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Technical Memorandum

Operable Unit 1 Demonstration Study System Progress Report
March 2006 through August 2006
National Aeronautics and Space Administration, Jet Propulsion Laboratory, Pasadena, California

Final October 2006

This technical memorandum provides a summary of field, analytical, and operational data collected from March 1, 2006, through August 31, 2006, for the Operable Unit 1 (OU-1) demonstration study system. The OU-1 system is being implemented as part of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) program at the National Aeronautics and Space Administration (NASA) Jet Propulsion Laboratory (JPL) in Pasadena, California.

This memorandum summarizes system performance based on the extracted and reinjected groundwater volumes, volatile organic compound (VOC) removal, and perchlorate removal. Other operational issues discussed include actions taken to monitor and mitigate sulfate reduction (and hydrogen sulfide generation), the performance of the biomass removal and backwash recovery system, reinjection well performance, and an assessment to evaluate the water levels and water quality data collected within the OU-1 target treatment zone. In addition, the following attachments are included:

- Attachment A: Field Monitoring Results
- Attachment B: Laboratory Analytical Results
- Attachment C: Los Angeles County Sanitation District Industrial Wastewater Discharge Permit

System Performance Summary

Table 1 summarizes the performance of the OU-1 system through August 31, 2006.

Table 1. OU-1 System Operational Summary (Through August 31, 2006)

Parameter	Units	EW-1	EW-2	Total
Total Volume of Groundwater Extracted	Acre Feet	112	199	311
Total Volume of Wastewater to Sewer	Acre Feet	–	–	0.30
Mass of Perchlorate Removed	lb	217	336	553
Mass of Carbon Tetrachloride (CCl_4) Removed	lb	2.5	12.3	14.8
Mass of Trichloroethylene (TCE) Removed	lb	0.6	2.0	2.6

EW = Extraction Well

System performance is discussed below in terms of the extraction well flow rates, injection well flow rates, wastewater discharges, and the overall mass removal achieved:

- **Extraction.** The OU-1 system has operated at an average extraction flow rate of 140 gallons per minute (gpm) and has extracted approximately 311 acre-ft of water through August 31, 2006. The flow rate from EW-1 (the shallow well) has varied from 60 to 87 gpm, with an average value of 61 gpm. The flow rate from EW-2 (the deep well) has varied from 67 to 168 gpm, with an average value of 101 gpm. EW-1 was only operated from March 2006 through May 2006; the

reason for temporarily ending extraction from EW-1 was based on the total reinjection flow that the system could handle. Since the reinjection wells were only accepting approximately 150 gpm, the decision was made to use only EW-2. By using only EW-2, the need for excess back pressure on the EW-2 pump (flow reduction) was eliminated and it allowed the higher concentrations of chemicals to be removed. As can be seen below, the VOC concentrations in EW-1 have been reduced below the analytical detection limit at this time. EW-1 will continue to be used once reinjection well rehabilitation is complete.

- **Reinjection.** Sustained reinjection flow rates have been achieved at Injection Well No. 1 (IW-1) at a level up to 98 gpm, with an average value of 88 gpm. The pressure at the IW-1 wellhead ranged from 0 to 43 pounds per square inch (psi), with an average value of 20psi. Sustained reinjection flow rates have been achieved at IW-2 at levels up to 130 gpm, with an average value of 79 gpm. The pressure at the IW-2 wellhead has ranged from 0 to 39 psi, with an average value of 25 psi.

  In May 2006, IW-1 was rehabilitated due to increased pressure and reduced flow. Just prior rehabilitation, well head pressure was at 43 psi and flow was limited to 75 gpm. Post-rehabilitation, the IW-1 wellhead was at 0 psi and could handle up to 150 gpm. Four weeks after rehabilitation, the condition in IW-1 yielded a wellhead pressure of 10-20 psi and flows of 100-130 gpm. By the end of August IW-1 yielded a wellhead pressure of 40-47 psi and flows of 50-75 gpm.

- **Wastewater Discharges.** The amount of wastewater discharged to the sanitary sewer during this operating period was 41,500 gallons, or approximately 0.13 acre-ft. The total amount of wastewater discharged over the course of the OU-1 operation was 98,500 gallons or approximately 0.30 acre-ft. Discharges to the sanitary sewer occur, on average, once every four weeks. At the end of each month, the total amount of discharges to the sanitary sewer system, along with the extracted and reinjected water volumes, are reported to the Raymond Basin Management Board. On July 31, 2006, a new Industrial Wastewater Discharge Permit was issued by the Los Angeles County Sanitation District to replace the interim permit that had previously been issued. A copy of the new permit can be found as Attachment C. The new permit allows for wastewater discharges from the OU-1 system without taking samples prior to discharge. The self monitoring requirement is still in place requiring that a sample be taken during discharge once every six months.

- **Mass Removal.** The total cumulative chemical mass removed by the OU-1 system through the end of August 2006 was estimated at 553 lb of perchlorate, 14.8 lb of CCl_4, and approximately 2.6 lb of TCE. Between February 28, 2006, and August 31, 2006, the chemical mass removed by the OU-1 system was 101 lb of perchlorate, 4.8 lb of CCl_4, and approximately 0.7 lb of TCE. Figure 1 shows the cumulative perchlorate removal over time for the OU-1 system. The mass removal estimates were based on the amount of groundwater extracted during each month from each well, the monthly average influent perchlorate concentration from each well, and the monthly average influent CCl_4 and TCE concentrations from each well.

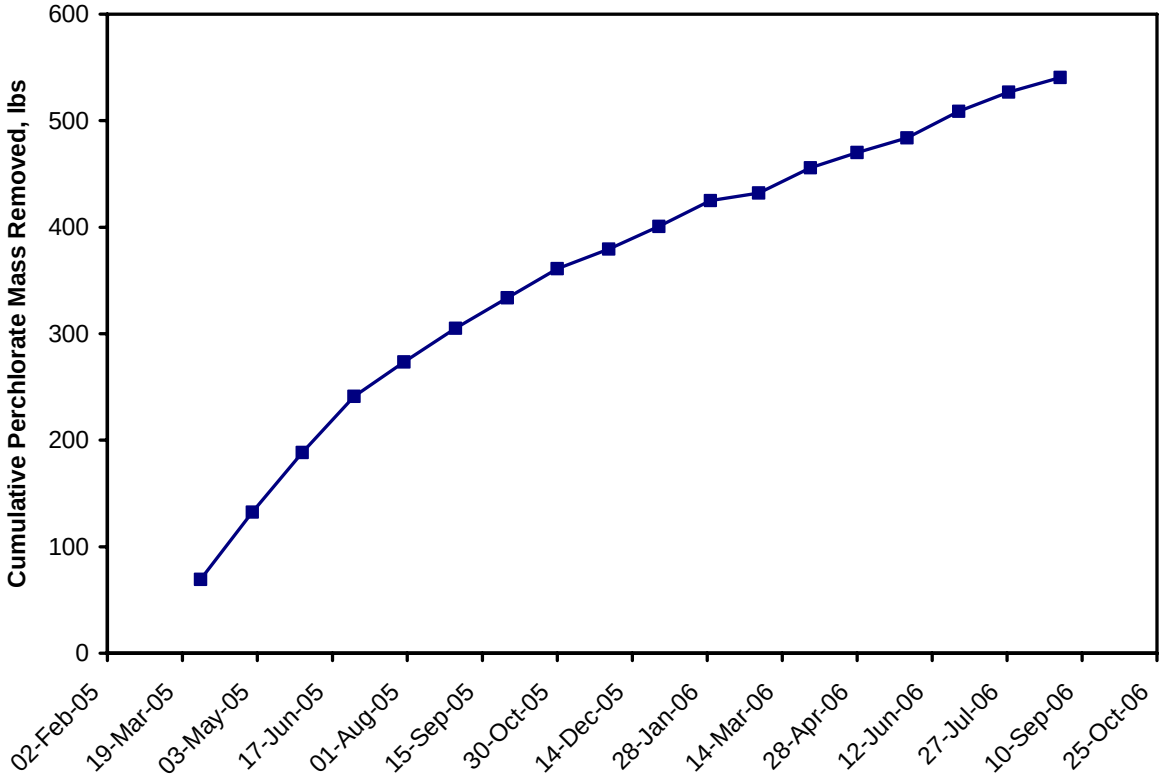


Figure 1. Cumulative Mass of Perchlorate Removed by the OU-1 System

IW-1 Rehabilitation

Rehabilitation of IW-1 took place between May 2, 2006 and May 17, 2006. Prior to the start of well rehabilitation activities, flow to the injection well was shut down. The drilling subcontractor (WDC) disconnected the associated plumbing and removed the injection piping from the well. All of the downhole piping was visually inspected for signs of biofouling and mineral encrustation (none were noted). A video log was performed by Pacific Surveys using a submersible camera system that allowed horizontal and downhole video capture. Video of the entire casing, screen and sump was collected, and still photos were taken of zones of interest; zones of increased and decreased fouling were noted. After completion of the video log, physicochemical and biological assay samples were collected from the well using a stainless steel bailer.

The physicochemical (inorganic) data analyses included phenolphthalein alkalinity, pH, chlorides, total dissolved solids (TDS), total hardness, carbonate hardness, non-carbonate hardness, calcium, magnesium, phosphate, iron, copper, nitrate, tannin/lignin, sulfate, silica as SiO_2, manganese, saturation index, and redox potential. The iron, manganese, and sulfur (total, Fe^{2+}/Fe^{3+}, Fe minerals and complexes, total, Mn^{4+}/Mn^{2+}, minerals and complexes, and total, $S^{2-}/S^{0}/SO_4^{2-}$, S minerals and complexes) were analyzed in order to predict the clogging potential, presence of biofouling, and redox potential shifts (Eh shifts). The analyses of pH indicate acidity or basicity which predicts corrosion or encrustation. In addition, pH is combined with Eh to determine the likely metallic mineral states present. Conductivity is used to indicate the TDS content and is a component of the corrosivity assessment.

Biological assay analyses included the assessment of the total bacterial count per milliliter, the anaerobic bacterial load on the system, the presence of sulfur-reducing bacteria, the presence of iron oxidizing bacteria, branching or filamentous bacteria, protozoans, and the identification of the two largest populations of bacteria present.

The groundwater samples were submitted to Water Systems Engineering for analysis, and the results will be compared to the baseline data that were collected during initial development of the well, and used to determine the current well conditions. Based on this data, rehabilitation and maintenance measures can be fine-tuned based on observed changes. The sample analytical results from Water Systems Engineering are provided in Attachment B.

Due to the presence of biofouling in this well, chemical rehabilitation in association with mechanical agitation was used to treat this well. An initial treatment of 85% phosphoric acid, NuWell-310 (bioacid dispersant), and potable water were added to the well. Following the chemical treatment, the well was agitated using a surge block, monitored to keep the pH below 3.0, and allowed to sit overnight. The next day, the well was surged, pH monitored and then the well was pumped using an airlift pumping system. Approximately 4,000 gallons of treated water was purged from the well. The water was neutralized at the surface using soda ash prior to temporary storage of 21,000 gallon tanks. A second chemical treatment was performed followed by the air lift pumping of approximately 19,200 gallons of treated water from the injection well.

An injection test was performed to monitor the effectiveness of the chemical treatment. Following the injection test, the well was treated with NuWell-220 (a mud dispersant chemical) to remove drilling mud from the borehole wall, filter pack, and formation. Following this treatment, the well was pumped at six intervals using the air lift pump system. Approximately 41,500 gallons was removed from the well.

Following the air lift pumping, the well was pumped using a conventional submersible pump (Grundfos) capable of pumping 240 gpm. The well was pumped at 50 gpm, surged three times, pumped at 150 gpm, surged three times, and then pumped at 240 gpm. Approximately 33,500 gallons of water was pumped from the well.

The total amount of water removed from IW-1 during the rehabilitation was approximately 98,200 gallons; this water was processed within the OU-1 treatment plant and reinjected into the groundwater. Finally, the associated piping was installed and the plumbing was reconnected.

VOC Removal by Liquid-Phase Granular Activated Carbon

Liquid-phase granular activated carbon (LGAC) is used to remove VOCs from the groundwater, and the LGAC vessels are arranged in a lead-lag configuration. Samples were collected on a weekly basis from each extraction well, the combined LGAC influent, the LGAC lead vessel effluent, and LGAC lag vessel effluent. Samples were analyzed for VOCs and 1,4-dioxane (see Attachment B).

The total VOCs in the combined LGAC influent ranged from 15 to 34 μg/L during March through August 2006. CCl_4 represents the highest fraction of the total influent VOCs and ranged from 12 to 25 μg/L during this time period. Figure 2 shows an overall declining trend in the influent total VOCs over time in both wells and in the combined influent. The VOC concentrations in EW-1 continue to be below detection limit for this period of operation. Figure 2 also shows March and July 2006 breakthroughs of CCl_4 in the lead LGAC vessel. On May 1, 2006, the lead LGAC vessel was changed out and the lag vessel moved to the lead configuration. This same process was repeated on

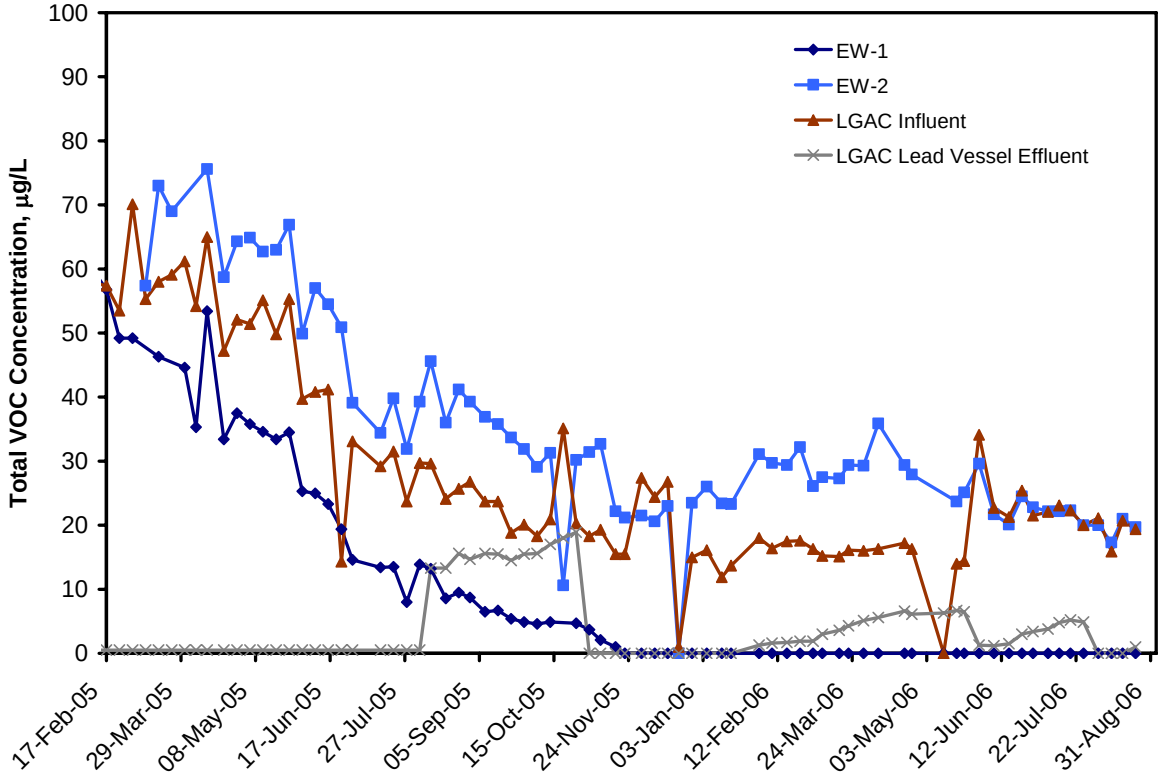


Figure 2. Total VOC Influent and Effluent Concentrations
(VOCs Have Not Been Detected in Any LGAG Lag Vessel Effluent Samples)

July 27,2006 for the change out of the lead vessel. These change outs yielded perchlorate absorption for approximately five weeks. Over the first 18 months of operation, the LGAC vessels were changed out on average every seven months. There has been no detection of any VOCs at the effluent of the lag LGAC vessel.

Nitrate and Perchlorate Removal by the Fluidized Bed Reactor (FBR)

Nitrate and perchlorate biodegradation occur within the FBR when the dissolved oxygen (DO) concentrations are low (<1 mg/L), the oxidation reduction potential (ORP) indicates reducing conditions, and there is an adequate supply of electron donor (acetic acid) and nutrients (urea/diammonium phosphate). The end products of treatment within the FBR are biomass, carbon dioxide, water, nitrogen, and chloride. A summary is provided below of nitrate and perchlorate removal in the FBR through August 31, 2006. Also discussed are data related to ORP conditions and sulfate reduction within the FBR.

During this timeframe, the total flow rate of the FBR ranged from 1,055 to 1,258 gpm, with an average value of 1,166 gpm. At an average value of 140 gpm for the forward feed, this represents an 87% recycle rate within the FBR. The fluidized bed height ranged from 14.0 ft to 18.0 ft during this timeframe.

*Nitrate Removal***.** Figure 3 shows the nitrate concentrations in the extracted groundwater from EW-1 and EW-2 and in the combined plant influent over time. The figure shows an overall declining trend in the plant influent nitrate concentration from greater than 9 mg/L at the start of plant operations in February 2005 to approximately 3 mg/L eighteen months later. Since the end of 2005, the nitrate

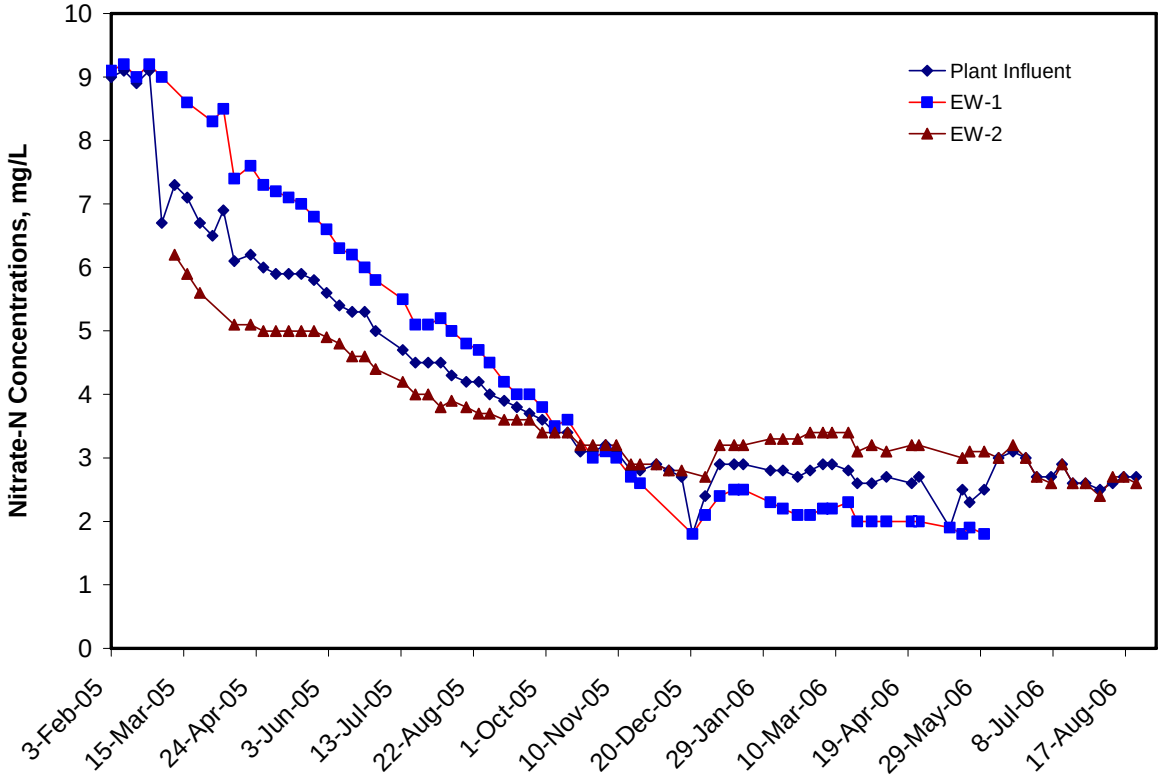


Figure 3. Influent Nitrate Concentrations at EW-1, EW-2, and Combined Plant Influent

concentrations have remained consistently between 2mg/L and 3 mg/L. The dissolved oxygen, nitrate, and perchlorate concentrations in the extracted groundwater are the parameters that determine the acetic acid demand within the FBR. As the influent nitrate and perchlorate concentrations have decreased over time, the acetic acid concentrations have been manually adjusted on a weekly basis to match the changing influent conditions. The range of dosage during this time period has been 2 to 14 gallons per day (gpd) with an average of 6 gpd.

Figure 4 shows the influent and effluent nitrate concentrations across the FBR over time. It is important to optimize nitrate removal because nitrate-reducing conditions must be achieved before perchlorate removal occurs. As Figure 4 shows, the percentage of nitrate removal has varied from 72% to 96%, depending on the influent nitrate concentrations and the acetic acid dose applied to the FBR, with an average value of 89%. From March 2006 to August 2006, the FBR influent nitrate concentration ranged from 1.5 to 6.4 mg/L, with an average value of 3.9mg/L. During this timeframe, the FBR effluent nitrate concentration ranged from <0.25 to 1.4mg/L with an average value of 0.40 mg/L.

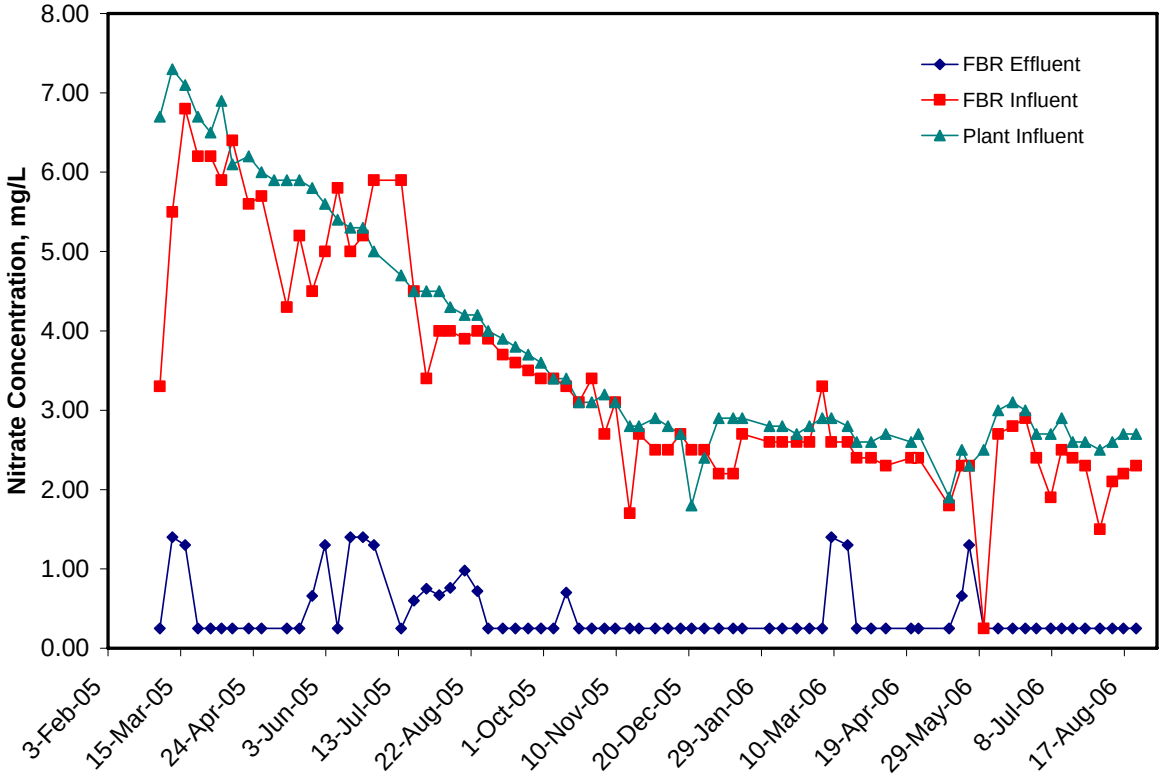


Figure 4. Nitrate Removal by the FBR

*Perchlorate Removal***.** Figure 5 shows the perchlorate concentrations in the extracted groundwater from EW-1 and EW-2 and in the combined plant influent over time, indicating an overall declining trend in plant influent perchlorate concentrations from 2,300 µg/L in February 2005 to an average value of 260 µg/L in August 2006. EW-1 initially had slightly higher influent perchlorate concentrations than EW-2 in the extracted groundwater. However, currently the perchlorate concentrations within EW-1 are lower than EW-2. Perchlorate concentrations averaged 238 µg/L in EW-1 and 486 µg/L in EW-2 from March to August 2006. Currently the OU-1 treatment plant has been operating with EW-2 extraction water only since the end of May 2006.

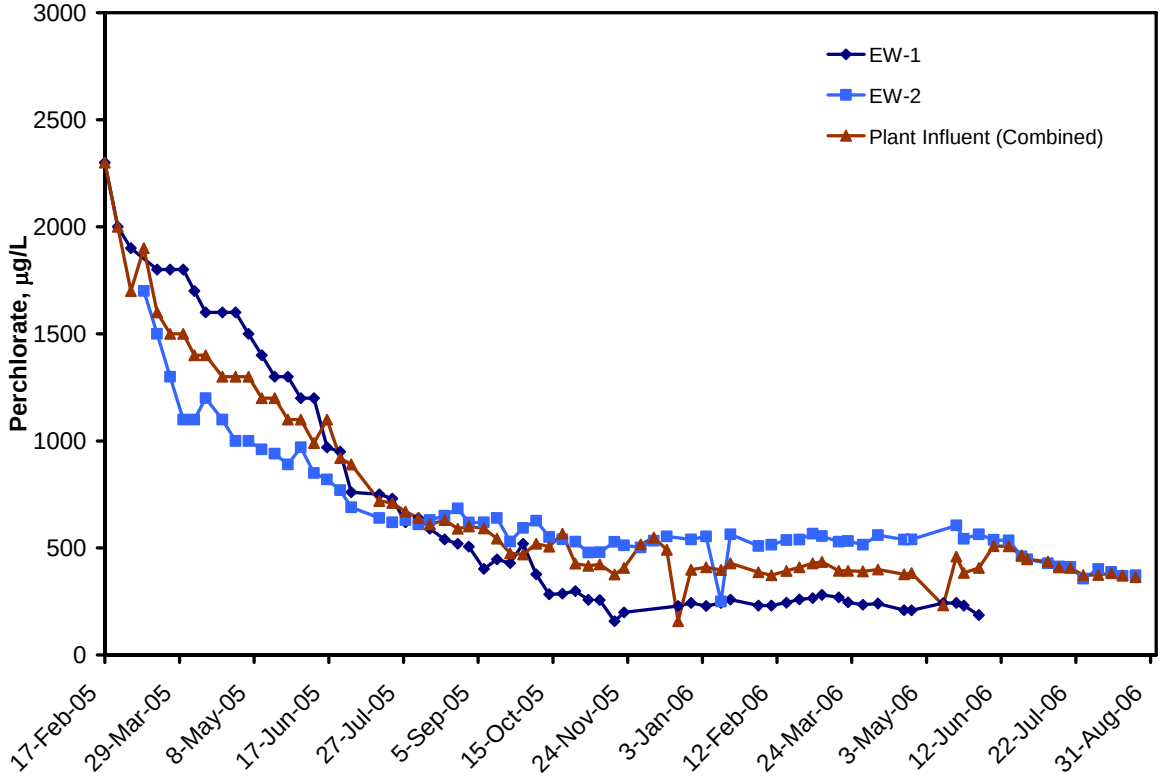


Figure 5. Influent Perchlorate Concentrations at EW-1, EW-2, and the Combined Plant Influent

Figure 6 shows the influent and effluent perchlorate concentrations across the FBR over time. The perchlorate removal between March and August 2006 has been 100%. The steady-state perchlorate concentrations and optimized monitoring techniques have allowed for fine tuning of the FBR and the chemical dosing. Figure 7 represents the correlation between the acetic acid dosing and the perchlorate concentrations leaving the FBR. The lower influent perchlorate concentrations have allowed for a much lower acetic acid dosing (current rate of 4 gpd) during the past six months. As shown in Figure 8, the ORP has remained very consistent at the effluent of the FBR ranging from -315 mV to 19 mV and averaging -150 mV during this time period. This consistency contributes to the successful removal of perchlorate across the FBR.

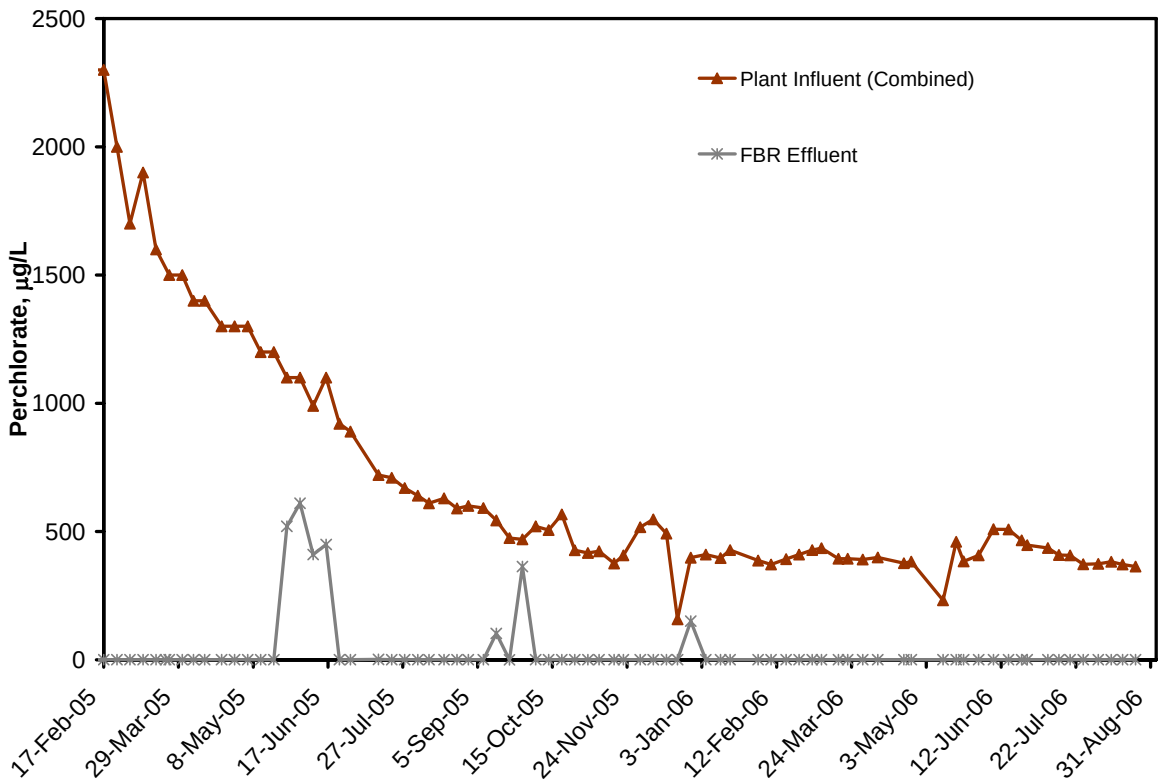


Figure 6. Perchlorate Removal by the FBR

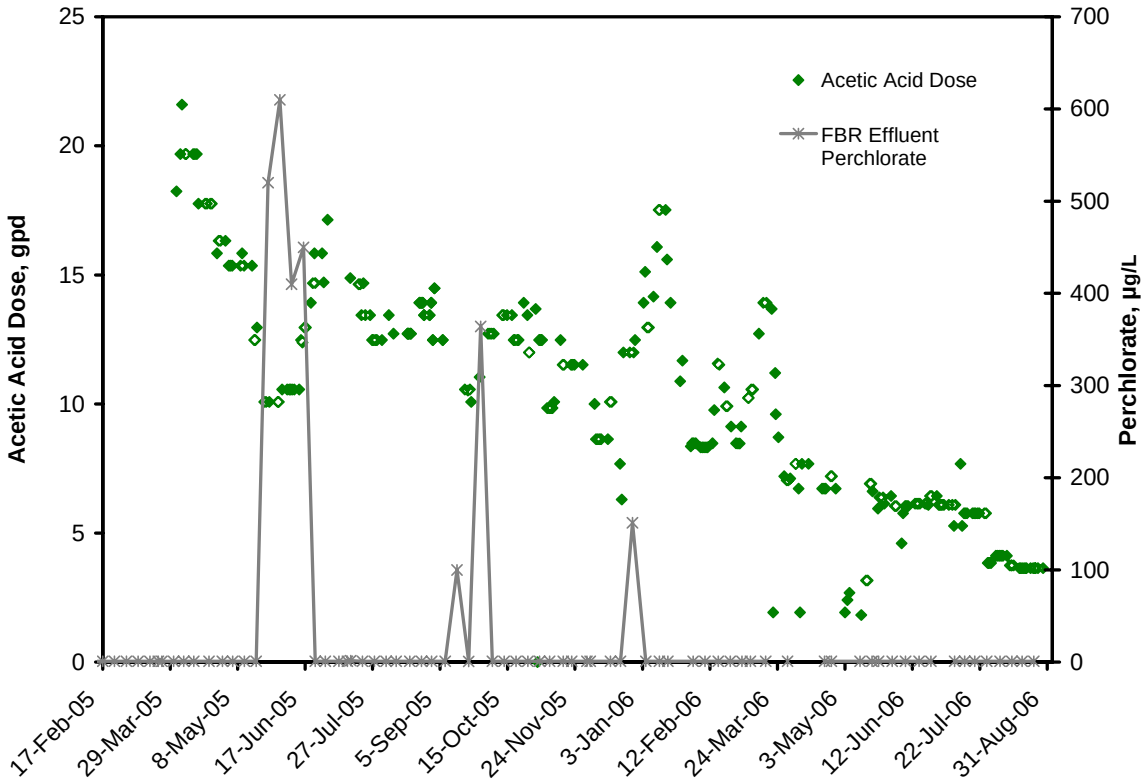


Figure 7. Acetic Acid Dosage Rate and FBR Effluent Perchlorate Concentrations

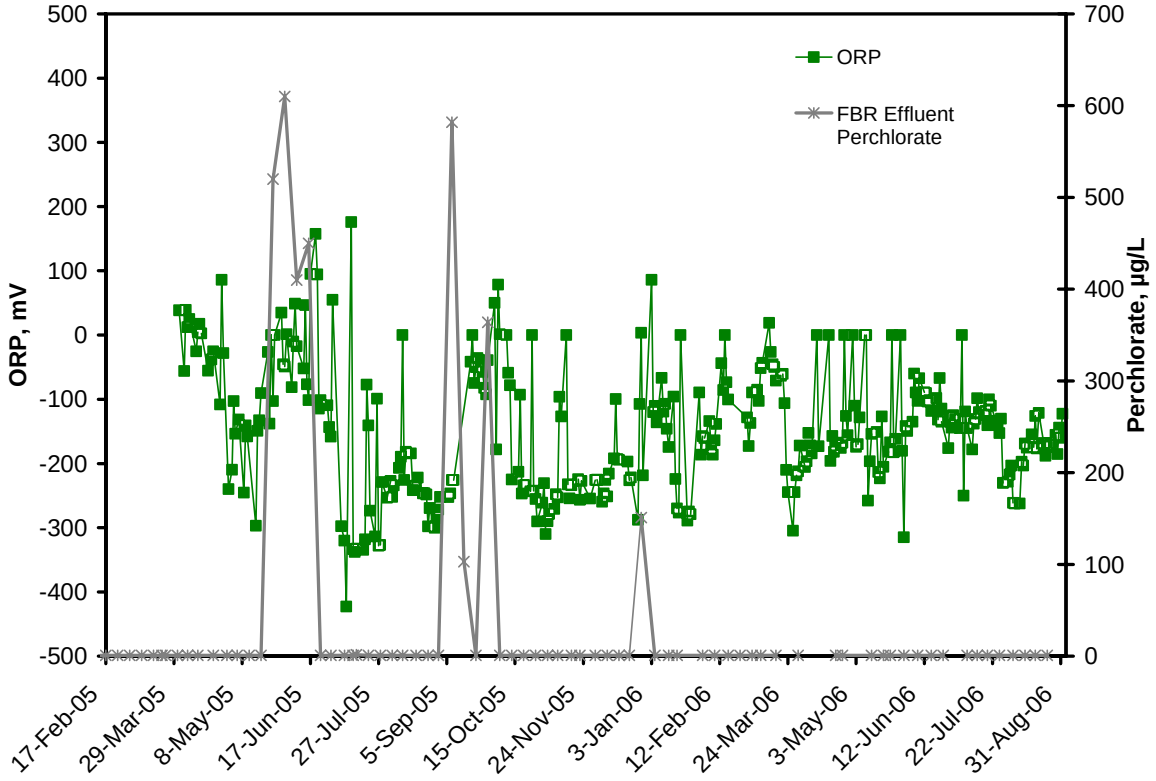


Figure 8. ORP Conditions and FBR Effluent Perchlorate Concentrations

ORP Conditions and Sulfate Reduction. Under normal operations, the biological treatment unit at the OU-1 treatment plant will convert small amounts of natural sulfate in the groundwater to dissolved hydrogen sulfide (H_2S). During certain upset conditions, larger amounts of H_2S can be generated. Hydrogen sulfide can create a noticeable odor at a threshold value of 0.0005 parts per million by volume (ppmv) in the ambient air (Agency for Toxic Substances and Disease Registry).

Figure 9 illustrates the relationship between ORP concentrations and total sulfide in the FBR effluent, which is a product of sulfate reduction. The total sulfide measurement is completed on-site using a Hach™ spectrophotometer which indicates the total quantity of H_2S, HS-, and metal sulfides in a sample. Based on the neutral pH of the treated water, it is assumed that the majority of the total sulfide is present in the form of H_2S.

Sulfide levels in the FBR effluent water only once reached a concentration higher than the typical threshold of 100µg/L and averaged 19µg/L over the past six months. The daily H_2S monitoring at the OU-1 treatment plant yielded no detectable (>1 ppmv) concentrations in the aeration tank effluent air between March and August 2006.

As a precautionary measure, two tailored carbon vessels are in place, in a lead/lag configuration to ensure no H_2S releases into the ambient air. These vessels are located at the air exhaust of the aeration tank.

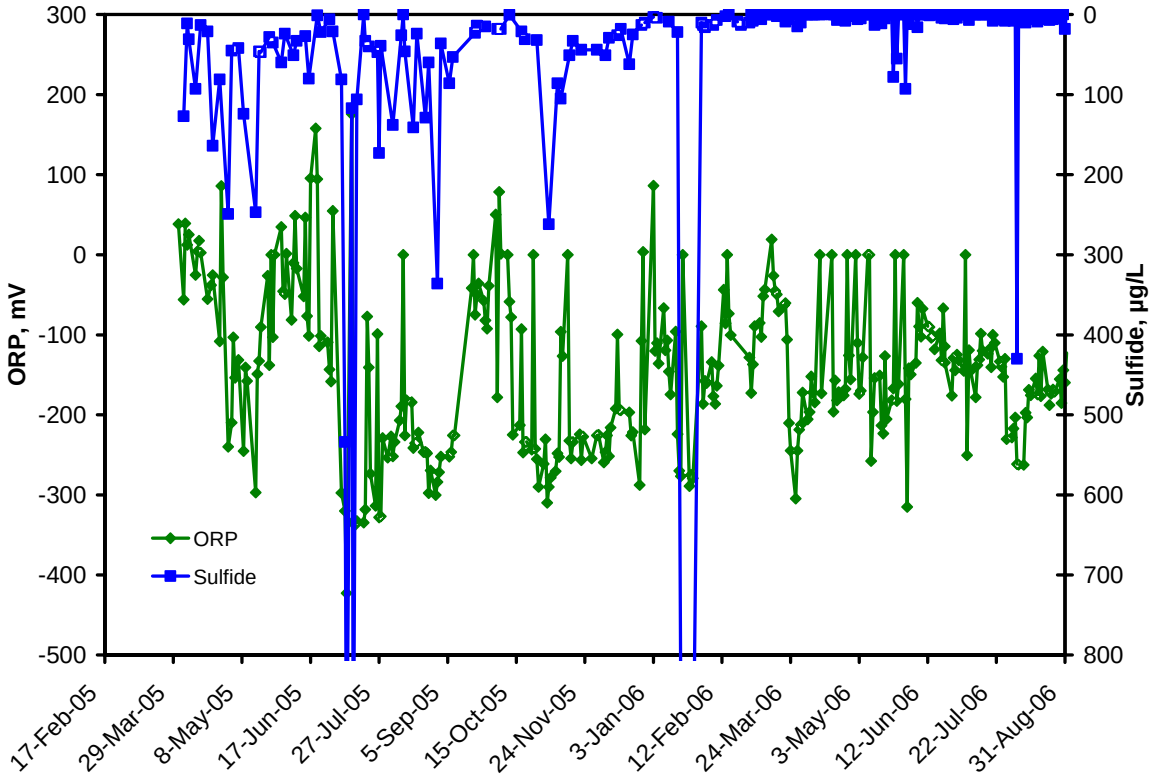


Figure 9. ORP Conditions and Sulfide Concentration within the FBR

Biomass Removal and Backwash Water Recovery

The biomass removal and backwash recovery system consists of the Trimite™ filter, the backwash sump, and the clarifier. The filter helps to recover biomass solids and to reduce the turbidity of the reinjected treated water to protect the injection wells. Figure 10 shows the effluent turbidity over time from the filter based on Hach™ turbidimeter readings. The effluent turbidity from the filter ranged from 0.07 to 2.0 nephelometric turbidity units (NTU), with an average value of 0.19 NTU from March 2006 to August 2006. In comparison, wells are typically developed until the recovered groundwater maintains a turbidity of less than 4 NTU.

Table 2 shows the total suspended solids (TSS) load from the FBR to the filter which ranged from 5 to 250 lb/day. The TSS concentrations entering the filter ranged from 3 to 130 mg/L, with decreasing values over the past six months. The TSS concentrations in the filter effluent ranged from <2.5 to <4.0 mg/L (over what time period) and the corresponding TSS removal rate was optimal given the minimum detection limits.

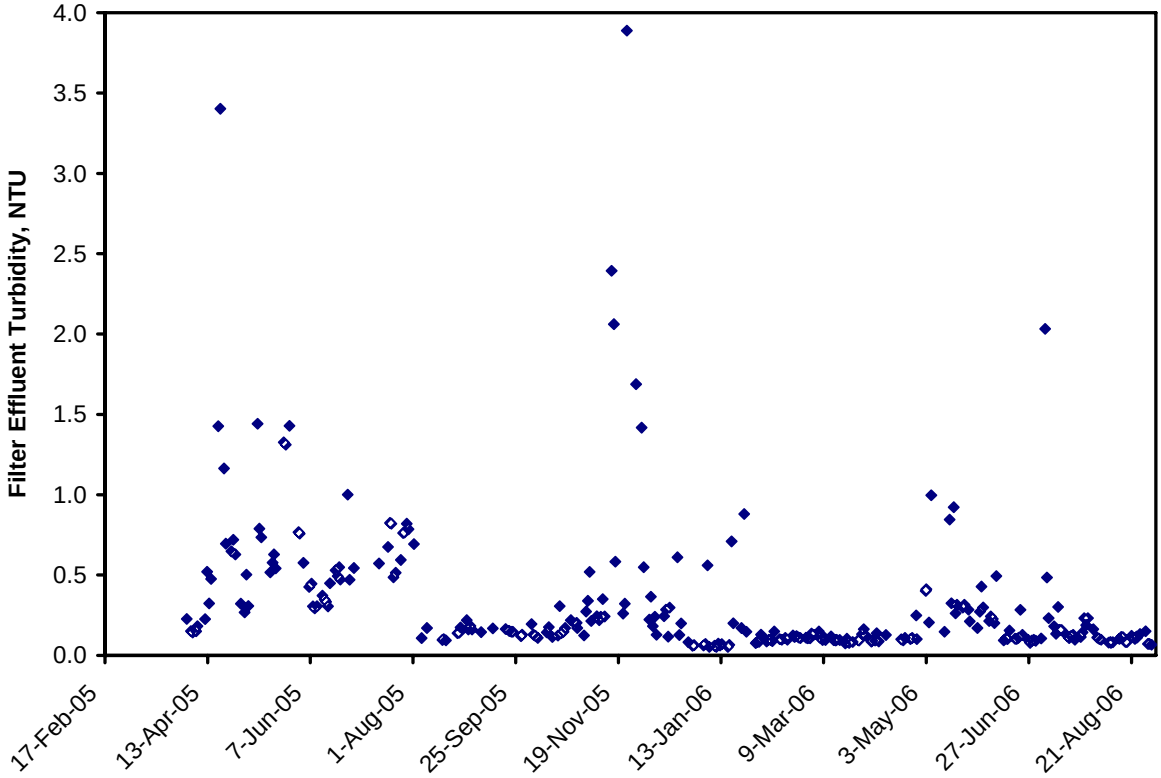


Figure 10. Trimite™ Filter Effluent Turbidity

Table 2. Summary of Biomass Solids Removal from Trimite™ Filter

Date	Filter Influent TSS		Filter Effluent TSS		Percent Removal[b]
	mg/L	lb/day[a]	mg/L	lb/day	
09/29/05	130	250	<4.0	<7	97-100%
10/27/05	14	27	<4.0	<7	77-100%
12/28/05	3	5	<2.5	<5	0-100%
02/02/06	4	8	<2.5	<5	38-100%
8/31/06	4	8	<2.5	<5	38-100%

(a) Based on an average flow rate of 160 gpm and 24 hour per day operation.
(b) Ranges given based on a Minimum Detection Limit for TSS.

The backwash water from the Trimite™ filter is sent to the sump, and pumped to the clarifier. After the biomass solids settle out in the clarifier, the clarified (supernatant) water is returned to the FBR inlet. Currently, no polymers and/or coagulant aids are being used in the clarifier. The clarifier solids are being discharged to the sanitary sewer at a rate of approximately once every four weeks.

Water Level and Water Quality Assessment

Groundwater level elevation and chemical data were used to investigate the impact of the OU-1 system operations on local aquifer conditions. Groundwater level elevation data have been collected quarterly from the NASA JPL monitoring wells and transducers are used to record data from the extraction wells. In addition, groundwater levels are collected on a weekly basis from NASA-JPL monitoring wells MW-7, MW-8, MW-13, MW-16, and IRZ-IW2 as part the OU-1 system operations.

Historic elevation data (April 2004) indicate a steep southwest gradient from the mouth of the Arroyo Seco to the OU-1 system area coupled with a southeast gradient from the northwest of the JPL facility. Flow converges to the south of the treatment system and migrates toward the south/southeast under a reduced gradient (Figure 11). The groundwater elevation contour map showing conditions after system startup (Figure 12) indicates groundwater flow is significantly affected by operation of the system, with a drawdown of roughly 25-30 ft observed in the extraction wells. Although no groundwater level elevation data are available from the injection wells, it appears that the extraction wells will effectively influence groundwater within a greater than 160-ft radius of the extraction wells and the groundwater injected upgradient at IW-1 and IW-2. Graphs of historical groundwater level elevation data in select wells (Figure 13) show a significant seasonal fluctuation and also indicate a significant rise in elevation in the spring of 2005 that is likely due to increased recharge from precipitation. Groundwater levels observed in August 2006 declined approximately 20 to 25 feet from the April 2005 high level (Figures 12 and 13).

Isoconcentration contour maps are provided for TCE, CCl_4, and perchlorate for baseline conditions before extraction (October/November 2004) and after extraction (May/June 2006) as Figures 14 through 16. Figure 17 is an isoconcentration contour map showing the nitrate conditions before extraction (May 2004) and after extraction (May/June 2006). These data indicate the following:

- The concentration of VOCs and perchlorate in the treatment zone (i.e., MW-7 and MW-24) has decreased significantly since system startup.
- Concentrations of TCE in the treatment zone are below 1 μg/L.
- Concentrations of CCl_4 in MW-7 are below the 0.5 μg/L.
- Perchlorate concentrations in the MW-7 and MW-24 have declined from 4,810 μg/L and 4,880 μg/L to concentrations of 12 μg/L and 73 μg/L, respectively.
- Concentrations of VOCs and perchlorate have declined or remained the same in the wells near the facility's eastern boundary (MW-11) and western boundary (MW-22 and MW-23).
- Elevated concentrations of VOCs and perchlorate continue to be observed in source area wells MW-13 and MW-16 located outside the demonstration study treatment zone. The proposed system expansion includes an additional extraction and injection well to the west of the existing wells, which is intended to address chemical concentrations in these wells.

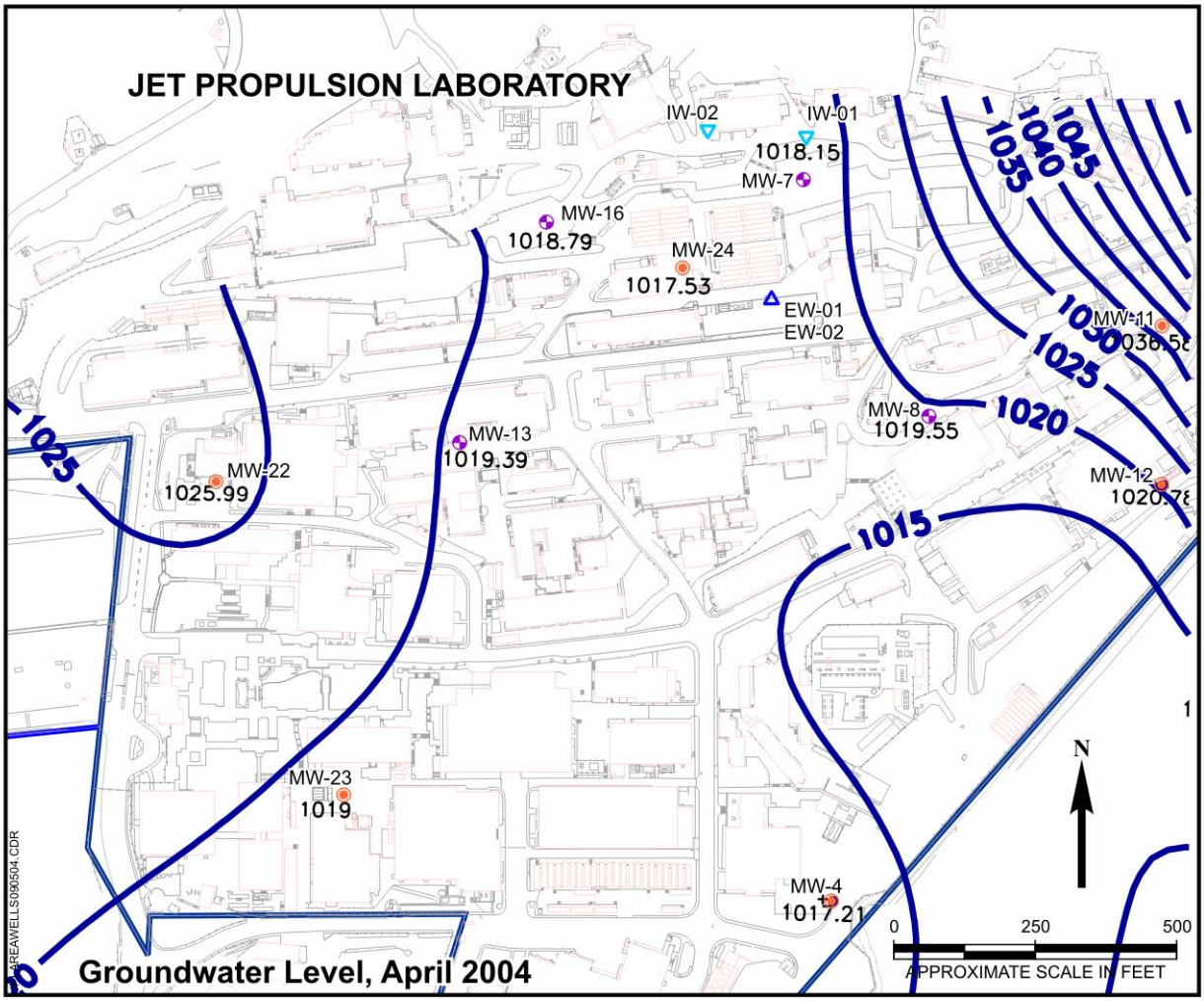


Figure 11. Groundwater Contour Map April 2004 (Baseline Before Extraction)

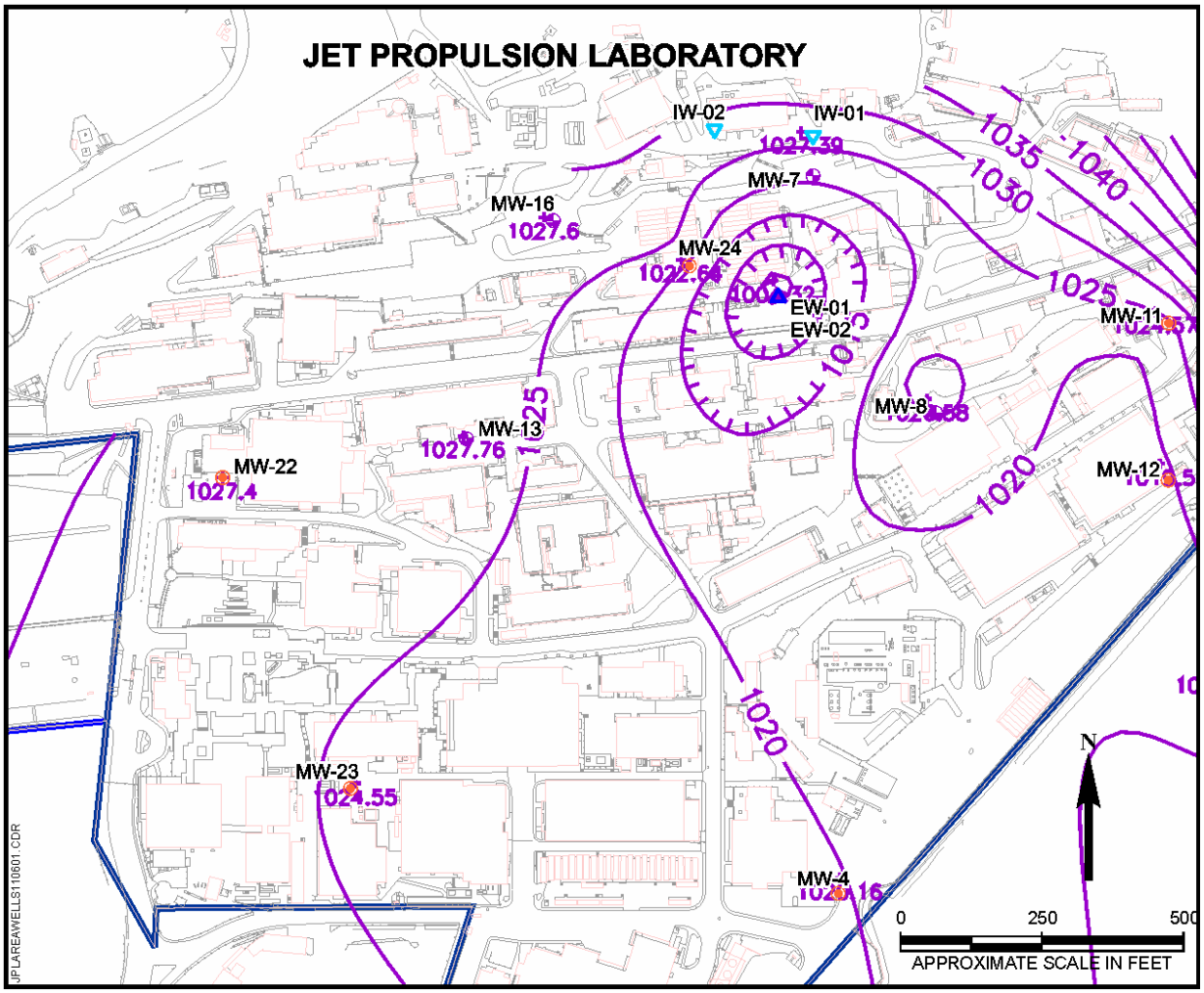


Figure 12. Groundwater Contour Map May/June 2006 (With Extraction)

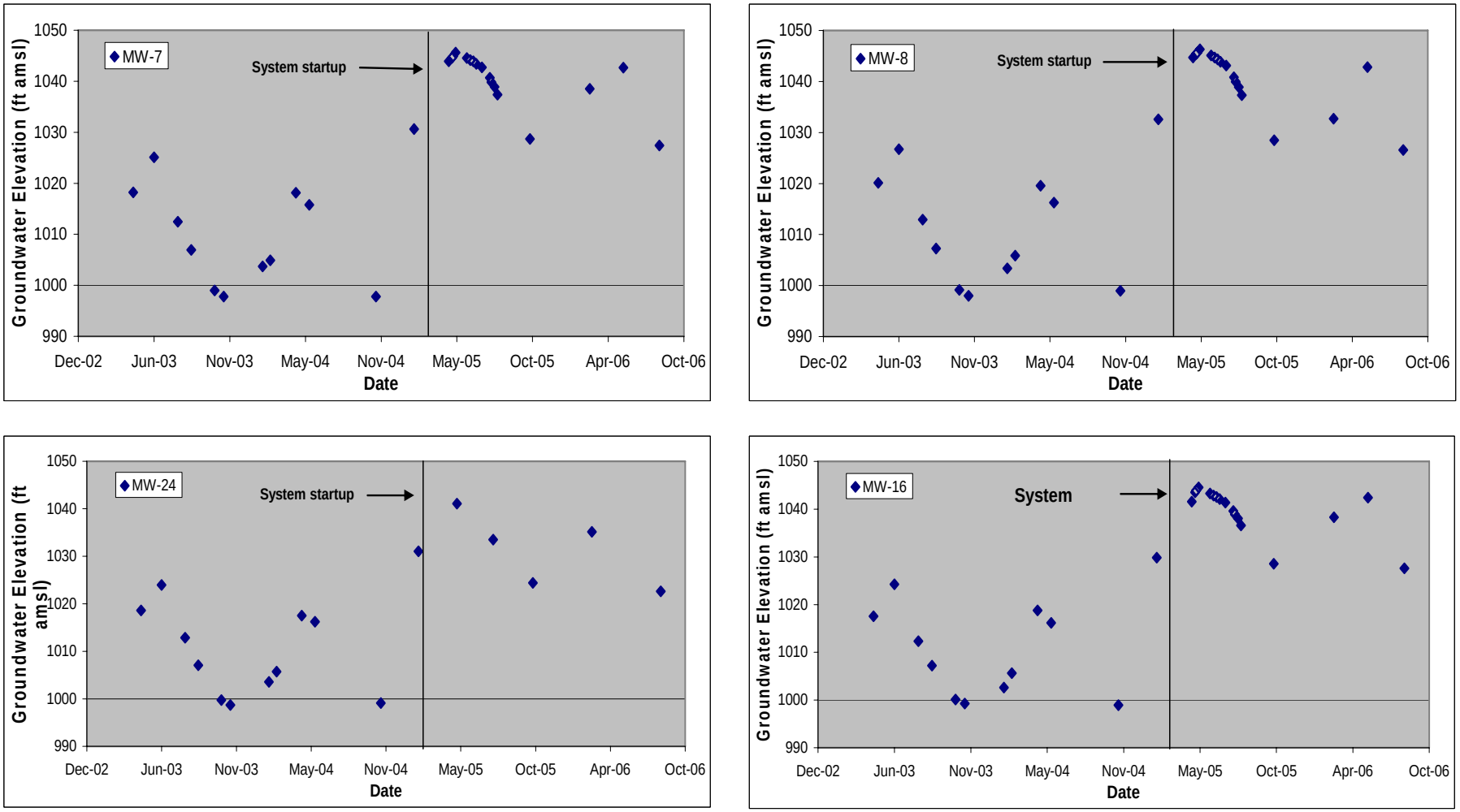
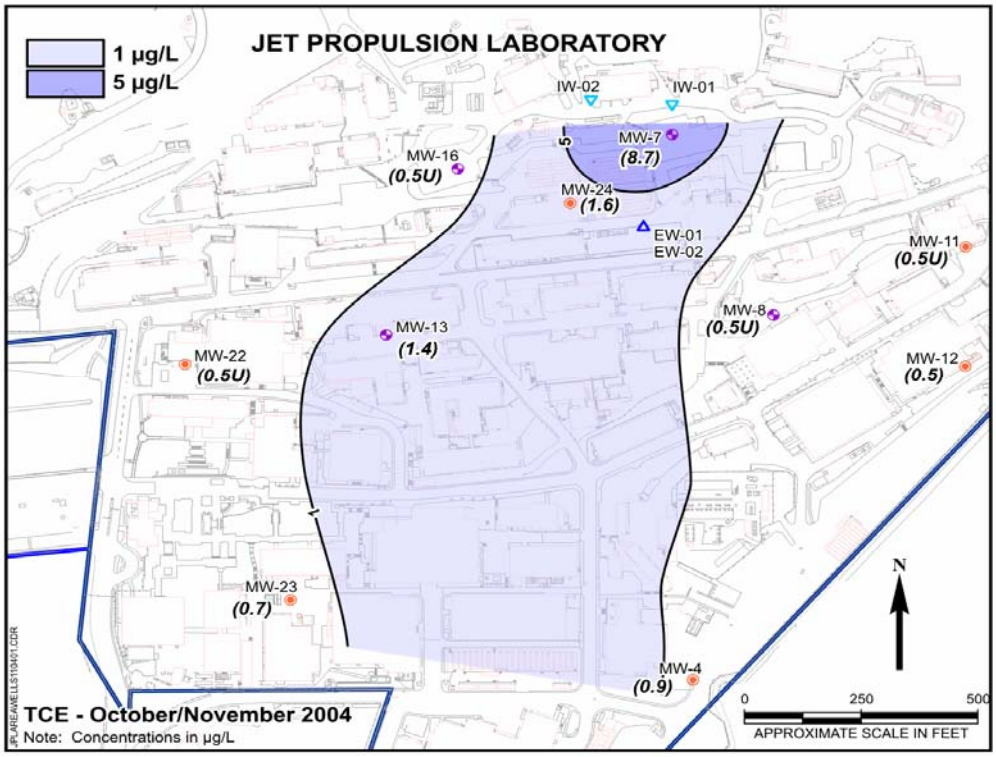


Figure 13. Historical Groundwater-Level Elevations in MW-7, MW-8, MW-24, and MW-16



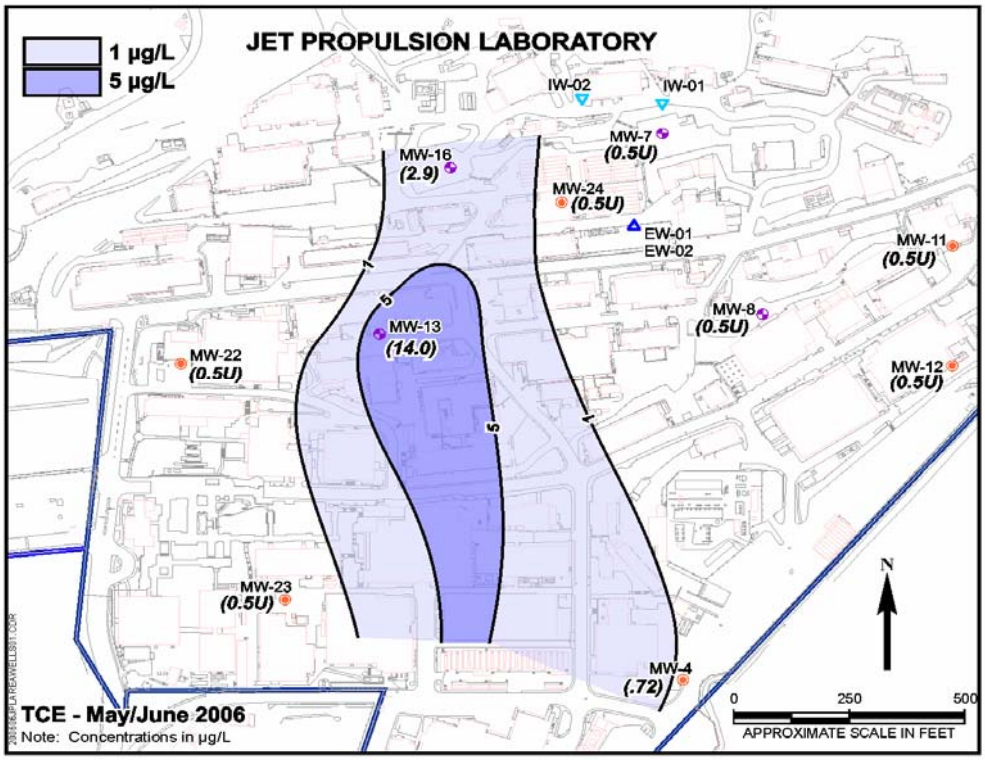


Figure 14. TCE in Groundwater Before (October/November 2004) and After (May/June 2006) System Implementation

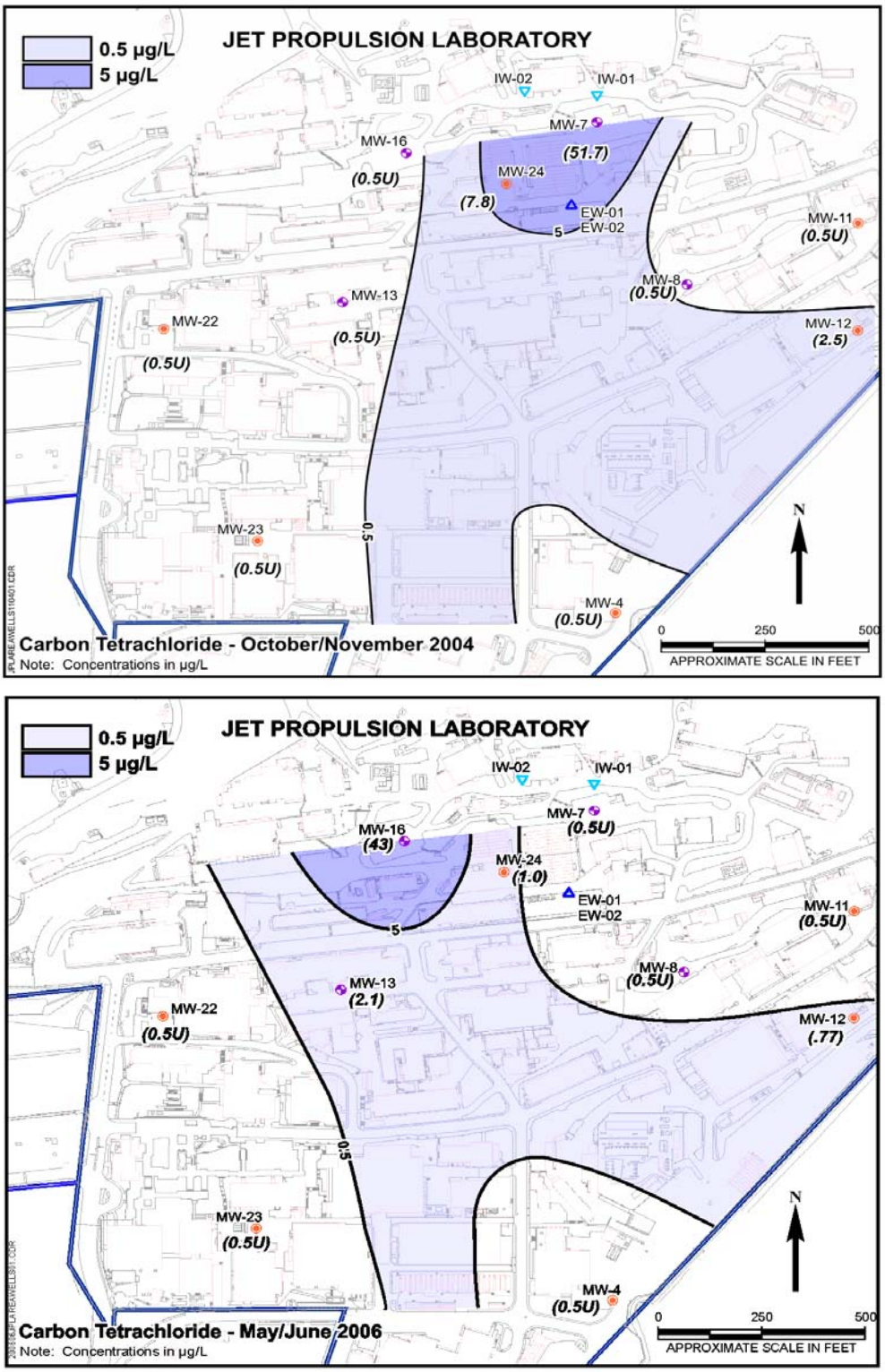


Figure 15. CCl_4 in Groundwater Before (October/November 2004) and After (May/June 2006) System Implementation

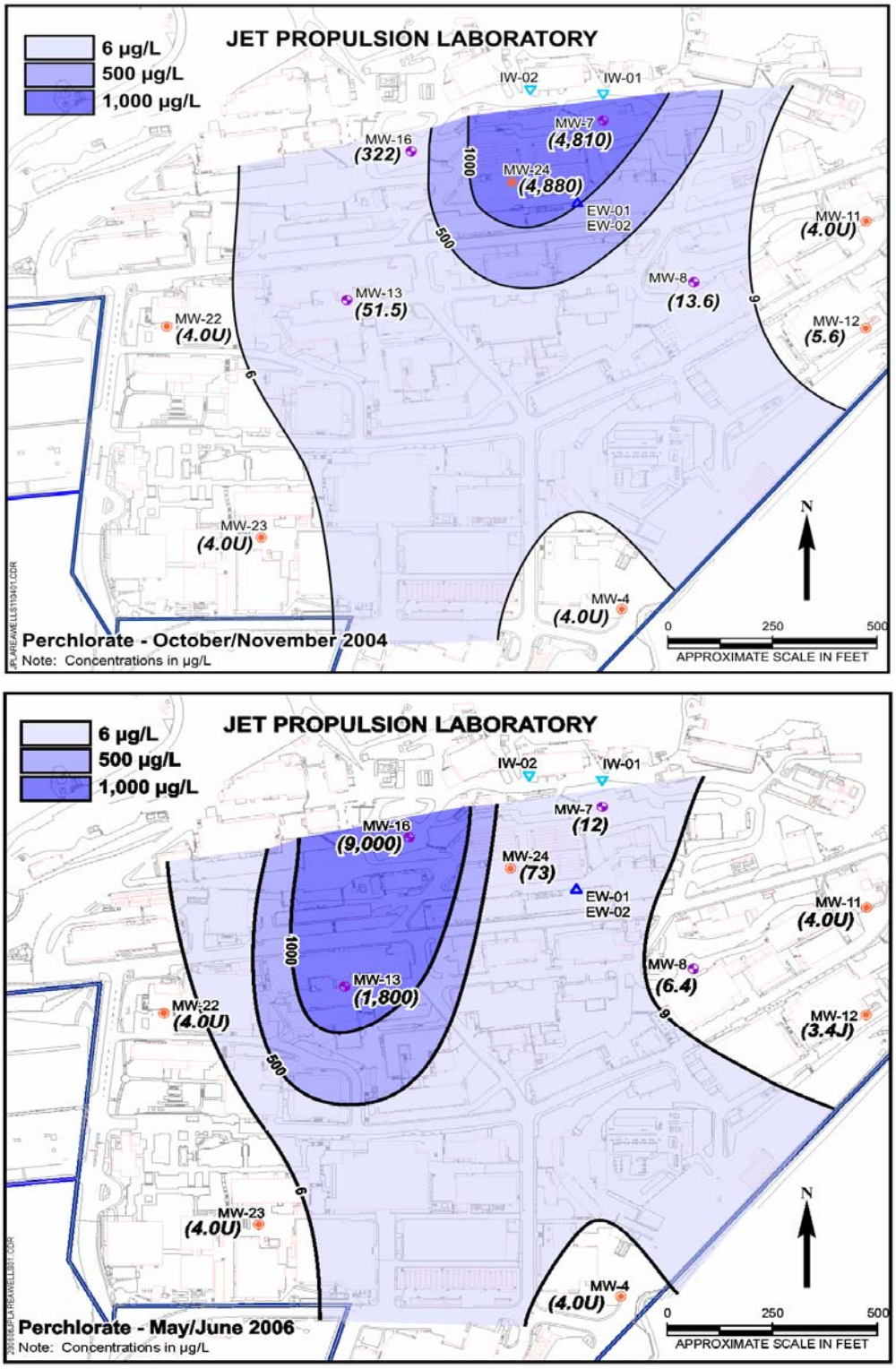


Figure 16. Perchlorate in Groundwater Before (October/November 2004) and After (May/June 2006) System Implementation

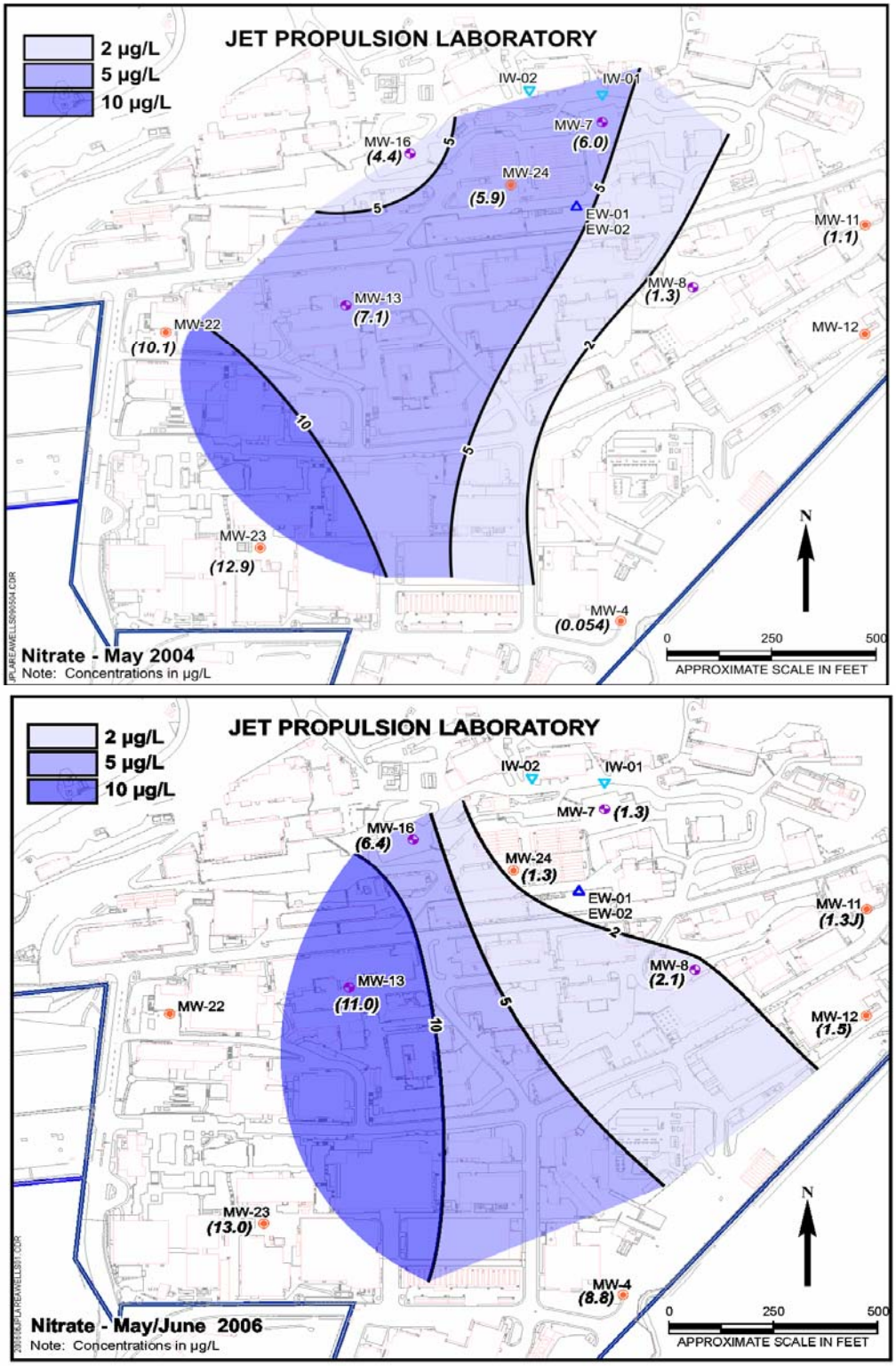


Figure 17. Nitrate in Groundwater Before (May 2004) and After (May/June 2006) System Implementation

Conclusions and Recommendations

Conclusions and recommendations associated with the OU-1 system performance during the March 2006 to August 2006 timeframe are as follows:

- Approximately 15 lb of carbon tetrachloride and 2.6 lb of TCE have been removed through August 31, 2006. VOC removal to non-detectable concentrations has been achieved at the effluent of the lag LGAC vessel through August 31, 2006. The lead LGAC vessels are breaking through after approximately seven months of operation.

- Approximately 553 lb of perchlorate have been removed since the startup of the OU-1 system. The perchlorate removal was 100% for 73 out of 80 sampling events since system startup. The last known breakthrough occurred almost 12 months ago. The perchlorate laboratory results from the FBR effluent will continue on a 24-hour turnaround basis to allow rapid response time to changing process conditions.

- No events occurred during the March to August 2006 timeframe in which sulfate reduction within the FBR resulted in measurable sulfide production. The vapor phase system ensures that the system does not release any nuisance odors to the ambient air. H_2S concentrations in the ambient air are also measured daily at points within and nearby the OU-1 plant.

- The total volume sent to the clarifier to date is 98,500 gallons, or approximately 0.30 acre-ft. Sampling prior to discharge is no longer required.

- Rehabilitation of IW-1 was completed in May 2006.

- The rehabilitation of IW-2 is planned for September 2006

- A significant decrease in chemical concentrations has been observed in the vicinity of MW-7 and MW-24, which are located within the OU-1 demonstration study system treatment zone. Source area concentrations in MW-16 and MW-13 remain elevated while groundwater levels continue to recede from their historical high levels. The proposed system expansion includes an additional extraction and injection well to the west of the existing wells, which is intended to address chemical concentrations in these wells.

- A sterilization schedule for the OU-1 treatment plants poly tanks is being developed for implementation to reduce biological growth within Tanks 201 and 501.

- A cleaning of the sump is recommended within the next six months to eliminate any potential excess biological buildup within.

Attachment A
Field Monitoring Results

Table A-1. OU-1 On Site Water Quality Log Comparison Sheet FBR Influent and Effluent								
Date	DO In	DO Out	ORP In	ORP Out	ClO4 In[a]	ClO4 Out[a]	Nitrate-N In	Nitrate-N Out
d/m/y	mg/L	mg/L	mV	mV	mg/L	mg/L	mg/L	mg/L
1-Mar-06	3.14	0.13	97.0	-172.8	0.34	0.06	2.9	0.6
2-Mar-06	3.00	0.13	88.6	-136.8	0.36	0.07	3	0.8
3-Mar-06	3.02	0.13	94.1	-89.4	0.36	0.07	2.6	0.5
6-Mar-06	3.42	0.14	88.6	-85.3	0.35	0.06	2.9	0.4
7-Mar-06	3.53	0.09	89.6	-102.6	0.35	0.06	3	0.5
8-Mar-06	3.62	0.17	86.9	-51.7	0.35	0.06	3.1	0.5
9-Mar-06	3.61	0.22	100.7	-43.4	0.40	0.07	3.2	0.7
13-Mar-06	3.76	0.18	97.9	19.0	0.39	0.09	3.10	0.7
14-Mar-06	3.69	0.18	103.9	-26.2	0.37	0.08	3.30	0.3
15-Mar-06	3.27	0.15	105.4	-45.4	0.37	0.06	3.00	0.7
16-Mar-06	3.72	0.19	103.5	-49.7	0.37	0.06	3.10	0.7
17-Mar-06	3.60	0.14	115.3	-70.8	–	0.07	3.20	0.6
20-Mar-06	2.96	0.13	107.2	-63.4	0.40	0.06	4.20	0.4
21-Mar-06	3.25	0.17	103.8	-60.5	0.38	0.06	3.40	0.8
22-Mar-06	3.75	0.18	104.8	-106.1	0.38	0.05	3.50	0.3
23-Mar-06	3.10	0.17	134.4	-210.2	0.38	0.06	3.30	0.7
24-Mar-06	3.37	0.21	121.0	-244.7	0.38	0.09	3.30	0.6
27-Mar-06	3.38	0.19	116.6	-304.6	0.40	0.13	3.40	0.9
28-Mar-06	3.03	0.13	119.5	-244.8	0.41	0.07	3.60	0.4
29-Mar-06	2.82	0.16	117.8	-218.5	0.41	0.07	3.5	0.5
30-Mar-06	3.71	0.14	114.0	-212.2	0.41	0.07	3.40	0.4
31-Mar-06	3.60	0.16	102.0	-172.1	0.40	0.07	3.10	0.5
3-Apr-06	2.42	0.21	107.1	-205.6	0.40	0.07	3.10	0.4
4-Apr-06	3.42	0.13	99.6	-196.7	0.40	0.07	3.30	0.4
5-Apr-06	3.38	0.13	91.3	-152.2	0.41	0.07	3.30	0.4
6-Apr-06	3.63	0.22	85.7	-172.0	0.41	0.07	3.20	0.05
7-Apr-06	3.01	0.25	81.5	-184.5	0.40	0.07	3.10	0.03
10-Apr-06	–	–	–	–	–	–	–	–
11-Apr-06	4.10	0.22	101.7	-173.1	0.40	0.07	3.30	0.04
17-Apr-06	–	–	–	–	–	–	–	–
18-Apr-06	2.9	0.16	96.3	-196.0		–	–	–
19-Apr-06	3.26	0.26	90.2	-157.1	0.42	0.08	3.00	0.1
20-Apr-06	3.32	0.23	103.7	-181.9	0.42	0.08	3.20	0.4
21-Apr-06	3.40	0.20	99.5	-171.6	0.40	0.07	3.30	0.6
24-Apr-06	3.83	0.22	103.6	-175.9	0.41	0.07	3.10	0.8
25-Apr-06	3.23	0.21	101.8	-167.7	0.40	0.07	3.00	0.4
26-Apr-06	–	–	–	–	–	–	–	–
27-Apr-06	3.29	0.25	116.3	-125.9	0.40	0.06	3.10	0.6
28-Apr-06	2.37	0.11	115.5	-155.8	0.40	0.07	3.10	0.3
1-May-06	935	–	20	–	7	–	–	–
2-May-06	2.88	0.27	108.2	-110.1	0.58	0.07	2.80	0.5
3-May-06	2.95	0.10	97.0	-174.0	0.52	0.07	2.90	0.4

Table A-1. OU-1 On Site Water Quality Log Comparison Sheet FBR Influent and Effluent								
Date	DO In	DO Out	ORP In	ORP Out	ClO4 In[a]	ClO4 Out[a]	Nitrate-N In	Nitrate-N Out
d/m/y	mg/L	mg/L	mV	mV	mg/L	mg/L	mg/L	mg/L
4-May-06	2.44	0.13	94.5	-169.9	0.47	0.07	2.80	0.4
5-May-06	2.35	0.24	106.0	-128.2	0.46	0.07	2.80	0.5
8-May-06	1440	–	21	–	8	–	–	–
9-May-06	930	–	19	–	7	–	–	–
10-May-06	2.03	0.27	-33.1	-257.7	0.49	0.12	2.20	–
11-May-06	0.49	0.13	-22.0	-196.5	7	–	–	–
12-May-06	0.59	0.10	49.3	-153.9	0.37	0.06	2.70	0.7
15-May-06	0.86	0.20	89.6	-150.9	0.33	0.06	2.80	0.5
16-May-06	1.03	0.17	56.1	-213.3	0.30	0.07	2.80	0.6
17-May-06	3.18	0.25	95.7	-223.3	0.26	0.08	2.90	0.7
18-May-06	5.10	0.26	77.3	-126.6	0.28	0.07	2.90	0.6
19-May-06	3.15	0.14	78.1	-205.4	0.28	0.07	2.90	0.6
22-May-06	4.34	0.19	103.3	-181.7	0.33	0.06	3.20	0.1
23-May-06	3.49	0.14	74.2	-167.0	0.32	0.05	3.30	0.4
24-May-06	900	–	20	–	8	–	–	–
25-May-06	2.37	0.13	100.6	-182.6	0.32	0.06	3.30	0.5
26-May-06	3.51	0.25	84.3	-161.7	0.32	0.07	3.20	0.4
29-May-06	1540	–		–		–	–	–
30-May-06	3.80	0.20	79.5	-180.4	0.34	0.06	2.70	0.2
31-May-06	1.74	0.18	-3.6	-315.1	0.11	0.12	0.40	1.9
1-Jun-06	2.48	0.19	69.3	-141.9	0.12	0.07	1.80	0.8
2-Jun-06	2.22	0.23	48.4	-149.5	0.12	0.08	2.50	0.5
5-Jun-06	0.48	0.17	69.3	-135.0	0.13	0.06	3.40	0.7
6-Jun-06	2.13	0.16	182.0	-60.0	0.12	0.05	3.80	0.5
7-Jun-06	2.02	0.25	124.2	-89.6	0.13	0.05	3.60	0.6
8-Jun-06	2.23	0.21	104.7	-102.5	0.13	0.05	3.00	0.5
9-Jun-06	1.91	0.24	81.0	-67.5	0.13	0.05	3.40	0.5
12-Jun-06	0.48	0.17	107.7	-89.3	7	–	–	–
13-Jun-06	1.74	0.28	91.9	-90.3	0.13	0.05	3.70	0.9
14-Jun-06	1.83	0.19	90.6	-103.7	0.12	0.05	3.60	0.8
15-Jun-06	1.99	0.33	92.9	-101.2	0.12	0.05	3.70	0.7
16-Jun-06	2.09	0.26	101.0	-118.2	0.15	0.05	3.70	0.8
19-Jun-06	2.29	0.27	89.7	-98.2	0.17	0.05	3.90	0.8
20-Jun-06	2.24	0.18	95.2	-131.8	0.18	0.05	4.00	0.4
21-Jun-06	2.25	0.31	94.7	-66.9	0.20	0.05	4.00	0.5
22-Jun-06	2.12	0.25	103.7	-114.5	0.21	0.05	3.20	0.5
22-Jun-06	2.24	0.24	87.7	-134.9	0.22	0.06	3.60	0.4
26-Jun-06	2.40	1.19	101.8	-176.0	0.26	0.06	2.90	0.5
27-Jun-06	2.18	0.28	90.7	-129.0	0.27	0.05	2.90	0.4
28-Jun-06	2.02	3.84	91.8	-144.4	0.27	0.05	2.80	0.5
29-Jun-06	1.98	0.00	80.5	-124.9	0.30	0.05	3.00	0.5
30-Jun-06	1.81	0.00	99.2	-131.9	0.32	0.06	3.00	0.5

Table A-1. OU-1 On Site Water Quality Log Comparison Sheet FBR Influent and Effluent								
Date	DO In	DO Out	ORP In	ORP Out	ClO4 In[a]	ClO4 Out[a]	Nitrate-N In	Nitrate-N Out
d/m/y	mg/L	mg/L	mV	mV	mg/L	mg/L	mg/L	mg/L
3-Jul-06	2.11	0.00	88.9	-145.1	0.45	0.05	3.00	0.5
4-Jul-06	–	–	–	–	–	–	–	–
5-Jul-06	2.05	0.00	40.2	-250.3	0.47	0.06	3.90	0.5
6-Jul-06	1.98	0.00	28.4	-119.1	0.50	0.07	3.90	0.8
7-Jul-06	2.38	0.00	93.3	-145.1	0.41	0.06	2.60	0.9
10-Jul-06	2.05	0.00	75.4	-178.0	0.41	0.06	2.70	0.3
11-Jul-06	2.03	0.18	90.8	-137.9	0.41	0.06	2.60	0.2
12-Jul-06	2.07	0.00	84.1	-131.0	0.39	0.06	2.70	0.2
13-Jul-06	1.98	0.00	77.1	-98.5	0.37	0.05	2.80	0.2
14-Jul-06	2.18	0.00	91.6	-120.0	0.38	0.05	2.80	0.3
17-Jul-06	1.96	0.00	55.2	-123.9	0.38	0.06	3.10	0.5
18-Jul-06	1.90	0.28	84.6	-117.9	0.38	0.06	3.40	0.6
19-Jul-06	2.08	0.98	81.5	-140.5	0.39	0.06	2.90	0.8
20-Jul-06	1.90	0.00	81.9	-100.1	0.39	0.05	3.00	0.7
21-Jul-06	1.98	0.00	82.0	-110.1	0.39	0.05	3.00	0.7
24-Jul-06	2.24	0.00	94.0	-133.3	0.43	0.06	3.00	0.3
25-Jul-06	2.15	0.00	89.7	-140.1	0.44	0.06	2.90	0.2
26-Jul-06	2.10	0.00	84.3	-152.6	0.44	0.06	3.30	0.3
27-Jul-06	2.11	0.00	86.4	-130.1	0.44	0.06	3.10	0.3
28-Jul-06	2.03	0.00	60.9	-230.3	0.16	0.09	2.60	0.1
31-Jul-06	0.32	0.00	70.5	-228.2	0.15	0.08	3.20	0.8
1-Aug-06	1.97	0.00	79.3	-217.2	0.15	0.07	2.90	0.7
2-Aug-06	2.02	0.00	89.3	-203.4	0.16	0.07	3.00	0.7
3-Aug-06	1.78	0.00	88.6	-261.4	0.14	0.11	2.30	1
4-Aug-06	1.92	0.00	78.0	-262.2	0.15	0.10	2.50	–
7-Aug-06	2.16	0.00	65.0	-262.4	0.14	0.09	2.70	0.7
8-Aug-06	2.13	0.00	79.2	-197.3	0.15	0.06	2.60	0.7
9-Aug-06	1.90	0.00	81.4	-203.4	0.15	0.06	2.80	0.6
10-Aug-06	2.10	0.00	94.6	-168.9	0.15	0.06	2.70	0.6
11-Aug-06	2.03	0.00	85.3	-175.5	0.16	0.06	2.80	0.6
14-Aug-06	2.04	0.00	79.2	-154.7	0.18	0.05	2.70	0.09
15-Aug-06	2.15	0.00	90.5	-174.6	0.18	0.05	3.10	0.04
16-Aug-06	2.09	0.00	93.7	-126.1	0.18	0.05	3.00	0.05
17-Aug-06	2.12	0.00	83.0	-176.7	0.18	0.05	3.00	0.05
18-Aug-06	2.10	0.00	84.3	-121.1	0.18	0.05	2.90	0.06
21-Aug-06	2.50	0.00	88.8	-168.2	0.22	0.05	3.00	0.4
22-Aug-06	2.27	0.00	92.8	-188.0	0.22	0.06	2.80	0.3
23-Aug-06	1.92	0.00	81.0	-173.8	0.23	0.05	2.80	0.5
24-Aug-06	1.98	0.00	83.1	-168.2	0.23	0.05	2.90	0.4
25-Aug-06	2.03	0.00	85.8	-171.1	0.23	0.05	2.80	0.4
28-Aug-06	2.22	0.00	83.6	-155.4	0.27	0.06	2.90	–
29-Aug-06	2.03	0.00	70.6	-185.3	0.27	0.05	3.30	0.5

Table A-1. OU-1 On Site Water Quality Log Comparison Sheet FBR Influent and Effluent								
Date	DO In	DO Out	ORP In	ORP Out	ClO4 In[a]	ClO4 Out[a]	Nitrate-N In	Nitrate-N Out
d/m/y	mg/L	mg/L	mV	mV	mg/L	mg/L	mg/L	mg/L
30-Aug-06	2.03	0.00	82.5	-144.2	0.27	0.05	2.80	0.7
31-Aug-06	2.49	0.00	76.0	-159.9	0.27	0.05	2.90	0.2

Note:

(a) The ion selective probe for perchlorate is calibrated to <0.1 mg/L. Readings below this value are

(b) Samples shaded red are possible monitoring/equipment errors and are not included in calculations.

(c) A dash signifies parmeters that were not read.

(d) UR = Under Range

Table A-2. OU-1 On Site Water Quality Log Sheet FBR Effluent

Date	Time	PH	Temperature	Conductivity	DO	ORP	ClO4[a]	Sulfide[b]	Nitrate-N	Nitrite-N	Sulfate	Ammonia-N	PO_4[c]	Filtered TOC
d/m/y			°C	µS/cm	mg/L	mV	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
1-Mar-06	1630	7.12	20.6	530	0.13	-172.8	0.06	–	0.6	–	–	–	–	–
2-Mar-06	1335	7.28	20.5	553	0.13	-136.8	0.07	8	0.8	0.004	44	–	1.8	3.1
3-Mar-06	1000	7.21	20.4	550	0.13	-89.4	0.07	–	0.5	–	–	–	–	–
6-Mar-06	1250	7.07	20.2	532	0.14	-85.3	0.06	–	0.4	–	–	–	1.32	–
7-Mar-06	1900	7.03	20.1	531	0.09	-102.6	0.06	6	0.5	0.003	40	0.8	1.28	–
8-Mar-06	1150	7.14	20.2	540	0.17	-51.7	0.06	–	0.5	–	–	–	–	–
9-Mar-06	1450	7.09	19.9	542	0.22	-43.4	0.07	0	0.7	0.003	47	1.7	2.02	–
13-Mar-06	1320	7.14	19.9	538	0.18	19.0	0.09	–	0.7	–	–	–	–	–
14-Mar-06	1350	7.05	20.3	535	0.18	-26.2	0.08	0	0.3	0.002	40	0.7	0.95	3.9
15-Mar-06	1245	6.95	20.0	529	0.15	-45.4	0.06	–	0.7	–	–	–	1.11	–
16-Mar-06	1230	6.99	20.2	528	0.19	-49.7	0.06	2	0.7	0.003	41	0.8	1.1	4.5
17-Mar-06	1200	7.03	19.5	534	0.14	-70.8	0.07	–	0.6	–	–	–	1.49	–
20-Mar-06	1340	7.00	19.7	528	0.13	-63.4	0.06	–	0.4	–	–	1.3	1.52	–
21-Mar-06	1210	6.74	19.7	499	0.17	-60.5	0.06	9	0.8	0.004	39	0.7	1.47	4.6
22-Mar-06	1205	6.56	20.4	491	0.18	-106.1	0.05	–	0.3	–	–	–	–	–
23-Mar-06	1430	6.80	21.1	506	0.17	-210.2	0.06	6	0.7	0.003	42	0.2	1.54	4.2
24-Mar-06	1230	6.93	20.5	514	0.21	-244.7	0.09	–	0.6	–	–	–	–	–
27-Mar-06	1150	6.97	20.3	527	0.19	-304.6	0.13	–	0.9	–	–	0.6	–	–
28-Mar-06	1220	7.08	19.0	528	0.13	-244.8	0.07	15	0.4	0.003	46	0.8	1.41	4.3
29-Mar-06	1130	7.09	19.9	528	0.16	-218.5	0.07	–	0.5	–	–	–	–	–
30-Mar-06	1700	7.15	20.0	528	0.14	-212.2	0.07	10	0.4	0.003	41	0.8	1.35	4.4
31-Mar-06	1445	7.07	19.5	538	0.16	-172.1	0.07	–	0.5	–	–	–	–	–
3-Apr-06	1350	7.05	20.4	530	0.21	-205.6	0.07	–	0.4	–	–	–	1.55	–
4-Apr-06	1330	7.21	19.5	532	0.13	-196.7	0.07	0	0.4	0.004	40	0.8	1.5	4.5
5-Apr-06	1200	7.14	19.3	532	0.13	-152.2	0.07	–	0.4	–	–	–	–	–
6-Apr-06	1330	7.18	19.5	533	0.22	-172.0	0.07	0	0.05	0.003	39	0.8	1.53	4.6
7-Apr-06	1200	7.22	20.3	535	0.25	-184.5	0.07	–	0.03	–	–	–	–	–
10-Apr-06	–	–	–	–	–	–	–	–	–	–	–	–	–	–
11-Apr-06	1230	7.23	20.2	534	0.22	-173.1	0.07	0	0.04	0.003	40	0.8	1.56	–
17-Apr-06	–	–	–	–	–	–	–	–	–	–	–	–	–	–
18-Apr-06	–	–	–	–	0.16	-196.0	–	–	–	–	–	–	–	–
19-Apr-06	1205	7.06	20.9	535	0.26	-157.1	0.08	–	0.1	–	–	–	–	–
20-Apr-06	1340	6.84	21.2	532	0.23	-181.9	0.08	7	0.4	0.003	45	0.6	1.47	4.4
21-Apr-06	1305	6.77	21.1	531	0.20	-171.6	0.07	–	0.6	–	–	–	–	–
24-Apr-06	1245	7.23	20.5	532	0.22	-175.9	0.07	–	0.8	–	–	–	–	–
25-Apr-06	930	7.2	19.3	534	0.21	-167.7	0.07	8	0.4	0.002	42	0.8	1.82	4.9
26-Apr-06	–	–	–	–	–	–	–	–	–	–	–	–	–	–
27-Apr-06	1330	7.1	20.0	534	0.25	-125.9	0.06	2	0.6	0.003	42	0.7	1.7	5
28-Apr-06	1600	7.1	19.9	533	0.11	-155.8	0.07	–	0.3	–	–	–	–	–
1-May-06	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2-May-06	1430	7.0	21.5	522	0.27	-110.1	0.07	6	0.5	0.003	47	1.1	1.6	–
3-May-06	1225	7.0	20.2	519	0.10	-174.0	0.07	–	0.4	–	–	–	–	–
4-May-06	1230	7.0	20.0	517	0.13	-169.9	0.07	5	0.4	0.004	46	0.9	1.48	–
5-May-06	1545	7.1	21.1	514	0.24	-128.2	0.07	–	0.5	–	–	–	–	–
8-May-06	–	–	–	–	–	–	–	–	–	–	–	–	–	–
9-May-06	–	–	–	–	–	–	–	–	–	–	–	–	–	–
10-May-06	900	–	–	–	0.27	-257.7	0.12	–	–	–	–	–	–	–
11-May-06		–	–	–	0.13	-196.5	–	–	–	–	–	–	–	–
12-May-06	1575	7.1	21.4	599	0.10	-153.9	0.06	13	0.7	0.005	52	0.7	–	–
15-May-06	1725	7.0	22.0	515	0.20	-150.9	0.06	–	0.5	–	–	–	–	–
16-May-06	1420	6.9	22.3	506	0.17	-213.3	0.07	11	0.6	0.004	46	0.4	–	4.1
17-May-06	1600	7.1	21.4	518	0.25	-223.3	0.08	–	0.7	–	–	–	–	–
18-May-06	1700	7.4	21.9	554	0.26	-126.6	0.07	5	0.6	0.005	44	0.4	2.7	4.3
19-May-06	1300	7.4	21.8	542	0.14	-205.4	0.07	–	0.6	–	–	–	–	–
22-May-06	1600	7.2	19.8	524	0.19	-181.7	0.06		0.1	–	–	–	1.75	–
23-May-06	1130	7.2	20.5	532	0.14	-167.0	0.05	78	0.4	0.003	40	1.1	1.75	4.6
24-May-06	–	–	–	–	–	–	–	–	–	–	–	–	–	–
25-May-06	1530	7.2	20.6	533	0.13	-182.6	0.06	55	0.5	0.003	41	0.4	0.65	–
26-May-06	910	7.2	20.2	534	0.25	-161.7	0.07	–	0.4	–	–	–	–	–
29-May-06	–	–	–	–	–	–	–	–	–	–	–	–	–	–
30-May-06	945	7.2	20.9	532	0.20	-180.4	0.06	93	0.2	0.003	45	0.6	1.56	4.5
31-May-06	1100	7.3	20.9	519	0.18	-315.1	0.12	–	1.9	–	–	–	–	–
1-Jun-06	1530	7.7	21.8	564	0.19	-141.9	0.07	12	0.8	0.004	40	1.7	2.33	–
2-Jun-06	1100	8.8	20.9	575	0.23	-149.5	0.08	–	0.5	–	–	–	–	–
5-Jun-06	1130	7.4	21.1	560	0.17	-135.0	0.06	–	0.7	–	–	–	–	–
6-Jun-06	1220	7.3	20.7	559	0.16	-60.0	0.05	16	0.5	0.005	40	0.6	1.39	3.8
7-Jun-06	1320	7.3	21.2	546	0.25	-89.6	0.05	–	0.6	–	–	–	–	–
8-Jun-06	1130	7.2	20.5	543	0.21	-102.5	0.05	0	0.5	0.002	39	0.6	1.27	–
9-Jun-06	1345	7.2	20.4	540	0.24	-67.5	0.05	–	0.5	–	–	–	–	–

Table A-2. OU-1 On Site Water Quality Log Sheet FBR Effluent

Date	Time	PH	Temperature	Conductivity	DO	ORP	ClO4[a]	Sulfide[b]	Nitrate-N	Nitrite-N	Sulfate	Ammonia-N	PO_4[c]	Filtered TOC
d/m/y			°C	µS/cm	mg/L	mV	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
12-Jun-06	–	–	–	–	0.17	-89.3	–	–	–	–	–	–	–	–
13-Jun-06	1300	7.1	21.3	531	0.28	-90.3	0.05	1	0.9	0.005	42	0.5	1.22	3.9
14-Jun-06	1730	7.2	21.1	530	0.19	-103.7	0.05	–	0.8	–	–	–	–	–
15-Jun-06	1200	7.2	21.7	530	0.33	-101.2	0.05	0	0.7	0.003	40	0.4	1.2	3.8
16-Jun-06	1130	7.1	21.8	534	0.26	-118.2	0.05	–	0.8	–	–	–	–	–
19-Jun-06	1400	7.2	21.4	534	0.27	-98.2	0.05	–	0.8	–	–	–	–	–
20-Jun-06	1200	7.2	21.2	533	0.18	-131.8	0.05	4	0.4	0.001	45	0.7	1.04	4.1
21-Jun-06	1200	7.2	21.1	535	0.31	-66.9	0.05	–	0.5	–	–	–	–	–
22-Jun-06	1230	7.1	21.4	530	0.25	-114.5	0.05	5	0.5	0.003	43	0.6	1.06	3.9
22-Jun-06	1400	7.1	21.6	529	0.24	-134.9	0.06	–	0.4	–	–	–	–	–
26-Jun-06	1315	7.2	21.4	531	1.19	-176.0	0.06	–	0.5	–	–	–	1.05	–
27-Jun-06	1400	7.2	21.2	533	0.28	-129.0	0.05	6	0.4	0.004	38	0.4	1	4.3
28-Jun-06	1330	7.2	21.8	532	3.84	-144.4	0.05	–	0.5	–	–	–	–	–
29-Jun-06	1220	7.1	21.9	536	0.00	-124.9	0.05	4	0.5	0.003	39	0.4	1	4.3
30-Jun-06	1400	7.2	21.8	535	0.00	-131.9	0.06	–	0.5	–	–	–	–	–
3-Jul-06	1200	7.2	21.8	532	0.00	-145.1	0.05	–	0.5	–	–	–	–	–
4-Jul-06	–	–	–	–	–	–	–	–	–	–	–	–	–	–
5-Jul-06	1500	7.0	21.8	545	0.00	-250.3	0.06	–	0.5	–	–	–	–	–
6-Jul-06	1350	7.8	22.6	573	0.00	-119.1	0.07	7	0.8	0.005	47	1.5	1.35	4.4
7-Jul-06	1230	7.5	20.9	542	0.00	-145.1	0.06	–	0.9	–	–	0.6	1.08	–
10-Jul-06	1400	7.2	22.3	533	0.00	-178.0	0.06	–	0.3	–	–	–	–	–
11-Jul-06	1235	7.2	22.2	532	0.18	-137.9	0.06	0	0.2	0.003	41	0.4	0.9	4
12-Jul-06	1240	7.2	22.3	538	0.00	-131.0	0.06	–	0.2	–	–	–	–	–
13-Jul-06	1030	7.2	21.6	535	0.00	-98.5	0.05	0	0.2	0.003	40	0.4	0.96	4.2
14-Jul-06	1100	7.2	21.8	534	0.00	-120.0	0.05	–	0.3	–	–	–	–	–
17-Jul-06	1450	7.2	22.8	539	0.00	-123.9	0.06	–	0.5	–	–	–	–	–
18-Jul-06	1340	7.2	22.3	539	0.28	-117.9	0.06	0	0.6	0.002	40	0.4	0.96	4.1
19-Jul-06	1130	7.2	22.1	539	0.98	-140.5	0.06	–	0.8	–	–	–	–	–
20-Jul-06	1445	7.1	22.4	543	0.00	-100.1	0.05	8	0.7	0.004	38	0.5	1.21	4.6
21-Jul-06	1100	7.1	22.2	542	0.00	-110.1	0.05	–	0.7	–	–	–	–	–
24-Jul-06	1645	7.1	23.3	536	0.00	-133.3	0.06	–	0.3	–	–	–	–	–
25-Jul-06	1200	7.1	23.3	536	0.00	-140.1	0.06	6	0.2	0.003	40	0.4	0.94	4.7
26-Jul-06	1730	7.1	22.6	535	0.00	-152.6	0.06	–	0.3	–	–	–	–	–
27-Jul-06	1000	7.1	22.5	535	0.00	-130.1	0.06	8	0.3	0.002	39	0.41	0.96	4.8
28-Jul-06	1300	7.2	22.6	549	0.00	-230.3	0.09	–	0.1	–	–	–	–	–
31-Jul-06	1130	7.2	21.1	542	0.00	-228.2	0.08	–	0.8	–	–	–	–	–
1-Aug-06	1035	7.2	21.0	543	0.00	-217.2	0.07	8	0.7	0.003	43	0.3	0.89	4.4
2-Aug-06	1120	7.2	21.3	543	0.00	-203.4	0.07	–	0.7	–	–	–	–	–
3-Aug-06	1000	7.2	21.0	536	0.00	-261.4	0.11	430	1	0.004	35	0.7	0.92	3.6
4-Aug-06	1630	7.2	21.5	536	0.00	-262.2	0.10	–	–	–	–	–	–	–
7-Aug-06	1700	7.1	22.3	541	0.00	-262.4	0.09	–	0.7	–	–	–	–	–
8-Aug-06	1350	7.2	22.4	543	0.00	-197.3	0.06	10	0.7	0.005	47	0.4	0.91	3.2
9-Aug-06	1320	7.2	23.0	540	0.00	-203.4	0.06	–	0.6	–	–	–	–	–
10-Aug-06	1330	7.2	23.3	541	0.00	-168.9	0.06	6	0.6	0.004	45	0.4	0.93	3.1
11-Aug-06	1340	7.2	23.3	541	0.00	-175.5	0.06	–	0.6	–	–	–	–	–
14-Aug-06	1125	7.1	21.5	537	0.00	-154.7	0.05	–	0.09	–	–	–	–	–
15-Aug-06	1140	7.2	21.5	536	0.00	-174.6	0.05	9	0.04	0.004	37	0.5	1.01	4.4
16-Aug-06	1020	7.2	21.0	537	0.00	-126.1	0.05	–	0.05	–	–	–	–	–
17-Aug-06	1230	7.2	21.4	537	0.00	-176.7	0.05	6	0.05	0.003	39	0.5	0.98	4.2
18-Aug-06	1100	7.2	21.5	537	0.00	-121.1	0.05	–	0.06	–	–	–	–	–
21-Aug-06	1600	7.2	22.9	539	0.00	-168.2	0.05	–	0.4	–	–	–	–	–
22-Aug-06	1530	7.2	23.7	538	0.00	-188.0	0.06	7	0.3	0.003	41	0.3	1.08	4.5
23-Aug-06	1130	7.2	22.2	538	0.00	-173.8	0.05	–	0.5	–	–	–	–	–
24-Aug-06	1030	7.2	22.3	538	0.00	-168.2	0.05	6	0.4	0.004	40	0.3	1.06	4.4

Attachment B
Laboratory Analytical Results

Table B-1. Laboratory Analytical Data OU-1 Treatment System - March 2006

Sampling Date		3/3/2006								3/8/2006						3/17/2006						3/22/2006						4/30/2006							
Sample Locations		EW-1	EW-2	GACIN	GACMID	FBR Inlet	FBR Outlet	TRIMITE INLET	TRIMITE OUTLET	EW-1	EW-2	GACIN	GACMID	FBR Inlet	FBR Outlet	EW-1	EW-2	GACIN	GACMID	FBR Inlet	FBR Outlet	EW-1	EW-2	GACIN	GACMID	FBR Inlet	FBR Outlet	EW-1	EW-2	GACIN	GACMID	FBR Inlet	FBR Outlet	Trimite In	Trimite Out
Parameter	Unit																																		
Conductivity	µS/cm	510	540	522	–	520	540	–	–	500	530	510	–	520	520	530	540	520	–	520	530	510	560	530	–	520	–	500	530	530	–	530	520	–	–
Perchlorate	µg/L	266	567	428	–	415	<2.00	–	–	281	555	435	–	428	<2.00	269	529	394	–	389	<2.00	246	532	394	–	403	–	235	515	391	–	385	<2.00	–	–
Nitrite	mg/L	<.25	<.25	<.25	–	<.25	<.25	–	–	<.25	<.25	<.25	–	<.25	<.25	<.25	<.25	<.25	–	<.25	<.25	<.25	<.25	<.25	–	<.25	<.25	<.25	<.25	<.25	–	<.25	<.25	–	–
Nitrate	mg/L	2.2	3.4	2.9	–	2.5	<.25	–	–	2.2	3.4	2.9	–	2.6	<.25	2.3	3.4	2.8	–	2.6	<.25	2.0	3.1	2.6	–	2.4	<.25	2.0	3.2	2.6	–	2.4	<.25	–	–
Bromide	mg/L	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Sulfate	mg/L	42	45	45	–	45	45	–	–	47	42	44	–	45	43	48	42	45	–	45	45	49	43	46	–	45	45	48	43	46	–	46	46	–	–
Chlorate	mg/L	<0.5	<0.5	<0.5	–	<0.5	<0.5	–	–	<0.5	<0.5	<0.5	–	<0.5	<0.5	<0.5	<0.5	<0.5	–	<0.5	<0.5	<0.5	<0.5	<0.5	–	<0.5	<0.5	<0.5	<0.5	<0.5	–	<0.5	<0.5	–	–
Chloride	mg/L	–	–	–	–	–	–	–	–	29	32	31	–	31	31	30	33	32	–	32	32	28	32	30	–	30	30	28	32	31	–	30	30	–	–
Sulfide	mg/L	–	–	–	–	<.10	<.10	–	–	–	–	–	–	<.10	<.10	–	–	–	–	<.10	<.10	–	–	–	–	<.10	<.10	–	–	–	–	<.10	<.10	–	–
TOC	mg/L	–	–	–	–	–	8.8	–	–	–	–	–	–	–	1.4	–	–	–	–	<1.0	–	–	–	–	–	1	–	–	–	–	–		<1.0	–	–
TKN	mg/L	–	–	–	–	0.49	1.90	–	–	–	–	–	–	0.30	2.20	–	–	–	–	3.10	2.30	–	–	–	–	1.40	2.00	–	–	–	–	0.26	2.00	–	–
Phosphorus	mg/L	0.28	0.24	0.25	–	0.26	0.41	–	–	0.19	0.17	0.14	–	0.27	0.65	0.17	<.10	0.17	–	0.26	0.57	0.15	0.14	0.15	–	0.23	0.52	0.11	0.15	<.10	–	0.17	–	–	–
Alkalinity	mg/L	–	–	180	–	190	–	190	180	–	–	–	–	170	–	–	–	–	–	180	–	–	–	–	–	170	–	–	–	170	–	170	–	190	190
TDS	mg/L	–	–	320	–	310	320	330	310	–	–	–	–	310	–	–	–	–	–	320	–	–	–	–	–	310	–	–	–	300	–	310	–	310	310
TSS	mg/L	–	–	<2.5	–	<2.5	–	8.0	<2.5	–	–	–	–	<2.5	–	–	–	–	–	2.8	–	–	–	–	–	<2.5	–	–	–	<2.5	–	<2.5	–	8.0	<2.5
Turbidity	NTU	–	–	<.10	–	0.30	–	0.50	<.10	–	–	–	–	0.27	–	–	–	–	–	0.19	–	–	–	–	–	0.16	–	–	–	<.10	–	0.23	–	<.10	<.10
BOD	mg/L	–	–	<3.0	–	–	–	–	<3.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
COD	mg/L	–	–	<5.0	–	–	–	–	<5.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	<5.0	–	–	–	–	8
1,1-Dichloroethene	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	–	–	–	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	–	<1.0	1.2	<1.0	<1.0	<1.0	–	–	–
Chloroform	µg/L	<1.0	2.9	2.0	1.9	<1.0	–	–	–	<1.0	3.0	1.9	2.0	<1.0	<1.0	<1.0	3.1	2.0	2.2	<1.0	<1.0	<1.0	3.2	2.1	2.4	<1.0	–	<1.0	3.3	2.1	2.6	<1.0	–	–	–
Carbon Tetrachloride	µg/L	<1.0	18.0	11.0	<1.0	<1.0	–	–	–	<1.0	19.0	10.0	1	<1.0	<1.0	<1.0	18	10	1.4	<1.0	<1.0	<1.0	20	11	1.9	<1.0	–	<1.0	20	11	2.5	<1.0	–	–	–
Trichloroethene	µg/L	<1.0	3.1	1.9	<1.0	<1.0	–	–	–	<1.0	3.3	1.9	<1.0	<1.0	<1.0	<1.0	3.1	1.8	<1.0	<1.0	<1.0	<1.0	3.1	1.7	<1.0	<1.0	–	<1.0	3.0	1.8	<1.0	<1.0	–	–	–
Tetrachloroethene	µg/L	<1.0	2.1	1.4	<1.0	<1.0	–	–	–	<1.0	2.2	1.4	<1.0	<1.0	<1.0	<1.0	2.0	1.3	<1.0	<1.0	<1.0	<1.0	2.0	1.3	<1.0	<1.0	–	<1.0	1.8	1.1	<1.0	<1.0	–	–	–
Total VOC's	µg/L	0.0	26.1	16.3	1.9	0.0	–	0.0	0.0	0.0	27.5	15.2	3.0	0.0	0.0	0.0	27.3	15.1	3.6	0.0	0.0	0.0	29.4	16.1	4.3	0.0	–	0.0	29.3	16.0	5.1	0.0	–	–	–
1,4-Dioxane	µg/L	<3.0	<3.0	<3.0	<3.0	<3.0	–	–	–	–	–	–	–	–	–	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	–	<3.0	<3.0	<3.0	<3.0	<3.0	–	–	–

Table B-2. Laboratory Analytical Data OU-1 Treatment System - April 2006

Sampling Date		4/7/2006						4/21/2006						4/25/2006							
Sample Locations		EW-1	EW-2	GACIN	GACMID	FBR Inlet	FBR Outlet	EW-1	EW-2	GACIN	GACMID	FBR Inlet	FBR Outlet	EW-1	EW-2	GACIN	GACMID	FBR Inlet	FBR Outlet	TF IN	TF OUT
Parameter	Unit																				
Conductivity	µS/cm	510	540	530	–	530	–	520	540	530	–	530	530	530	540	520	–	530	530	–	–
Perchlorate	µg/L	241	560	399	–	412	–	210	539	377	–	387	<2.0	209	540	383	–	361	<2.0	–	–
Nitrite	mg/L	<.25	<.25	<.25	–	<.25	<.25	<0.25	<0.25	<0.25	–	<0.25	<0.25	<0.25	<0.25	<0.25	–	<0.25	<0.25	–	–
Nitrate	mg/L	2.0	3.1	2.7	–	2.3	<.25	2.0	3.2	2.6	–	2.4	<0.25	2.0	3.2	2.7	–	2.4	<0.25	–	–
Bromide	mg/L	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Sulfate	mg/L	48	43	46	–	46	46	48	45	46	–	46	46	51	44	46	–	46	46	–	–
Chlorate	mg/L	<0.5	<0.5	<0.5	–	<0.5	<0.5	<0.5	<0.5	<0.5	–	<0.5	<0.5	<0.5	<0.5	<0.5	–	<0.5	<0.5	–	–
Chloride	mg/L	28	32	30	–	30	31	28	31	30	–	30	30	28	31	30	–	30	30	–	–
Sulfide	mg/L	–	–	–	–	<.10	<.10	–	–	–	–	<0.10	<0.10	–	–	–	–	<0.10	<0.10	–	–
TOC	mg/L	–	–	–	–	–	<1.0	–	–	–	–	–	1.9	–	–	–	–	–	1.4	–	–
TKN	mg/L	–	–	–	–	<.25	1.20	–	–	–	–	0.41	1.60	–	–	–	–	0.47	2.50	–	–
Phosphorus	mg/L	0.14	0.13	0.17	–	0.23	0.60	0.12	0.22	0.16	–	0.26	0.58	<0.10	0.13	<0.10	–	0.36	0.59	–	–
Alkalinity	mg/L	–	–	–	–	180	–	–	–	–	–	160	–	–	–	160	–	160	–	170	160
TDS	mg/L	–	–	–	–	320	–	–	–	–	–	320	–	–	–	320	–	310	–	310	310
TSS	mg/L	–	–	–	–	<2.5	–	–	–	–	–	<2.5	–	–	–	<2.5	–	<2.5	–	4.0	<2.5
Turbidity	NTU	–	–	–	–	0.24	–	–	–	–	–	0.26	–	–	–	0.22	–	0.21	–	–	0.78
BOD	mg/L	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
COD	mg/L	–	–	–	–	–	–	–	–	–	–	–	–	–	–	<5.0	–	–	–	–	<5.0
1,1-Dichloroethene	µg/L	<1.0	1.1	<1.0	<1.0	<1.0	–	<1.0	<1.0	<1.0	<1.0	<1.0	–	<1.0	<1.0	<1.0	<1.0	<1.0	–	–	–
Chloroform	µg/L	<1.0	3.5	2.0	2.5	<1.0	–	<1.0	2.9	1.8	2.4	<1.0	–	<1.0	3.2	2.0	2.4	<1.0	–	–	–
Carbon Tetrachloride	µg/L	<1.0	25.0	11.0	3.1	<1.0	–	<1.0	21.0	12.0	4	<1.0	–	<1.0	19	11	3.7	<1.0	–	–	–
Trichloroethene	µg/L	<1.0	3.9	2.0	<1.0	<1.0	–	<1.0	3.6	2.1	<1.0	<1.0	–	<1.0	3.6	2.1	<1.0	<1.0	–	–	–
Tetrachloroethene	µg/L	<1.0	2.4	1.3	<1.0	<1.0	–	<1.0	1.9	1.3	<1.0	<1.0	–	<1.0	2.1	1.2	<1.0	<1.0	–	–	–
Total VOC's	µg/L	0.0	35.9	16.3	5.6	0.0	–	0.0	29.4	17.2	6.6	0.0	–	0.0	27.9	16.3	6.1	0.0	–	–	–
Toluene	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	–	<1.0	<1.0	<1.0	<1.0	0.68	–	<1.0	<1.0	<1.0	<1.0	<1.0	–	–	–
1,4-Dioxane	µg/L	<3.0	<3.0	<3.0	<3.0	<3.0	–	<3.0	<3.0	<3.0	<3.0	<3.0	–	<3.0	<3.0	<3.0	<3.0	<3.0	–	–	–

Table B-3. Laboratory Analytical Data OU-1 Treatment System - May 2006

Sampling Date		5/12/2006						5/19/2006						5/23/2006						5/31/2006							
Sample Locations		EW-1	EW-2	GACIN	GACMID	FBR Inlet	FBR Outlet	EW-1	EW-2	GACIN	GACMID	FBR Inlet	FBR Outlet	EW-1	EW-2	GACIN	GACMID	FBR Inlet	FBR Outlet	EW-1	EW-2	GACIN	GACMID	FBR Inlet	FBR Outlet	Trimite In	Trimite Out
Parameter	Unit																										
Conductivity	µS/cm	520	–	510	–	700	580	500	540	520	–	520	520	500	540	520	–	520	530	500	540	500	–	520	510	–	–
Perchlorate	µg/L	242	–	232	–	430	<10.0	243	605	460	–	326	<2.0	231	543	384	–	361	<2.00	187	564	407	–	15.2	<2.00	–	–
Nitrite	mg/L	<0.25	–	<0.25	–	<0.25	<0.25	<0.25	<0.25	<0.25	–	<0.25	<0.25	<.25	<.25	<.25	–	<.25	<.25	<0.25	<0.25	<0.25	–	<0.25	<0.25	–	–
Nitrate	mg/L	1.9	–	1.9	–	1.8	<0.25	1.8	3.0	2.5	–	2.3	<0.25	1.9	3.1	2.3	–	2.3	<.25	1.8	3.1	2.5	–	<0.25	<0.25	–	–
Bromide	mg/L	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Sulfate	mg/L	48	–	48	–	56	54	48	45	48	–	48	46	50	44	46	–	47	46	48	43	45	–	40	42	–	–
Chlorate	mg/L	<0.5	–	<0.5	–	<0.5	<0.5	<0.5	<0.5	<0.5	–	<0.5	<0.5	<0.5	<0.5	<0.5	–	<0.5	<0.5	<0.5	<0.5	<0.5	–	<0.5	<0.5	–	–
Chloride	mg/L	30	–	30	–	33	31	31	35	34	–	34	33	32	36	33	–	34	33	28	32	30	–	32	32	–	–
Sulfide	mg/L	–	–	–	–	<0.10	<0.10	–	–	–	–	<0.10	<0.10	–	–	–	–	0.14	0.15	–	–	–	–	<.10	1.70	–	–
TOC	mg/L	–	–	–	–	–	1.5	–	–	–	–	1.2	–	–	–	–	–	<1.0	–	–	–	–	–	–	<1.0	–	–
TKN	mg/L	–	–	–	–	0.35	1.70	–	–	–	–	0.34	1.60	–	–	–	–	0.44	1.70	–	–	–	–	0.64	2.30	–	–
Phosphorus	mg/L	0.10	–	0.11	–	72	30	<0.10	<0.10	<0.10	–	0.37	0.73	0.14	0.14	0.12	–	0.32	0.53	0.11	<0.10	0.11	–	0.50	0.79	–	–
Alkalinity	mg/L	–	–	–	–	180	–	–	–	–	–	170	–	–	–	–	–	160	–	–	–	160	–	180	–	180	170
TDS	mg/L	–	–	–	–	600	–	–	–	–	–	310	–	–	–	–	–	310	–	–	–	320	–	320	–	300	310
TSS	mg/L	–	–	–	–	<2.5	–	–	–	–	–	4.0	–	–	–	–	–	5.0	–	–	–	<2.5	–	10.0	–	7	<2.5
Turbidity	NTU	–	–	–	–	0.35	–	–	–	–	–	0.26	–	–	–	–	–	1.10	–	–	–	<0.10	–	0.37	–	4.90	<0.10
BOD	mg/L	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
COD	mg/L	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	<5.0	–	–	–	–	<5.0
1,1-Dichloroethene	µg/L	<1.0	–	<1.0	<1.0	<1.0	–	<1.0	<1.0	<1.0	<1.0	<1.0	–	<1.0	<1.0	<1.0	<1.0	<1.0	–	<1.0	1.1	<1.0	<1.0	<1.0	–	–	–
Chloroform	µg/L	<1.0	–	<1.0	2.6	<1.0	–	<1.0	2.7	1.7	2.6	1.1	–	<1.0	2.8	1.7	2.4	1.2	–	<1.0	3.0	1.8	1.3	<1.0	–	–	–
Carbon Tetrachloride	µg/L	<1.0	–	<1.0	3.7	<1.0	–	<1.0	16.0	9.2	4.1	<1.0	–	<1.0	17.0	9.6	4.1	<1.0	–	<1.0	20.0	11.0	<1.0	<1.0	–	–	–
Trichloroethene	µg/L	<1.0	–	<1.0	<1.0	<1.0	–	<1.0	3.2	1.9	<1.0	<1.0	–	<1.0	3.3	1.9	<1.0	<1.0	–	<1.0	3.4	20.0	<1.0	<1.0	–	–	–
Tetrachloroethene	µg/L	<1.0	–	<1.0	<1.0	<1.0	–	<1.0	1.8	1.2	<1.0	<1.0	–	<1.0	2.0	1.2	<1.0	<1.0	–	<1.0	2.1	1.3	<1.0	<1.0	–	–	–
Total VOC's	µg/L	0.0	–	0.0	6.3	0.0	–	0.0	23.7	14.0	6.7	1.1	–	0.0	25.1	14.4	6.5	1.2	–	0.0	29.6	34.1	1.3	0.0	–	–	–
1,4-Dioxane	µg/L	<3.0	–	<3.0	<3.0	<3.0	–	<3.0	<3.0	<3.0	<3.0	<3.0	–	<3.0	<3.0	<3.0	<3.0	<3.0	–	<3.0	<3.0	<3.0	<3.0	<3.0	–	–	–

Table B-4. Laboratory Analytical Data OU-1 Treatment System - June 2006

Sampling Date		6/8/2006						6/16/2006						6/23/2006						6/29/2006							
Sample Locations		EW-1	EW-2	GACIN	GACMID	FBR Inlet	FBR Outlet	EW-1	EW-2	GACIN	GACMID	FBR Inlet	FBR Outlet	EW-1	EW-2	GACIN	GACMID	FBR Inlet	FBR Outlet	EW-1	EW-2	GACIN	GACMID	FBR Inlet	FBR Outlet	Trimite In	Trimite Out
Parameter	Unit																										
Conductivity	µS/cm	–	530	530	–	530	530	–	520	510	–	520	510	–	540	540	–	540	530	–	550	540	–	540		–	–
Perchlorate	µg/L	–	538	509	–	2.31	<2.00	–	535	508	–	30.3	<2.00	–	461	466	–	191	<2.00	–	447	447	–	286		–	–
Nitrite	mg/L	–	<0.25	<0.25	–	<0.25	<0.25	–	<0.25	<0.25	–	<0.25	<0.25	–	<0.25	<0.25	–	<0.25	<0.25	–	<0.25	<0.25	–	<0.25	<0.25	–	–
Nitrate	mg/L	–	3.0	3.0	–	2.7	<0.25	–	3.2	3.1	–	2.8	<0.25	–	3.0	3.0	–	2.9	<0.25	–	2.7	2.7	–	2.4	<0.25	–	–
Bromide	mg/L	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Sulfate	mg/L	–	45	46	–	47	46	–	48	48	–	49	49	–	49	48	–	48	48	–	44	44	–	45	44	–	–
Chlorate	mg/L	–	<0.5	<0.5	–	<0.5	<0.5	–	<0.5	<0.5	–	<0.5	<0.5	–	<0.5	<0.5	–	<0.5	<0.5	–	<0.5	<0.5	–	<0.5	<0.5	–	–
Chloride	mg/L	–	36	35	–	36	36	–	39	39	–	39	39	–	39	39	–	39	39	–	34	34	–	35	35	–	–
Sulfide	mg/L	–	–	–	–	<0.10	<0.10	–	–	–	–	<0.10	<0.10	–	–	–	–	<0.10	<0.10	–	–	–	–	<0.10	<0.10	–	–
TOC	mg/L	–	–	–	–	–	<1.0	–	–	–	–	<1.0	–	–	–	–	–	<1.0		–	–	–	–	–	<1.0	–	–
TKN	mg/L	–	–	–	–	0.47	1.50	–	–	–	–	0.54	1.90	–	–	–	–	0.52	0.64	–	–	–	–	1.00	1.70	–	–
Phosphorus	mg/L	–	<0.10	0.13	–	0.23	–	–	<0.10	0.13	–	0.24	0.42	–	0.12	0.16	–	0.25	0.36	–	–	0.19	<0.10	–	0.19	0.46	–
Alkalinity	mg/L	–	–	–	–	180	–	–	–	–	–	170	–	–	–	–	–	170	–	–	–	180	–	190	–	190	190
TDS	mg/L	–	–	–	–	320	–	–	–	–	–	320	–	–	–	–	–	310	–	–	–	330	–	320	–	330	320
TSS	mg/L	–	–	–	–	3.0	–	–	–	–	–	<2.5	–	–	–	–	–	<2.5	–	–	–	<2.5	–	<2.5	–	10.0	<2.5
Turbidity	NTU	–	–	–	–	0.36	–	–	–	–	–	0.10	–	–	–	–	–	<0.10	–	–	–	<0.10	–	0.10	–	0.98	<0.10
BOD	mg/L	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
COD	mg/L	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	<5.0	–	–	–	–	<5.0
1,1-Dichloroethene	µg/L	–	<1.0	<1.0	<1.0	<1.0	–	–	<1.0	<1.0	<1.0	<1.0	–	–	<1.0	<1.0	<1.0	<1.0	–	–	<1.0	<1.0	<1.0	<1.0	–	–	–
Chloroform	µg/L	–	2	2.4	1.2	<1.0	–	–	2.1	2.2	1.5	<1.0	–	–	2.2	2.3	<1.0	<1.0	–	–	2.4	2.2	1.8	<1.0	–	–	–
Carbon Tetrachloride	µg/L	–	15.0	16.0	<1.0	<1.0	–	–	14.0	15.0	<1.0	<1.0	–	–	18.0	19.0	1.7	<1.0	–	–	16.0	15.0	1.6	<1.0	–	–	–
Trichloroethene	µg/L	–	2.6	2.7	<1.0	<1.0	–	–	2.4	2.5	<1.0	<1.0	–	–	2.5	2.5	1.3	<1.0	–	–	2.7	2.6	<1.0	<1.0	–	–	–
Tetrachloroethene	µg/L	–	2	1.6	<1.0	<1.0	–	–	1.6	1.6	<1.0	<1.0	–	–	1.8	1.6	<1.0	<1.0	–	–	1.7	1.7	<1.0	<1.0	–	–	–
Total VOC's	µg/L	–	21.7	22.7	1.2	0.0	–	–	20.1	21.3	1.5	0.0	–	–	24.5	25.4	3.0	<1.0	–	–	22.8	21.5	3.4	0.0	–	–	–
1,4-Dioxane	µg/L	–	<3.0	<3.0	<3.0	<3.0	–	–	<3.0	<3.0	<3.0	<3.0	–	–	<3.0	<3.0	<3.0	<3.0	–	–	<3.0	<3.0	<3.0	<3.0	–	–	–

Table B-5. Laboratory Analytical Data OU-1 Treatment System - July 2006

Sampling Date		7/7/2006						7/13/2006						7/19/2006						7/26/2006							
Sample Locations		EW-1	EW-2	GACIN	GACMID	FBR Inlet	FBR Outlet	EW-1	EW-2	GACIN	GACMID	FBR Inlet	FBR Outlet	EW-1	EW-2	GACIN	GACMID	FBR Inlet	FBR Outlet	EW-1	EW-2	GACIN	GACMID	FBR Inlet	FBR Outlet	Trimite In	Trimite Out
Parameter	Unit																										
Conductivity	µS/cm	–	540	540	–	540	540	–	530	550	–	540	540	–	550	550	–	540	550	–	460	510	–	520	510	–	–
Perchlorate	µg/L	–	428	436	–	449	<2.0	–	414	409	–	394	<2.00	–	411	407	–	413	<2.00	–	357	373	–	443	<2.00	–	–
Nitrite	mg/L	–	<0.25	<0.25	–	<0.25	<0.25	–	<0.25	<0.25	–	<0.25	<0.25	–	<.25	<.25	–	<.25	<.25	–	<.25	<.25	–	<.25	<.25	–	–
Nitrate	mg/L	–	2.6	2.7	–	1.9	<0.25	–	2.9	2.9	–	2.5	<0.25	–	2.6	2.6	–	2.4	<.25	–	2.6	2.6	–	2.3	<.25	–	–
Bromide	mg/L	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Sulfate	mg/L	–	44	44	–	44	43	–	48	48	–	49	48	–	45	45	–	45	46	–	45	45	–	45	45	–	–
Chlorate	mg/L	–	<0.5	<0.5	–	<0.5	<0.5	–	<0.5	<0.5	–	<0.5	<0.5	–	<0.5	<0.5	–	<0.5	<0.5	–	<0.5	<0.5	–	<0.5	<0.5	–	–
Chloride	mg/L	–	35	35	–	35	35	–	38	38	–	39	38	–	34	34	–	34	34	–	34	34	–	34	34	–	–
Sulfide	mg/L	–	–	–	–	<0.10	<0.10	–	–	–	–	<0.10	<0.10	–	–	–	–	<.10	<.10	–	–	–	–	<.10	<.10	–	–
TOC	mg/L	–	–	–	–	<1.0	–	–	–	–	–	–	<1.0	–	–	–	–	–	1.2	–	–	–	–	–	<1.0	–	–
TKN	mg/L	–	–	–	–	0.59	0.97	–	–	–	–	0.54	0.97	–	–	–	–	0.39	0.90	–	–	–	–	–	–	–	–
Phosphorus	mg/L	–	0.15	0.12	–	0.19	0.34	–	0.12	0.10	–	0.21	0.32	–	<.10	<.10	–	0.17	0.26	–	0.16	0.18	–	0.30	0.39	–	–
Alkalinity	mg/L	–	–	–	–	190	–	–	–	–	–	180	–	–	–	–	–	160	–	–	–	160	–	160	–	170	180
TDS	mg/L	–	–	–	–	310	–	–	–	–	–	330	–	–	–	–	–	360	–	–	–	320	–	330	–	320	310
TSS	mg/L	–	–	–	–	6.0	–	–	–	–	–	3.0	–	–	–	–	–	3.7	–	–	–	12.0	–	57.0	–	10.0	<2.5
Turbidity	NTU	–	–	–	–	0.37	–	–	–	–	–	0.33	–	–	–	–	–	0.28	–	–	–	<.10	–	<.10	–	0.78	<.10
BOD	mg/L	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
COD	mg/L	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	<5.0	–	–	–	–	<5.0
1,1-Dichloroethene	µg/L	–	<1.0	<1.0	<1.0	<1.0	–	–	<1.0	<1.0	<1.0	<1.0	–	–	<1.0	<1.0	<1.0	<1.0	–	–	<1.0	<1.0	<1.0	<1.0	–	–	–
Chloroform	µg/L	–	2	2.4	2.0	<1.0	–	–	2.5	2.4	2.2	<1.0	–	–	2.4	2.5	2.2	<1.0	–	–	2.0	2.0	2.0	<1.0	–	–	–
Carbon Tetrachloride	µg/L	–	16.0	16.0	1.8	<1.0	–	–	16.0	17.0	2.6	<1.0	–	–	16.0	16.0	3.0	<1.0	–	–	14.0	14.0	2.9	<1.0	–	–	–
Trichloroethene	µg/L	–	2.4	2.3	<1.0	<1.0	–	–	2.3	2.3	<1.0	<1.0	–	–	2.4	2.4	<1.0	<1.0	–	–	2.3	2.3	<1.0	<1.0	–	–	–
Tetrachloroethene	µg/L	–	1.4	1.4	<1.0	<1.0	–	–	1.4	1.4	<1.0	<1.0	–	–	1.5	1.4	<1.0	<1.0	–	–	1.7	1.7	<1.0	<1.0	–	–	–
Total VOC's	µg/L	–	22.20	22.10	3.80	0.00	–	–	22.20	23.10	4.80	0.00	–	–	22.30	22.30	5.20	0.00	–	–	20.00	20.00	4.90	0.00	–	–	–
1,4-Dioxane	µg/L	–	<3.0	<3.0	<3.0	<3.0	–	–	<3.0	<3.0	<3.0	<3.0	–	–	<3.0	<3.0	<3.0	<3.0	–	–	<3.0	<3.0	<3.0	<3.0	–	–	–

Table B-6. Laboratory Analytical Data OU-1 Treatment System - August 2006

Sampling Date		8/3/2006						8/10/2006						8/16/2006						8/23/2006					
Sample Locations		EW-1	EW-2	GACIN	GACMID	FBR Inlet	FBR Outlet	EW-1	EW-2	GACIN	GACMID	FBR Inlet	FBR Outlet	EW-1	EW-2	GACIN	GACMID	FBR Inlet	FBR Outlet	EW-1	EW-2	GACIN	GACMID	FBR Inlet	FBR Outlet
Parameter	Unit																								
Conductivity	µS/cm	–	530	530	–	540	530	–	530	530	–	530	530	–	510	520	–	530	520	–	530	530	–	530	530
Perchlorate	µg/L	–	401	374	–	30.5	<2.00	–	388	382	–	59.2	<2.0	–	369	372	–	104	<2.0	–	372	364	–	188	<2.0
Nitrite	mg/L	–	<.25	<.25	–	<.25	<.25	–	<.25	<.25	–	<.25	<.25	–	<.25	<.25	–	<.25	<.25	–	<0.25	<0.25	–	<0.25	<0.25
Nitrate	mg/L	–	2.4	2.5	–	1.5	<.25	–	2.7	2.6	–	2.1	<.25	–	2.7	2.7	–	2.2	<.25	–	2.6	2.7	–	2.3	<0.25
Bromide	mg/L	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Sulfate	mg/L	–	42	42	–	41	41	–	46	46	–	47	46	–	45	45	–	45	44	–	48	48	–	49	48
Chlorate	mg/L	–	<0.5	<0.5	–	<0.5	<0.5	–	<0.5	<0.5	–	<0.5	<0.5	–	<0.5	<0.5	–	<0.5	<0.5	–	<0.5	<0.5	–	<0.5	<0.5
Chloride	mg/L	–	32	32	–	32	32	–	36	37	–	37	36	–	37	37	–	37	37	–	37	38	–	38	38
Sulfide	mg/L	–	–	–	–	<.10	1.00	–	–	–	–	<.10	<.10	–	–	–	–	<.10	<.10	–	–	–	–	<.10	<.10
TOC	mg/L	–	–	–	–	–	<1.0	–	–	–	–	<1.0		–	–	–	–	–	<1.0	–	–	–	–	–	<1.0
TKN	mg/L	–	–	–	–	<.25	0.43	–	–	–	–	<.25	0.44	–	–	–	–	0.49	0.68	–	–	–	–	<.25	0.60
Phosphorus	mg/L	–	0.11	0.12	–	0.23	0.36	–	<.10	0.13	–	0.22	0.34	–	<.10	0.12	–	0.20	0.34	–	0.14	0.13	–	0.23	0.40
Alkalinity	mg/L	–	–	–	–	180	–	–	–	–	–	180	–	–	–	–	–	170	–	–	–	–	–	190	–
TDS	mg/L	–	–	–	–	330	–	–	–	–	–	320	–	–	–	–	–	310	–	–	–	–	–	310	–
TSS	mg/L	–	–	–	–	<2.5	–	–	–	–	–	<2.5	–	–	–	–	–	<2.5	–	–	–	–	–	<2.5	–
Turbidity	NTU	–	–	–	–	0.21	–	–	–	–	–	0.26	–	–	–	–	–	0.27	–	–	–	–	–	0.14	–
BOD	mg/L	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
COD	mg/L	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1,1-Dichloroethene	µg/L	–	<1.0	<1.0	<1.0	<1.0	–	–	<1.0	<1.0	<1.0	<1.0	–	–	<1.0	<1.0	<1.0	<1.0	–	–	<1.0	<1.0	<1.0	<1.0	–
Chloroform	µg/L	–	2.2	2.3	<1.0	<1.0	–	–	1.9	1.8	<1.0	<1.0	–	–	2.3	2.2	<1.0	<1.0	–	–	2.2	2.1	<1.0	<1.0	–
Carbon Tetrachloride	µg/L	–	14.0	15.0	<1.0	<1.0	–	–	12.0	11.0	<1.0	<1.0	–	–	15.0	15.0	<1.0	<1.0	–	–	14.0	14.0	<1.0	<1.0	–
Trichloroethene	µg/L	–	2.3	2.3	<1.0	<1.0	–	–	2.0	1.8	<1.0	<1.0	–	–	2.2	2.1	<1.0	<1.0	–	–	2.1	2.0	<1.0	<1.0	–
Tetrachloroethene	µg/L	–	1.5	1.5	<1.0	<1.0	–	–	1.4	1.3	<1.0	<1.0	–	–	1.5	1.4	<1.0	<1.0	–	–	1.4	1.3	<1.0	<1.0	–
Total VOC's	µg/L	–	20.00	21.10	0.00	0.00	–	–	17.30	15.90	0.00	0.00	–	–	21.00	20.70	0.00	0.00	–	–	19.70	19.40	<1.0	<1.0	–
1,4-Dioxane	µg/L	–	<3.0	<3.0	<3.0	<3.0	–	–	<3.0	<3.0	<3.0	<3.0	–	–	<3.0	<3.0	<3.0	<3.0	–	–	<3.0	<3.0	<3.0	<3.0	–

Table B-7. Summary of Laboratory Analytical for Metals

Sampling Date		3/30/2006		4/26/2006		5/31/2006		6/29/2006		7/26/2006		8/23/2006	
Sampling Location		GACIN	Trimite Outlet	GACIN	Trimite Outlet	GACIN	Trimite Outlet	GACIN	Trimite Outlet	GACIN	Trimite Outlet	GACIN	Trimite Outlet
Parameter	Unit												
Beryllium	mg/L	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	–	–
Magnesium	mg/L	18	17	17	17	18	18	16	17	19	19	–	–
Calcium	mg/L	60	56	54	56	60	56	54	56	58	59	–	–
Vanadium	mg/L	<0.0030	<0.0030	0.0043	<0.0030	<0.0030	<0.0030	0.0042	<0.0045	0.0046	<0.0030	–	–
Chromium	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	–	–
Hexavalent Chromium	mg/L	2.4	<1.0	2.7	<1.0	-	-	-	-	2.4	<1.0	–	–
Manganese	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.022	<0.0050	<0.0050	<0.0050	<0.0050	–	–
Iron	mg/L	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	–	–
Cobalt	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	–	–
Nickel	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	–	–
Copper	mg/L	<0.010	<0.010	<0.010	0.015	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	–	–
Zinc	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<.10	<0.10	<0.10	<0.10	–	–
Arsenic	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	–	–
Selenium	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	–	–
Molybdenum	mg/L	0.0077	0.0068	0.0150	0.0078	0.0063	0.0081	0.0110	0.0097	0.0190	<0.0089	–	–
Silver	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	–	–
Cadmium	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	–	–
Antimony	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	–	–
Barium	mg/L	0.068	0.061	0.065	0.058	0.064	0.070	0.073	0.067	0.075	<0.0069	–	–
Mercury	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	–	–
Thallium	mg/L	0.0046	<0.0020	0.0083	<0.0020	<0.0020	<0.0020	0.0034	0.0023	0.0067	<0.0020	–	–
Lead	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	–	–

Note:
(a) Sample taken from FBR outlet.

Water Systems Engineering Inc.
3201 Labette Terrace Phone: 785-242-6166
P.O. Box 700 Fax: 785-242-9411
Ottawa, KS 66067-0700

WATER TREATMENT ANALYSIS AND CONTROL REPORT

David J. Conner
Battelle
3990 Old Town Ave., Suite C-205
San Diego, CA 92110

Date: June 1, 2006

Lab Report #16950

RE: Jet Propulsion Labs, Pasadena CA; Injection Well IW-1, sample dated 5/2/06

Complete Profile (1), P.O. #205023

*(as $CaCO_3$)	**IW-1 11:05** mg/l
Phenolphthalein Alkalinity*	0
Total Alkalinity*	180
Hydroxide Alkalinity	0
Carbonate Alkalinity	0
Bicarbonate Alkalinity	180
pH Value	7.6
Chlorides (as Cl)	41.2
Total Dis. Solids	481
Conductivity (micromhos)	625
Total Hardness*	212
Carbonate Hardness	180
Non Carbonate Hardness	32
Calcium*	148
Magnesium*	64
Sodium (as Na)	22.9
Potassium (as K)	2.4
Phosphate (as PO_4)	0.7
Dissolved Iron (as Fe^{2+})	6.6
Suspended Iron (as Fe^{3+})	0.1
Iron Total (as Fe)	0.1
Iron (resuspended)	59.5
Copper (as Cu)	0.0
Tannin/Lignin	0.3
Nitrate (Nitrogen)	0.1
Sulfate (as SO_4)	49.8
Silica (as SiO_2)	31.8
Manganese (as Mn)	0.7
Total Organic Carbon (C)	2.4
Saturation Index	- 0.14
Chlorine (as Cl)	0.0

ORP	- 161 mV

Bacterial Analysis:

	IW-1 11:05
Plate Count (colonies/ml)	200
Sulfate Reducing Bacteria	Positive
Anaerobic Growth	50%
ATP (cells per ml)	133.9 M
Bacterial Identification	*Bacillus cereus/thuringiensis;* *Bacillus polymyxa;* *Serratia marcescens;*

Microscopic Evaluation:

Moderate visible bacterial activity, large number of algae, minor number of protozoa, moderate number of crystals, heavy biofilm with moderate iron oxide, minor number of stalked bacteria.

Observations:

Chemical analyses of the sample identified low hardness, moderate alkalinity and a slightly elevated pH present within the well. General conditions were sufficient for the calculation of a slightly negative saturation index, indicating no or limited potential for carbonate mineral scale deposition. The water chemistry within the well appears very oxidative and would favor corrosion of steel or iron bearing screen and casing material. Overall, ion concentrations were minimal; however elevated concentrations of iron, manganese, and phosphate were noted. The level of resuspended iron within the well is severely elevated, reflecting both the total iron as well as any organically mobilized or oxidized iron precipitating out within the well.

Biological analyses of the samples identified an excessive bacterial population present within the well. The population observed far exceeds normal population levels observed in potable wells, and is elevated for an environmental well. Although the presences of protozoans within the sample may serve to artificially inflate the ATP reading, the population identified still remains excessive for an active system. Anaerobic growth, as a percentage of the total population, was present in a high percentage indicating an advanced bacterial community and strong anoxic conditions within the well. Testing for sulfate reducing bacteria was positive. Visible bacterial activity was moderate with good plate growth noted. In addition to algae and heavy biofilm, the sample contained silica crystalline debris, and iron oxide as well as iron oxide entrained biomass.

In addition to multiple forms of protozoans, the dominant bacterial species within the sample was the common slime forming bacteria *Bacillus.* The coliform and opportunistic pathogen *Serratia marcescens* was identified in the sample as well. The presence of this bacterium

does not readily identify a contamination of the well or sample, however, it does serve to demonstrate the advanced microbial state existing within Well IW-1.

Interpretations:

The water chemistry is oxidative and corrosive in nature, resulting in reduced potential for carbonate mineral scale and an increased potential for iron oxide accumulations. The current level of corrosion does not appear excessive although some degree of microbial induced corrosion may be present.

The sample indicates that a mature and diverse bacterial community exists within Well IW-1. The strong presence of protozoans, commonly found in surface water, can indicate rapid recharge zones as well as surface water contamination. The significant level of anaerobic growth within the large population size suggests that severe flow impedance is likely occurring. The anaerobic bacteria require a strong anoxic zone which typically develops in impacted areas as well as the lower extensions of the well.

The reduction in well yield noted is most likely resulting from the substantial biofouling potential identified in the analyses of the sample. The shear magnitude of bacteria, diversity, and common traits associated with the types of bacteria identified, suggests the well is experiencing biofouling of the “well proper”, gravel pack and borehole interface zone. The percentage of anaerobic growth observed in the casing sample further confirms that low flow zones have been created within the water column.

Recommendations:

Chemical rehabilitation, in association with mechanical agitation and a final disinfection treatment, is recommended to reduce the impact the severe biofouling has placed on the well. The well should be aggressively purged following treatment to thoroughly flush all disrupted debris. Furthermore, post rehabilitation monitoring is recommended to identify bacterial fouling potential before it reaches the current levels and can be treated more effectively.

I would be happy to develop more detailed recommendations including chemical estimates and mechanical methodology, upon request. Should you have any questions regarding the information presented herein, please feel free to contact our office for further discussion.

Michael Schnieders
Hydrogeologist

Attachment C
Los Angeles County Sanitation District
Industrial Wastewater Discharge Permit

COUNTY SANITATION DISTRICTS
OF LOS ANGELES COUNTY

1955 Workman Mill Road, Whittier, CA 90601-1400
Mailing Address: P.O. Box 4998, Whittier, CA 90607-4998
Telephone: (562) 699-7411, FAX: (562) 699-5422
www.lacsd.org

JAMES F. STAHL
Chief Engineer and General Manager

July 31, 2006
File: 16-06-007024Y
Account No.: 1710061

Ms. Bonnie Hopkins
Principal Engineer
City of Pasadena
100 N. Garfield Ave., Rm 212
Pasadena, CA 91109-7215

Dear Ms. Hopkins:

Industrial Wastewater Discharge Permit No. 007024 R-3

Jet Propulsion Laboratory
4800 Oak Grove Dr.
Pasadena, CA 91011

Enclosed are two (2) sets of plans and copies of the approved Industrial Wastewater Discharge Permit for the subject company. This permit application was submitted in accordance with Ordinance requirements to apply for a permit revision upon a substantial decrease in wastewater quantity. Please review these for compliance with your requirements, and retain the copies you require for your files. The applicant's copy of the approved plans and Industrial Wastewater Discharge Permit, along with a copy of this letter and requirement list, should be forwarded to the applicant. A copy of this letter is forwarded to the applicant as notification of the Districts' permit requirements, which are in force from the current date. If any additional permit requirements are issued to the applicant by your agency, copies should be forwarded to the Districts for our records. The approved plans consist of:

1. Jet Propulsion Laboratory, Site Plan - Facility Locations
2. JPL Sewer Plan
3. Building 302 First Floor Plan
4. Drawing P-2: Building 302 Floor Plan & Tank Elev.
5. Building 302/0A Second Floor Plan
6. Drawing M3.2: Microdevices Laboratory Building 302, Level 2 Plumbing & Piping Plan
7. Drawing M3.1: Microdevices Laboratory Building 302, Level 1 Plumbing & Piping Plan
8. Building 300/00 First Floor Plan
9. Building 300 Plumbing, First Floor Plan, Area III
10. Building 300 Plumbing, First Floor Plan, Area I
11. Building 233 Modify Plumbing Plan - First Floor - North
12. Car Wash Building 177, Sewer Connection (Process Flow Diagram)

13. Building 177/00 First Floor Plan
14. Waterjet Machine Tool, Building 170, Room 130, (Floor Diagram)
15. Building 170, Room 130, Sewer Connection (Process Flow Diagram)
16. Building 170/00 First Floor Plan
17. Building 158/OA First Floor Plan
18. Drawing No. 158/50-6: Materials Research & Processing Laboratory
19. Building 103/00 First Floor Plan
20. Building 103 Nitrogen, DI Water, Drain, RM's, Floor Plan, Details, Equip. Schedule

Approval of the permit is subject to compliance with all applicable Ordinance requirements, upon any corrections shown in red on the drawings, and upon the items indicated on the attached requirement list. Failure to comply with all items on the requirement list invalidates this approval and issuance. Invalidation of this permit will result in the applicant being deemed to be operating without a valid permit and subject to immediate discontinuance of sewer services for industrial operations. Successful compliance with all conditions of approval will result in a formal approval that will be valid for five (5) years from the date of this letter.

If you have any questions concerning these requirements, please contact Alicia Barrera of the Districts' Industrial Waste Section at extension 2918.

Very truly yours,

James F. Stahl

For Suzanne S. Wienke
Supervising Civil Engineer

SSW:AB
cc: George Beck
Jet Propulsion Laboratory
4800 Oak Grove Dr. MS200-203
Pasadena, CA 91109-8099

COUNTY SANITATION DISTRICTS OF LOS ANGELES COUNTY (DISTRICTS)

James F. Stahl, Chief Engineer and General Manager
1955 Workman Mill Road, P.O. Box 4998, Whittier, California 90607

INDUSTRIAL WASTEWATER DISCHARGE PERMIT

REQUIREMENT LIST

COMPANY NAME: Jet Propulsion Laboratory

INDUSTRIAL WASTEWATER DISCHARGE PERMIT NUMBER: 7024 R-3

ACCOUNT NUMBER: 1710061

DATE OF APPROVAL: July 31, 2006 EXPIRATION DATE: July 30, 2011

The approval and issuance of this permit is being made conditionally and subject to Jet Propulsion Laboratory (permittee) being in compliance with all indicated items on this list. Satisfactory evidence of compliance with these conditions should be supplied to the Districts where requested. Satisfactory evidence will consist of a minimum of written notification signed by a responsible company official, and in some cases may involve the submission of additional drawings and data, or verification by a Districts representative. Failure to comply with all items on the requirement list, including all deadlines specified, invalidates this approval and issuance. Invalidation of this permit will result in the permittee being deemed to be operating without a valid permit and subject to immediate discontinuance of sewer services for industrial operations.

1. This industrial wastewater discharge permit is issued only for the discharge of treated wastewater from alkaline cleaning of printed circuit boards and metal parts, aqueous cleaning metal parts, RO reject, water jet cutter, car/truck wash pad, film processing, slurry waste from grinding epoxy, wafer processing wet scrubber, groundwater treatment system, chiller and cooling tower bleed-off. The discharge of any other type of waste will require prior approval from the Districts. The permittee is being designated a Significant Industrial User. This approved permit will be valid for five (5) years from the date of the accompanying transmittal letter.

2. The permittee is required to notify the Districts of any change in the status of the subject facility, if ownership or operating responsibility changes, or if the industrial waste connection is legally abandoned.

3. A new permit application must be submitted when there is a significant change in wastewater quantity (25% or more) or quality from that given in the approved permit information. The completed application should be submitted to the local governmental agency for initial processing prior to Districts' review. Approval must be obtained prior to any construction of new facilities.

4. Waste haulers reports must be obtained and kept on file for a period of at least four (4) years for any solid wastes from the wastewater pretreatment system and liquid wastes leaving the plant other than in the sewer system. These reports must be made available to representatives of the Districts upon request.

5. All wastewater discharged to the sewer must have a temperature lower than 140°F (60°C) and a closed cup flash point greater than 140°F (60°C).

6. All wastewater discharged to the sewer must not contain over 0.1 milligram/liter of dissolved sulfides.

7. The pH of the wastewater must be maintained at or above 6.0 and below 10.0 at all times. Proper neutralization procedures must be observed to assure that this limit is not violated.

8. The Districts are required by law to enforce the Categorical Pretreatment Regulations established by the United States Environmental Protection Agency. Based on information submitted and verified by the Districts, the permittee is no longer required to comply with pretreatment standards for existing sources in the Metal Finishing Category (40 CFR 433). The wafer processing wet scrubber discharge in Building 302 is however subject to the Electrical and Electronic Components regulation, EPA Category (40 CFR 469), Subpart A - Semiconductor. The compliance date was July 1, 1984. Therefore the permittee is required to be in compliance now with the pretreatment standards shown below at **sampling location No. 807024**. The permittee is advised that any discharge in excess of these standards requires corrective action by the discharger. Penalties applicable to violations of these limits will be strictly enforced by the Districts.

Pollutant	Daily Maximum (mg/l)	Monthly Average (mg/l)
TTO	1.37	---

For industrial pollutants not regulated by the EPA regulation or where the EPA regulation is less stringent than those of the Districts, the Districts will continue to enforce its effluent limitations shown in the following list of "Industrial Wastewater Effluent Limitations" at **sampling location No. 007024.** The subject EPA regulations do not authorize any violations of the Districts' regulations. The permittee is advised that any discharge in excess of these limits requires corrective action by the discharger. Penalties applicable to violations of these limits will be strictly enforced by the Districts.

INDUSTRIAL WASTEWATER EFFLUENT LIMITATIONS
PHASE I CONTROL PERIOD

Parameter	Limit (mg/l)*
Arsenic	3
Cadmium	15
Chromium (Total)	10
Copper	15
Lead	40
Mercury	2
Nickel	12
Silver	5
Zinc	25
Cyanide (Total)	10
Total Identifiable Chlorinated Hydrocarbons**	Essentially None

* - Maximum concentration at any time
** - Total Identifiable Chlorinated Hydrocarbons (TICH) comprise:
Aldrin, Dieldrin, Endrin, Chlordane (cis & trans), trans-nonachlor, oxychlordane, heptachlor and heptachlor epoxide
DDT and derivatives: p, p', and o, p' isomers of DDT, DDD, and DDE
HCH: sum of α, β, γ, δ isomers of hexachlorocyclohexane
Toxaphene and Polychlorinated biphenyls (PCB's)

9. The effluent discharge limits applicable at **sampling location No. 907024** for the volatile organic parameters (per EPA Test Methods 601 and 602, or 624) is 1 mg/L; for the semi-volatile organic parameters (per EPA Test Method 625) is 1 mg/L; for perchlorate is 100 μg/l and for 1,4 dioxane is 5 μg/l.

10. The scrubber discharge sump located in Room 236 of Building 302 is hereby designated as legal **sampling location No. 807024**. The sample box located in the northeastern corner of the groundwater treatment pad is hereby designated as legal sampling location **No. 907024**. The 6" Parshall flume located inside the fenced southern end of the JPL facility is hereby designated as **sampling location No. 007024** and is the legal sampling point for surcharge reporting purposes and for determining compliance with the Districts' Phase I Limits for the subject facility. The permittee is responsible for maintaining and cleaning the sampling points to prevent any build-up of oil and grease, sediment or sludge; failure to do so does not invalidate sampling test results. Analytical results from samples taken from these locations according to accepted sampling procedures shall be accepted as binding. Safe and convenient access to the sampling points must be provided for representatives of the Districts. Should Districts' staff determine that the sampling locations are unsafe, difficult to access or require modification, the permittee must propose alternatives which will provide sampling facilities acceptable to the Districts.

11. The Districts' personnel may provide a split of any composite sample collected if sufficient sample volume is available. Districts' personnel may also provide split, concurrent, or sequential grab samples. These samples will be left with a designated company representative. If the designee is not available, these samples will be left with whomever is available.

    The permittee is required to follow appropriate preservation techniques, analytical procedures, and holding periods specified in 40 CFR 136, if the analytical test results from these samples are to be used for compliance or surcharge reporting purposes. Failure to follow the prescribed procedures will invalidate the test results.

12. The permittee is advised that additional industrial wastewater pretreatment equipment may be required if inspection or monitoring indicates prohibited materials are discharged to the public sewer.

13. Any plans for changes in equipment or processes must be submitted (for approval before implementation) to the Districts.

14. Regular calibration and maintenance of the existing flow measurement system (the 6" Parshall flume) will be required in accordance with the "Industrial Wastewater Discharge Flow Measurement Requirements," available from the Districts' web site at http://www.lacsd.org/iw/forms/forms.htm. Specifically, hydraulic calibrations of the system shall be performed at least once every three years while instrument calibrations shall be performed at least once per year.

15. The permittee must implement a regular program of cleaning, checking and maintaining all the components of the existing flow measurement system. This program must include frequent cleaning of the primary element and probes, performing independent checks and calibrations to evaluate the system's accuracy, etc. All maintenance performed on the flow measurement system must be recorded on the "Flow Monitoring System Maintenance Records" available from the Districts' web site at http://www.lacsd.org/iw/forms/forms.htm.

16. The "Flow Monitoring System Maintenance Records" form must be maintained by the company or the consultant at the recorder location, or another location easily accessible for inspection by Districts' employees. Maintenance activities, recorded on the above mentioned form, shall be submitted to the Districts with all calibration report submittals. These activities include: checking the "zero flow" level of the system, cleaning the system (including the primary element, depth measurement probe, and upstream/downstream piping), changing the recorder's chart, performing independent checks to evaluate the system's accuracy, etc. Furthermore, the maintenance records must contain totalizer readings together with the date and time that the data was gathered. This information must also be concurrently noted on the recorder chart, which should be annotated on a regular basis (preferably daily but no less than weekly).

17. The permitted peak flow rate for the permittee is 550 gallons per minute and is defined as the highest average rate at which wastewater is allowed to be discharged to the public sewer during any five minute time period. This rate is not to be exceeded at any time. For surcharge reporting purposes, peak flow charges are calculated using a separate definition, as set forth in Section A-

34 of the *Wastewater Ordinance*.

18. Batch neutralization prior to discharge is required for any wastewater tanks containing acidic solutions with pH less than 6.0.

19. The permittee is required to notify the Districts at least 24 hours in advance of anticipated discharge from the wet scrubber discharge sump (**sampling location No. 807024**). Notification should be made by telephone to Bill Garrett at (562) 699-7411, extension 2907. Batches should be discharged Monday through Thursday only. (Notification for Monday discharges should be made by 3:00 p.m. on the previous Friday.) If the Districts have obtained adequate samples, this notification requirement may be temporarily suspended. The permittee will be verbally notified of a suspension and given a date for resumption of the notification requirement.

20. The permittee is no longer required to follow the previously issued pre-discharge monitoring requirements for the batches of discharge from the groundwater storage tanks (T-802 and T-202). However, the batch discharge requirement outlined in item No. 21 below still applies.

21. Pretreatment data for each batch of process solution discharged from the groundwater storage tanks (T-802 and T-202) must be kept in a log book that must be made available for inspection by representatives of the Districts at any time during business hours. This log book must contain the following information:

    A. The date and time a batch treatment begins
    B. The type of treatment provided
    C. The batch discharge tank ID number
    D. The date and time a batch is discharged to the sewer
    E. The volume of wastewater discharged
    F. Initials of the operator with any comments on difficulties encountered during treatment

22. <u>Operation, Maintenance and Calibration of the Groundwater Pretreatment System</u>:

    A. The permittee shall prepare and maintain up to date an Operation and Maintenance Manual of the pretreatment system for ready reference by company employees and Districts' representatives. Checklists for operation and maintenance for routine use should be developed (The manual does not need to be submitted for approval).

    B. The permittee shall operate, maintain and calibrate the pretreatment system per the Operation and Maintenance Manual.

    C. The permittee shall provide an adequate number of qualified personnel to operate and maintain the pretreatment system.

    D. The permittee shall maintain a current operation and maintenance log at the control center of the pretreatment system. The log shall record all pretreatment system malfunctions, equipment failures, and other related information, and shall be properly dated and signed. The log shall be made accessible for inspection by Districts' representatives at all times.

E. The permittee shall maintain an adequate stock of replacement parts for key components of the pretreatment system, and an adequate supply of all pretreatment chemicals and other materials.

23. The discharge of high solids wastes which tend to create obstruction of flow problems in the sewer is prohibited. The permittee may be required to install a solids removal system if it is determined that the discharge from the groundwater pretreatment system causes obstruction problems in the District' sewerage system.

24. Under no circumstances shall process solution spills be discharged directly to the sewer. Unreclaimed or untreated process solution spills shall be hauled to a legal disposal site.

25. Any rainwater discharge to the sewer system must be in accordance with the Districts' *Guidelines For The Discharge Of Rainwater, Stormwater, Groundwater And Other Water Discharges.* Impounded rainwater must only be discharged to the sewer two hours after the cessation of a rain event, at a flowrate not to exceed the permitted peak flowrate of 550 gallons per minute.

26. The permittee is no longer required to submit Self-Monitoring Reports from **sampling location No. 007024**. Changes in the Districts' policies or in the company's business operations may require that your company resume Self-Monitoring in the future.

27. Self-monitoring of the industrial wastewater must be performed at the intervals indicated on the enclosed Self-Monitoring Requirements Forms for **sampling locations No. 807024 and No. 907024** and reported on the Self-Monitoring Report (SMR) forms. The Districts will send the necessary SMR forms before each reporting period. All indicated analyses must be performed by a State or Districts' certified laboratory. The certification section of the SMR forms must be completed and signed by a responsible company official. For each reporting period, the completed SMR form and the corresponding laboratory report must be submitted to the Districts' Industrial Waste Section no later than the due date indicated on the form. The wastewater samples analyzed must be collected in such a way that they are representative of the total discharge generated by a typical day's operations. Each representative sample (composite and/or grab) should be collected over one 24-hour period and analyzed for all parameters in Table 1 of the Self-Monitoring Requirements form. All representative samples must meet all applicable limits. If the permittee is subject to EPA Categorical Pretreatment Standards, violations of categorical effluent limitations must be reported to the Districts within 24 hours of the discharger becoming aware of the violation ((562) 699-7411, extension 2907). Additional sampling and analysis must be conducted for all categorical parameters in violation. The results of the repeat analysis must be submitted within 30 days of becoming aware of the violation. It is the responsibility of the permittee to submit results from any additional self-monitoring, and to notify the Districts of any other toxic materials which are known to be present in the wastewater.

28. The permittee is required to file a Long Form Surcharge Statement. Surcharge tests of the industrial wastewater must be performed at the intervals indicated on the table below of Surcharge Test Frequency and submitted annually with the wastewater treatment surcharge statement. All samples taken for surcharge tests must be collected from **sampling location No. 007024** (the 6" Parshall flume). The permittee is reminded that the <u>surcharge testing requirements are independent of the tests for self-monitoring reports required in Item No. 26.</u>

SURCHARGE TESTING FREQUENCY FOR COD AND SS (Must be 24-hour Composite Samples)	
Yearly Cumulative Flow from Each Outlet (in million gallons)	**Required Testing Frequency**
Less than 15.00	1 sample per 3 months
15.01 to 40.00	1 sample per 2 months
40.01 to 100.00	2 samples per month
100.01 to 250.00	1 sample per week
More than 250.00	2 samples per week

29. Companies subject to EPA regulations under 40 CFR 469 (Electrical and Electronic Components) are required to show compliance with TTO limitations by monitoring for TTO compounds or to operate under a toxic organic management plan (TOMP) approved by the Districts. To this date, the Districts have not approved a TOMP or a Toxic Organic Summary listing the regulated toxic organic compounds stored or used at the facility, for the permittee. Therefore, the permittee will be required to monitor their discharge for TTO compounds as indicated in the Self-Monitoring Requirements form. At a future date the permittee may determine that a TOMP would be suitable in lieu of TTO monitoring. A TOMP could then be submitted to the Districts for review, and upon approval the TTO monitoring requirements would be altered. To reduce, but not completely eliminate TTO monitoring, the permittee may choose to submit a Toxic Organic Summary for Districts approval. An explanation of these options and their benefits is provided in the document entitled Total Toxic Organics - Monitoring Requirements and Toxic Organic Management Plans, which is available at http://www.lacsd.org/iw/forms/tomp.pdf.

30. If the wastewater flowrate and strength data indicate an increase in the sewerage capacity unit usage by 25% or more, the permittee may be required to revise their permit, and will be required to pay a corresponding connection fee should existing sewerage baseline capacity units be insufficient to accommodate discharge at that time.

31. Any floor drains shall have grated covers with 3/8" maximum openings to prevent larger particles from clogging the sewer.

32. In the event of the discharge of any prohibited waste, excessive quantities or concentrations of any restricted waste, or of the discharge of material not covered under this permit, the company must immediately notify the Districts by calling 562-699-7411, extension 2907, during office hours or the Long Beach Pumping Plant, 562-437-6520, during non-office hours.

The Districts must also be notified of any circumstances affecting plant processes or facility operations that may potentially result in the discharge of similarly prohibited or restricted wastes,

including but not limited to the malfunction, upset or improper operation of plant processes, pretreatment systems, spill containment facilities, or diversion/bypass mechanisms. Failure to immediately notify the Districts of any such event or condition is a violation of the *Wastewater Ordinance*.

33. The accompanying Sanitation Districts of Los Angeles County Industrial Wastewater Discharge Permit Fact Sheets **must** be visibly posted by the permittee near the legal sampling points.

34. This approval of the existing pretreatment system by the Districts is for only the general concept presented. The proper maintenance and operation of the system is the responsibility of the permittee and his contractors.

35. Every person or permittee violating any provision of this Industrial Wastewater Discharge Permit (permit) or the Districts' *Wastewater Ordinance* (*Ordinance*) is guilty of a misdemeanor, and upon conviction is punishable as provided by law (California Health & Safety Code Section 4766 currently allows for a fine not to exceed $1000, or imprisonment for not more than thirty (30) days, or both. Misdemeanor violations of California Health & Safety Code Section 25189.5 currently allow for a fine not to exceed $100,000 and imprisonment not to exceed one year. Misdemeanor violations of the Clean Water Act, 33 USC 1319(c) currently allow for a fine not to exceed $25,000 and imprisonment not to exceed one year.) Each day during which any violation continues shall constitute a separate offense. The Chief Engineer is authorized to seek, through the office of the District Attorney of Los Angeles County or other appropriate authority, prosecution of criminal charges against any person violating any provision of the permit or the Ordinance. Violations of discharge limitations established under this permit or the *Ordinance* may also be violations of state and federal environmental laws which may be punishable as felonies and which may also carry substantial fines and penalties (California Health & Safety Code 25189.5 currently allows for a fine not to exceed $100,000 (except the fine can be up to $250,000 for great bodily injury or substantial probability of death) and imprisonment up to 3 years and 33 USC Section 1319(c) currently allows for a fine not to exceed $1,000,000 for a first conviction and imprisonment of up to 15 years.)

    In addition, any person or permittee who violates any provision of the *Ordinance* or any term or condition of any permit issued pursuant to the *Ordinance* or plan approval that prohibits or limits the discharge of any waste or imposes any pretreatment requirement shall be civilly liable to the Districts in the maximum sum provided by law for each day in which such violation occurs (California Government Code Section 54740 currently allows for civil penalties which include, but are not limited to, a fine of up to $25,000 per day of violation.)

36. The permittee shall maintain records of all information resulting from any monitoring activities required by 40 CFR 403.12, including self-monitoring reports and baseline monitoring reports. Such records shall include for all samples:
    A. The date, exact place, method, and time of sampling and the name of the person or persons taking the samples;
    B. The dates analyses were performed;
    C. Who performed the analyses;
    D. The analytical techniques/methods used; and
    E. The results of such analyses.

The permittee is required to retain for a minimum of 4 years any records of monitoring activities and results (whether or not such monitoring activities are required by 40 CFR 403.12) and shall make such records available for inspection and copying by the Districts. This period of retention shall be extended during the course of any unresolved litigation regarding the permittee or when requested by the Districts.

37. In accordance with federal regulations found at 40 CFR Part 403.17, the permittee must not bypass required pretreatment equipment unless the bypass was unavoidable to prevent loss of life, personal injury or severe property damage and there were no feasible alternatives to the bypass and the permittee notified the Districts at least 10 days prior to an anticipated bypass or within 24 hours of an unanticipated bypass. Severe property damage does not include economic loss due to production delays. Feasible alternatives include use of auxiliary treatment facilities, retention of untreated wastes or cessation of production.

The permittee shall submit oral notice of an unanticipated bypass that exceeds applicable categorical effluent limitations to the Districts within 24 hours from the time the permittee becomes aware of the bypass.

A written submission shall also be provided within 5 days of the time that the permittee becomes aware of the bypass. The written submission shall contain a description of the bypass and its cause; the duration of the bypass, including exact dates and times, and, if the bypass has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the bypass. The Districts may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

The permittee may allow any bypass to occur which does not cause Pretreatment Standards or Requirements to be violated, but only if it also is for essential maintenance (i.e. pipe or pump failures) to assure efficient operation. However, routine maintenance should be conducted during normal periods of production downtime. Notification is not required for bypasses that do not result in federal categorical violations.

The Districts will determine whether the permittee has met all bypass criteria above thus avoiding enforcement action for violation of federal categorical regulations. However, this does not relieve a discharger of the responsibility to comply with Districts' *Ordinance* or effluent limitations at all times. Any repair or maintenance costs to Districts' facilities associated with any bypass of pretreatment equipment will be borne by the permittee.

38. Upon request by the Districts, the permittee is required to develop a Slug Discharge Control Plan which complies with the Districts' Spill Containment Guidelines and includes, at a minimum, the following elements:

A. Description of discharge practices, including non-routine batch discharges (non-routine batch discharges are not allowed unless specified as an approved discharge in the permit);
B. Description of stored chemicals;

C. Procedures for immediately notifying the Districts of slug discharges, including any discharge that would violate a prohibition under 40 CFR 403.5(b), with procedures for follow-up written notification within five days;

D. If necessary, procedures to prevent adverse impact from accidental spills, including inspection and maintenance of storage areas, handling and transfer of materials, loading operations, control of plant site run-off, worker training, building of containment structures or equipment, measures for containing toxic organic pollutants (including solvents), and/or measures and equipment for emergency response. ;

E. This plan must be maintained at the discharge location and must be made available for review by Districts' personnel. Copies may be required to be submitted to the Districts for review.

SANITATION DISTRICTS OF LOS ANGELES COUNTY
INDUSTRIAL WASTE SECTION
P.O. BOX 4998
WHITTIER, CA 90607

SELF-MONITORING REQUIREMENTS

Significant Noncategorical Industrial User
Groundwater Pretreatment System

Date	July 31, 2006	Sampling	
Firm Name	Jet Propulsion Laboratory	Location No.	907024
Situs Address	4800 Oak Grove Dr.	Account No.	1710061
	Pasadena, CA 91011	District No.	16
Contact Person	George Beck	SIC No.	9999 9661
Telephone No.	(818) 354-4922	Annual Flow (MGY)	0.80

Sampling Point: Sample box located in the northeastern section of the groundwater treatment pad.

Self-monitoring of industrial wastewater is required as a condition of your industrial wastewater discharge permit. At the frequency specified below, samples must be collected and preserved in accordance with 40 CFR 136.

Frequency of Analysis - Once per six (6) months

Analysis of the samples must be performed for the parameters listed in Table 1 by a laboratory that is certified by either the Districts or the State Department of Health Services.

TABLE 1. REQUIRED WASTEWATER CHARACTERIZATION TESTS

TEST CODE	TEST PARAMETER	UNIT	LIMIT	TYPE OF SAMPLE
101	pH	pH units	≥ 6.0 and ≤ 10.0	Grab
3B2	Perchlorate	ug/l	100	24-hour Composite
662	MTBE	ug/l	5	Grab
696	1,4 Dioxane	ug/l	5	Grab
T09	Volatile Organics[1]	ug/l	1,000	Not Applicable[2]

[1] Volatile and Semi Volatile Organics are defined as the sum of the organics listed with test codes beginning with 6 and 8, respectively, which are individually present at concentrations greater than 10 ug/l. These compounds are included

TABLE 1. REQUIRED WASTEWATER CHARACTERIZATION TESTS				
TEST CODE	TEST PARAMETER	UNIT	LIMIT	TYPE OF SAMPLE
601	Methylene chloride	ug/l		Grab
602	Chloroform	ug/l		Grab
603	1,1,1 - Trichloroethane	ug/l		Grab
604	Carbon tetrachloride	ug/l		Grab
605	1,1 - Dichloroethene	ug/l		Grab
606	Trichloroethylene	ug/l		Grab
607	Tetrachloroethylene	ug/l		Grab
608	Bromodichloromethane	ug/l		Grab
609	Dibromochloromethane	ug/l		Grab
610	Bromoform	ug/l		Grab
611	Chlorobenzene	ug/l		Grab
612	Vinyl chloride	ug/l		Grab
613	o - Dichlorobenzene	ug/l		Grab
614	m - Dichlorobenzene	ug/l		Grab
615	p - Dichlorobenzene	ug/l		Grab
616	1,1 - Dichloroethane	ug/l		Grab
618	1,1,2 - Trichloroethane	ug/l		Grab
619	1,2 - Dichloroethane	ug/l		Grab
620	Benzene	ug/l		Grab
621	Toluene	ug/l		Grab
624	Ethyl benzene	ug/l		Grab

in this list and must be monitored for as a minimum. Your company must report the presence of any additional regulated toxic organic compounds it believes to be present in the wastewater even if it is not listed on this form. Additionally, the Districts must be separately notified in writing that additional compounds are expected to be present in your wastewater and the reason for this change.

[2] Type of sample is specified for each organic compound included in the Volatile and Semi Volatile listing.

TABLE 1. REQUIRED WASTEWATER CHARACTERIZATION TESTS				
TEST CODE	TEST PARAMETER	UNIT	LIMIT	TYPE OF SAMPLE
645	Trans - 1,2 - dichloroethylene	ug/l		Grab
646	Bromomethane	ug/l		Grab
647	Chloroethane	ug/l		Grab
648	2 - Chloroethylvinylether	ug/l		Grab
649	Chloromethane	ug/l		Grab
650	1,2 - Dichloropropane	ug/l		Grab
651	Cis - 1,3 - dichloropropene	ug/l		Grab
652	Trans - 1,3 - dichloropropene	ug/l		Grab
653	1,1,2,2 - Tetrachloroethane	ug/l		Grab
T10	Semi Volatile Organics[1]	ug/l	1,000	Not Applicable[2]
800	Acenaphthene	ug/l		Grab
801	Acenaphthylene	ug/l		Grab
802	Anthracene	ug/l		Grab
803	Benzidine	ug/l		Grab
804	1,2 - Benzanthracene	ug/l		Grab
805	Benzo (a) pyrene	ug/l		Grab
806	3,4 - Benzofluoroanthene	ug/l		Grab
807	1,12 - Benzoperylene	ug/l		Grab
808	11,12 - Benzofluoranthene	ug/l		Grab
809	Bis (2 - chloroethoxy) methane	ug/l		Grab
810	Bis (2 - chloroethyl) ether	ug/l		Grab
811	Bis (2 - chloroisopropyl) ether	ug/l		Grab
812	Bis (2 - ethylhexyl) phthalate	ug/l		Grab
813	4 - Bromophenyl phenyl ether	ug/l		Grab
814	Butyl benzyl phthalate	ug/l		Grab

TABLE 1. REQUIRED WASTEWATER CHARACTERIZATION TESTS				
TEST CODE	TEST PARAMETER	UNIT	LIMIT	TYPE OF SAMPLE
815	2 - Chloronaphthalene	ug/l		Grab
816	4 - Chlorophenyl phenyl ether	ug/l		Grab
817	Chrysene	ug/l		Grab
818	1,2,5,6 - Dibenzanthracene	ug/l		Grab
822	3,3 - Dichlorobenzidene	ug/l		Grab
823	Diethyl phthalate	ug/l		Grab
824	Dimethyl phthalate	ug/l		Grab
825	Di - n - butyl phthalate	ug/l		Grab
826	2,4 - Dinitrotoluene	ug/l		Grab
827	2,6 - Dinitrotoluene	ug/l		Grab
828	Di - n - octyl phthlate	ug/l		Grab
829	1,2 - Diphenylhydrazine	ug/l		Grab
830	Fluoranthene	ug/l		Grab
831	Fluorene	ug/l		Grab
832	Hexachlorobenzene	ug/l		Grab
833	Hexachlorobutadiene	ug/l		Grab
834	Hexachlorocyclopentadiene	ug/l		Grab
835	Hexachloroethane	ug/l		Grab
836	Indeno (1,2,3 - c,d) pyrene	ug/l		Grab
837	Isophorone	ug/l		Grab
838	Naphthalene	ug/l		Grab
839	Nitrobenzene	ug/l		Grab
840	N-nitrosodimethylamine	ug/l		Grab
841	N-nitrosodi-n-propylamine	ug/l		Grab
842	Phenanthrene	ug/l		Grab

TABLE 1. REQUIRED WASTEWATER CHARACTERIZATION TESTS				
TEST CODE	TEST PARAMETER	UNIT	LIMIT	TYPE OF SAMPLE
843	Pyrene	ug/l		Grab
845	2 - Chlorophenol	ug/l		Grab
846	1,2,4 - Trichlorobenzene	ug/l		Grab
847	2,4 - Dichlorophenol	ug/l		Grab
848	2,4 - Dimethylphenol	ug/l		Grab
849	2,4 - Dinitrophenol	ug/l		Grab
850	2 - Methyl - 4,6 - Dinitrophenol	ug/l		Grab
851	2 - Nitrophenol	ug/l		Grab
852	4 - Nitrophenol	ug/l		Grab
853	4 - Chloro - 3 - Methylphenol	ug/l		Grab
854	Pentachlorophenol	ug/l		Grab
855	Phenol	ug/l		Grab
856	2,4,6 - Trichlorophenol	ug/l		Grab
857	N - nitrosodiphenylamine	ug/l		Grab

Self-monitoring results must be reported on the Self-Monitoring Report form provided, along with the appropriate laboratory analysis sheet(s). Due dates are shown in Table 2.

TABLE 2:
SELF-MONITORING REPORTING SCHEDULE[3]

Analysis Frequency	Reporting Period	Due Date[4]
Once per year	July 1 - June 30	July 15 (the following year)
Once per 6 months	January 1 - June 30 July 1 - December 31	July 15 January 15
Once per 3 months	January 1 - March 31 April 1 - June 30 July 1 - September 30 October 1 - December 31	April 15 July 15 October 15 January 15
Once per month	Day 1 - Day 31 of the month	Day 15 (the following month)

[3] The laboratory data sheet(s) for each analysis performed during the reporting period must be included with the Self-monitoring Report form. However, only the results from the most recent sample collected during the reporting period should be recorded on the Self-monitoring Report form.

[4] The Self-monitoring Report form may be submitted before the due date as long as the sample is taken during the appropriate reporting period.

SANITATION DISTRICTS OF LOS ANGELES COUNTY
INDUSTRIAL WASTE SECTION
P.O. BOX 4998
WHITTIER, CA 90607

SELF-MONITORING REQUIREMENTS
Electrical and Electronic Components
Subcategory: Semiconductor

Date	July 31, 2006	Sampling Location No.	807024
Firm Name	Jet Propulsion Laboratory	Account No.	1710061
Situs Address	4800 Oak Grove Dr.	District No.	16
	Pasadena, CA 91011	SIC No.	3674 9661
Contact Person	George Beck	Annual Flow (MGY)	<0.01
Telephone No.	(818)354-4922		
Sampling Point	Scrubber discharge sump located in Room 236 of Building 302		

Self-monitoring of industrial wastewater is required as a condition of your industrial wastewater discharge permit. At the frequency specified below, samples must be collected and preserved in accordance with 40 CFR 136.

Frequency of Analysis is once per six (6) months

Analysis of the samples must be performed for the parameters listed in Table 1 by a laboratory that is certified by either the Districts or the State Department of Health Services.

TABLE 1. REQUIRED WASTEWATER CHARACTERIZATION TESTS

Test Code	Test Parameter	Unit	Daily Max. Limit	30 Day Avg. Limit	Type of Sample
101	pH	pH units	≥ 6.0 and ≤ 10.0		Grab
T04	Total Toxic Organics (TTO)[1]	ug/l	1370		Not Applicable[2]
601	Methylene chloride	ug/l			Grab

[1] TTO is defined as the sum of the organics listed with test codes beginning with 5, 6 and 8 which are individually present at concentrations greater than 10 ug/l. These and other compounds listed in Table 1 must be monitored for as a minimum. Your company must report the presence of any additional regulated toxic organic compounds it believes to be present in the wastewater even if it is not listed on this form.

[2] Type of sample is specified for each organic compound included in the TTO listing.

TABLE 1. REQUIRED WASTEWATER CHARACTERIZATION TESTS

Test Code	Test Parameter	Unit	Daily Max. Limit	30 Day Avg. Limit	Type of Sample
602	Chloroform	ug/l			Grab
603	1,1,1 - Trichloroethane	ug/l			Grab
604	Carbon tetrachloride	ug/l			Grab
605	1,1 - Dichloroethene	ug/l			Grab
606	Trichloroethylene	ug/l			Grab
607	Tetrachloroethylene	ug/l			Grab
608	Bromodichloromethane	ug/l			Grab
613	1,2 - Dichlorobenzene	ug/l			Grab
614	1,3 - Dichlorobenzene	ug/l			Grab
615	1,4 - Dichlorobenzene	ug/l			Grab
618	1,1,2 - Trichloroethane	ug/l			Grab
619	1,2 - Dichloroethane	ug/l			Grab
621	Toluene	ug/l			Grab
624	Ethyl benzene	ug/l			Grab
802	Anthracene	ug/l			Grab
812	Bis (2 - ethylhexyl) phthalate	ug/l			Grab
814	Butyl benzyl phthalate	ug/l			Grab
825	Di - n - butyl phthalate	ug/l			Grab
829	1,2 - Diphenylhydrazine	ug/l			Grab
837	Isophorone	ug/l			Grab
838	Naphthalene	ug/l			Grab
845	2 - Chlorophenol	ug/l			Grab
846	1,2,4 - Trichlorobenzene	ug/l			Grab
847	2,4 - Dichlorophenol	ug/l			Grab
851	2 - Nitrophenol	ug/l			Grab

TABLE 1. REQUIRED WASTEWATER CHARACTERIZATION TESTS					
Test Code	**Test Parameter**	**Unit**	**Daily Max. Limit**	**30 Day Avg. Limit**	**Type of Sample**
852	4 - Nitrophenol	ug/l			Grab
854	Pentachlorophenol	ug/l			Grab
855	Phenol	ug/l			Grab
856	2,4,6 - Trichlorophenol	ug/l			Grab

Self-monitoring results must be reported on the Self-Monitoring Report form provided, along with the appropriate laboratory analysis sheet(s). Due dates are shown in Table 2.

TABLE 2. SELF-MONITORING REPORTING SCHEDULE[3]		
Analysis Frequency	**Reporting Period**	**Due Date[4]**
Once per 6 months	January 1 - June 30 July 1 - December 31	July 15 January 15
Once per 3 months	January 1 - March 31 April 1 - June 30 July 1 - September 30 October 1 - December 31	April 15 July 15 October 15 January 15
Once per month	Day 1 - Day 31 of the month	Day 15 of the next month

[3] The laboratory data sheet(s) for each analysis performed during the reporting period must be included with the Self-monitoring Report form. However, only the results from the most recent sample collected during the reporting period should be on the Self-monitoring Report form.

[4] The Self-monitoring Report form may be submitted before the due date as long as the sample is taken during the appropriate reporting period.

SANITATION DISTRICTS OF LOS ANGELES COUNTY
INDUSTRIAL WASTEWATER DISCHARGE PERMIT FACT SHEET

This fact sheet MUST be visibly posted by the discharger near the legal sampling point No. 007024.

COMPANY NAME	Jet Propulsion Laboratory	**I.W. NO.**	7024 R-3
SITUS ADDRESS	4800 Oak Grove Dr. Pasadena, CA 91011	**SURCH. ACCT.**	1710061
MAILING ADDRESS	4800 Oak Grove Dr. MS200-203 Pasadena, CA 91109-8099	**DISTRICT NO.**	16
TAX ASSESSOR NO.	5817-025-901	**TG**	535/E4
COMPANY CONTACT	Henry D. Koyamatsu	**TELEPHONE NO.**	(818)354-2873
OTHER PERMITS AT SITUS	None		
APPROVAL DATE	July 31, 2006	**EXPIRATION DATE**	July 30, 2011
EVALUATION ENGINEER	Alicia Barrera	**LOCAL AGENCY**	City of Pasadena
LOCATION OF CONNECTION TO PUBLIC SEWER	Local sewer on Oak Grove Dr.		
DISTRICTS' MANHOLE NO.	28-0001	**TREATMENT PLANT**	02 - Whittier Narrows WRP
TYPE OF INDUSTRY	Space Science Research & Development		
SIC NO(S).	9661 3471		
EPA CATEGORY	40 CFR 469 (at sampling location No. 807024)		
HOURS OF OPERATION/DAY	0000 to 2400	**OPERATING DAYS/WEEK**	7
TIME OF DISCHARGE IF DIFFERENT FROM ABOVE		**NUMBER OF EMPLOYEES**	7500
PERMIT FLOWRATE	128,200 gpd	**PEAK FLOWRATE**	550 gpm
PRODUCTS PRODUCED AT SITUS	N/A		
RAW MATERIAL USED AT SITUS	Various metals, substrates, and chemicals.		
APPROVED WASTEWATER PRODUCING OPERATIONS	Alkaline cleaning of PCB's and metal parts, aqueous cleaning of metal parts, RO reject, water jet cutter, car/truck wash pad, film processing rinse, slurry waste from grinding epoxy, wafer processing wet scrubber, groundwater treatment system, chiller and cooling tower bleed-off		
CONSTITUENTS OF WASTEWATER	Dissolved and suspended solids, trace metals and toxic organics		
LEGAL SAMPLING POINT No. 007024	The 6" Parshall flume located inside the fenced southwest end of the JPL facility		
IS SELF-MONITORING REQUIRED?	No		
REQUIRED PRETREATMENT/ EQUIPMENT	Clarifiers and groundwater pretreatment system		
REQUIRED MONITORING EQUIPMENT	Effluent flow measurement system (6" Parshall flume)		
COMPANY SPECIFIC PERMIT CONDITIONS	None.		

IN THE EVENT OF THE DISCHARGE OF PROHIBITED OR RESTRICTED WASTES, PLEASE CALL:
OFFICE HRS: 562-699-7411, EXTENSION 2907; NON-OFFICE HOURS: 562-437-6520

SANITATION DISTRICTS OF LOS ANGELES COUNTY
INDUSTRIAL WASTEWATER DISCHARGE PERMIT FACT SHEET

This fact sheet MUST be visibly posted by the discharger near the legal sampling point No. 807024.

COMPANY NAME	Jet Propulsion Laboratory	**I.W. NO.**	807024
SITUS ADDRESS	4800 Oak Grove Dr. Pasadena, CA 91011	**SURCH. ACCT.**	1710061
MAILING ADDRESS	4800 Oak Grove Dr. MS200-203 Pasadena, CA 91109-8099	**DISTRICT NO.**	16
TAX ASSESSOR NO.	5817-025-901	**TG**	535/E4
COMPANY CONTACT	Henry D. Koyamatsu	**TELEPHONE NO.**	(818)354-2873
OTHER PERMITS AT SITUS	None		
APPROVAL DATE	July 31, 2006	**EXPIRATION DATE**	July 30, 2011
EVALUATION ENGINEER	Alicia Barrera	**LOCAL AGENCY**	City of Pasadena
LOCATION OF CONNECTION TO PUBLIC SEWER	Local sewer on Oak Grove Dr.		
DISTRICTS' MANHOLE NO.	28-0001	**TREATMENT PLANT**	02 - Whittier Narrows WRP
TYPE OF INDUSTRY	Space Science Research & Development		
SIC NO(S).	3674 9661		
EPA CATEGORY	Electrical and Electronic Components EPA Category (40 CFR 469, Subpart A - Semiconductor).		
HOURS OF OPERATION/DAY	0000 to 2400	**OPERATING DAYS/WEEK**	7
TIME OF DISCHARGE IF DIFFERENT FROM ABOVE	Once per six months	**NUMBER OF EMPLOYEES**	N/A
PERMIT FLOWRATE	1,500 gpd	**PEAK FLOWRATE**	5 gpm
PRODUCTS PRODUCED AT SITUS	N/A		
RAW MATERIAL USED AT SITUS	Various metals, substrates, and chemicals.		
APPROVED WASTEWATER PRODUCING OPERATIONS	Wafer processing wet scrubber		
CONSTITUENTS OF WASTEWATER	Dissolved and suspended solids		
LEGAL SAMPLING POINT No. 807024	The scrubber discharge sump located in Room 236 of Building 302 is designated as the sampling point for compliance with 40 CFR 469.		
SELF-MONITORING REQUIRED?	Yes .		
REQUIRED PRETREATMENT	N/A		
REQUIRED MONITORING EQUIP.	N/A		
COMPANY SPECIFIC PERMIT CONDITIONS	The permittee must notify the Districts at least 24 hours in advance of anticipated discharge from the wet scrubber discharge sump. Notification should be made by telephone to Bill Garrett at (562) 699-7411, extension 2907. Batches should be discharged Monday through Thursday only. (Notification for Monday discharges should be made by 3:00 p.m. on the previous Friday.) The permittee will be verbally notified of a suspension and given a date for resumption of the notification requirement.		

IN THE EVENT OF THE DISCHARGE OF PROHIBITED OR RESTRICTED WASTES, PLEASE CALL:
OFFICE HRS: 562-699-7411, EXTENSION 2907; NON-OFFICE HOURS: 562-437-6520

SANITATION DISTRICTS OF LOS ANGELES COUNTY
INDUSTRIAL WASTEWATER DISCHARGE PERMIT FACT SHEET

This fact sheet MUST be visibly posted by the discharger near the legal sampling point No. 907024.

COMPANY NAME	Jet Propulsion Laboratory	**I.W. NO.**	907024
SITUS ADDRESS	4800 Oak Grove Dr. Pasadena, CA 91011	**SURCH. ACCT.**	1710061
MAILING ADDRESS	4800 Oak Grove Dr. MS200-203 Pasadena, CA 91109-8099	**DISTRICT NO.**	16
TAX ASSESSOR NO.	5817-025-901	**TG**	535/E4
COMPANY CONTACT	Henry D. Koyamatsu	**TELEPHONE NO.**	(818)354-2873
OTHER PERMITS AT SITUS	None		
APPROVAL DATE	July 31, 2006	**EXPIRATION DATE**	July 30, 2011
EVALUATION ENGINEER	Alicia Barrera	**LOCAL AGENCY**	City of Pasadena
LOCATION OF CONNECTION TO PUBLIC SEWER	Local sewer on Oak Grove Dr.		
DISTRICTS' MANHOLE NO.	28-0001	**TREATMENT PLANT**	02 - Whittier Narrows WRP
TYPE OF INDUSTRY	Space Science Research & Development		
SIC NO(S).	9999 9661		
EPA CATEGORY	Noncategorical Significant Industrial User		
HOURS OF OPERATION/DAY	0000 to 2400	**OPERATING DAYS/WEEK**	7
TIME OF DISCHARGE IF DIFFERENT FROM ABOVE		**NUMBER OF EMPLOYEES**	N/A
AVERAGE FLOWRATE	18,600 gpd	**PEAK FLOWRATE**	25 gpm
PRODUCTS PRODUCED AT SITUS	N/A		
RAW MATERIAL USED AT SITUS	Groundwater and treatment chemicals.		
APPROVED WASTEWATER PRODUCING OPERATIONS	Backwash of new and spent GAC, slurry transfer of new clean GAC, backwash of sand filter, FBR biomass recovery system, and rainfall within the contained groundwater pretreatment area.		
CONSTITUENTS OF WASTEWATER	Suspended solids, oxygen demand, and trace metals, perchlorate and toxic organics.		
LEGAL SAMPLING POINT No. 907024	Sample box located in the northeastern corner of the groundwater treatment pad.		
IS SELF-MONITORING REQUIRED?	Yes		
REQUIRED PRETREATMENT/ EQUIPMENT	Granular activated carbon (GAC) units, biological degredation of perchlorate in fluidized bed reactor (FBR), aeration tank, multimedia sand filter, and clarifier.		
REQUIRED MONITORING EQUIPMENT	N/A.		
COMPANY SPECIFIC PERMIT CONDITIONS	Permittee must maintain a batch discharge log book .		

IN THE EVENT OF THE DISCHARGE OF PROHIBITED OR RESTRICTED WASTES, PLEASE CALL:
OFFICE HRS: 562-699-7411, EXTENSION 2907; NON-OFFICE HOURS: 562-437-6520