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**SELF-MONITORING REPORT –  
SECOND QUARTER 2007  
NPDES PERMIT NO. CAG912002**

**GROUNDWATER REMEDIATION AT  
CITY OF OAKLAND  
MUNICIPAL SERVICES CENTER  
7101 EDGEWATER DRIVE  
OAKLAND, CALIFORNIA**

Prepared for

**City of Oakland  
Public Works Agency  
Environmental Services Division  
250 Frank H. Ogawa Plaza, Suite 5301  
Oakland, CA94612**

July 2007

Prepared by

**OTG**  
**Enviroengineering  
Solutions, Inc.**

464 19<sup>th</sup> Street, Suite 206  
Oakland, CA 94612

July 13, 2007

Mr. Farhad Azimzadeh  
Regional Water Quality Control Board  
1515 Clay Street, Suite 1400  
Oakland, CA 94612

Reference: RWQCB Order No. R2-2006-0075, NPDES Permit #CAG912002

Subject: Self-Monitoring Report – Second Quarter 2007  
Groundwater Remediation at 7101 Edgewater Drive, Oakland, CA

Dear Mr. Azimzadeh:

On behalf of the City of Oakland, OTG Enviroengineering Solutions, Inc. is pleased to submit this Self-Monitoring Report for a groundwater extraction, treatment and discharge system at the City of Oakland Municipal Services Center (MSC) located at 7101 Edgewater Drive, Oakland, California. No violations of RWQCB Order No. R2-2006-0075 and NPDES Permit #CAG912002 were identified during this reporting period of time.

### **Certification**

I certify under penalty of law that this document and all attachments are prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who managed the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Please contact the undersigned at (510) 465-8982 if you have questions or comments.

Sincerely,  
*OTG EnviroEngineering Solutions, Inc.*



Xinggang Tong, PhD, PE  
Project Manager



cc: Mr. Gopal Nair, City of Oakland  
Mr. Barney Chan, Alameda County Department of Environmental Health

464 19<sup>th</sup> Street, Suite 206, Oakland, CA 94612  
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P.O. Box 70125, Oakland, CA 94612

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## 1 INTRODUCTION

The City of Oakland Municipal Services Center (MSC) is located at 7101 Edgewater Drive, Oakland, CA (Figure 1). The site was originally part of a waterfront tidal marsh complex, which was filled between 1950 and 1971. The MSC occupies an area of approximately 17 acres. The City leased the land from the Port of Oakland for use as a corporation yard. Bordering the MSC site to the west and the north is the Martin Luther King Regional Shoreline Park. This park land is also owned by the Port of Oakland. Damon Slough is located to the north, and commercial developments are located to the east and south.

The MSC site has been the subject of numerous environmental investigations starting in about 1989. The suspected sources of on-site contamination include releases from underground storage tanks (USTs), gasoline and diesel fuel hydrant system, and the floor drain waste collection pits formerly located adjacent to Building No. 5. In addition, some or all of the material used to fill the site may have been waste or contaminated prior to placement at the site. A comprehensive investigation conducted by Baseline in 2000 identified the existence of free-phase petroleum hydrocarbon product at four separate areas within the MSC. They are labeled as Plumes A through D on Figure 2. Baseline's investigation is documented in the report of *Site History and Characterization* (January 2001).

Groundwater monitoring has been conducted quarterly from the fourth Quarter of 1989 through the third quarter of 2002 and then semi-annually to current. Shallow groundwater elevation varies from 2 to 10 feet below ground surface and is partially subject to tidal influence. Shallow groundwater flow is toward the southwest to the nearest shoreline along San Leandro Bay across much of the site. In the northern portion of the MSC, groundwater flows in a more northerly direction toward the curving shoreline and Damon Slough (Baseline, January 2001)

Pilot-scale Dual-Phase Extraction (DPE) tests were conducted in 2002 to enhance the removal of free-phase petroleum product from the four identified areas (Cambria, August 13, 2002 and URS, August 29, 2002). Extracted groundwater was treated on-site through two 2,000-lb granular activated carbon units connected in series and discharged to on-site storm drain via a NPDES permit granted by the San Francisco Bay Regional Water Quality Control Board (NPDES Permit No. CAG912002). Based on the pilot test result, the City retained Cambria in May 2003 to design a full-scale application of product recovery and groundwater/soil vapor extraction at Plumes C and D. Cambria's design was revised in October 2005 by Groundwater and Environmental Services (GES) to focus the first phase of product removal in Plume D. The final design drawings were included in Appendix A of the Startup Report (OTG, June 2006). Chemical oxidation and enhanced bioremediation through periodic injections of hydrogen peroxide have been implemented in Plumes A, B and C since July 2004.

In March 2006, the City retained URS Corporation and its subcontractor ERRG to construct the GES' revised remediation system of product recovery and groundwater/soil vapor extraction. The construction was completed in early May 2006. Seven wells within Plume D were connected to the extraction system. On May 22, 2006, the product recovery and groundwater

extraction portion of the remediation system was turned on. On May 14, 2007, the DPE portion of the remediation system was turned on. Six additional extraction wells were installed within Plume D in March 2007. They were connected to the DPE system and were brought on-line under extraction on June 11, 2007.

## **2. DESCRIPTION OF REMEDIATION SYSTEM**

The remediation system consists of extraction of liquid (petroleum product and groundwater) and soil vapor from 13 wells located in Plume D area (Figure 3), separation of petroleum product from groundwater, treatment of groundwater by activated carbon, discharge of treated water to local storm drain via a NPDES permit, treatment of soil vapor, and discharge of treated vapor to the atmosphere via an air discharge permit. A process and instrumentation diagram of the remediation system is illustrated on Figure 4. Design details were included in Appendix A of the Startup Report (OTG, June 2006).

The 13 wells are: RW-D1 through RW-D11, TBW-5 and RW-1. Their locations are shown on Figure 3. RW-D1 through RW-D5 were constructed in December 2001 and RW-D6 through RW-D11 in March 2007 specifically for remediation purposes, and RW-1 and TBW-5 were placed during backfilling of the excavation of former fuel hydrant lines in the early 1990s. All wells, except RW-D6 through RW-D11, were equipped with both total fluid recovery pneumatic pumps specifically designed for viscous petroleum product recovery and vacuum lines for DPE. The pneumatic pumps were manufactured by Clean Environment Equipment in Oakland and has the Model # AP-Custom. An Ingersoll-Rand air compressor (model # SSR UP6-10) provides compressed air to the pneumatic pumps. All wells are piped into a high vacuum extraction unit that can produce up to 28 inches of mercury vacuum. This vacuum unit can be operated at either mode of soil vapor extraction only or soil vapor and liquid simultaneous extraction. The pneumatic pumps and the vacuum extraction unit can be operated independently.

The liquid extracted by the pneumatic pumps and the vacuum unit is pumped into an oil/water separator (Model # AGM-3SS-90V, Hydro Quip, Inc.). Recovered oil is contained in 55-gallon drums, which are sent to an off-site oil recycling facility. Groundwater is treated through three (3) granular activated carbon (GAC) units connected in series (Model #ASC-2000, U.S.Filter/Westates Carbons) before being discharged into local storm drain. Each GAC unit contains 2,000 lbs of GAC. Figure 5 illustrates the groundwater treatment portion of the remediation system and identifies sampling ports.

A 40 hp liquid-ring vacuum pump capable of 500 ACFM and up to 28" Hg extracts soil vapor and liquid from the 13 wells. The vapor is abated by a combination of thermal and catalytic oxidizer. At low vapor organic concentrations, activated carbon can also be used for vapor abatement.

### 3 OPERATIONS AND MAINTENANCE

On May 22, 2006, the pneumatic pumps were turned on to start the remediation process. The vacuum extraction portion remained off line. Because the free-phase product appears to be a mixture of gasoline, diesel, and some other highly viscous organics (petroleum tank bottom or coal tar like material), the vacuum extraction, if turned on, will vaporize gasoline and a portion of the diesel and will make the removal of the viscous product even more difficult. The plan is to first use the pneumatic pumps to remove the free-phase product as much as practically achievable and then to use the vacuum extraction system to enhance the removal of the remaining petroleum hydrocarbons.

Free-phase product recovered by the pneumatic pumps decreased steadily from the startup in May 2006 to April 2006. On May 14, 2007, RW-D2, RW-D4 and RW-D5 were switched to DPE operations, while RW-D1, RW-D3, TBW-5 and RW-1 remained under pneumatic pump extraction. On June 11, 2007, the newly installed six wells (RW-D6 through RW-D11) were also brought on-line under DPE operations.

The groundwater extraction, treatment, and discharge system was operated continuously during the First Quarter 2007. Operations and maintenance (O&M) of the system were performed following the instruction of *Operation & Maintenance Manual for Groundwater Remediation System at City of Oakland Municipal Services Center, Draft* (OTG, July 2006), which included daily check of air compressor's oil & pressure levels, functions of liquid level sensors and pumps, draining condensate from air tank, removing oil from the oil/water separator, and other tasks necessary for maintaining proper functions of the remediation system. The lead carbon unit was changed with new carbon due to excessively pressure built up in the lead unit. There was no breakthrough of any of the petroleum hydrocarbon constituents at the time of carbon change. The unit with the fresh carbon remained as the lead unit.

On-site measurement included temperature, pH, and electric conductivity using an Oakton pH/Con 10 meter (Serial #311648) and turbidity using an Oakton T-100 meter (Serial #316738). Before measurement, the pH probe was calibrated with standard solutions of pH 4.00, 7.00, and 10.00; the electric conductivity probe calibrated with 1413 ug/cm standard solution; and the turbidity meter calibrated with standards of 0.02, 20.0, 100, and 800 NTUs.

Chemical analyses were performed by Curtis & Tompkins, Ltd of Berkeley. Fish toxicity bioassay was conducted by Block Environmental Services of Pleasant Hill. The data received from laboratories was found to be of acceptable quality with qualifications as noted in the laboratory reports.

### 4 DISCHARGE MONITORING – SECOND QUARTER 2007

Field measured data and laboratory analysis results are summarized in the following tables:

- Table 1 – Summary of Laboratory Analytical Procedures

- Table 2 – Summary of Operational Data and Field Measured Parameters
- Table 3 – Summary of Petroleum Hydrocarbon Analytical Data
- Table 4 – Summary of Analytical Data for Inorganic Constituents & Fish Bioassay
- Table 5 – Summary of Analytical Data for Organic Constituents
- Table 6 – Dual-Phase Extraction Vapor Monitoring Data
- Table 7 – Petroleum Hydrocarbons Removed through Soil Vapor Extraction
- Table 8 – TPH removed through Dissolved in Groundwater, Floating Product Recovered and Soil Vapor Extracted.

**Major highlights for the Second Quarter 2007 are:**

- Groundwater extracted by the pneumatic pumps and the DPE for this reporting period (April 1 through June 30, 2007) totaled 238,150 gallons, which was treated and discharged into the local storm drain, resulting in an average monthly flow rate of 1.455 gallons per minute (gpm) in April, 1.782 gpm in May, and 2.220 gpm in June (Table 2).
- Thirteen (13) gallons, or 92 lbs assuming a gravity of 0.85 kg/L, of separate-phase floating product (TPH) was recovered, 195 lbs of TPH was removed through dissolved in groundwater, and 3,699 lbs of TPH was removed through soil vapor by the DPE (Table 8). The total weight of TPH removed from Plume D this quarter was 3,986 lbs, of which 93% was removed by the DPE through soil vapor extracted. Since the remediation system started in May 2006, a cumulative of 6,856 lbs, or 969 gallons, of TPH has been removed from Plume D (Table 8). The removed floating product is highly viscous and black in color. Its appearance does not resemble gasoline or diesel.
- Monthly monitoring was conducted on April 24, May 17, and June 21, respectively. Monthly monitoring results are summarized in Tables 2 and 3.
- Effluent (treated groundwater) had pHs between 7.22 and 7.45, temperatures between 15.7 and 19.2 °C, conductivities between 7.1 and 15.13 ms/cm, and turbidities between 0.04 and 0.08 (Table 2).
- TPH gas, diesel, benzene, toluene, ethylbenzene, and xylenes (BTEX), and MTBE in the monthly effluent samples were all below their respective reporting limits. The reporting limit was 0.5 ug/L for BTEX, 2.0 ug/L for MTBE, and 50 ug/L for TPH gas and TPH diesel (Table 3). No breakthrough of any monitored organic constituents was reported after the treatment of first carbon unit and after the second carbon unit.
- Daily mass discharges calculated based on the average daily flow rate and the quarterly monitoring data (March 14) for all inorganic constituents were significantly below their respective daily mass limits imposed by the discharge permit for the category of less than 10 gpm discharge rate (Table 4). After the first year of quarterly monitoring, these inorganic constituents are under annual monitoring frequency for subsequent years of operations. The next monitoring event for these inorganic constituents is planned in the first quarter 2008.
- Effluent concentrations of volatile organic compounds (VOCs) and fuel oxygenates analyzed by EPA8260, methanol and ethanol by EPA 8015, semi-VOCs by EPA8270 and EPA8310 were all below their respective reporting limits (Table 5). A sample collected from Btw-2 (after the second carbon unit) on March 14 was also analyzed for



VOCs by EPA 8260 and none of the VOCs was reported at or above its reporting limit. These parameters are under semi-annual monitoring schedule and will be analyzed in the third quarter 2007.

- The rainbow trout survival rate was 100% in the 96-hour static renewal bioassay conducted for the effluent sample collected on March 14 (Table 4). After the first year of quarterly testing, the fish bioassay is under annual monitoring schedule for subsequent years of operations and the next scheduled testing is in the first quarter 2008.
- The average concentration for the influent (after the oil/water separator, but before the carbon treatment) for the second quarter 2007 was 34.6 mg/L TPH gas, 64.6 mg/L TPH diesel, and 0.83 mg/L benzene.

## 5 REFERENCES

Baseline Environmental Consulting, *Site History and Characterization*, January 2001

Cambria Environmental Technology, Inc. *TPE Pilot Test and Feasibility Report*, August 13, 2002.

California Regional Water Quality Control Board – San Francisco Bay Region, *Notice of General Permit Coverage for Discharge from the City of Oakland Municipal Service Center located at 7101 Edgewater Drive, Oakland, Alameda County, CA 94621, under the Requirements of Order No. R2-2006-0075, NPDES Permit No. CAG912002 (Fuel General Permit)*, March 12, 2007.

California Regional Water Quality Control Board – San Francisco Bay Region, *Authorization to Discharge Treated Groundwater Under the Requirements of Order No. 01-100, NPDES Permit No. CAG 912002*, April 23, 2002.

OTG Enviroengineering Solutions, Inc. *Self-Monitoring Report – First Quarter 2007, Groundwater Remediation at City of Oakland Municipal Services Center*, April 2007

OTG Enviroengineering Solutions, Inc. *Self-Monitoring Report – Fourth Quarter & YEAR 2006, Groundwater Remediation at City of Oakland Municipal Services Center*, January 2007

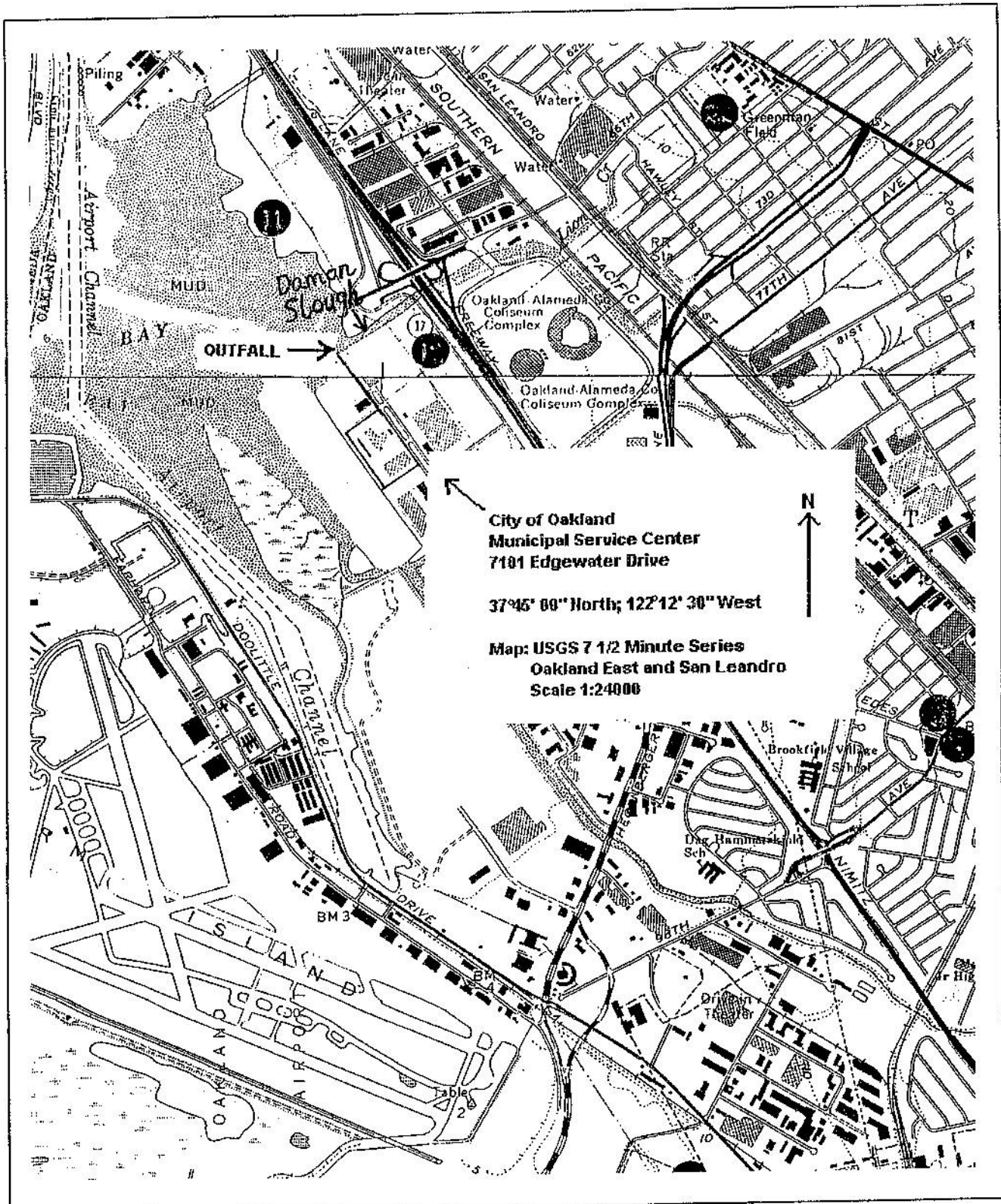
OTG Enviroengineering Solutions, Inc. *Self-Monitoring Report – Third Quarter 2006, Groundwater Remediation at City of Oakland Municipal Services Center*, October 2006

OTG Enviroengineering Solutions, Inc. *Self-Monitoring Report – Second Quarter 2006, Groundwater Remediation at City of Oakland Municipal Services Center*, July 2006

OTG Enviroengineering Solutions, Inc. *Operation & Maintenance Manual for Groundwater Remediation System at City of Oakland Municipal Services Center, Draft*, July 2006

OTG Enviroengineering Solutions, Inc. *Startup Report, Groundwater Remediation at City of Oakland Municipal Services Center*, June 2006

URS Corporation, *Results of Dual-Phase Extraction Pilot Test for Plumes A & B, City of Oakland Municipal Services Center*, August 29, 2002.



**FIGURE 1 SITE LOCATION AND DISCHARGE LOCATION**

**OTG** EnviroEngineering  
*Solutions, Inc.*

City of Oakland Municipal Service Center  
7101 EdgeWater Drive, Oakland, CA

**EXPLANATION**

- MW-1 ● Monitoring well location
- RW-1 ⚡ Remediation well location
- TBW-1 ⚡ Tank Backfill Well
- MW-3 ⊗ Abandoned Well
- Fence
- Former underground piping
- Area of free product on groundwater

DAMON SLOUGH

EDGEWATER DRIVE

SAN LEANDRO BAY

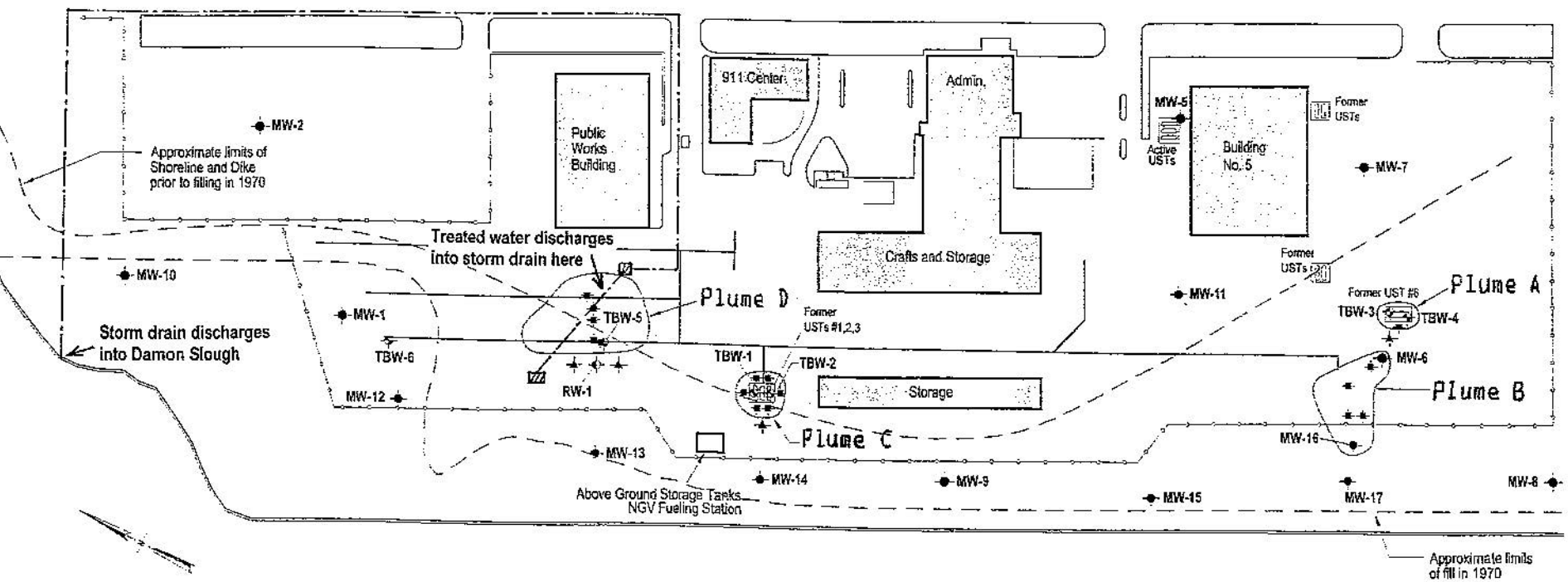
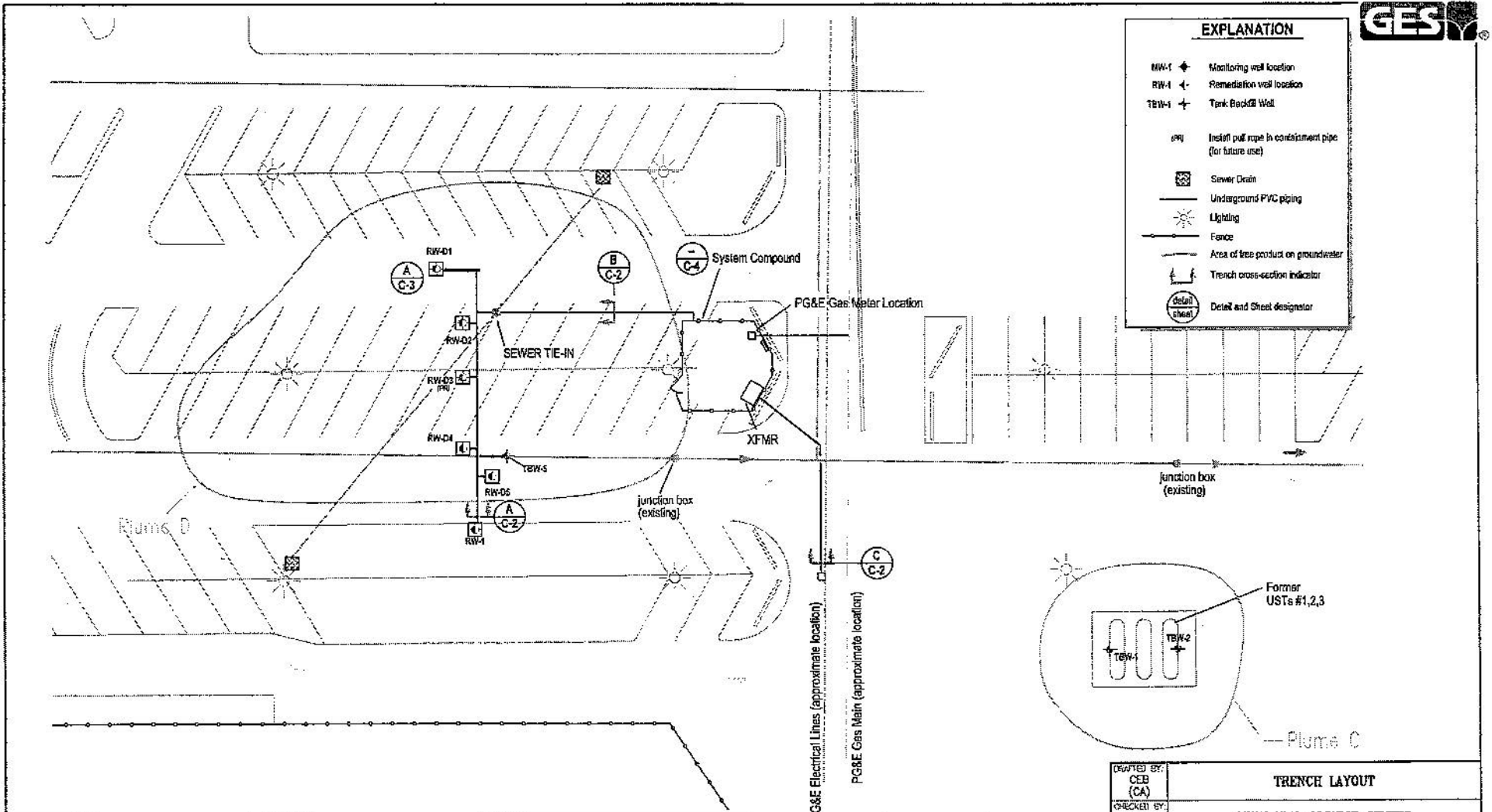


FIGURE 2 Identification of Free-Phase Petroleum Product Locations

**OTG** EnviroEngineering Solutions, Inc.

City of Oakland Municipal Services Center  
7101 Edgewater Drive, Oakland, CA



EXPLANATION	
MW-1	Monitoring well location
RW-1	Remediation well location
TBN-1	Tank Backfill Well
(PW)	In-situ put pipe in containment pipe (for future use)
[Symbol]	Sewer Drain
[Symbol]	Underground PVC piping
[Symbol]	Lighting
[Symbol]	Fence
[Symbol]	Area of free product on groundwater
[Symbol]	Trench cross-section indicator
(detail sheet)	Detail and Sheet designator

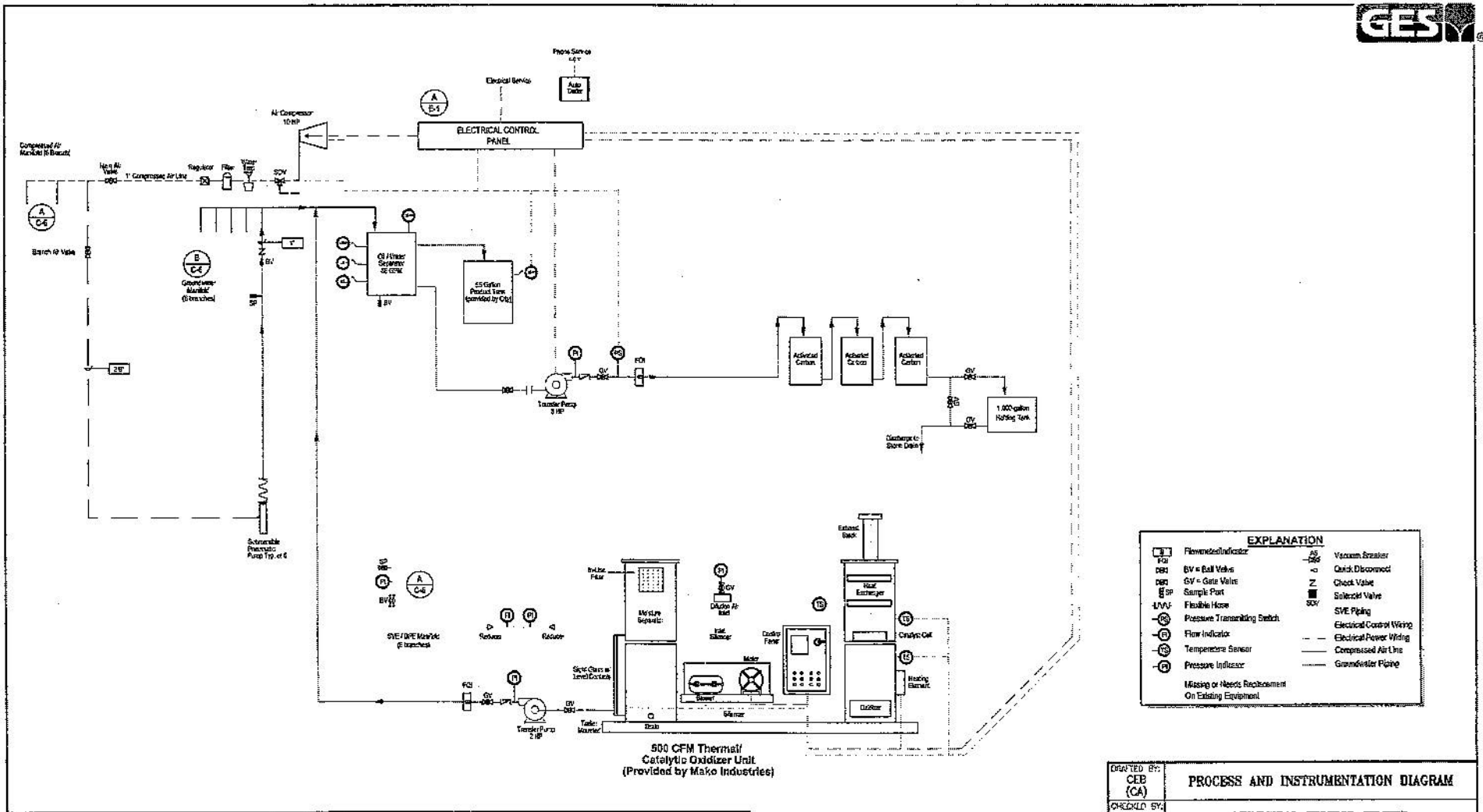
**FIGURE 3 Identification of Extraction Wells & Trench Layout**

**OTG EnviroEngineering Solutions, Inc.**

City of Oakland Municipal Services Center  
7101 Edgewater Drive, Oakland, CA

Above Ground Storage Tanks  
NGV Fueling Station

TRENCH LAYOUT		
DRAFTED BY: CEB (CA) CHECKED BY: GWH REVIEWED BY:		
MUNICIPAL SERVICE CENTER 7101 EDGEWATER DRIVE OAKLAND, CALIFORNIA		
Groundwater & Environmental Services, Inc. 333 VINCENT ROAD, SUITE 222, PLEASANT HILL, CA 94523		
NORTH 	APPROX. SCALE 	DATE 11-02-05
		FIGURE C-1



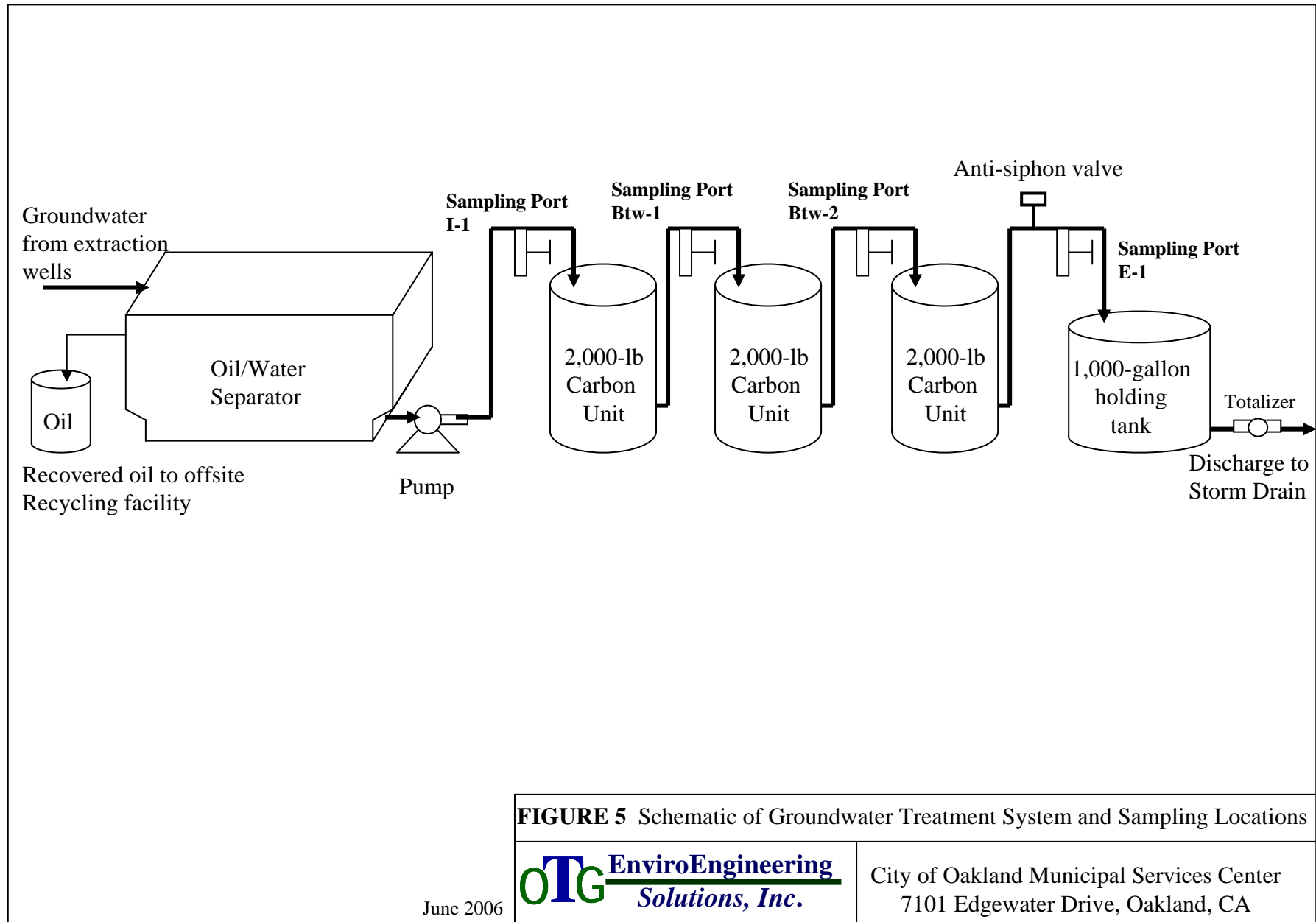
EXPLANATION	
FI	Flowmeter/Indicator
SV	Sample Valve
DE	Drain
SP	Sample Port
LV	Flexible Hose
PT	Pressure Transducing Switch
FI	Flow Indicator
TS	Temperature Sensor
PI	Pressure Indicator
AS	Vacuum Breaker
DC	Quick Disconnect
Z	Check Valve
Z	Shut-off Valve
SV	SVE Piping
—	Electrical Control Wiring
—	Electrical Power Wiring
—	Compressed Air Line
—	Groundwater Piping

FIGURE 4 Remediation System Process & Instrumentation Diagram

**OTG** EnviroEngineering  
*Solutions, Inc.*

City of Oakland Municipal Services Center  
7101 Edgewater Drive, Oakland, CA

DRAFTED BY: CEB (CA)	<b>PROCESS AND INSTRUMENTATION DIAGRAM</b>	
CHECKED BY: GMH	<b>MUNICIPAL SERVICE CENTER 7101 EDGEWATER DRIVE OAKLAND, CALIFORNIA</b>	
REVIEWED BY: NORTH	Groundwater & Environmental Services, Inc. 333 VINCENT ROAD, SUITE 222, PLEASANT HILL, CA 94523	
	NOT TO SCALE	DATE 11-02-05
		FIGURE M-1



**FIGURE 5** Schematic of Groundwater Treatment System and Sampling Locations

June 2006

**OTG** **EnviroEngineering**  
*Solutions, Inc.*

City of Oakland Municipal Services Center  
7101 Edgewater Drive, Oakland, CA

**Table 1** - Summary of Laboratory Analytical Procedures  
City of Oakland Municipal Services Center Groundwater Remediation Project

	5/22/06	5/30/06	6/26/06	7/25/06	9/5/06	10/4/06	11/8/06
				& 8/11/06		& 12/6/06	
Flow rate	onsite totalizer	onsite totalizer	onsite totalizer	onsite totalizer	onsite totalizer	onsite totalizer	onsite totalizer
Turbidity	on-site	on-site	on-site	on-site	on-site	on-site	on-site
Fish bioassay			EPA/821/R-02/012		EPA/821/R-02/012		EPA/821/R-02/012
pH	on-site	on-site	on-site	on-site	on-site	on-site	on-site
DO							
Temperature	on-site	on-site	on-site	on-site	on-site	on-site	on-site
E. conductivity	on-site	on-site	on-site	on-site	on-site	on-site	on-site
Benzene	EPA 8021B	EPA 8021B	EPA 8021B	EPA 8021B	EPA 8260B	EPA 8021B	EPA 8021B
Toluene	EPA 8021B	EPA 8021B	EPA 8021B	EPA 8021B	EPA 8260B	EPA 8021B	EPA 8021B
Ethylbenzene	EPA 8021B	EPA 8021B	EPA 8021B	EPA 8021B	EPA 8260B	EPA 8021B	EPA 8021B
Total xylenes	EPA 8021B	EPA 8021B	EPA 8021B	EPA 8021B	EPA 8260B	EPA 8021B	EPA 8021B
MTBE	EPA 8021B	EPA 8021B	EPA 8021B	EPA 8021B	EPA 8260B	EPA 8021B	EPA 8021B
TPH g&d	EPA 8015B	EPA 8015B	EPA 8015B	EPA 8015B	EPA 8015B	EPA 8015B	EPA 8015B
EDB		EPA 8260B			EPA 8260B		
VOCs		EPA 8260B			EPA 8260B		
TAME		EPA 8260B			EPA 8260B		
DIPE		EPA 8260B			EPA 8260B		
ETBE		EPA 8260B			EPA 8260B		
TBA		EPA 8260B			EPA 8260B		
Ethanol		EPA 8015B			EPA 8260B		
Methanol		EPA 8015B			EPA 8015B		
SVOCs		EPA 625			EPA 8270C		
PAHs		EPA 610			EPA 8310		
Hardness	SM 2340B	SM 2340B	SM 2340B		SM 2340B		SM 2340B
Antimony	EPA 200.8	EPA 200.8	EPA 6020		EPA 6020		EPA 6020
Arsenic	EPA 200.8	EPA 200.8	EPA 6020		EPA 6020		EPA 6020
Beryllium	EPA 200.8	EPA 200.8	EPA 6020		EPA 6020		EPA 6020
Cadmium	EPA 200.8	EPA 200.8	EPA 6020		EPA 6020		EPA 6020
Chromium	EPA 200.8	EPA 200.8	EPA 6020		EPA 6020		EPA 6020
Cr +6	EPA 7196	EPA 7196	EPA 7199		EPA 7199		EPA 7199
Copper	EPA 200.8	EPA 200.8	EPA 6020		EPA 6020		EPA 6020
Cyanide	EPA 335.2	EPA 335.2	EPA 335.2		EPA 335.2		EPA 335.2
Lead	EPA 200.8	EPA 200.8	EPA 6020		EPA 6020		EPA 6020
Mercury	EPA 245.1	EPA 245.1	EPA 7470A		EPA 7470A		EPA 7470A
Nickel	EPA 200.8	EPA 200.8	EPA 6020		EPA 6020		EPA 6020
Selenium	EPA 200.8	EPA 200.8	EPA 6020		EPA 6020		EPA 6020
Silver	EPA 200.8	EPA 200.8	EPA 6020		EPA 6020		EPA 6020
Thallium	EPA 200.8	EPA 200.8	EPA 6020		EPA 6020		EPA 6020
Zinc	EPA 200.8	EPA 200.8	EPA 6020		EPA 6020		EPA 6020
	pH/Conductivity/Tempt were measured on-site using a Oakton pH/Con 10 meter, Serial #311648, calibrated daily before use.						
	Turbidity was measured on-site using a Oakton T-100 meter, Serial #316738, calibrated daily before use.						



**Table 1** - Summary of Laboratory Analytical Procedures  
 City of Oakland Municipal Services Center Groundwater Remediation Project

	1/19/07 & 2/22/07	3/14/07	4/24/07 5/17 & 6/21
Flow rate	onsite totalizer	onsite totalizer	onsite totalizer
Turbidity	on-site	on-site	on-site
Fish bioassay		EPA/821/R-02/012	
pH	on-site	on-site	on-site
DO			
Temperature	on-site	on-site	on-site
E. conductivity	on-site	on-site	on-site
Benzene	EPA 8021B	EPA 8260B	EPA 8021B
Toluene	EPA 8021B	EPA 8260B	EPA 8021B
Ethylbenzene	EPA 8021B	EPA 8260B	EPA 8021B
Total xylenes	EPA 8021B	EPA 8260B	EPA 8021B
MTBE	EPA 8021B	EPA 8260B	EPA 8021B
TPH g&d	EPA 8015B	EPA 8015B	EPA 8015B
EDB		EPA 8260B	
VOCs		EPA 8260B	
TAME		EPA 8260B	
DIPE		EPA 8260B	
ETBE		EPA 8260B	
TBA		EPA 8260B	
Ethanol		EPA 8015B	
Methanol		EPA 8015B	
SVOCs		EPA 8270C	
PAHs		EPA 8310	
Hardness		SM 2340B	
Antimony		EPA 6020	
Arsenic		EPA 6020	
Beryllium		EPA 6020	
Cadmium		EPA 6020	
Chromium		EPA 6020	
Cr +6		EPA 7199	
Copper		EPA 6020	
Cyanide		EPA 335.2	
Lead		EPA 6020	
Mercury		EPA 7470A	
Nickel		EPA 6020	
Selenium		EPA 6020	
Silver		EPA 6020	
Thallium		EPA 6020	
Zinc		EPA 6020	

**Table 2** - Summary of Operational Data and Field Measured Parameters  
City of Oakland Municipal Services Center Groundwater Remediation Project

Date	Time	Effluent (E-1)				Influent (I-1)			Btw-1	Btw-2	Totalizer Reading (gallons)	Monthly Treated (gallons)	Monthly ave. rate (gal/min)	Product recovered (gallons)	Notes
		pH	Temp (°C)	E. conduc (ms/cm)	Turbidity (NTU)	pH	Temp (°C)	E. cond. (ms/cm)							
5/22/2006	7:00										1,389				Before turn on system
5/22/2006	11:25	8.3	20.4	8.81	0.2	7.12	21.4	10.2	sampled		2,050				treated water held in tank
5/22/2006	14:15										2,414				stopped, waiting for analy data
5/24/2006	13:00										2,414				system on, start discharge
5/30/2006	12:30	7.48	19.4	8.25	0.04	6.98	23.1	8.32	sampled		14,230			20	
5/31/2006	10:00										18,980	17,591	1.705		
6/2/2006	16:30								sampled	sampled	31,080				
6/9/2006	8:30										48,610				
6/16/2006	10:20										67,755				
6/19/2006	9:40										74,670				
6/22/2006	11:00										90,480				
6/26/2006	9:00	7.32	22.3	13	0.1	7.37	23.3	13.4	sampled	sampled	106,950				Monthly monitoring
6/30/2006	9:00										122,860	103,880	2.405	100	
7/5/2006	10:00										140,500				two full drums of product
7/12/2006	9:30								sampled	sampled	163,230				
7/19/2006	9:30										182,740				
7/25/2006	9:30	7.35	23.6	12.5	0.04	7.4	24.2	13.1	sampled		197,030				Monthly monitoring
7/31/2006	19:30										212,010	89,150	1.997	155	
8/2/2006	19:30										216,790			165	three full drums of product
8/9/2006	9:00										233,260				<b>Morgan removed 3 drums prodt</b>
8/11/2006	9:30	6.95	21.5	12.8	0.1	7.25	22.3	12.6	sampled	sampled	238,380				Monthly monitoring
8/14/2006	8:00										246,180				lowered pumps in wells
8/17/2006	11:30										255,030				
8/28/2006	11:30										283,080				
9/1/2006	18:30										294,910	82,900	1.801	220	one full drum of product on site
9/5/2006	11:00	7	19.7	12.3	0.1	7.1	22.8	11.5	sampled	sampled	301,450				Monthly & Qtrly monitoring
9/9/2006	18:00										310,750				
9/17/2006	13:00										333,310				
9/22/2006	13:30										349,210				
9/27/2006	10:00										364,350				
9/29/2006	15:00										371,290				
10/2/2006	14:30										380,360	85,450	1.925	245	
10/4/2006	11:00	7.1	19.4	12.67	0.04	7.3	21.5	12.22	sampled	sampled	386,160				monthly monitoring
10/9/2006	13:00										402,090				
10/16/2006	11:00										417,310				
10/23/2006	17:00										436,170				
10/27/2006	18:30										443,640				
10/30/2006	11:00										448,220			275	two full drums of product

**Table 2** - Summary of Operational Data and Field Measured Parameters  
City of Oakland Municipal Services Center Groundwater Remediation Project

Date	Time	Effluent (E-1)				Influent (I-1)			Btw-1	Btw-2	Totalizer Reading (gallons)	Monthly Treated (gallons)	Monthly ave. rate (gal/min)	Product recovered (gallons)	Notes
		pH	Temp (°C)	E. conduc (ms/cm)	Turbidity (NTU)	pH	Temp (°C)	E. cond. (ms/cm)							
11/1/2006	10:30										453,340	72,980	1.689		
11/8/2006	11:00	7.35	18.6	10.03	0.1	7.03	21.7	10.79	sampled	sampled	461,210				monthly & quarterly monitoring
11/14/2006	12:30										483,660				
11/20/2006	10:30										487,970				
12/1/2006	11:30										499,540	46,200	1.069	295	
12/6/2006	11:00	7.1	12.3	15.4	0.08	8.45	14.8	17.7	sampled	sampled	504,500				monthly monitoring
12/15/2006	10:00										513,050				
12/22/2006	14:30										533,130				
12/27/2006	10:00										540,340			315	2 full drums plus 40 gal product
1/2/2007	9:00										548,820	49,280	1.073		
1/10/2007	11:00										559,230				
1/19/2007	10:00	7.15	9.4	19.9	0.04	8	13.5	19.5	sampled	sampled	569,740				monthly monitoring
1/30/2007	10:00										592,780			330	3 full drums product on site
2/2/2007	10:00										607,920	59,100	1.322		
2/8/2007	16:30										615,000				
2/22/2007	10:00	7.12	13.8	15.5	0.04	7.67	15.2	19.13	sampled	sampled	672,610				monthly monitoring
2/28/2007	10:30										693,430	85,510	2.282	343	
3/9/2007	10:00										729,160				
3/14/2007	11:30	7.25	17.6	13.34	0.04	7.28	18.2	13.05	sampled	sampled	748,440				monthly & quarterly monitoring
3/21/2007	12:00										776,540				
3/30/2007	10:00										809,690	116,260	2.693	355	3 full drums+25 gal prod onsite
4/2/2007	10:00										819,750				
4/13/2007	10:00										849,540				
4/24/2007	10:00	7.45	15.7	7.1	0.08	7.3	18.6	6.9	sampled	sampled	866,110				
4/30/2007	19:00										875,415	65,725	1.455	360	3 full drums+30 gal prod onsite
5/4/2007	10:30										880,280				
5/14/2007	12:00														DPE online with D2,D4,D5wells
5/14/2007	18:00														DPE in & out vapor sampling
5/17/2007	11:30	7.22	18	14.15	0.04	7.55	19.8	14.54	sampled	sampled	907,175				monthly monitoring
5/22/2007	11:15										952,055				DPE down for Phase II tie-in
5/31/2007	11:00										954,120	78,705	1.782	364	3 full drums+34 gal prod onsite
6/11/2007	10:00										954,920				DPE restart with all wells
6/14/2007	10:00										973,900				
6/21/2007	10:00	7.38	19.2	15.13	0.04	7.45	20.1	15.24	sampled	sampled	991,590				monthly monitoring
6/26/2007	18:40										1,028,960				DPE in & out vapor sampling
6/29/2007	18:30										1,047,840	93,720	2.22	368	3 full drums+38 gal prod onsite
7/3/2007	11:30										1,051,974				DPE down, knockout pump fail

**Table 3 - Summary of Petroleum Hydrocarbon Analytical Data**  
 City of Oakland Municipal Services Center Groundwater Remediation Project

Date	Effluent (E-1)							Influent (I-1)							
	TPH gas (ug/L)	TPHdiesel (ug/L)	benzene (ug/L)	toluene (ug/L)	ethyl benz (ug/L)	xylenes (ug/L)	MTBE (ug/L)	TPH gas (ug/L)	TPHdiesel (ug/L)	TPH mo (ug/L)	benzene (ug/L)	toluene (ug/L)	ethyl ben (ug/L)	xylenes (ug/L)	MTBE (ug/L)
Eff. Limit	50	50	5	5	5	5	13								
5/22/06	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)	52,000	25,000 (h,l)	NA	6,100	5,200	1,200	6,100	ND (100)
5/30/06	ND (50)	130 (y, a1)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	57,000	9,200 (l,y)	NA	4900	5300	1100	7100	ND (36)
6/2/06		ND (50)													
6/26/06	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)	50,000	10,000(h,l,y)	NA	4800	6900	1100	7200	ND (50)
7/25/06	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)	60,000	4,000(l,y)	NA	5800	8800	1100	9000	ND (80)
8/11/06	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	4.6 (a1a)	59,000	4,100 (l,y)	NA	4900	7300	930	7000	ND (100)
9/5/06	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)	44,000	4,800 (l,y)	NA	4700	4800	1200	5400	ND (50)
10/4/06	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)	42,000	9,100 (h,l,y)	NA	5100	7300	1400	6700	ND (100)
11/8/06	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)	32,000	7,800 (h,l,y)	NA	3100	3800	590	2880	ND (50)
12/6/06	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)	55,000	7,600 (h,l,y)	NA	5800	8600	820	6600	ND (50)
1/19/07	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)	49,000	3,600 (l,y)	NA	3900	5400	390	5900	ND (50)
2/22/07	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)	38,000	7,900 (l,y)	NA	4100	4500	250	5200	ND (40)
3/14/07	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	32,000	7,800 (h,l,y)	NA	2700	2900	310	4,100	ND (13)
4/24/07	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)	11,000	6,200 (h,l)	1,500 (l)	930	110	26	760	ND (10)
5/17/07	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)	84,000	180,000(h,l,y)	27,000 (l)	1,100	3,100	1,200	8,800	ND (100)
6/21/07	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)	8,900	7,700 (h,l,y)	2,900 (l)	460	520	34	1060	ND (2.0)
(a1) - false positive detection, confirmed ND on 6/2/06 samples at E-1, Btw-1 & Btw-2								(a1a) - false positive, confirmed ND on 9/5/06 sample							
(h) - heavier hydrocarbons contributed to the quantitation															
(l) - lighter hydrocarbons contributed to the quantitation															
(y) - sample exhibits chromatographic pattern which does not resemble standard															

**Table 3** - Summary of Petroleum Hydrocarbon Analytical Data  
City of Oakland Municipal Services Center Groundwater Remediation Project

Date	After 1st Carbon Unit (Btw-1)							After 2nd Carbon Unit (Btw-2)						
	TPH gas (ug/L)	TPHdiesel (ug/L)	benzene (ug/L)	toluene (ug/L)	ethyl benz (ug/L)	xylenes (ug/L)	MTBE (ug/L)	TPH gas (ug/L)	TPHdiesel (ug/L)	benzene (ug/L)	toluene (ug/L)	ethyl benz (ug/L)	xylenes (ug/L)	MTBE (ug/L)
Eff. Limit	50	50	5	5	5	5	13	50	50	5	5	5	5	13
5/22/06	57 (y)		ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)							
5/30/06	ND (50)		ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)							
6/2/06	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)		NA	ND (50)					
6/26/06	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)	ND (50)	NA	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)
7/12/06	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)	ND (50)	NA	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	3.9 (a2)
7/25/06	ND (50)		ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	2.7							
8/11/06	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	5.1 (a2a)	ND (50)	NA	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	5.4 (a2a)
9/5/06	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)	NA	NA	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)
10/4/06	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)	ND (50)	NA	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)
11/8/06	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)	ND (50)	NA	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)
12/6/06	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)	ND (50)	NA	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)
1/19/07	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)	ND (50)	NA	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)
2/22/07	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)	ND (50)	NA	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)
3/14/07	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	3.9	NA	NA	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
4/24/07	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)	ND (50)	NA	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)
5/17/07	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)	ND (50)	NA	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)
6/21/07	ND (50)	ND (50)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)	ND (50)	NA	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)
(a2) - false positive detection, confirmed ND after the first carbon unit							(a2a) - false positive detection, confirmed ND on 9/5/06 sample							
(h) - heavier hydrocarbons contributed to the quantitation														
(l) - lighter hydrocarbons contributed to the quantitation														
(y) - sample exhibits chromatographic pattern which does not resemble standard														

**Table 4 - Summary of Analytical Data for Inorganic Constituents and Fish Bioassay**  
City of Oakland Municipal Services Center Groundwater Remediation Project

Constituent	Unit	Eff Limit (<10 gpm)	Effluent (E-1)										
			5/22/06	5/30/06	6/26/06	9/5/06	11/8/06	3/14/07					
Antimony	ug/L		2.3	1.8	0.12	0.13	0.35	0.15					
	g/day	3	0.02137	0.01672	0.001572	0.00138	0.00243	0.001628					
Arsenic	ug/L		36	24	7	3	4.3	1.6					
	g/day	1	0.33444	0.22296	0.0917	0.03177	0.0298	0.01736					
Beryllium	ug/L		ND (0.35)	ND (0.5)	ND (0.055)	ND (0.12)	ND (0.12)	ND (0.17)					
	g/day	3											
Cadmium	ug/L		1	0.5	ND (0.14)	ND (0.17)	ND (0.17)	0.12					
	g/day	1	0.00929	0.00465				0.001302					
Total Cr	ug/L		3.1	ND (0.5)	0.62	0.86	0.78	0.61					
	g/day	2	0.0288		0.008122	0.00911	0.00541	0.006619					
Cr +6	ug/L		ND (1.0)	ND (10)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)					
	g/day	2											
Copper	ug/L		1.3	0.9	1.3	1.5	1.2	ND (0.28)					
	g/day	3	0.01208	0.00836	0.01703	0.01589	0.00832						
Lead	ug/L		ND (0.1)	ND (0.25)	0.26	0.3	0.3	0.75					
	g/day	5			0.003406	0.00318	0.00208	0.008138					
Mercury	ug/L		ND(0.008)	ND(0.2)	ND (0.2)	ND (0.06)	ND (0.02)	0.063					
	g/day	0.01						0.000684					
Nickel	ug/L		11	67	15	9.6	2.9	1.5					
	g/day	5	0.10219	0.62243	0.1965	0.10166	0.0201	0.016275					
Selenium	ug/L		3	3	1.2	ND (0.35)	1.2	ND (0.27)					
	g/day	2	0.02787	0.02787	0.01572		0.00832						
Silver	ug/L		ND (0.02)	ND (0.1)	ND (0.041)	ND (0.07)	ND (0.07)	ND (0.079)					
	g/day	1											
Thallium	ug/L		0.06	ND (0.1)	0.21	ND (0.03)	ND (0.03)	ND (0.3)					
	g/day	3	0.00056		0.002751								
Zinc	ug/L		2	ND (10)	44	11	1.9	10					
	g/day	10	0.01858		0.5764	0.11649	0.01317	0.1085					
Cyanide	ug/L		ND (0.8)	ND (3)	ND (10)	ND (10)	ND (10)	ND (10)					
	g/day												
Hardness	mg/LCaCO3		560	960	1100	1100	1,500	1,400					
<b>Fish Bioassay -</b>													
% survival of Rainbow Trout					100%	100%	100%	100%					

**Table 4 - Summary of Analytical Data for Inorganic Constituents and Fish Bioassay**  
City of Oakland Municipal Services Center Groundwater Remediation Project

Inorganic	Unit	Eff Limit (<10 gpm)	Influent (I-1)											
			5/22/06	5/30/06										11/8/06
Antimony	ug/L		ND (60)	ND (1)										
	g/day	3							1.1					
Arsenic	ug/L		7.2	8.5					0.011935					
	g/day	1	0.06689	0.07897					5.4					
Beryllium	ug/L		ND (2)	ND (1)					0.05859					
	g/day	3							ND (0.17)					
Cadmium	ug/L		34	10					0.33					
	g/day	1	0.31586	0.0929					0.003581					
Total Cr	ug/L		ND (10)	ND (1)					0.91					
	g/day	2							0.009874					
Cr +6	ug/L		ND (0.5)	ND (0.5)					ND (0.5)					
	g/day	2												
Copper	ug/L		250	25					ND (0.28)					
	g/day	3	2.3225	0.23225										
Lead	ug/L		28	21					8.1					
	g/day	5	0.26012	0.19509					0.087885					
Mercury	ug/L		ND (0.2)	ND (0.2)					0.047					
	g/day	0.01							0.00051					
Nickel	ug/L		68	19					2.8					
	g/day	5	0.63172	0.17651					0.03038					
Selenium	ug/L		9.4	ND (1)					0.31					
	g/day	2	0.08733						0.003364					
Silver	ug/L		ND (5)	ND (1)					ND (0.079)					
	g/day	1												
Thallium	ug/L		25	ND (1)					ND (0.30)					
	g/day	3	0.23225											
Zinc	ug/L		31	57					23					
	g/day	10	0.28799	0.52953					0.24955					
Cyanide	ug/L		10	10				20	30					
	g/day		0.0929	0.0929					0.3255					

Table 5 - Summary of Analytical Data for Organic Constituents  
 City of Oakland Municipal Services Center Groundwater Remediation Project

	Max Daily Eff. Limit	Effluent (E-1)						
		5/30/06	9/5/06	3/14/07				
<b>VOCs (EPA8260)</b>	(ug/L)	(ug/L)	(ug/L)	(ug/L)				
Benzene	5	ND (0.5)	ND (0.5)	ND (0.5)				
Carbon tetrachloride	5	ND (0.5)	ND (0.5)	ND (0.5)				
Chloroform	5	ND (0.5)	ND (0.5)	ND (0.5)				
1,1-Dichloroethane	5	ND (0.5)	ND (0.5)	ND (0.5)				
1,2-Dichloroethane	5	ND (0.5)	ND (0.5)	ND (0.5)				
1,1-dichloroethylene	5	ND (0.5)	ND (0.5)	ND (0.5)				
Ethylbenzene	5	ND (0.5)	ND (0.5)	ND (0.5)				
Methylene chloride	5	ND (0.5)	ND (0.5)	ND (10)				
Tetrachloroethylene	5	ND (0.5)	ND (0.5)	ND (0.5)				
Toluene	5	ND (0.5)	ND (0.5)	ND (0.5)				
c-1,2-Dichloroethylene	5	ND (0.5)	ND (0.5)	ND (0.5)				
t-1,2-Dichloroethylene	5	ND (0.5)	ND (0.5)	ND (0.5)				
1,1,1-Trichloroethane	5	ND (0.5)	ND (0.5)	ND (0.5)				
1,1,2-Trichloroethane	5	ND (0.5)	ND (0.5)	ND (0.5)				
Trichloroethylene	5	ND (0.5)	ND (0.5)	ND (0.5)				
vinyl chloride	5	ND (0.5)	ND (0.5)	ND (0.5)				
total xylenes	5	ND (0.5)	ND (0.5)	ND (0.5)				
MTBE	13	ND (0.5)	ND (0.5)	ND (0.5)				
Ethylene dibromide	5	ND (0.5)	ND (0.5)	ND (0.5)				
Trichlorotrifluoroethane	5	ND (5)	ND (5)	ND (5)				
TPH gas	50	ND (50)	ND (50)	ND (50)				
TPH diesel	50	ND (50)	ND (50)	ND (50)				
TAME		ND (0.5)	ND (0.5)	ND (0.5)				
DIPE		ND (0.5)	ND (0.5)	ND (0.5)				
ETBE		ND (0.5)	ND (0.5)	ND (0.5)				
TBA		ND (10)	ND (10)	ND (10)				
Ethanol		ND(1000)	ND(1000)	ND(1000)				
Methanol		ND(1000)	ND(1000)	ND(1000)				
Other VOCs (EPA 8260)		ND	ND	ND				
<b>PAHs (EPA 8310 or 610)</b>								
All analytes		ND (1.0)	ND (0.1)	ND (0.1)				
<b>SVOCs(EPA8270 or625)</b>								
All analytes		ND (5.0)	ND (9.4)	ND (9.6)				



Table 5 - Summary of Analytical Data for Organic Constituents  
City of Oakland Municipal Services Center Groundwater Remediation Project

	<b>Influent (I-1)</b>					
	5/30/06		3/14/07			
<b>VOCs (EPA 8260)</b>	(ug/L)		(ug/L)			
Benzene	4900		2,700			
Carbon tetrachloride	ND (36)		ND (13)			
Chloroform	ND (36)		ND (13)			
1,1-Dichloroethane	ND (36)		ND (13)			
1,2-Dichloroethane	ND (36)		ND (13)			
1,1-dichloroethylene	ND (36)		ND (13)			
Ethylbenzene	1100		310			
Methylene chloride	ND (36)		ND (250)			
Tetrachloroethylene	ND (36)		ND (13)			
Toluene	5300		2,900			
c-1,2-Dichloroethylene	ND (36)		ND (13)			
t-1,2-Dichloroethylene	ND (36)		ND (13)			
1,1,1-Trichloroethane	ND (36)		ND (13)			
1,1,2-Trichloroethane	ND (36)		ND (13)			
Trichloroethylene	ND (36)		ND (13)			
vinyl chloride	ND (36)		ND (13)			
total xylenes	7100		4,100			
MTBE	ND (36)		ND (13)			
Ethylene dibromide	ND (36)		ND (13)			
Trichlorotrifluoroethane	ND (360)		ND (13)			
TPH gas	57000		32,000			
TPH diesel	9200		7,800			
TAME	ND (36)		ND (13)			
DIPE	ND (36)		ND (13)			
ETBE	ND (36)		ND (13)			
TBA	ND (710)		ND (25)			
Ethanol	ND(1000)		ND(1000)			
Methanol	ND(1000)		ND(1000)			
Isopropylbenzene	40		16			
Propylbenzene	120		36			
1,3,5-Trimethylbenzene	410		270			
1,2,4-Trimethylbenzene	1500		960			
Naphthalene	370		260			
Other VOCs (EPA 8260)	ND		ND			
<b>PAHs (EPA 8310 or 610)</b>						
Benzo(a)anthracene	1.7		0.14			
Benzo(a)pyrene	1.6		0.12			
Benzo(g,h,i)perylene	ND (1.0)		0.21			
Chrysene	2.6		0.17			
Fluoranthene	3.8		0.63			
Naphthalene	130		230			
Pyrene	3.3		0.56			
Acenaphthene	ND (1.0)		130			
Acenaphthylene	ND (1.0)		58			
Fluorene	ND (1.0)		6.4			
Phenanthrene	ND (1.0)		1.6			
Anthracene	ND (1.0)		0.13			
<b>SVOCs(EPA8270 or625)</b>						
Dimethylphthalate	28		ND (97)			
bis(2-Ethylhexyl)phthalate	12		ND (97)			
Naphthalene	290		160			
Phenol	13		270			
All other SVOCs	ND (5)		ND (97)			

Table 5 - Summary of Analytical Data for Organic Constituents  
 City of Oakland Municipal Services Center Groundwater Remediation Project

		After First Carbon Unit (Btw-1)						
	Max Daily	5/30/06	9/5/06					
	Eff. Limit							
	(ug/L)	(ug/L)						
Benzene	5	ND (0.5)	ND (0.5)					
Carbon tetrachloride	5	ND (0.5)	NA					
Chloroform	5	ND (0.5)	NA					
1,1-Dichloroethane	5	ND (0.5)	NA					
1,2-Dichloroethane	5	ND (0.5)	NA					
1,1-dichloroethylene	5	ND (0.5)	NA					
Ethylbenzene	5	ND (0.5)	ND (0.5)					
Methylene chloride	5	ND (0.5)	NA					
Tetrachloroethylene	5	ND (0.5)	NA					
Toluene	5	ND (0.5)	ND (0.5)					
c-1,2-Dichloroethylene	5	ND (0.5)	NA					
t-1,2-Dichloroethylene	5	ND (0.5)	NA					
1,1,1-Trichloroethane	5	ND (0.5)	NA					
1,1,2-Trichloroethane	5	ND (0.5)	NA					
Trichloroethylene	5	ND (0.5)	NA					
vinyl chloride	5	ND (0.5)	NA					
total xylenes	5	ND (0.5)	ND (0.5)					
MTBE	13	ND (0.5)	ND (2)					
Ethylene dibromide	5	ND (0.5)	NA					
Trichlorotrifluoroethane	5	ND (5)	NA					
TPH gas	50	ND (50)	ND (50)					
TPH diesel	50	ND (50)	ND (50)					
TAME		ND (0.5)	NA					
DIPE		ND (0.5)	NA					
ETBE		ND (0.5)	NA					
TBA		ND (10)	NA					
Ethanol		NA	NA					
Methanol		NA	NA					
Other VOCs (EPA 8260)		ND	NA					
PAHs (EPA 8310 or 610)		NA						
SVOCs(EPA8270 or625)		NA						

Table 5 - Summary of Analytical Data for Organic Constituents  
 City of Oakland Municipal Services Center Groundwater Remediation Project

		After Second Carbon Unit (Btw-2)					
	Max Daily		9/5/06	3/14/07			
	Eff. Limit						
	(ug/L)		(ug/L)	(ug/L)			
Benzene	5		ND (0.5)	ND (0.5)			
Carbon tetrachloride	5		ND (0.5)	ND (0.5)			
Chloroform	5		ND (0.5)	ND (0.5)			
1,1-Dichloroethane	5		ND (0.5)	ND (0.5)			
1,2-Dichloroethane	5		ND (0.5)	ND (0.5)			
1,1-dichloroethylene	5		ND (0.5)	ND (0.5)			
Ethylbenzene	5		ND (0.5)	ND (0.5)			
Methylene chloride	5		ND (0.5)	ND (10)			
Tetrachloroethylene	5		ND (0.5)	ND (0.5)			
Toluene	5		ND (0.5)	ND (0.5)			
c-1,2-Dichloroethylene	5		ND (0.5)	ND (0.5)			
t-1,2-Dichloroethylene	5		ND (0.5)	ND (0.5)			
1,1,1-Trichloroethane	5		ND (0.5)	ND (0.5)			
1,1,2-Trichloroethane	5		ND (0.5)	ND (0.5)			
Trichloroethylene	5		ND (0.5)	ND (0.5)			
vinyl chloride	5		ND (0.5)	ND (0.5)			
total xylenes	5		ND (0.5)	ND (0.5)			
MTBE	13		ND (0.5)	ND (0.5)			
Ethylene dibromide	5		ND (0.5)	ND (0.5)			
Trichlorotrifluoroethane	5		ND (5)	ND (5)			
TPH gas	50		NA	NA			
TPH diesel	50		NA	NA			
TAME			ND (0.5)	ND (0.5)			
DIPE			ND (0.5)	ND (0.5)			
ETBE			ND (0.5)	ND (0.5)			
TBA			ND (10)	110			
Ethanol			ND (1000)	NA			
Methanol			NA	NA			
Other VOCs (EPA 8260)			ND	ND			
PAHs (EPA 8310 or 610)			NA	NA			
SVOCs(EPA8270 or625)			NA	NA			

**Table 6 - Dual-Phase Extraction Vapor Monitoring Data**  
 City of Oakland Municipal Services Center Groundwater Remediation Project

Date	Time	DPE run-time	Vapor flow	Thermo	Vacuum Pump		A-2 Exhaust (Effluent)				A-2 Inlet (Influent)				Notes		
		meter reading (cumulative hr)	rate (1) (ACFM)	Oxidizer Temp (F)	Vacuum (inch Hg)	discharge Temp (F)	POC (2) (ppbv)	benzene (ppbv)	toluene (ppbv)	ethyl benz (ppbv)	xylenes (ppbv)	POC (2) (ppmv)	benzene (ppmv)	toluene (ppmv)		ethyl benz (ppmv)	xylenes (ppmv)
5/14/07	12:00	12.5	275	1440	15	160	1100	42	28	5.9	21	2000	18	21	6.5	21.4	DPE startup
5/17/07	11:25	83.9	276	1448	15	160											NPDES sampling
5/22/07	11:15	203.7	284	1551	15	160											shutdown @11:30 PhII tie-in
5/31/07	11:00	203.7															
6/11/07	10:00	204	235	1438	16.5	165											re-start with all wells
6/14/07	10:00	276.5	280	1455	15	170											
6/18/07	19:00	276.7	280	1460	11.5	160											
6/21/07	10:00	328.8	276	1450	15	165											NPDES sampling
6/26/07	18:40	446.7	288	1454	11.5	160	2760	63	60	2.3	18.4	2410	25	35	4.6	28.7	
6/29/07	18:30	518.5	294	1479	14	160											
7/3/07	11:30	536.2															knockout tank pump down

Note (1) - measured at the discharge side of the vacuum pump, the pressure is approx 1.05 atm.  
 Note (2) - POC = precursor organic compound measured by TPH volatile in vapor



**Table 8 - TPH Removed Through Dissolved in Groundwater, Floating Product Recovered and Soil Vapor Extracted  
City of Oakland Municipal Services Center Groundwater Remediation Project**

Month	groundwater	TPH gas	TPH diesel	Mass removed through groundwater			Floating product	TPH removed	total monthly	total monthly	Cumulative product removed	
	removed (gallons)	Influent (mg/L)	Influent (mg/L)	as TPH gas (lbs)	as TPH diesel (lbs)	combined (lbs)	recovered (gallons)	by vapor (lbs)	removal (gallons)	removal (lbs)	(floating + dissolved+vapor) (gallons)	(lbs)
May-06	17,591	54.5	17.1	7.98	2.50	10.49	20	0	21.48	152	21.48	152
Jun-06	103,880	50	10	43.25	8.65	51.90	80	0	87.33	618	108.81	770
Jul-06	89,150	60	4	44.54	2.97	47.51	65	0	71.71	508	180.53	1,278
Aug-06	82,900	59	4.1	40.73	2.83	43.56	55	0	61.15	433	241.68	1,711
Sep-06	85,450	44	4.8	31.31	3.42	34.72	25	0	29.91	212	271.59	1,922
Oct-06	72,980	42	9.1	25.52	5.53	31.05	30	0	34.39	243	305.97	2,166
Nov-06	46,200	32	7.8	12.31	3.00	15.31	20	0	22.16	157	328.14	2,323
Dec-06	49,280	55	7.6	22.57	3.12	25.69	20	0	23.63	167	351.77	2,490
Jan-07	59,100	49	3.6	24.11	1.77	25.89	15	0	18.66	132	370.42	2,622
Feb-07	85,510	38	7.9	27.06	5.63	32.68	13	0	17.62	125	388.04	2,747
Mar-07	116,260	32	7.8	30.98	7.55	38.53	12	0	17.44	123	405.49	2,870
Apr-07	65,725	11	6.2	6.02	3.39	9.41	5	0	6.33	45	411.82	2,915
May-07	78,705	84	180	55.05	117.97	173.02	4	1,252	205.35	1,453	617.16	4,368
Jun-07	93,720	8.9	7.7	6.95	6.01	12.95	4	2,447	351.50	2,488	968.66	6,856
Note:	Morgan Environmental disposed of three (3) 55-gallon drums full of recovered product on 8/9/06											

## **APPENDIX A**

### Laboratory Analytical Reports for Groundwater Samples

## **APPENDIX B**

### Laboratory Analytical Reports for DPE Vapor Samples