00        |
| • WCD 5 – Sampling & Monitoring    | \$180,013.74        |
| • Change Order 2                   | <u>\$605,689.70</u> |
| • Total Impact                     | \$1,235,703.44      |

# CLOSING THOUGHTS

- The lift station consolidation model is an effective strategy to remove sanitary overflow sources
- Deep sewers resulting from eliminating lift stations are unlikely to be susceptible to leaks and infiltration from root intrusions and improper service connections
- Direct-jack trenchless installations eliminate leaks from differential settlement and poor haunch support
- Although the source of the plume is identified in ESA I, the plume's distance from the work site left it outside the range for elevating to the ESA II study

# The Memorial/Post Oak Project



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