Prepared for:

U.S. Environmental Protection Agency, Region IX 75 Hawthorne Street (SFD-7-3) San Francisco, CA 94105

FIELD PILOT STUDY OF IN SITU CHEMICAL OXIDATION USING OZONE AND HYDROGEN PEROXIDE TO TREAT CONTAMINATED GROUNDWATER AT THE COOPER DRUM COMPANY SUPERFUND SITE

Prepared by:

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December 2006



February 13, 2007

Mr. Eric Yunker Superfund Project Manager U.S. Environmental Protection Agency (SFD-7-3) 75 Hawthorne Street San Francisco, CA 94105

SUBJECT:RAC IX Contract No. W-98-225
Cooper Drum Company WA No. 247-RDRD-091N
Transmittal of Final Field Pilot Study of ISCO Using Ozone
And Hydrogen Peroxide To Treat Contaminated Groundwater

Dear Mr. Yunker:

This letter transmits three copies and four electronic copies of the above referenced field pilot study at the Cooper Drum Company Superfund Site in South Gate, California. EPA Region 9 and DTSC comments have been incorporated in the final report.

If you have any questions or require further information, please contact me at (916) 679-2049.

Sincerely,

URS Group, Inc

Don Gruber Task Manager

Attachment

 cc: Ms. Michelle Simon, U.S. EPA (1 copy w/attachment) Ms. Lori Parnass, DTSC (1 copy w/attachment Site Repository, South Gate, CA (1 copy w/attachment) Project File (w/attachment) Chron File (w/o attachment)

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ACRONYMS

AOP	advanced oxidation process
APT	Applied Process Technology, Inc.
bgs	below ground surface
cfm	cubic feet per minute
COC	contaminant of concern
Cr(VI)	hexavalent chromium
DCA	dichloroethane
DCE	dichloroethene
DHS	Department of Health Services
DO	dissolved oxygen
DPA	drum-processing area
DTSC	California Environmental Protection Agency Department of Toxic Substances Control
EPA	United States Environmental Protection Agency
EW	extraction well
FS	feasibility study
ft	feet
g/hr	grams per hour
g/kg	grams per kilogram
gpd	gallons per day
H ₂ O ₂	hydrogen peroxide
HRC [®]	hydrogen release compound
HSA	hollow-stem auger
HWA	Hard Wash Area
ID	inner diameter
ISCO	in situ chemical oxidation
lb	pound
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mV	millivolt
MW	monitoring well
O ₃	ozone
OD	outside diameter
ORP	oxidation reduction potential

ACRONYMS (Continued)

PLC	programmable logic controller
PRG	preliminary remediation goal
psi	pounds per square inch
PVC	polyvinyl chloride
RD	remedial design
RI	remedial investigation
ROD	record of decision
ROI	radius of influence
RWQCB	Regional Water Quality Control Board
SAP scfh SOD SVOC	sampling and analysis plan standard cubic feet per hour standard cubic feet per minute soil oxidant demand semivolatile organic compound
TCE	trichloroethene
TOC	total organic content
URS	URS Group, Inc.
USCS	Unified Soil Classification System
UV	ultraviolet
VOC	volatile organic compound
WDR	Waste Discharge Requirement
μg/L	micrograms per liter

EXECUTIVE SUMMARY

This report presents the results of a field pilot study using an in situ chemical oxidation (ISCO) technology at the Cooper Drum Company Superfund Site (Site) in South Gate, Los Angeles County, California (see Figure 1). The ISCO technology used in the field pilot study is an advanced oxidation process (AOP) using the application of ozone and ozone with hydrogen peroxide. Given the Site groundwater contaminants (1,4-dioxane and volatile organic compounds [VOCs]), the ISCO process is considered a breakthrough technology. The field pilot study was conducted during the remedial design (RD) phase by the U.S. Environmental Protection Agency (EPA) to determine whether to include ISCO into the groundwater remedy for the Site. Use of an ISCO technology is consistent with the groundwater cleanup strategy contained in the Cooper Drum Record of Decision (ROD). The project team consisted of the EPA Region 9 Superfund Project Manager (Eric Yunker), EPA Office of Research and Development (Michelle Simon), URS Group, Inc., Project Manager (Don Gruber), URS Group, Inc., Senior Engineer (Venus Sadeghi), and Applied Process Technology, Inc. (APT) (Doug Gustafason). The work plan for the pilot study was reviewed and approved by the California Environmental Protection Agency Department of Toxic Substances Control (DTSC). As discussed below, the field pilot study results showed reductions of up to approximately 90% in the site groundwater contaminants of concern (COCs) (see Table 1).

BACKGROUND

The use of ozone/hydrogen peroxide is being evaluated because 1,4-dioxane is purportedly resistant to biodegradation. The use of ozone/hydrogen peroxide for in situ treatment of 1,4-dioxane is innovative and is not known to have been implemented in the past at other sites, in part because 1,4-dioxane is an emergent chemical that has not been monitored routinely in California groundwater. Combined ozone and hydrogen peroxide has been used for ex situ treatment of 1,4-dioxane. Therefore, this field pilot study also served the dual purpose of evaluating the effectiveness of an innovative application of an existing technology at this site and hopefully for use at other federal, state, and private sites.

Before performing the ISCO pilot study, an enhanced reductive dechlorination field pilot study was performed at the site using a hydrogen release compound (HRC[®]). The HRC[®] pilot study was conducted to evaluate whether the naturally reductive conditions in the site groundwater could be enhanced to promote complete reductive dechlorination of groundwater COCs. During the HRC[®] pilot study, groundwater monitoring results for emergent compounds showed the presence of 1,4-dioxane. Because the reductive dechlorination process was not found to be effective on this compound, the HRC[®] Field Pilot Study was discontinued. Consequently, an ISCO bench-scale test was performed in May 2005 on the Site soil and groundwater to evaluate the effectiveness of using ozone and ozone combined with hydrogen peroxide to remediate site groundwater (see Appendix A). The results indicated that ozone alone, as well as ozone combined with hydrogen peroxide, was equally effective in destroying all detected COCs in groundwater. The removal of 1,4-dioxane was apparently enhanced/facilitated by the presence of natural constituents, such as iron and bicarbonate, in the Site soil and groundwater.

PILOT STUDY DESIGN AND OPERATIONS

Data obtained from the bench-scale test and groundwater monitoring performed through April 2005 were used to design and initiate the ISCO pilot study in July 2005. The location of the pilot study was approxi-

mately 140 feet downgradient from the former Hard Wash Area (HWA), the main contaminant source area (see Figures 2 and 3). The installation consisted of a barrier configuration with three ozone/hydrogen peroxide injection wells laterally spaced from 35 and 50 feet apart. Each injection well contained two injection points at approximately 70 and 90 feet below ground surface (bgs). The pilot study monitor wells (extraction well [EW]-1, monitoring well [MW]-33A/33B, and MW-20/20B) were located downgradient and within a maximum of 30 feet of the three injection wells (M_{OX} -1, M_{OX} -2, and M_{OX} -3) (see Figures 4 and 5). Each monitor well location included a shallow (approximately 60 to 63 feet bgs) and deep (85 feet bgs) sampling depth.

The pilot study took place between July 2005 and June 2006 for a period of 321 days (approximately 10.5 months). Oxidant injection during this period generally consisted of the following.

- Ozone only for the first 5 months (148 days) in the 3 injection wells. Ozone was injected at a rate of 0.5 pound per day for 50 days and then increased to 2 pounds per day for the remainder of the 5-month period.
- Ozone and hydrogen peroxide for the remaining 5.5 months;
- Increasing the ozone and hydrogen peroxide injection rates by focusing the injection into only two injection wells after 8 months or 244 days. This phase will be referred to as "focused injection" in the remainder of this report.
- Increasing the ozone injection rate (by adding a second ozone generator) from 2 to 4 pounds per day, and reducing the hydrogen peroxide injection rate to 0.7-to-1 moles peroxide per moles ozone (mole:mole), after just over 9 months (281 days) and for the remaining 40 days of the pilot study.

Optimal system operating parameters were eventually achieved by performing the following:

- Using continuous downhole monitoring of the dissolved oxygen (DO) and oxidation reduction potential (ORP) to evaluate the lateral and vertical effect of varying the operating parameters, such as oxidant injection cycles and injection locations;
- Focusing/increasing oxidant injection into two injection wells (M_{OX}-1 and M_{OX}-2);
- Modifying (reducing) the hydrogen peroxide injection rate; and
- Increasing the ozone injection rate from approximately 2 pounds per day to 4 pounds per day.

Note that air also was injected following each oxidant injection to enhance the distribution of the oxidant. The air volume was increased from 1.1 to 2.2 standard cubic feet per minute (scfm) after 99 days and then decreased back to 1.1 scfm after 244 days, and for the remainder of the pilot study.

MONITORING RESULTS

In situ oxidation of site COCs, including trichloroethene (TCE), cis-1,2-dichloroethene (DCE), 1,1-dichloroethane (DCA), and 1,4-dioxane, was observed in all wells, with significant reductions (up to 90%) in concentrations of both TCE and 1,4-dioxane, which are the primary COCs. The largest decreases in concentration were observed from the three shallow monitor wells. Concentration trends were unique

for each well during the pilot study and are discussed generally hereafter and shown on Figures 7 through 12.

Over the first 5 months of the pilot study, COC concentrations generally showed an overall decrease in the three shallow monitor wells and one deep well (note that one shallow well, MW-33A, showed an increase in TCE prior to the end of the 5-month period). After the 5-month period, when both ozone and hydrogen peroxide were being injected, COC concentrations increased slightly and/or stabilized in the two shallow monitor wells (EW-1 at 63 feet bgs [EW-1-63'] and MW-20) and one deeper well (EW-1 at 85 feet bgs [EW-1-85']). This stabilized trend persisted in one shallow well (EW-1-63') and continued even after initiation of the focused injection. However, the sampling results at this well 40 days after the ozone injection rate was increased from 2 to 4 pounds showed a decrease of 350 micrograms per liter ($\mu g/L$) of 1,4-dioxane and 135 $\mu g/L$ of TCE. At MW-33A, where TCE concentrations increased prior to the injection of hydrogen peroxide (i.e., toward the end of the first 5-month period), the other COC concentrations continued to show an overall decreasing trend throughout the pilot study. TCE eventually decreased at this well by an additional 490 $\mu g/L$. 1,1-DCA concentrations decreased by an average of 73% in the three shallow wells; this is notable, considering the reluctant nature of chlorinated ethanes. Monitoring of the third shallow well (MW-20) was discontinued after injection in the closest injection well (M_{Ox}-3) was terminated as part of the focused injection phase.

CONCLUSIONS

Based on the pilot study monitor well results, the following conclusions are made for the Site.

- Ozone injection alone can significantly reduce the concentrations of the site COCs, including TCE, cis-1,2-DCE, 1,1-DCA, and 1,4-dioxane. At the end of the pilot study, concentrations of 7 out of the 12 Site COCs at EW-1-63' were reduced to below MCLs (PCE was below MCLs prior to the test and remained as such.). Those still present at concentrations greater than MCLs at this well included TCE (65 μg/L), cis-DCE (44 μg/L), 1,1-DCA (6.2 μg/L), and 1,4-dioxane (47 μg/L).
- Increased injection of oxidants increases the amount of contaminant (or COC) destruction.
- The effect of hydrogen peroxide on COC destruction is not clear. However, ex situ testing of the site groundwater does indicate that it is likely that the injection of stoichiometric (0.7–to– 1 mole:mole) or less of hydrogen peroxide to ozone is required to achieve optimal results and to increase oxidation kinetics. This conclusion is supported by the results of laboratory tests conducted to evaluate the destruction efficiency of 1,4-dioxane; one literature source cites the optimal hydrogen peroxide to ozone mole ratio as being greater than zero but less than 0.4 to 0.45 mole:mole (Suh and Mohseni, 2004).
- As corroborated by the bench-test results, the presence of high levels of secondary constituents in the groundwater (e.g., iron, bicarbonates, organic matter) may have enhanced the effectiveness of oxidation by ozone. The presence of these compounds also can lead to scaling, biofouling, and general plugging of equipment installed below the water table. However, during the pilot study, only one well became plugged, and it was easily rehabilitated with a dilute acid.

- Ozone injection rates were crucial to the success of the pilot study. Whereas the soil oxidant demand estimated in the bench test (3 grams per kilogram [g/kg]) appears to have been too high, the pilot study results indicated that an ozone injection rate of 2 pounds per day (lbs/day) per injection well (or 1 lb/day per injection interval) was required to achieve optimal results.
- Overall, a greater radius of influence (ROI) was achieved in the upper injection interval in the shallow aquifer. The ROI of the injection wells appears to be approximately 30 feet, which is the largest distance between an injection well and a monitor well in the pilot study. Vertical profiling of DO and ORP indicated that, for optimal results, the oxidant injection interval probably should be placed a maximum of 10 feet below the targeted treatment area. In addition, the presence of less permeable aquifer material in the 40- to 50-foot bgs interval probably increased the ROI for the shallow injection wells. Therefore, the larger ROI in the upper portion of the shallow aquifer (approximately 50 to 80 feet bgs) may have been related to the injection screen placement and should be considered in full-scale application of the technology.
- Continued migration of contaminant mass from the site source area and the naturally reducing aquifer conditions probably impacted the outcome of the pilot study. A more aggressive network of injection wells and higher oxidant injection rates associated with a full-scale system would be expected to produce a steady reduction in contaminant mass.
- Data logging and the real-time measurement of field parameters, specifically DO and ORP, was crucial to the optimization of the operating parameters.
- The rate of air injection was found not to be a very important factor, though higher injection rates (>1 cubic foot per minute [cfm]) should be avoided to minimize agitating fine sediments in the aquifer.
- An evaluation of the COC destruction trends in conjunction with ORP data (see Section 3.3) indicates that COC destruction was caused by chemical oxidation and not a physical process, such as air stripping
- The introduction of air and oxidants resulted in highly oxygenated and aerobic conditions, which probably promoted the growth of aerobic bacteria. While these bacteria may contribute to direct and/or cometabolic degradation of some COCs, they may cause some biofouling and possible plugging of submerged equipment.
- There was a zero to modest rebound of COC concentrations in the pilot study monitor wells in August 2006, three months after cessation of the pilot study (see Table 7). Some rebound was expected because contaminated plumes originating 30 feet or farther upgradient were expected to reach the pilot study area during this time. Modest rebound was observed in EW-1-63', where the largest reductions in concentrations had been obtained during the pilot study. TCE concentrations also rebounded slightly in MW-20. Conversely, TCE concentrations in MW-33A and 1,4-dioxane concentrations in MW-33A and MW-20 continued to decline during the three months.

RECOMMENDATIONS

In summary, once the system operating parameters were optimized, the ozone/peroxide injection system was successful in achieving the test objectives of evaluating system performance and reducing COC concentrations without significant rebound. Based on these observations, the following recommendations are made.

- The use of this technology is recommended for full-scale application. It is recommended that the lessons learned from the field pilot study (i.e., optimal operating parameters and injection well construction/placement) be considered in the full-scale application of this technology.
- The full-scale system design should include both injection of ozone and hydrogen peroxide. However, operation of the full-scale system could begin with injection of ozone only and transition to combined injection of hydrogen peroxide and ozone at less than stoichiometric mole ratios of peroxide to ozone.
- With robust remedial design of a full-scale system, it is possible to attain MCLs for all site COCs. It is noted, however, that as concentrations approach MCLs, the oxidation reaction kinetics are expected to be first order with respect to the oxidant concentrations and slower than those observed in the pilot study. Therefore, the ISCO system should be designed to address COC concentrations greater than 50 μ g/L. The portions of the plume less than the design concentration but greater than MCLs will be addressed with a downgradient remedy, likely to include groundwater extraction per the ROD.
- The injection wells should be placed so that their ROIs overlap for adequate coverage; therefore, the recommended spacing between injection wells is 50 feet (corresponding to a minimum ROI of 25 feet). The oxidant injection interval probably should be placed at a maximum of 10 feet below the targeted treatment area. Optimal screen placement also will depend on location-specific lithology.
- The full-scale system should be designed for ozone injection rates of 2 lbs/day per injection well (or 1 lb/day per injection interval).
- It is recommended that remediation of the contaminated vadose zone in the source area occur before or concurrently with the full-scale groundwater remediation to minimize further impacts to groundwater.

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1.0 INTRODUCTION

This report presents the results of the field pilot study conducted to evaluate the use of in situ chemical oxidation (ISCO) technology (using ozone and hydrogen peroxide) to facilitate the remediation of 1,4-dioxane and volatile organic compounds (VOCs) in groundwater at the Cooper Drum Company Superfund Site (Site) at 9316 South Atlantic Avenue in South Gate, Los Angeles County, California (see Figure 1). The pilot study was located approximately 140 feet downgradient from the former Hard Wash Area (HWA), which is believed to be the contaminant source area (see Figures 2 and 3). Use of ISCO to remediate contaminated groundwater is consistent with the cleanup strategy selected for groundwater in the *Cooper Drum Record of Decision* (ROD) (United States Environmental Protection Agency [EPA], 2002).

The remainder of this section provides background information on the previous bench-scale and field pilot tests, on the rationale for the present field pilot-test design, and on site hydrogeology and the contaminant plume. Section 2.0 presents the field pilot-study objectives and system design, installation, operation and monitoring. Section 3.0 presents the results of the field pilot test. Section 4.0 provides the conclusions and recommendations. Section 5.0 lists the references cited in this report.

Appendices A through E provide the following documentation:

- Appendix A: Bench-scale test report;
- Appendix B: Field Pilot Study Photographs;
- Appendix C: Boring logs and well completion details;
- Appendix D: Field data sheets; and
- Appendix E: Downhole dissolved oxygen (DO) and oxidation reduction potential (ORP) data.

All tables and figures are provided at the end of this report.

1.1 BACKGROUND

The field pilot study is the second step in conducting treatability studies to evaluate chemical oxidation and to determine whether it is effective under site conditions. A bench-scale test was performed initially in May 2005. The test evaluated the effectiveness of using ozone (O_3) and ozone combined with hydrogen peroxide (H_2O_2) to remediate site groundwater, which was mixed with saturated soil collected at boring SB-33 (see Figure 4) at a depth of 55 to 80 feet below ground surface (bgs).

The results of the bench test indicated that ozone alone, as well as ozone combined with hydrogen peroxide, was equally effective in destroying all detected contaminants of concern (COCs) (see Table 1) in groundwater, including the following:

- 1,4-Dioxane (a relatively recent COC discovered in groundwater since the publication of the ROD);
- Chlorinated ethenes, such as trichloroethene (TCE), isomers of 1,2-dichloroethene (1,2-DCE), both cis and trans isomers, and 1,1-dichloroethene (1,1-DCE); and
- Chlorinated ethanes, such as 1,1-dichloroethane (1,1-DCA).

The bench test discovery that ozone alone was equally capable of destroying 1,4-dioxane in the groundwater was unexpected because this is not commonly observed in ex situ treatment of water contaminated with 1,4-dioxane. In ex situ treatment, the destruction of 1,4-dioxane is achieved by promoting the formation of the hydroxyl radical, either using a combination of ultraviolet (UV) light and hydrogen peroxide, or using hydrogen peroxide in conjunction with ozone. However, it is known that the hydroxyl radical can be produced (at a fraction of the ozone concentration) with ozone alone; literature sources indicate that hydroxyl radical formation can be affected by the presence of iron, soil organic matter, alkalinity (carbonates and bicarbonates), or even olefins (unsaturated hydrocarbons with the general formula C_nH_{2n} , such as ethene) (Bower and Miller, 2002; Donahue, Anderson, and Demerjian, 1998).

Therefore, it was inferred that such constituents in site soil and groundwater might be promoting hydroxyl radical formation even when ozone is used without hydrogen peroxide. This would be a fortunate outcome because it would make it possible to remediate contaminated site groundwater in situ, with ozone injection alone.

To evaluate whether certain soil or groundwater constituents could affect the hydroxyl radical production and 1,4-dioxane destruction, additional bench tests were performed. The results of these bench tests confirmed the initial bench test results and indicated that other constituents, such as iron and bicarbonate, enhance the degradation of 1,4-dioxane. The bench-scale tests also showed the formation of hexavalent chromium (Cr[VI]) and bromate, especially when ozone alone was used. The use of hydrogen peroxide with ozone was found to suppress both Cr(VI) and bromate formation. The final bench test report is included as Appendix A of this report.

A separate field pilot study to evaluate the effectiveness of enhanced reductive dechlorination using a modified hydrogen release compound (HRC[®]) was performed in December 2003 (URS, 2003a). The test consisted of injecting approximately 4,500 pounds of HRC[®] into a 15-foot by 25-foot grid area (see Figure 4, HRC[®] area) in the site source area. The HRC[®] area is approximately 100 feet upgradient from the oxidation field pilot-test area; therefore, contamination originating in the HRC area would be expected to impact the oxidation pilot study area after approximately 10 months. The results of groundwater sampling after the start of the HRC[®] pilot study indicated that injection of HRC[®] promoted and enhanced anaerobic bacterial activity and reductive dechlorination within distances of 50 feet or more directly downgradient from the test area. In fact, full-scale application of HRC[®] may have been feasible to treat VOCs in groundwater had it not been for the discovery of 1,4-dioxane in groundwater. This semivolatile organic compound (SVOC), routinely used as a solvent stabilizer in the past, has been detected in the monitoring wells in the VOC plume footprint at concentrations ranging from below detection limits to a maximum concentration goal (PRG) for 1,4-dioxane is 6.1 µg/L, and the Department of Health Services (DHS) action level for this compound is 3 µg/L.

As a result of the HRC field pilot study, reduced/anaerobic aquifer conditions persisted in the vicinity and downgradient from the HRC injection area. (Accordingly, groundwater originating from this area was expected to present a higher oxidant demand as it passed through the oxidation barrier.)

The use of ozone/hydrogen peroxide is being evaluated because 1,4-dioxane is purportedly resistant to biodegradation. (However, aerobic biodegradation of 1,4-dioxane has been observed in a laboratory setting. See, for example, the paper by Mahendra and Alvarez-Cohen [2006] in which the authors discuss the discovery of no less than 13 bacterial isolates capable of transforming 1,4-dioxane.) The use of ozone/hydrogen peroxide for in situ treatment of 1,4-dioxane is innovative and is not known to have been

implemented in the past at other sites, in part because 1,4-dioxane is an emergent chemical that has not been monitored routinely in California groundwater. As mentioned earlier, combined ozone and hydrogen peroxide has been used for ex situ treatment of 1,4-dioxane. Therefore, this field pilot study also served the dual purpose of evaluating the effectiveness of an innovative application of an existing technology at this site and hopefully for use at other federal, state, and private sites. In addition, the bench test observation that ozone alone, for the specific conditions at the Site, may be capable of producing enough hydroxyl radicals to destroy 1,4-dioxane in the site soil and groundwater was a promising, and potentially cost saving, possibility that was worth pursuing. The same effect can be obtained using a liquid oxidant, such as Fenton's reagent, which also generates hydroxyl radicals. However, liquid oxidants are commonly applied in temporary injection points during injection events and, because of the relatively high costs, are usually more applicable for source area treatment and for COC concentrations greater than 1,000 μ g/L. In addition, there are health and safety concerns with the use of a strong liquid oxidant, such as Fenton's reagent, which can lead to increased subsurface temperatures and off-gassing. In comparison, ozone injection, with or without hydrogen peroxide injection, is an equally aggressive but less costly oxidation process that can be performed cost-effectively in permanent injection wells.

Data obtained from the bench-scale tests, the 2002 Cooper Drum Superfund Site remedial investigation/ feasibility study (RI/FS), and groundwater monitoring performed through April 2005 were used to design this field pilot study. The design involved the injection of ozone, with and without hydrogen peroxide, into the shallow aquifer and monitoring the contaminated groundwater for COC concentrations and other relevant parameters.

Regulatory requirements associated with the field pilot-study design included fulfilling the substantive components (i.e., groundwater monitoring) of the existing General Waste Discharge Requirement (WDR), Order No. R4-2005-0030, for the field test in the Los Angeles Basin, as specified by the California Regional Water Quality Control Board (RWQCB), Los Angeles Region, which were satisfied by the *Cooper Drum Pilot-Scale Field Test Treatability Study Work Plan* (Work Plan) (URS, 2005).

1.2 SITE HYDROGEOLOGY AND CONTAMINANT PLUME

This section provides an overview of the site hydrogeology and the contaminant plume. A detailed description of the site hydrogeology can be found in the 2002 RI/FS report (URS, 2002). The estimated lateral and vertical extent of VOCs (based on TCE concentrations) in the shallow aquifer at the Site is presented on Figure 3. Figure 4 presents a close up of the contaminant plume in the area of the field pilot study. The pilot test was located approximately 120 to 140 feet south-southeast of the HWA, as shown on Figure 4. That figure also includes TCE baseline concentrations for the six monitor wells used during the pilot study. Further discussion of these data is provided in the following sections. A generalized geologic cross section showing the relative locations of the pilot study injection wells and the associated monitor wells is shown on Figure 5.

1.2.1 Site Hydrogeology

As shown on the cross section in Figure 5, the lithology in the pilot study area consists of interbedded deposits of sand and silt with lenses of clay. Shallow groundwater occurs at a depth of approximately 45 to 50 feet bgs. Sandy units varying from very fine to medium and coarse are generally present from approximately 55 to 95 feet bgs, with an underlying finer-grained material. Based on pump test results from EW-1 and EW-2, the average groundwater velocity in this area is estimated at 0.30 foot per day

(ft/day). The groundwater flow direction beneath the former HWA in the northeastern portion of the Site is south to southeast, as indicated on Figure 6. On the eastern side of the Site, along Rayo Avenue, the groundwater flow direction is southerly.

Shallow groundwater beneath the Site occurs within or is controlled by an area of lower permeability, the near-surface Bellflower Aquiclude, which incorporates a perched aquifer. The perched aquifer is present in the HWA at approximately 35 feet bgs and is at least 5 feet thick. The perched aquifer has been observed to be intermittent (for example, from 1991 to 1996 the perched zone was dry), and the lateral extent has not been confirmed. The Bellflower Aquiclude extends to a depth of approximately 70 feet bgs, where it overlies the Gaspur Aquifer (also referred to as the shallow aquifer). This aquifer extends to a depth of approximately 110 feet bgs, the maximum depth of the site lithology presented on Figure 5. Groundwater contamination at concentrations exceeding drinking water standards has been found only down to the shallow Gaspur Aquifer. Finer-grained material (clays and silts) are present within the upper portion of the Bellflower Aquiclude and the lower portion of the Gaspur Aquifer, and they have minimized the vertical migration of COCs (including 1,4-dioxane) down into the Exposition Aquifer and deeper aquifers, which are used for drinking water. Municipal groundwater production wells in the vicinity of the Site draw water from the Gage Aquifer, the deepest of the Lakewood Formation aquifers, at approximately 300 feet bgs, as well as from deeper aquifers within the San Pedro Formation. The Exposition Aquifer is the uppermost unit of the deeper aquifer system, and it underlies the Gaspur Aquifer. The Exposition Aquifer is one of four water-bearing units within the Upper Pleistocene Lakewood Formation.

1.2.2 Contaminant Plume in the Source Area

There is evidence that the contaminant plume in the source area has been affected by natural attenuation and the two pilot tests carried out in the vicinity and downgradient of the HWA.

VOC and 1,4-dioxane concentrations in the site groundwater have been significantly (2 to 3 orders of magnitude) higher beneath the HWA as compared to the DPA. This is consistent with the data plotted on Figure 3, which indicate the TCE plume is originating from the HWA. In the HWA, observed concentrations have been historically up to $800 \mu g/l$ of TCE, $1200 \mu g/L$ of cis-1,2-DCE, and $710 \mu g/L$ of 1,4-dioxane. As shown in the table below, evidence of biodegradation from naturally reductive conditions has been observed at the onsite wells in the HWA (see MW-2). Enhancement of the reductive conditions in late 2003 and early 2004 with the HRC pilot test stimulated significant decreases in VOC concentrations in the HWA that appears to be continuing to the present (see EW-2). For example, overall TCE and cis-1,2-DCE concentrations have decreased in EW-2 (located in HWA just downgradient of the HRC test location but upgradient of the ISCO pilot test location). In addition, ethene concentrations have also increased at this well, indicating the presence of a complete reductive dechlorination sequence. (1,4-dioxane concentrations in EW-2 also decreased by approximately 30% during this period, from approximately 700 to 500 µg/L, but this reduction cannot be attributed to reductive biodegradation).

As will be explained in detail in subsequent sections of this report, results from the August 2006 sampling event (approximately three months after completion of the herein ISCO field pilot study) indicate that COC concentrations have significantly decreased in wells monitored in the location of the ISCO pilot test (located approximately 140 feet downgradient of the HRC test).

In conclusion, reductions in VOC concentrations are evident in the plume source area as a result of the two pilot studies that were carried out in the vicinity. In general, the 100 μ g/L TCE contour shown in

Figure 3 has significantly contracted in both the upgradient and downgradient areas. (A similar reduction has also been observed in cis-1,2-DCE concentrations.) By contrast, significant 1,4-dioxane reductions have mainly occurred in the area of the ISCO pilot study.

$\begin{array}{c c} <10 \\ <1.0 \\ <1.0 \\ 0.5 \\ <25 \\ <1.0 \\ <0.5 \\ <0.5 \\ <0.5 \\ <0.5 \\ <0.5 \\ <0.5 \\ <0.5 \\ <0.5 \\ <0.5 \\ <0.5 \\ <0.5 \\ <0.5 \end{array}$	640 780 800 290 230 240 220 290 220 270 220 370 250	1,100 1,200 800 730 790 810 770 990 730 790 840	46 32 10 15 29 13 12 10 15 19	46 34 19 47 46 52 48 50 46	$ \begin{array}{r} 14\\ 12\\ 5\\ 9\\ <25\\ 17\\ 15\\ 10\\ 11\\ \end{array} $	220 190 52 72 65 75 73 86	97 82 20 30 <25 14 19 19		
<1.0	800 290 230 240 220 290 220 290 220 270 220 370	800 730 790 810 770 990 730 790 840	10 15 29 13 12 10 15	19 47 46 52 48 50 46	5 9 <25 17 15 10	52 72 65 75 73 86	20 30 <25 14 19	0.064	
$\begin{array}{c c} 0.5 \\ <25 \\ <1.0 \\ <0.5 \\ <0.5 \\ <2.5 \\ <0.5 \\ <0.5 \\ <0.5 \\ <0.5 \\ <0.5 \end{array}$	290 230 240 220 290 220 270 220 270 220 370	730 790 810 770 990 730 790 840	15 29 13 12 10 15	47 46 52 48 50 46	9 <25 17 15 10	72 65 75 73 86	30 <25 14 19	0.064	
<25	230 240 220 290 220 270 220 370	790 810 770 990 730 790 840	29 13 12 10 15	46 52 48 50 46	<25 17 15 10	65 75 73 86	<25 14 19	0.064	
<1.0 <0.5 <0.5 <2.5 <0.5 <0.5 <0.5 <0.5 <0.5	240 220 290 220 270 220 370	810 770 990 730 790 840	13 12 10 15	52 48 50 46	17 15 10	75 73 86	14 19	0.064	
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<0.5	290 220 270 220 370	990 730 790 840	10 15	50 46	10	86			
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<0.5 <0.5 <0.5 <0.5	270 220 370	790 840			11			<10.0	69
<0.5 <0.5 <0.5	220 370	840	19		11	64	<2.5	0.88	_
<0.5 <0.5	370			46	23	75	23	0.68	_
< 0.5			11	38E	5.8	61	16	0.6	67
	250	900	23	46	21	130	32	<1.0	100
< 0.5	250	640	14	31	15	85	20	1.1	75
	69	510	7.9	26	30	64D	22	3.4	79
<50	86	1,300	46	39	12	260	46	< 0.67	
<1.0	16	1,200	72	55	13	320	36	0.56	
<5.0	140	1,000	56	44	12	230	39	0.84	
< 0.5	270	1,200	54	63	84	280	48	<8.0	710
<2.0	130	390	27	51	460	250	39	10	
< 0.5	130	210	34	72	1,100	240	41	7.8	700
< 0.5	81	140	12	66	360	260	24	20	560
< 0.5	190	120	25	59	430	250	22	21	510
< 0.5	42	20	4.1	42	190	200	16	88	550
< 0.5	30	46	5.4	40	110	200	21	34	430
2.3	870	370	25	14	5.2	61	17	0.36	
2.2	680	330	27	16	4.9	51	17	0.49	
3	980	490	50	20	5	80	20	<8.0	280
2.8	640	340	29	15	5.8	69	17	<0.6	
2.1	720	430	24	11	64	59	21	0.89	
0.43	450	300	13	11	20	32	10	1.2	170
< 0.5	220	120	28	12	18	35	6	0.5	240
1	390	280	19	17	23	50	12	6.1	360
< 0.5	260	260	20	19	30	55	16	12	280
	2.1 0.43 <0.5 <0.5 <0.5	2.1 720 0.43 450 <0.5	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	2.1 720 430 24 0.43 450 300 13 <0.5	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	2.1 720 430 24 11 64 59 21 0.89 0.43 450 300 13 11 20 32 10 1.2 <0.5

HRC[®] Pilot Study Monitor Well Results

PCE = tetrachloroethene

TCE = trichloroethene

µg/L = micrograms per liter

All results in µg/L

HRC[®] Pilot Study began in December 2003 with the injection of 4,500 pounds of HRC[®].

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2.0 PILOT STUDY DESCRIPTION

This section describes the field pilot study, including its objectives and components. The section describes the ozone and hydrogen peroxide delivery system and the contaminant destruction process, pilot study layout, system installation, monitor well installation, system operation, and groundwater monitoring program.

2.1 PILOT STUDY OBJECTIVES

The primary objectives of the pilot-scale field test were generally the same as those for the bench-scale test:

- To determine whether ozone, with or without hydrogen peroxide, is capable of destroying 1,4-dioxane and the other COCs; and
- To further assess the soil oxidant demand.

The overall goal was to determine whether ozone/hydrogen peroxide injection is a viable full-scale cleanup strategy for the site groundwater. Unlike the bench-scale test, the field pilot study was performed in situ, under actual site conditions, and was evaluated using data collected from the site monitor wells.

The pilot-scale field test would be deemed successful if the following were observed:

- Concentrations of target COCs were significantly reduced;
- Field monitoring indicated no permanent increase in unwanted products, such as hexavalent chromium and bromate; and
- There was no significant rebound in COC concentrations within a reasonable timeframe, after allowing for the influx of upgradient COCs.

2.2 PILOT STUDY COMPONENTS

2.2.1 Specifications of Ozone and Hydrogen Peroxide Delivery System

The pilot-scale field test consisted of a barrier configuration with three ozone/hydrogen peroxide injection wells and an ozone and hydrogen peroxide delivery system. Applied Process Technologies (APT) provided the ozone/hydrogen peroxide delivery equipment, consisting of a trailer unit chemical oxidation system, the Pulse-Ox 100T, which can direct moderate flow rates of ozone and hydrogen peroxide into injection wells fitted with proprietary MaxOx injection points. The system is designed to remediate both adsorbed and dissolved-phase organic compounds. APT, in Pleasant Hill, California, is a vendor/operator of the remediation equipment and provides a wide range of delivery systems that can supply up to 15 pounds per day (lbs/day) of ozone. Photographs of the Pulse-Ox 100T system and the pilot study injection wells are provided in Appendix B of this report (to be provided in the final report).

The trailer system can be operated to inject individual or variable combinations of air, oxygen, ozone, and hydrogen peroxide into the saturated zone. It uses a pressure-swing adsorption oxygen-generating system

for the production and delivery of up to 23 standard cubic feet per hour (scfh) of 90% to 95% oxygen, and it provides sufficient oxygen for the ozone generator to produce up to 36 grams per hour (g/hr) (approximately 2 lbs/day) of ozone. A standard chemical feed pump delivers the hydrogen peroxide from a tank storing 35 gallons of 7% to 35% strength hydrogen peroxide. An air compressor with an 8-port gas delivery manifold provides up to 3.9 standard cubic feet per minute (scfm) of compressed air at 60 pounds per square inch (psi). The Pulse-Ox 100T also contains a 24-port gas/chemical delivery manifold with 0.25-inch stainless steel solenoid valves for pulsing oxygen, air, ozone, and/or hydrogen peroxide into a maximum of eight wells; it is controlled through an integrated programmable logic controller (PLC) system that controls valve sequencing and activates all audio/visual alarms. A call-out modem is included for reporting the system operational status.

2.2.2 Pilot Study Layout

The pilot-scale field test implemented an injection barrier comprising three proprietary $MaxOx^{\text{(8)}}$ ozone/hydrogen peroxide injection wells completed in the vicinity of EW-1 and MW-20. The pilot study layout is presented on Figures 4 and 5. Naturally occurring reductive conditions are observed in this area but not to the extent observed in upgradient monitoring wells closer to the HRC⁽⁸⁾ injection area, such as EW-2 and MW-21. The concentration of COCs in this area has remained high, with initial TCE and 1,4-dioxane concentrations greater than 750 μ g/L (Figure 5).

The injection wells contained injection points at depths of 70 and 90 feet bgs and were laterally spaced from 35 to 50 feet apart. The radius of influence (ROI) of each injection well was conservatively assumed to be 15 to 20 feet; therefore, to maximize the use of existing monitoring wells, an injection well was installed 15 feet upgradient from EW-1, and another injection well was installed 10 feet upgradient from MW-20. The third injection well was placed between MW-20 and EW-1 (Figure 4). Subgrade piping was installed to connect the individual wells to the Pulse-Ox 100T reagent delivery system, as shown on Figure 4.

2.2.3 System Installation

During the week of July 5, 2005, the three dual-completion MaxOx wells and three additional monitor wells were installed by Gregg Drilling and Testing of Signal Hill, California. Hollow-stem auger (HSA) drilling methods were used to install the wells inside a 10-inch diameter soil boring. Drilling and well installation were directed by a URS geologist using the methods specified in the *Cooper Drum Company Remedial Design Sampling and Analysis Plan* ([RD SAP]; URS, 2003b).

The injection wells were proprietary MaxOx[®] wells with the following components: two hydrogen peroxide and two ozone injection screens, each completed with 1-inch outer diameter (OD) stainless steel, 0.02-inch, V-slotted screens, 0.5-inch OD stainless steel tubing, and check valves to prevent backpressure into the injection lines. The ozone and hydrogen peroxide screens for each depth range were provided in a pre-fabricated assembly. The MaxOx[®] injection assembly was installed with the ozone screen at 90 feet bgs, the bottom of the injection well boring. A Monterey No. 3 sand filter pack was placed surrounding the screens to a depth of 1.5 feet above the top of the screen. A 1.5-foot bentonite seal was then placed above the sand pack surrounding the 1-foot-long ozone screen to prevent short-circuiting. The 3-foot-long hydrogen peroxide screen and to a depth of 2 feet above the top of the screen. The borehole was then sealed with bentonite to a depth of 72 feet bgs, where the upper MaxOx[®] unit was placed in the borehole and

installed as described for the deeper unit. Following the installation of the prefabricated assembly and tubing, each borehole was filled with bentonite and then completed with a protective, lockable access vault. Construction diagrams and boring logs for the MaxOx[®] injection wells are included in Appendix C.

Following the injection well installations, trenching was performed, and the conveyance piping/tubing was installed from the well vaults to the PulseOx trailer. Teflon tubing (3/8-inch inner diameter [ID]) was used for the ozone, and polypropylene (1/4-inch ID) was used for the hydrogen peroxide. All tubing was contained in 1.5-inch diameter Schedule 40 polyvinyl chloride (PVC) pipe.

2.2.4 Monitor Well Installation

Three new monitor wells (MW-20B, MW-33A, and MW-33B) were installed downgradient from the MaxOx[®] wells at the locations/depths where previously installed monitor wells were not present. The monitor well spacing from the injection locations was varied (10, 15, 20, and 30 feet) (Figure 4) to evaluate the ROI of the injection wells. During drilling of the monitor wells, soil samples were collected for lithologic logging purposes and logged according to the Unified Soil Classification System (USCS). Soil boring logs are presented in Appendix C. Groundwater monitor wells were constructed in boreholes using 2-inch ID, Schedule 40, flush-threaded PVC well casing. Ten feet of 0.020-inch machine-slotted well screen was set at the bottom of each boring. A Monterey No. 3 sand filter pack was installed from the bottom of the boring to 4 feet above the well screen. A 3-foot bentonite seal was placed above the sand pack, and bentonite-cement grout was used to seal the remaining annular space to the surface. The surface completions are traffic-rated, flush-mounted well boxes. Locking well caps were placed on the top of the casings. Well completion details are presented on the boring logs (Appendix C).

2.2.5 System Operation

The oxidation system was brought on line on July 19, 2005. System operation was conducted under the following conditions.

- For the first 148 days (5 months) of operation, ozone and air alone were injected sequentially in the 6 injection points during an hour-long cycle. Ozone was injected at a rate of 0.55 lbs/day for the first 45 days, at which time the ozone injection rate was increased to approximately 1.9 lbs/day over the next 3 weeks. The injection sequence consisted of 10 minutes of ozone/air followed by 5 minutes of air alone into each injection point. The initial volumetric flow rate of pulsed air was 1.1 scfm, which was increased to 2.2 scfm after approximately 100 days of operation.
- Hydrogen peroxide injection was initiated after 148 days (5 months), at a two-to-one mole ratio of peroxide to ozone (2.5 gallons per day [gpd] of 16% hydrogen peroxide solution). Hydrogen peroxide was injected for an hour, followed by 5 hours of lag time. After 195 days of operation, the lag time was reduced to 2 hours, in effect doubling the hydrogen peroxide injection rate (i.e., 5 gpd of 16% hydrogen peroxide solution). Also at this time, two of the deeper injection points (the deeper injection screens of M_{OX} -1, M_{OX} -2), which were found to be plugged, were cleared up. (Note that plugging of M_{OX} -2 occurred as a result of infiltration of fines during installation and was cleared with high pressure water jetting. M_{OX} -1 became plugged after being temporarily shut down. There appeared to be a greenish bio-film on the tubing lowered into the well during an acid treatment; however, acid treatment rehabilitated the well screen, suggesting the screen may have been calcified.)

- After 244 days (8 months), the injection of ozone and hydrogen peroxide was limited to wells M_{OX}-1 and M_{OX}-2 (at shallow and deep intervals) to evaluate the effect of focused ozone/peroxide injection on COC concentrations in monitor wells EW-1 and MW-33. At this time, the ozone injection sequence consisted of a 30-minute cycle, with 5 minutes of ozone in the shallow injection screens and 10 minutes in the deeper injection screens. The hydrogen peroxide injection remained at one hour on, followed with 2 hours of lag time. The focused injection was initiated because continuous data logging with a downhole ORP/DO probe indicated that elevated ORP levels could be sustained over longer time periods when oxidant injection was restricted to a smaller volume, thus increasing the oxidant concentrations. (Downhole data logging was initiated when negative ORP values were observed in the shallow monitor wells [EW-1 and MW-33A] during the November 2005 and January 2006 groundwater sampling events. See Section 3.3 for additional detail.)
- After 281 days (approximately 9 months), an additional ozone generator was installed, and the rate of ozone injection into M_{OX} -1 and M_{OX} -2 was doubled to approximately 4 lbs/day. At this time, the hydrogen peroxide injection rate was reduced (1 hour on, followed by 4 hours of lag time) to obtain a stoichiometric (0.7-to-1 mole:mole) ratio of peroxide to ozone.
- After 292 days (approximately 10 months), ozone injection was increased from 5 minutes to 10 minutes in M_{OX}-1A (shallow interval), thus extending the ozone injection cycle from 30 to 35 minutes.

From system startup on July 19, 2005, until termination of the pilot study on June 5, 2006, the PulseOx-100T operated over a period of 321 days, for a total of 7,182 hours, which equates to an uptime of 93 percent. A detailed summary of all system operational events that occurred during the pilot study is presented as Table 2. A summary of pilot study costs are presented in Table 3.

2.2.6 Groundwater Monitoring Program

Performance of the pilot-scale field test was evaluated using groundwater monitoring that was conducted at 3- to 6-week intervals. Five wells (MW-20 and EW-1 and new wells MW-20B, MW-33A, MW-33B) were monitored to validate the ozone/hydrogen peroxide advanced oxidation process. Well MW-20 is screened from 55 to 70 feet bgs, and the EW-1 screen interval is 48.5 to 88.5 feet bgs. Because of the long screen interval in EW-1 (40 feet), groundwater samples were collected at two depths in this well (63 and 85 feet, as shown on Figure 3). New well MW-20B is screened from 80 to 90 feet bgs; wells MW-33A and MW-33B are screened from 55 to 65 feet bgs and 80 to 90 feet bgs, respectively. Well MW-20, MW-33A, and EW-1 were consistently sampled at depths of 63, 60, and 63 feet bgs, respectively. Wells MW-20B, MW-33B, and EW-1 were consistently sampled at 85 feet bgs. For the purpose of evaluation, MW-20, MW-33A, and EW-1-63' are referred to as shallow wells and MW-20B, MW-33B and EW-1-85' are referred to as deep wells.

On July 12, 2005, an initial or "baseline" round of sampling was performed to identify groundwater conditions before the startup of the ozone/hydrogen peroxide injection system. After system startup, groundwater samples were collected every 3 weeks for 9 weeks, followed by every 4 to 6 weeks for 36 weeks based on evaluation of the concentration trends. A total of 13 groundwater sampling events were performed.

The monitoring protocol employed standard low-flow groundwater sampling techniques with a flow through cell (as specified in the RD SAP) (URS, 2003b). The RD SAP has been updated with an addendum to include the treatability testing, the ongoing monitoring for natural attenuation parameters, and the ongoing sampling of new wells. The addendum is included in the *Cooper Drum Pilot-Scale Field Test Treatability Study Work Plan* (URS, 2005).

The monitor wells were sampled by URS scientists, with the assistance of a field technician from Blaine Tech Services. Field parameters measured during well purging and sampling were recorded on the field data sheets presented in Appendix C. Groundwater samples were shipped by Federal Express to the EPA Region 9 Laboratory in Richmond, California, within 24 hours of collection. Samples analyzed for metals were sent by Federal Express to independent laboratories. On three occasions (July 12 and 28, 2005, and March 1, 2006), the VOC samples also were shipped to an independent laboratory. Given the 24-hour hold time requirements, samples analyzed for Cr(VI) were delivered by courier to EMAX laboratory on the day they were collected. All samples were transported in a cooler with ice under chain-of-custody protocol. The electronic data tables provided by the laboratory and the data validation reports are available at the Records Center at EPA Region 9 in San Francisco.

Beginning on February 21, 2006, URS installed data loggers with downhole probes (YSI 600 XLM system) in wells EW-1, MW-20, and MW-33A to measure the real-time response of DO and ORP to adjustments made in the timing of system operation cycles. Downhole data logging was initiated as a result of negative ORP readings during the November 2005 and January 2006 sampling events, which happened to coincide with the leveling off of COC concentrations. Earlier, DO and ORP were routinely monitored in the flow-through cells during the sampling events. On two occasions (August 5 and December 14, 2005), the DO and ORP readings were verified with a downhole probe in response to low ORP readings. The data logging data, which were downloaded from the downhole probes, are presented in Appendix E. In addition, vertical profiling at 5-foot intervals in the monitor wells was performed; these results also are included in Appendix E. The roster of measured field parameters was modified to include the occasional use of field test kits for hydrogen peroxide and ozone testing.

Water-level measurements were collected during each sampling event from the five monitor wells and selected wells in the area. The water-level data sheets are included in Appendix E.

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3.0 **RESULTS**

An interpretation of groundwater elevations and analytical data from the 13 monitoring events is provided in the following sections.

3.1 GROUNDWATER FLOW DIRECTIONS AND GRADIENTS

A recent groundwater elevation contour map of the site, based on depth-to-water measurements made on June 6, 2006, is presented as Figure 6. The data indicate that the groundwater gradient in the area of the pilot study was to the south at 0.0017 feet per foot. This is consistent with previous flow directions inferred for this portion of the site and confirms that the monitor wells sampled during the pilot study are generally downgradient from the nearest injection point.

The water levels measured from the shallow wells MW-20 and MW-33A increased up to approximately one foot when compared to the deeper well pair (MW-20B and MW-33B) and more distant wells in the vicinity of the test. This response probably was related to the injection cycle. Considerable air pressure was evident in these wells (and in EW-1) when the well caps were removed for sampling. However, water levels in EW-1 did not appear to be elevated from the injection. The deeper monitor wells and those more distant from the injection wells did not appear to be influenced by the injection.

The pressure buildup observed in the shallow monitor wells is directly related to the finer material (clays and silts) that have been identified as beneath the site from approximately 40 to 50 feet bgs (Figure 5). This material also supports the perched aquifer zone previously identified. The injected air and ozone does not readily flow up through this material, therefore, a temporary pressure buildup is created when the system operates. Consequently, the migration of ozone through the vadose zone and to the surface is very unlikely, and larger injection ROIs would be expected in the shallow injection interval.

3.2 TREND ANALYSIS OF COC CONCENTRATIONS

3.2.1 Shallow Monitor Wells

The concentrations over time of select COCs reported in groundwater samples from shallow monitor wells EW-1 (at 63 feet bgs), MW-33A, and MW-20 are depicted in Figures 7, 8, and 9, respectively. These figures also indicate changes made to the system operating parameters described in Section 2.6. COC concentration data are presented in Table 4. Other general groundwater chemistry data and metal results are presented in Table 5. The following observations are made.

- The COC concentrations display unique trends in each of the monitoring wells.
- Figure 7, EW-1 (at 63 feet bgs): Decreasing COC concentration trends were observed almost immediately after the start of system operation. Maximizing the ozone injection rate had a relatively small effect on these trends. Doubling the air flow rate followed by the start of hydrogen peroxide injection did not improve concentration trends; rather, the start of hydrogen peroxide injection appeared to coincide with a period of increasing COC concentrations. However, the start of focused injection into M_{OX}-1 and M_{OX}-2 and doubling of the

ozone injection rate resulted in significant reduction (>75%) in TCE and 1,4-dioxane concentrations.

- Figure 8, MW-33A: With the exception of 1,4-dioxane, COC concentrations first increased and then leveled off and decreased, once the ozone injection rate was increased. Increasing the volumetric air flow rate appeared to coincide with a period of increasing trends in COC concentrations. Injection of hydrogen peroxide did not significantly affect these trends; however, there was a decrease in COC concentrations once the peroxide injection rate was doubled. There was an additional decrease in concentrations following focused injection into M_{OX}-1 and M_{OX}-2 and after the ozone injection rate was doubled, but the decrease was moderate (<30%). Aside from the moderate increase of TCE midway through the test, COC concentrations steadily decreased throughout the test.
- Figure 9, MW-20: Decreasing COC concentration trends were observed immediately after the start of system operation, but they seemed to level off shortly thereafter. Maximizing the ozone injection rate and increasing the air flow rate had a relatively small decreasing effect on the concentration trends. Injection of hydrogen peroxide did not improve concentration trends; rather, the start of hydrogen peroxide injection coincided with a period of increasing COC concentrations. COC concentrations decreased when hydrogen peroxide was doubled but rebounded after ozone and hydrogen peroxide injections ceased in M_{OX}-3, which is the closest injection well to MW-20.

3.2.2 Deep Monitoring Wells

The COC concentration trends in wells EW-1 (85 feet), MW-33B, and MW-20B are depicted in Figures 10 through 12, respectively.

The data plotted in Figures 10 through 12 show that, in all wells, the initial increase in the ozone injection rate resulted in decreasing concentration trends while doubling the air flow rate and start of hydrogen peroxide injection generally did not (there is an exception in the case of EW-1, where concentrations appeared to decrease following the increase in air flow rates). However, doubling the hydrogen peroxide injection rate coincided with additional reductions in concentrations, especially in MW-33B and MW-20B. The start of focused injection into M_{OX} -1 and M_{OX} -2, followed by doubling of the ozone injection rate, resulted in significant concentration reductions in EW-1 and, to a lesser degree, in MW-33B. As with MW-20, concentrations rebounded in MW-20B after oxidant injection into M_{OX} -3 ceased.

3.2.3 TCE and 1,4-Dioxane Concentrations

For a better perspective, the reported concentrations of TCE and 1,4-dioxane for the six monitoring locations at the beginning and end of the pilot-scale test are listed in Table 6 and shown on the geologic cross section of the sparge barrier on Figure 5.

On average, TCE concentrations decreased by 83%, and 1,4-dioxane concentrations decreased by 74% in the shallow monitor wells. The largest reductions were observed in EW-1 (63 feet), where COC reductions exceeding 90% were obtained. Note that the data provided in Table 6 for MW-20 and MW-20B are from April 2006 when oxidant injection ceased in the vicinity of this well.

Although not included in Table 6, the 1,1-DCA concentrations decreased by an average of 73% in the three shallow wells. This is very notable, considering the reluctant (ITRC, 2005) nature of chlorinated ethanes.

There were overall decreasing concentration trends in the deeper wells as well, with TCE concentrations decreasing an average of 48% in all of the wells. The largest decrease in TCE concentrations was observed in MW-20B, which is unexpected because injection into the nearest injection well ceased after approximately 260 days and this well did not benefit from the increase in ozone injection that occurred after this period. The 1,4-dioxane concentration reduction in EW-1 at 85 feet bgs, since the start of the pilot test, was 82 percent. However, initial 1,4-dioxane concentrations in MW-33B and MW-20B were too low to allow for any meaningful interpretation of concentration trends.

The concentration reductions in the deeper monitor wells, overall, were less than in the shallow monitor wells. The reason may be related to the cone-like diffusion pattern of injected ozone and air from the injection well screens, which results in an increasing ROI with vertical distance above the injection point. In addition, the presence of less permeable aquifer material in the 40- to 50-foot bgs interval probably increased the ROI for the shallow injection wells.

The reported reductions in TCE and 1,4-dioxane concentrations indicate that the application of ozone and hydrogen peroxide was effective at oxidizing the site COCs. Because of the complexity of the groundwater chemistry and the possible contribution from the upgradient source area, it was necessary to use an experimental approach to determine the optimal injection rates for ozone and hydrogen peroxide. It appears that the ozone injection rate is the critical factor in achieving maximum concentration reductions. However, it also is likely that the addition of hydrogen peroxide at stoichiometric ratios to ozone is an important factor. This presumption is corroborated by ex situ testing of water from MW-33A, which indicated that the oxidation reaction kinetics were enhanced by the addition of hydrogen peroxide. Figure 13 is a plot of the test results and shows the correlation between 1,4-dioxane concentrations and ozone. These results indicated that the 1,4-dioxane destruction rate (represented by the slope of the curve when 1,4-dioxane was plotted versus ozone) increased three-fold when hydrogen peroxide was used in addition to ozone. However, the results also showed that better destruction rates were obtained when water from another site was used, indicating that the Site groundwater probably had a larger soil oxidant demand (SOD). In addition, bench testing results previously indicated that addition of hydrogen peroxide suppressed both hexavalent chromium and bromate formation. At least one literature source (Suh and Mohseni, 2004) cites the optimal hydrogen peroxide to ozone mole ratio as being greater than zero but less than 0.40 to 0.45 mole: mole. Therefore, hydrogen peroxide and ozone should be injected at less than stoichiometric mole ratios, when used in a full-scale application.

No harmful by-products were created as a result of the pilot study. As indicated on Table 5, hexavalent chromium was not reported in any of the samples. Although not shown in Table 5, groundwater samples collected on June 5, 2006, also were analyzed for bromate. Bromate was not detected in these samples at levels exceeding the detection limit of $250 \mu g/L$.

3.3 DO AND ORP MEASUREMENTS

DO and ORP measurements are routinely considered the most important field parameters with respect to gauging the effectiveness and the ROI of the oxidant injection process. If oxidant injection is performed

successfully, DO and ORP levels are expected to rise. However, it should be noted that the range of these measurements may be undermined by ongoing chemical reactions in the surroundings, and by device selection and device calibration. For example, DO and ORP measurements using downhole and flow-through cell devices often differ significantly, probably because one is measured in situ and the other ex situ. Therefore, whereas the DO and ORP trends can be very helpful, individual readings may be less reliable or even contradictory.

3.3.1 Flow-Through Cell Measurements

The DO trends since the start of oxidation in the shallow and deep wells are shown on Figures 14 and 15, respectively. These data were collected during the groundwater sampling events using the flow-through cell. DO levels responded well to increases in oxidant amounts, as is evident from the positive slopes in the DO curves following increases in ozone and hydrogen peroxide injection rates. Surprisingly, DO levels did not respond positively to the doubling of the air injection rate. This may have been caused by the perturbation of fine sediments following the increase in injected air flow rates.

ORP trends in shallow and deep wells are depicted on Figures 16 and 17, respectively. These data also were collected using the flow-through cell. Similarly to DO trends, the ORP trends responded positively to increases in oxidant injection rates but negatively to increased air flow rate.

DO and ORP measurements (used to construct Figures 14 to 17), as well as other field parameter readings, are listed in Table 3. Note that the DO and ORP values shown on these figures represent a single measurement taken over an extended (4 to 6 week) period. However, these data are useful because they show a general trend with the COC destruction in the shallow monitor wells. For example, during the first three months of the pilot study, COC concentrations were decreasing and ORP values were also positive (see Figure 16). After this time, negative ORP values were observed during the sampling events and COC concentrations also leveled off. In late February 2006, a downhole probe was used to allow for continuous data logging of ORP (discussed in following section). The information obtained during this period led to the decision to focus the injection and ultimately to increase the ozone injection rate at individual injection wells.

3.3.2 Downhole Probe Measurements

Following these negative ORP readings, 24-hour downhole data logging was performed at MW-20 on February 21, 2006, with only M_{OX} -3 operating. These results indicated elevated ORP and DO levels could be sustained when the injection was focused at a single location. Additional data logging performed from March 20 through March 30, 2006, with only M_{OX} -1 and M_{OX} -2 operating, further supported the presence of sustained elevated levels of ORP and DO. Therefore, a decision was made to focus oxidant injection into M_{OX} -1 and M_{OX} -2 only and to continue to assess the real-time effect of varying operating parameters on DO and ORP levels with the data logging.

Results from data loggers installed and operated in EW-1 (63 feet) and MW-33A from April 17 through June 1, 2006 (272 to 317 days after the start of operations) are presented on Figures 18 and 19; these plots show the continuous ORP readings in EW-1 and MW-33A during this time.

In EW-1 (Figure 18), ORP levels remained negative during the first few days of data logging. On April 25, the system was temporarily shut down, and a second ozone generator was installed and operated, providing an ozone injection rate of approximately 4 lbs/day. Also at this time, the hydrogen

peroxide-to-ozone mole ratio was reduced to stoichiometric levels (0.7 to 1), and the air flow rate was reduced back to 1.1 scfm. Following these operational changes, there was a gradual build up in ORP levels to a sustainable ORP level greater than 300 millivolts (mV). These elevated ORP levels were regained shortly after the restart of system operations, following a temporary system shutdown on May 15.

The ORP readings in MW-33A (Figure 19) reflect a steadier elevated profile, but with similar end results. The surrounding lithology in MW-33A is more permeable, resulting in a more immediate response to oxidant injection, compared to EW-1.

The continuous data logging in EW-1 and MW-33A and the achievement of the sustainable and elevated ORP levels in these wells implied that the system operating parameters were at an optimal setting. Therefore, no further changes to the system operations were applied after this time.

These resulting conditions were a clear indication that oxidation was effective in the vicinity of the monitor wells. As noted in Section 3.2, COC concentrations in EW-1 were significantly reduced during this period (see Figure 7), indicating COC destruction was related to chemical oxidation and not a physical process such as air stripping. At 20°C, the dimensionless Henry's constants for TCE, 1,1-DCA, 1,2-DCA and 1,4-Dioxane are: 0.42, 0.23, 0.04, and 0.0002, respectively. TCE is the most volatile and has the highest Henry's constant and 1,4-dioxane (at 2,100 times lower than TCE) has the lowest Henry's constant and is only semi-volatile. The larger the Henry's constant, the more effectively the material is removed using air stripping. The results from EW-1 at 63 feet bgs over the length of the test indicate the TCE, 1,1-DCA, 1,2-DCA, and 1,4-dioxane destruction percentages are very similar (at 90%, 92%, 89%, and 94%, respectively). Considering the differences in volatility, these destruction percentages do not support an air stripping model.

Furthermore, guidelines on effective air sparging for in situ air stripping recommend air volumetric flow rates in the range 3 to 25 cfm (preferably in the higher range of 20 to 25 cfm). By contrast, the injection air flow rate maintained during the most effective portions of the pilot test was approximately 1 cfm. These low air flow rates would have had little or no effect on the less volatile constituents, such as 1,4-dioxane and 1,2-DCA. Additionally, the Site lithology is such that, in the absence of soil vapor extraction (SVE), a good fraction of hypothetical stripped gases would be expected to re-enter the dissolved phase, resulting in higher rebound in COC concentrations than what was observed three months after the pilot test was stopped.

The above is also supported by the bench-scale test (See appendix A), which indicated that the specific site soil and groundwater geochemistry likely led to effective chemical oxidation of all site COCs, even with ozone alone. The bench test indicated that none of the COC destruction occurred as a result of air stripping, as evidenced by the absence of COCs in the headspace of the test bottles. It is likely that the particular conditions of the site subsurface geochemistry may have led to formation of high concentrations of the hydroxyl radical, a non-selective oxidant capable of destroying "reluctant" contaminants, such as isomers of DCA. The characterization of DCA as "reluctant" (as opposed to "recalcitrant") comes from the 2005 ITRC guidance document "*Technical and Regulatory Guidance for In Situ Chemical Oxidation of Contaminated Soil and Groundwater*". This characterization implies that oxidation of DCA is to be expected when ozone and hydrogen peroxide are used as oxidants, although typically not as effectively as more readily oxidized contaminants, such as TCE and DCE. As discussed above, the results of the pilot test indicated that TCE, DCA, and 1,4-dioxane had similar destruction levels, even though the Henry's

constant of TCE at 20°C is approximately 2 times greater than that of 1,1-DCA, 11 times greater than that for 1,2-DCA, and 2,000 times greater than that for 1,4-dioxane.

The DO levels also were monitored continuously with the downhole probes. During the later stages of the extended data logging initiated on April 17, 2006, the DO probes were found to have been compromised by a marginal (low) voltage supply and by fine sediment buildup on the probe membrane. Therefore, the later DO readings are not considered accurate, and DO readings are not shown on the figures.

3.3.3 Vertical Profiling

DO and ORP measurements versus depth also were performed in the monitor wells using the downhole probe. These results are included in Appendix D. Measurements were collected at 5-foot intervals in the wells. Given the short screen intervals in MW-20B (10 feet) and MW-33B (10 feet), the measurements did not reflect a significant change in DO or ORP as a function of depth in these monitor wells. However, the shallow wells (MW-20 and MW-33A) did show increased levels of ORP and DO in the 50- to 55-foot depth interval versus the 60- to 65-foot depth interval. This was expected based on the pressure buildup in MW-20 and MW-33A, which was caused by the presence of the semi-confining layer just above 50 feet bgs.

The most remarkable information was from EW-1, which has a 40-foot screen interval. On three out of the five profiling events during the focused injection, there was a significant change (increase) in ORP (up to 230 mV) and DO (up to 5.2 milligrams per liter [mg/L]) at the 80-foot depth interval (as compared to the deeper interval), suggesting the vertical offset of the influence of the injection system was 10 feet or less at this location.

The results of vertical profiling indicated that, for optimal results, the injection interval should be a maximum of 10 feet below the remediation target area. This is likely because of the cone-like diffusion pattern of the injected ozone and air.

3.4 OTHER FIELD MEASUREMENTS

As noted, groundwater samples also were measured occasionally for hydrogen peroxide and ozone using HACH field test kits during the later stages of the pilot study. Ozone was measured at 0.3 mg/L in MW-20 on February 22, 2006. Hydrogen peroxide was detected at wells MW-33A and EW-1 (63 feet) in samples collected between April 17 and April 30, 2006. The hydrogen peroxide reading in MW-33A started out at 20 mg/L but decreased over time to low single digits as a result of system shutdowns and a reduction in the peroxide injection rates. As mentioned, the response to oxidant injection at MW-33A was more pronounced and immediate, probably because this well is screened in a fairly permeable soil interval. Conversely, the peroxide measurements in EW-1 (63 feet) were consistently in the low single digits. Ozone testing results at both of these locations were always negative. The reason may be related to the short half-life of ozone and the relatively larger separation distance between these monitor wells and the injection wells, compared to the distance between MW-20 and M_{OX} -3.

Measured temperature and pH did not vary significantly during the pilot-scale system operations. However, these parameters should be monitored because the injection of hydrogen peroxide at higher rates may lead to increases in temperature, followed by off-gassing (this is not likely if hydrogen peroxide to ozone mole ratios are maintained at less-than-stoichiometric levels). Hydrogen peroxide injection also may result in the formation of metal hydroxides, which could increase pH; conversely, the oxidation process, in general, can produce some acid that can temporarily decrease the pH.

The electrical conductivity measurements, the value of which depends on the amount of total dissolved salts (or ions), indicated an overall decreasing trend since the start of system operations. It should be noted that the amount of oxygen that can be dissolved in water increases with decreasing salt concentration. Total organic content (TOC) also had an overall decreasing trend.

Ferrous iron concentrations decreased to zero in the shallow monitor wells almost immediately after the start of system operations, indicating a rapid oxidation process. However, the decrease in ferrous iron concentrations in the deeper wells was more gradual and incremental.

The reader is referred to Table 5 for the complete listing of general water chemistry parameters and metals results since the start of system operation.

3.5 ANALYTICAL DATA QUALITY ASSESSMENT

The data validation of the groundwater analytical data collected during the 13 groundwater sampling events between July 12, 2005, and June 5, 2006, has been approximately 30% completed. The completed data validation reports (and subsequent reports) can be found in the Records Center at EPA Region 9 in San Francisco, California. The data from the completed reports were determined to be acceptable for decision-making purposes with some estimated data due to sampling and/or laboratory data quality issues.

The overall field sampling procedures and analytical laboratory performance met the acceptable data quality guidelines, with the data completeness result exceeding 99 percent.

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4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 CONCLUSIONS

Based on pilot study monitor well results, the following conclusions are made for the Site.

- Ozone injection alone can reduce significantly the concentrations of the site COCs, including TCE, cis-1,2-DCE, 1,1-DCA, and 1,4-dioxane. At the end of the pilot study, concentrations of seven out of the twelve Site COCs at EW-1-63' were reduced to below MCLs (PCE was below MCLs prior to the test and remained as such.). Those still present at concentrations greater than MCLs at this well included TCE (65 μg/L), cis-DCE (44 μg/L), 1,1-DCA (6.2 μg/L), and 1,4-dioxane (47 μg/L).
- Increased injection of oxidants increases the amount of contaminant (or COC) destruction.
- The effect of hydrogen peroxide on COC destruction is not clear. However, ex situ testing of the site groundwater does indicate that the injection of stoichiometric mole ratios (0.7 to 1 mole:mole) or less of hydrogen peroxide to ozone probably is required to achieve optimal results and to increase oxidation kinetics. This conclusion is supported by the results of laboratory tests conducted to evaluate the destruction efficiency of 1,4-dioxane; one literature source cites the optimal hydrogen peroxide to ozone mole ratio as being greater than zero but less than 0.4 to 0.45 mole:mole (Suh and Mohseni, 2004).
- As corroborated by the bench-test results, the presence of high levels of secondary constituents in the groundwater (e.g., iron, bicarbonates, organic matter) may have enhanced the effectiveness of oxidation by ozone. The presence of these compounds also can lead to scaling, biofouling, and general plugging of equipment installed below the water table. However, during the pilot study, only one well became plugged, and it was easily rehabilitated with a dilute acid.
- Ozone injection rates were crucial to the success of the pilot study. While the soil oxidant demand estimated in the bench test (3,000 milligrams per kilogram [mg/kg]) appears to have been too high, the pilot study results indicated that ozone injection rates of 2 lbs/day per injection well (or 1 lb/day per injection interval) were required to achieve optimal results.
- Overall, a greater ROI was achieved in the upper injection interval in the shallow aquifer. The ROI of the injection wells appears to be approximately 30 feet, the largest distance between an injection well and a monitor well in the pilot study. Vertical profiling of DO and ORP indicated that, for optimal results, the oxidant injection interval probably should be placed a maximum of 10 feet below the targeted treatment area. In addition, the presence of less permeable aquifer material in the 40- to 50-foot bgs interval probably increased the ROI for the shallow injection wells. Therefore, the larger ROI in the upper portion of the shallow aquifer (approximately 50 to 80 feet bgs) may have been related to the injection screen placement and should be considered in a full-scale application of the technology.
- Continued migration of contaminant mass from the Site source area and the naturally reducing aquifer conditions probably impacted the outcome of the pilot study. A more

aggressive network of injection wells and higher oxidant injection rates associated with a fullscale system would be expected to produce a steady reduction in contaminant mass.

- Data logging and real time measurement of field parameters, specifically DO and ORP, was crucial to the optimization of the operating parameters.
- The rate of air injection was found not to be a very important factor, though higher injection rates (>1 cfm) should be avoided to minimize agitating fine sediments in the aquifer.
- An evaluation of the COC destruction trends in conjunction with ORP data (see Section 3.3) indicates that COC destruction was caused by chemical oxidation and not a physical process, such as air stripping
- The introduction of air and oxidants resulted in highly oxygenated and aerobic conditions that probably promoted the growth of aerobic bacteria. While these bacteria may contribute to the direct and/or cometabolic degradation of some COCs, they may cause some biofouling and possible plugging of submerged equipment.
- There was zero to modest rebound of COC concentrations in the pilot study monitor wells in August 2006, three months after cessation of the pilot study (see Table 7). Some rebound was expected because contaminated plumes originating 30 feet or farther upgradient were expected to reach the pilot study area during this time. Modest rebound was observed in EW-1-63', where the largest reductions in concentrations had been obtained during the pilot study. TCE concentrations also rebounded slightly in MW-20. Conversely, TCE concentrations in MW-33A and 1,4-dioxane concentrations in MW-33A and MW-20 continued to decline during the three months.

4.2 **RECOMMENDATIONS**

In summary, once the system operating parameters were optimized, the ozone/peroxide injection pilotscale system was successful in achieving the test objectives of evaluating system performance and reducing COC concentrations. Based on these observations the following recommendation are made.

- The use of this technology is recommended for full-scale application. It is recommended that the lessons learned from the pilot study (i.e., optimal operating parameters and injection well construction/placement) be considered in the full-scale application of this technology.
- The full-scale system design should include the injection of ozone and hydrogen peroxide. However, operation of the full-scale system could begin with the injection of ozone only and transition to the combined injection of hydrogen peroxide and ozone at less than stoichiometric mole ratios of peroxide to ozone.
- With robust remedial design of a full-scale system, it is possible to attain MCLs for all site COCs. It is noted, however, that as concentrations approach MCLs, the oxidation reaction kinetics are expected to be first order with respect to the oxidant concentrations and slower than those observed in the pilot study. Therefore, the ISCO system should be designed to address COC concentrations greater than 50 μ g/L. The portions of the plume less than the design concentration but greater than MCLs will be addressed with a downgradient remedy, likely to include groundwater extraction per the ROD.

- The injection wells should be placed so that their ROIs overlap for adequate coverage; therefore, the recommended spacing between injection wells is 50 feet (corresponding to a minimum ROI of 25 feet). The oxidant injection interval probably should be placed a maximum of 10 feet below the targeted treatment area. Optimal screen placement also will depend on location-specific lithology.
- The full-scale system should be designed for ozone injection rates of 2 lbs/day per injection well (or 1 lb/day per injection interval).
- It is recommended that remediation of the contaminated vadose zone in the source area occur prior to or concurrently with the full-scale groundwater remediation to minimize further impact to groundwater.

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Groundwater Contaminants of Concern and Cleanup Levels Cooper Drum Company Superfund Site, South Gate, CA

		Cleanup Level	
Medium	Contaminant of Concern	(µg/L)	Basis for Cleanup Level
Groundwater (VOCs)	1,1-Dichloroethane (1,1-DCA)	5	MCL ^a
	1,1-Dichloroethene (1,1-DCE)	6	MCL
	1,2-Dichloroethane (1,2-DCA)	0.5	MCL
	1,2-Dichloropropane (1,2-DCP)	5	MCL
	1,2,3-Trichloropropane (1,2,3-TCP)	1	PQL ^b
	Benzene	1.0	MCL
	cis-1,2-Dichloroethene (cis-1,2-DCE)	6	MCL
	trans-1,2-Dichloroethene (trans-1,2-DCE)	10	MCL
	Tetrachloroethene (PCE)	5	MCL
	Trichloroethene (TCE)	5	MCL
	Vinyl chloride	0.5	MCL
Groundwater (non VOCs)	1,4-Dioxane	6.1	PRG ^c

^a MCLs from Title 22 California Code of Regulation Section 64431 and 64444, unless otherwise specified.

^b No MCL established for 1,2,3-trichloropropane. The PQL was identified as a remedial goal.

^c No MCL established for 1,4-dioxane. The concentration is for the ingestion of drinking water only and does not account for potential dermal and inhalation exposure. EPA has established a screening criteria for PRGs.

- EPA = United States Environmental Protection Agency
- MCL = California primary maximum contaminant level
- PQL = practical quantification limit
- PRG = EPA preliminary remediation goal for drinking water
- VOC = volatile organic compound
- $\mu g/L = micrograms per liter$

System Operation Events for Ozone/Hydrogen Peroxide Pilot Study Cooper Drum Company Superfund Site, South Gate, CA

Date	Event
19-Jul-05	ISCO pilot study began. Based on bench-scale test, only ozone was injected. Injection rate was 0.5 pound per day. Ozone screen at 2B was plugged; therefore, ozone was injected into H_2O_2 screen. Ozone injection cycle was hourly (10 minutes at each well).
7-Sep-05	Ozone injection concentration increased from 0.5 to 1.5 pounds per day (50 days after startup).
29-Sep-05	Ozone injection concentration increased from 1.5 to 1.85 pounds per day (77 days after startup).
26-Oct-05	Air injection volume increased from 1.1 to 2.2 cfm (99 days after startup).
28-Nov-05	System went down on November 28 at 1730. Sampled on November 29. System restarted on November 30 (134 days); however, well 1B (ozone) was plugged. Switched ozone injection to H_2O_2 screen at 1B.
14-Dec-05	Attempted to unplug ozone screens at 1B and 2B using air compressor and airlifting, was unsuccessful. Began injecting H_2O_2 on December 14 (148 days after startup). H_2O_2 injection cycle was one hour of pumping and 5 hours off. The hourly H_2O_2 cycle was 20 minutes at 1A and 2A and 10 minutes at 3A and 3B. Total daily H_2O_2 pumping was 4 hours per day. Ozone cycle remained hourly (10 minutes each well). H_2O_2 injection pump set at 0.5 gallon per hour for a daily use rate of 2 gallons. The H_2O_2 blend in injection tank was 20 gallons DI water and 15 gallons of 35% H_2O_2 (49 pounds), which calculated to 16% by weight of H_2O_2 . Also took round of field measurements with downhole probe on December 14 and 15 to confirm noticeably negative ORP values from the November 29 sampling event.
19-Jan-06	Cleared plugged ozone wells 1B (acidified with HCl) and 2B (jetted with water) 184 days after startup. Began injecting H_2O_2 at 1B and 2B at these two locations and switched ozone to the designed screen at these wells. Revised H_2O_2 hourly injection cycle from 20 minutes at 1A and 2A to 10 minutes at each well. Ozone cycle unchanged.
2-Feb-06	Took round of field measurements using downhole probe. Increased H_2O_2 injection cycle to one hour on and 2 hours off for a total run time of 8 hours per day.
14-Feb-06	Took round of downhole field measurements. Note system up and down appeared to be loose fitting and backpressure from H_2O_2 injection.
21-Feb-06	Performed 24-hour data logging of field measurements February 21 through 23. Performed vertical profiling at all wells; data logged overnight at EW-1 with normal cycle. Next morning, operated system with only MaxOx3A and 3B and data logged at MW-20. Switched back to normal cycle at approximately 8:30 pm and data logged overnight. Installed larger compressor on February 23. The larger compressor allowed the system to inject H_2O_2 at up to 50 psi. Previous shutdowns were related to low shutdown pressure for H_2O_2 injection. Treated 3A (H_2O_2) and 1B (ozone) with acid, based on increased pressure.
20-Mar-06	Performed 24-hour data logging from March 20 (244 days) through March 31. During data logging, system generally operated with only MaxOx1A&B, 2A&B operating on a 30-minute cycle (5 minutes shallow, 10 minutes deep); H_2O_2 remained on 3-hour cycle (1 hour on, 2 hours off); air volume decreased to 1.1 cfm). Minor variations performed to system operation during data logging.
17-Apr-06	Initiated 24-hour data logging at MW-33A and EW-1 on April 17. Shut system down on April 17 at 1600. Restarted at 0813 on April 18 with MaxOx1A&B, 2A&B injecting only oxygen on 30-minute cycle. Added air injection (1.1 scfm) at 0757 on April 19. Added H_2O_2 injection (3-hour cycle) at 1513 on April 19. Added ozone at 0745 on April 21. Sampled both wells for peroxide, ozone, VOCs, and dioxane. Sampled for H_2O_2 on April 17 at EW-1 (positive not quantified) and MW-33A (20+ mg/L). Ozone negative at both wells. Also sampled for H_2O_2 on April 19 (3 mg/L in MW-33A, 1 mg/L in EW-1), on April 21 (1 mg/L both wells), and on April 24 (1mg/L in both wells, ozone negative).

Date	Event
25-Apr-06	Installed additional ozone generator on April 25. System off and on. Put into steady operation at
	1800 on April 26 (281 days). Total ozone output 4 pounds, H ₂ O ₂ cycle switched to 5-hour cycle
	(60 minutes on, 240 minutes off) at 1 mole ratio (approximately 10% solution), air valves 1.1
	scfm. No change in injection well cycle (i.e., 1A&B and 2A&B operating at 30-minute cycle).
	24-hour data logging continued at EW-1 and MW-33A.
5-May-06	Increased cycle to 35 minutes by increasing O ₃ injection from 5 to 10 minutes at 1A. This was
	done as a result of the drop in ORP at EW-1, which appeared to happen approximately every
	3 days. Continued data logging at MW-33A and EW-1.
8-May-06	Sampled wells. H_2O_2 4.0 mg/L at MW-33a and <1.0 mg/L at EW-1 (55' and 63') and MW-33B.
	Ozone not detected at any location. No change to system operation. Data logging continued.
1-Jun-06	Changed DO membranes on data logging probes as a result of extremely low levels at MW-33A
	(0.2 mg/L) and somewhat low readings at EW-1. After resetting probes, batteries were deter-
	mined to be low when data was retrieved from probes. Therefore, data from June 1 to June 7
	were lost. Downhole probe measurements did show high levels of DO (up to 13 mg/L);
	therefore, it appears DO data were invalid from approximately May 21 to June 1.
5-Jun-06	Sampled wells. After arrival to sample, it was determined that system shutdown occurred on
	June 3, 2006, at 14:49. Total run time hours were 7,182 for O_3 and 961.51 for H_2O_2 . Run time
	hours for second O ₃ generator was 4,205 hours. System restarted at 1513 on June 5. Note second
	ozone generator would not restart. System shutdown on June 7 due to faulty timer on PSA. New
	PSA ordered; however, based on sampling results, pilot study was terminated.

cfm		auhia faat nan minuta
cim	=	edete feet per finnate
DI	=	deionized water
DO	=	dissolved oxygen
H_2O_2	=	hydrogen peroxide
HCl	=	hydrochloric acid
ISCO	=	in situ chemical oxidation
mg/L	=	milligrams per liter
ORP	=	oxidation reduction potential
O_3	=	ozone
PSA	=	pressure swing adsorption system
psi	=	pounds per square inch
scfm	=	standard cubic feet per minute
VOC	=	volatile organic compound

Ozone/Hydrogen Peroxide Pilot Study Costs Cooper Drum Company Superfund Site, South Gate, CA

Cost Category ^a	Cost
SITE PREPARATION	
Well Drilling – 3 Monitor Wells	\$14,250
6 MaxOx Injection wells	\$25,300
Electrical Connection	\$ 1,500
Trenching and piping	\$10,570
Permitting & Regulatory Requirements ^b	N/A
EQUIPMENT RENTAL ^c	
Chemical Oxidation System	\$18,750
Air compressor	\$ 1,250
Hydrogen Peroxide Skid	\$ 2,100
Mobilization	\$ 1,800
SYSTEM STARTUP	\$ 5,450
CONSUMABLES	
Health and Safety Gear	\$ 1,500
Hydrogen Peroxide	\$ 2,850
LABOR	
Monitor well and Injection Well Installation	\$17,000
Monitor Well Sampling (13 events)	\$44,000
UTILITIES	
Electricity (2 lbs/day Ozone generator)	\$ 1,800
Electricity (Air compressor)	\$ 300
RESIDUALS AND WASTE SHIPPING AND DISPOSAL	
Contaminated Drill Cuttings	\$ 4,170
Monitor Well Development and Purge water	\$ 2,500
GROUNDWATER MONITORING	
Equipment Rental, 13 Sampling events (Downhole ORP/DO probe, Field	\$21,200
test kits, etc.)	
ANALYTICAL SERVICES ^d	
VOCs, 1,4-dioxane, metals, cations, etc.	\$57,200
OPERATION AND MAINTENANCE	\$14,720
DEMOBILIZATION	\$ 1,400
TOTAL PILOT STUDY COSTS	\$249,610

^a Costs do not include EPA personnel, ongoing project management, data evaluation and final report preparation.

^b Federal Superfund Sites exempt from permit fees. Costs for Work Plan and Waste Discharge Requirement Permit not included.

^c Rental Rate discounted approximately 50% of full-scale rate.

^d Actual analytical costs budgeted from separate program. Analytical fees estimated at \$650/sample with 88 total samples. Analyses include VOCs, PP Metals, cations, 1,4-dioxane, hexavalent chromium, bromate, chloride, nitrate, sulfate, bromide, O-phosphate, alkalinity, TSS, TDD, TOC, and sulfide.

lbs/day = pounds per day

ORP = oxidation reduction potential

DO = dissolved oxygen

- EPA = United States Environmental Protection Agency
- VOC = volatile organic compound
- TSS = total suspended solids
- TOC = total organic carbon

Ozone/Hydrogen Peroxide Pilot Study Results for VOCs and 1,4-Dioxane (µg/L) Cooper Drum Company Superfund Site, South Gate, CA

Date	PCE	ТСЕ	cis-1,2-DCE	1,1-DCE	trans-1,2-DCE	VC	1,1-DCA	1,2-DCA	Benzene	1,2-DCPA	1,4-Dioxane	
MW-20												
12-Jul-05	3.2	520D	200D	18	8.2	4.7	54D	10	0.85	4.4	140	
28-Jul-05	1.2	210D	98D	3.8	3.5	0.69	22	8.4	0.45J	3.00	150	
16-Aug-05	2.7	230	81	11	5.5	2.3	30	11	0.5	4.30	160	1,1,2-Trichloroetha
07-Sep-05	2	160	60	6.3	2.6	1.1	24	6.8	0.3	2.6	140	Dibromomethane (1,2,3-trichloroprop
29-Sep-05	1.7	150	50	5.5	2.7	0.8	21	6.3	0.3	2.6	120	Dibromomethane (1,2,3-trichloroprop
26-Oct-05	2.4	220	71	6.5	3	1	34	6.5	0.4	3.6	120	Dibromomethane (1,2,3-trichloroprop
29-Nov-05	1.1	130	39	5.4	1.8	0.7	22	3.7	0.3	1.8	98	Dibromomethane (bromoform (23)
18-Jan-06	2.8	240	64	10	4.2	1	34	6.7	0.5	3.5	110	Dibromomethane (bromoform (27), cl
1-Mar-06	0.75	110D	31D	2	1	0.62	16	2.7	<0.5	< 0.5	79	Chlorobenzene (0.5
5-Jun-06	1.8	340	77	15	6	3.1	34	6.3	0.6	3.6	160	1,1,2-Trichloroetha 1,2,3-trichloroprop
55-Foot Sample											_	
1-Mar-06 @55 feet	<0.5	45D	14	0.74	<0.5	<0.5	8	1.6	<0.5	<0.5	36	Bromoform (55D),
MW-20B												
12-Jul-05	< 0.5	0.3J	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.8	
28-Jul-05	< 0.5	16	13	< 0.5	1.1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.5	
16-Aug-05	<0.5	19	17	0.2J	1.4	< 0.5	0.3J	< 0.5	< 0.5	<0.5	0.6	1,2,4-Trichloroben
07-Sep-05	<0.5	18	13	0.2J	1	< 0.5	0.4J	< 0.5	< 0.5	<0.5	0.5	
29-Sep-05	< 0.5	6.2	8.4	< 0.5	0.6	< 0.5	0.2J	< 0.5	< 0.5	<0.5	<1.0	
26-Oct-05	< 0.5	6	6.9	< 0.5	0.5	< 0.5	< 0.5	< 0.5	< 0.5	<0.5	<1.0	
29-Nov-05	< 0.5	6.1	14	0.2J	1	0.2J	0.4J	< 0.5	< 0.5	< 0.5	0.8J	
18-Jan-06	< 0.5	10	17	0.4	1.2	0.3	0.7	0.2	< 0.5	<0.5	1.8	Dibromomethane (
1-Mar-06	< 0.5	6.3	16	< 0.5	0.87	< 0.5	0.8	< 0.5	< 0.5	< 0.5	2.2	Chloromethane (0.
5-Jun-06		11	19	0.4J	1.4	0.4J	0.6	<0.5	<0.5	<0.5	1.9	Carbon disulfide (0
MW-33A												
12-Jul-05	< 0.5	2.3	<0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	<0.5	540	Chloromethane (1.
28-Jul-05	5.6	940D	190D	29E	12	4.6	50D	8.1	2.5	4.9	630	
16-Aug-05	4.6	1200	190	27	15	7.2	49	7.3	2.2	3.9	470	Chlorobenzene (5.1
07-Sep-05	4.9	1200	210	33	11	5.5	52	6.1	2	3.3	500	Toluene (0.2), 1,1,2 1,2,3-trichloroprop
29-Sep-05	1.6	990	100	9.9	4.3	1.6	19	4.2	0.9	1.9	350	Bromoform (0.30J)
26-Oct-05	2.9	450	100	16	6	2.4	26	4.4	1.2	2.7	440	Bromoform (5.4J), dibromomethane (0
29-Nov-05	4.4	680	140	20	7.8	3.2	42	5	1	3.4	300	Bromoform (9.8), dibromomethane (1
18-Jan-06	1.6	670	74	10	3.7	0.9	18	3.2	0.7	1.4	270	Bromoform (27), c dibromomethane (2
1-Mar-06	<2.5	280D	33	4.2	<2.5	<2.5	10	<2.5	<2.5	<2.5	170	Bromoform (19)

Other VOCs Detected

thane (0.40), chlorobenzene (2.3), 1,2,3-trichloropropane (4.4) e (1.7), 1,1,2-trichloroethane (0.3), chlorobenzene (1.4), opane (3.5), bromoform (19)

e (2.4), 1,1,2-trichloroethane (0.2J), chlorobenzene (1.5), opane (3.4), bromoform (20)

e (2.9), 1,1,2-trichloroethane (0.4J), chlorobenzene (1.8),

opane (3.9), bromoform (18J), isobutane (1.8)

e (2.0), chlorobenzene (0.9), 1,2,3-trichloropropane (1.8),

e (2.8), chlorobenzene (1.7), 1,2,3-trichloropropane (1.1), chlorodibromomethane (0.3)

0.59), bromoform (46D)

thane (0.3J), chlorobenzene (1.7), bromoform (0.9), ropane (2.8)

D), dibromochloromethane (0.56), acetone (6.2)

enzene (0.2J), naphthalene(0.5J),1,2,3-trichlorobenzene (0.5J)

e (0.2) (0.73) (0.3J)

(1.1)

(5.1), 1,2,3-trichloropropane (2.4) ,1,2-trichloroethane (0.30), chlorobenzene (5.0), ropane (2.1) 90J), chlorobenzene (2.3), 1,2,3-trichloropropane (1.4) HJ), chlorobenzene (3.5), 1,2,3-trichloropropane (1.9), e (0.6), 1,1,2-trichloroethane (0.2), 3 TICs B), chlorobenzene (3.3), 1,2,3-trichloropropane (2.5), e (1.7), 1,1,2-trichloroethane (0.3)), chlorobenzene (1.7), 1,2,3-trichloropropane (1.1), e (2.8)

Date	РСЕ	ТСЕ	cis-1,2-DCE	1,1-DCE	trans-1,2-DCE	VC	1,1-DCA	1,2-DCA	Benzene	1,2-DCPA	1,4-Dioxane	
MW-33A (cont	'd)											
5-Apr-06	0.60	160	25	2.3	1.1	0.3	9.4	1.7	0.3	0.9	140	Bromoform (26), ch dibromomethane (2
17-Apr-06	1.1	260	29	5.0	1.9	0.7	12	1.9	0.3	1.0	120	Bromoform (29), ch dibromomethane (2
8-May-06	0.4	120	14	1.7	0.7	0.2	5.3	0.8	<0.5	0.4	220	Bromoform (24), ch dibromomethane (1
5-Jun-06	1.6	180	62	3.5	2.1	0.6	22.0	2.3	0.3	2.4	99	Bromoform (3.3), c dibromomethane (0
MW-33B												
12-Jul-05	< 0.5	39D	41D	1.1	0.5JB	1.9B	1.3	< 0.5	< 0.5	< 0.5	1.4	
28-Jul-05	< 0.5	26D	30D	< 0.5	2.5	< 0.5	1.9	<0.5	0.15J	< 0.5	2.1	
16-Aug-05	< 0.5	30	36	2.3	3.8	0.6	2.9	0.5	< 0.5	< 0.5	2.5	
07-Sep-05	< 0.5	38	42	2.4	3.3	0.6	2.40	< 0.5	< 0.5	< 0.5	2.0	
29-Sep-05	< 0.5	34	32	1.5	2.7	< 0.5	1.7	< 0.5	< 0.5	< 0.5	<1.0	Pentene (1.1J)
26-Oct-05	< 0.5	35	28	1	2.1	0.2J	1.2	0.3	< 0.5	< 0.5	0.6	1,2,3-Trichloroprop
29-Nov-05	< 0.5	34	28	1.3	2.9	0.3	1.3	0.3	< 0.5	< 0.5	0.6J	
18-Jan-06	< 0.5	41	28	1.5	3.1	0.3	1.4	0.4	< 0.5	< 0.5	0.7	
01-Mar-06	< 0.5	26D	25D	0.97	1.9	< 0.5	1.2	< 0.5	< 0.5	< 0.5	0.8	
05-Apr-06	< 0.5	30.0	26.0	0.9	1.9	0.3	1.2	< 0.5	0.3J	< 0.5	0.8	
08-May-06	< 0.5	24.0	24.0	1.0	1.9	0.2J	1.1	< 0.5	< 0.5	< 0.5	0.8	
05-Jun-06	< 0.5	25.0	28.0	0.9	2.1	0.2	1.0	0.2J	< 0.5	< 0.5	1.0	
EW-1-63 Feet												
12-Jul-05	0.62	660D	310D	40D	13JD	4.3J	74D	5.6	1.5	2.8	750	
28-Jul-05	0.82	530D	190D	43E	11	3.8	35D	4.4	1.3	2.6	860	
16-Aug-05	2.3	560	150	27	11	5.1	38	5	1.2	2.9	590	Chlorobenzene (4.4
07-Sep-05	3.0	470	140	30	8.6	4.0	53	4.9	1.1	3.0	530	Chlorobenzene (3.9
29-Sep-05	1.1	200	55	8.2	3.0	1.1	22	3.1	0.5	1.8	340	Chlorobenzene (1.9
26-Oct-05	0.6	190	45	6.1	2	0.6	25	2.5	0.3	1.6	450	Chlorobenzene (1.1
29-Nov-05	0.5	140	38	5.7	3.2	0.7	21	1.6	0.2	1.1	250	Chlorobenzene (0.6
18-Jan-06	1.9	250	59	12	4.1	1.1	30	3.9	0.7	2.5	420	Chlorobenzene (2.5
1-Mar-2006	1.3	210D	53D	6.6	2.6	0.72	27D	3.1	0.52	1.9	420	Chlorobenzene (2.1
05-Apr-06	1.3 (1.3)	210 (220)	40 (41)	5.8 (5.8)	2.1 (2.0)	0.8 (0.7)	23 (23)	3.1 (3.0)	0.4 (0.4)	1.9 (1.9)	420 (370)	Chlorobenzene (1.8 [0.2J])
17-Apr-06	1.2	170.0	41.0	5.9	2.2	0.7	25.0	2.7	0.4	1.8	390.0	Chlorobenzene (1.6
08-May-06	1.3	200.0	48.0	7.6	2.5	1.0	23.0	3.0	0.5	1.9	410.0	Chlorobenzene (1.8
05-Jun-06	< 0.5	65	44	3.7	5.5	0.5	6.2	0.6	0.2	0.5	47	1,2,3-Trichloroprop
55-Foot Sample	е						•					
05-Apr-06 @ 53'	0.2J	80	31	2.4	1.2	0.2	17	2.3	0.2	1.2	230	Chlorobenzene (0.4
08-May-06 @ 55'	0.7	110	32	4.8	1.9	0.6	22	2.3	0.3	1.4	340	Chlorobenzene (1.0
EW-1-85 Feet		1	1	1	1	1	1	1	1	1		1
12-Jul-05	<0.5(<0.5)	44D(40D)	35D(35D)	3(2.9)	2.5(2.3)	0.16J(0.31J)	3.2(3.2)	0.61(0.58)	<0.5(0.15J)	0.22J(<0.5)	29 (29)	
<u></u>		•	•		•						• • •	

Other VOCs Detected
chlorobenzene (0.9), 1,2,3-trichloropropane (0.8), 2.3)
chlorobenzene (1.3), 1,2,3-trichloropropane (0.8), 2.6)
chlorobenzene (0.5), 1,2,3-trichloropropane (0.4), 1.6)
chlorobenzene (1.2), 1,2,3-trichloropropane (2.1), 0.7)
ppane (0.2J), 2 TICs
4), 1,2,3-trichloropropane (1.2) 9), 1,2,3-trichloropropane (1.4)
9), 1,2,3-trichloropropane (1.0)
1), 1,2,3-trichloropropane (1.1) 6), 1,2,3-trichloropropane (0.4J)
5), 1,2,3-trichloropropane (1.2)
1) 8, [1.8]), 1,2,3-trichloropropane (1.4, [1.4]), bromoform (0.2J,
6), 1,2,3-trichloropropane (1.4), bromoform (0.2J)
8), 1,2,3-trichloropropane (1.5), bromoform (0.7) ppane (0.6)
4), 1,2,3-trichloropropane (1.3)
0), 1,2,3-trichloropropane (1.3)

(Continued)

Date	РСЕ	TCE	cis-1,2-DCE	1,1-DCE	trans-1,2-DCE	VC	1,1-DCA	1,2-DCA	Benzene	1,2-DCPA	1,4-Dioxane	
EW-1-85 Feet	(cont'd)											
28-Jul-05	0.19J(0.21J)	55D (89D)	30D (46D)	3.9 (2.9)	3.3 (2.3)	<0.5 (<0.5)	6.3 (4.7)	1.1 (0.69)	0.27J(<0.5)	<0.5(<0.5)	51 (48)	
16-Aug-05	<0.5 (<0.5)	44 (45)	30 (31)	3.8 (3.8)	3.4 (3.5)	<0.5 (<0.5)	4.4 (4.6)	0.6 (0.6)	<0.5 (<0.5)	0.2J (0.2J)	48 (47)	Chlorobenzene (0.2
07-Sep-05	<0.5 (<0.5)	32 (32)	26 (26)	2.0 (2.1)	2.2 (2.3)	0.3 (0.3)	1.9 (2.0)	<0.5 (<0.5)	<0.5 (<0.5)	<0.5 (<0.5)	22 (20)	
29-Sep-05	<0.5 (<0.5)	40 (41)	27 (26)	1.8 (1.9)	2.3 (2.3)	0.3 (0.3)	2.9 (3.3)	0.5 (0.5)	<0.5 (<0.5)	<0.5 (<0.5)	18 (20)	Chlorobenzene (<0.
26-Oct-05	<0.5 (<0.5)	18 (18)	14 (14)	0.8 (0.8)	1.2 (1.2)	<0.5 (<0.5)	2.0 (1.8)	0.4J(0.4J)	<0.5 (<0.5)	<0.5 (<0.5)	52 (46)	Isobutane (1.2)
29-Nov-05	<0.5 (<0.5)	15 (15)	9.0 (9.0)	0.4 (0.4)	0.7 (0.6)	<0.5 (<0.5)	0.7 (0.7)	0.3 (0.4)	<0.5 (<0.5)	<0.5 (<0.5)	8.2 (7.9)	
18-Jan-06	<0.5 (<0.5)	36 (41)	33 (37)	2.2 (2.6)	3.1 (3.4)	0.3 (0.3)	3.4 (3.8)	0.5 (0.6)	<0.5 (0.2)	0.2 (0.3)	24	
1-Mar-06	<0.5 (<0.5)	36D (39D)	36D (38D)	1.8 (1.6)	2.6 (2.4)	<0.5 (<0.5)	3.7 (3.1)	0.58 (<0.5)	<0.5 (<0.5)	<0.5 (<0.5)	35 (40)	
05-Apr-06	< 0.5	58.0	46.0	2.1	3.0	0.3J	5.3	0.9	0.2J	0.5	48.0	Chlorobenzene (0.2
08-May-06	< 0.5	58.0	56.0	3.7	4.5	0.7	5.5	0.7	0.2J	0.5	27.0	Chlorobenzene (0.2
05-Jun-06	< 0.5	29 (30)	25 (24)	1.1	2.0	0.2	1.4	0.4	< 0.5	< 0.5	9.4 (5.6)	

analyte found in associated method blank and in sampledetection associated with sample dilution В

D

DCA = dichloroethane DCE = dichloroethane DCPA = dichloropropane

- concentration exceeds upper level of instrument calibration range
 estimated value Е
- J
- NA = compound not analyzed PCE = tetrachloroethene

TCE = trichloroethene

- TIC = tentatively identified compound
- VC = vinyl chloride
- VOC = volatile organic compound

 $\mu g/L = micrograms per liter$

Duplicate value for VOCs and 1,4-dioxane from EW-1-85 feet shown in parenthesis. Estimated and dilution values shown for April 2005 sampling round. All results reported in µg/L.

Other VOCs Detected	
0.2, [0.2J])	
<0.5, [0.2J])	
0.2J), 1,2,3-trichloropropane (0.5)	
0.2J), 1,2,3-trichloropropane (0.4)	

Ozone/Hydrogen Peroxide Pilot study Results for General Groundwater Chemistry Parameters Cooper Drum Company Superfund Site, South Gate, CA

Date	12-Jul-05	28-Jul-05	16-Aug-05	7-Sep-05	29-Sep-05	26-Oct-05	29-Nov-05	18-Jan-06	1-Mar-06	5-Jun-06
MW-20										
D.O. (mg/L)	0.12	0.54	7.59 (13)	11.11	7.24	10.2	1.6	1.99	3.66	1.52
ORP (mV)	38.6	-32.4	34 (203)	81.8	170	41.4	18.8	36.8	167	62.1
Temp. (C)	24.17	23.44	22.96	22.96	22.73	22.2	22.48	22.11	22.03	22.45
pН	7.15	7.3	7.93	7.15	7.4	7.5	7.43	7.3	7.44	7.23
Cond. (µmhos)	10,425	5,867	5,269	5,190	4,920	5,206	5,500	5,205	4,803	4,646
Ferrous Iron (mg/L)	1.0	0.0	0.0	0.0	0	0	0	0	0	0
TOC (mg/L)	18.0	25.0	14.0	13.0	11	11	7.1	12		9.8
Sulfide (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity (mg/L)	8,70.0	850.0	780.0	690.0	670	640	770	700	600	930
Chloride (mg/L)	390	390	440	430	420	340	310	320	310	250
Bromide (mg/L)	3	2.6	3.3	3.9	3.5	3.4	1.5	2.5	1.9	1.9
Nitrate (mg/L)	< 0.10	< 0.10	0.33	3.5	4.1	6.8	3.5A3	5.6	12	0.14
o-Phosphate (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Sulfate (mg/L)	2,500	2,400	2,100	2,200	2,200	1,900	1,900	1,900	1,900	1,800
Aluminum (mg/L)	0.0819	0.06	0.0587J	0.0345J	0.0254J	0.424	0.0336J	< 0.200	< 0.200	0.119J
Antimony (mg/L)	0.0005	0.00095	<0.001J	0.00099J	0.0012J	< 0.01	0.0023J	0.00074J	0.00006J	0.0016J
Arsenic (mg/L)	0.0794	0.0694	0.0596	0.0481	0.0354	0.0279	0.0221	0.016	0.0357	0.0113
Barium (mg/L)	0.251	0.22	0.105	0.0713	0.214	0.133	0.147	0.0705	0.0189	0.146J
Beryllium (mg/L)	< 0.002	<.001	<.001	<.001	<.001	< 0.005	< 0.005	< 0.001	< 0.001	< 0.004
Cadmium (mg/L)	< 0.001	<.001	<.001	<.001	0.00036J	< 0.005	< 0.005	0.00043J	< 0.001	0.0015J
Calcium (mg/L)	457	446	449	496	446	382	327	345	342	293
Chromium (mg/)	0.0021	< 0.002	0.0015J	< 0.002	0.00074J	0.0037	0.0005J	0.0013J	0.0018J	0.0013J
Hex. Chrom. (mg/L)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Cobalt (mg/L)	0.00081	0.00094	0.00098J	0.00077J	0.00081J	< 0.005	0.00039J	0.00054J	<0.00033J	0.0013J
Copper (mg/L)	0.0067	0.0109	0.0108	0.0157	0.0134	0.0109	0.0133	0.0122	0.0126	0.0306
Iron (mg/L)	0.589	0.092	0.0731J	< 0.1	< 0.1	0.408	< 0.1	<0.1	< 0.1	< 0.1
Lead (mg/L)	0.00013	0.00018	0.00014J	< 0.001	< 0.001	< 0.005	< 0.005	0.00029J	< 0.001	0.0051
Magnesium (mg/L)	180	183	192	208	193	159	152	143	148	144
Manganese (mg/L)	3.12	2.31	1.05	4.27	0.958	0.838	0.307	0.669	4.57	1.36

Date	12-Jul-05	28-Jul-05	16-Aug-05	7-Sep-05	29-Sep-05	26-Oct-05	29-Nov-05	18-Jan-06	1-Mar-06	5-Jun-06
MW-20 (cont'd)		-	-		-	-				
Mercury (mg/L)	0.00011	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Nickel (mg/L)	0.0225	0.0246	0.0327	0.0137	0.0251	0.0243	0.0172	0.015	0.0031	0.0268
Potassium (mg/L)	17	16	14.1	17.1	14.7	15.1	17	16.8	16.9	16.9
Selenium (mg/L)	0.012	0.0114	0.0206	0.0234	0.0356	0.0512	0.0194	0.0288	0.0027J	0.007J
Silver (mg/L)	< 0.01	< 0.001	< 0.001	< 0.001	< 0.001	< 0.005	< 0.005	< 0.001	< 0.001	< 0.004
Sodium (mg/L)	978	971	771	659	652	570	790	645	631	745
Thallium (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.005	< 0.005	< 0.001	< 0.001	< 0.004
Vanadium (mg/L)	< 0.01	0.0121	0.0071	0.0037	0.0095	0.008	0.0127	0.0125	0.00051J	0.0153
Zinc (mg/L)	0.0955	0.0104	0.0133	0.0565	0.0705	0.294	0.156	0.009	0.0043	0.0337
MW-20B										
D.O. (mg/L)	0.11	0.32	0.08 (2.36)	0.25	0.37	0.19	0.25	0.14	0.3	0.16
ORP (mV)	-77.7	-117.3	-89.3 (-29.1)	-62.4	-1.1	-3.1	-187.1	-164.8	-110.3	-136.3
Temp. (C)	23.12	22.67	22.97 (20.24)	22.62	23.37	21.9	22.1	21.98	22.72	22.57
pН	7.13	7.16	7.7	7.29	7.1	7.3	7.38	7.1	7.26	7.15
Cond. (µmhos)	16,112	8,912	8,801	8,586	8,146	9,495	9,244	10,080	8,493	8,160
Ferrous Iron (mg/L)	3.1	3.6	3.4	3.6	4.0	3.4	2.8	2.4	3	NM
TOC (mg/L)	12	26	7.9	7.0	6.8	6.7	5.2	6.3		6.4
Sulfide (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity (mg/L)	780	750	750.0	720.0	690.0	680.0	690	710	740	770
Chloride (mg/L)	190	170	160	150	140	130	130	130	120	110
Bromide (mg/L)	1.5	1.3	1.3	1.3	1.2	1.2	1.3	1.1	1.2	1.2
Nitrate (mg/L)	< 0.10	< 0.10	<0.10	< 0.10	< 0.10	< 0.10	<0.10	< 0.10	< 0.10	< 0.10
o-Phosphate (mg/L)	<1.0	<5.0	<5.0	<5.0	<5.0	<10.0	<1.0	<5.0	<1.0	<5.0
Sulfate (mg/L)	5,400	5,400	5,500	4,900	5,000	5,100	4,700	5,400	4,900	5,000
Aluminum (mg/L)	0.0532	<0.2	0.0949J	0.0386J	0.0396J	0.0511J	0.0381	<0.200	<0.200	< 0.200
Antimony (mg/L)	0.0005	0.0008	0.00047J	0.00023J	0.0012J	< 0.020	0.00027J	0.00012J	0.00059J	< 0.020
Arsenic (mg/L)	0.0444	0.0491	0.0481	0.0492	0.0384	0.0397	0.0372	0.0285	0.0114	0.0274

Date		12-Jul-05	28-Jul-05	16-	Aug-05	7-Sep-05	29-Sep-05	26-Oct-05	29-Nov-05	18-Jan-06	1-Mar-06	5-Jun-06
MW-20B (cont'd)				_	-							
Barium (mg/L)		0.138	0.179	0	0.201	0.0658	0.174	0.151	0.134	0.0163	0.07	0.0189J
Beryllium (mg/L)		< 0.001	< 0.001	<	0.001	< 0.001	< 0.001	< 0.010	< 0.005	< 0.001	< 0.001	< 0.010
Cadmium (mg/L)		< 0.001	< 0.001	<	0.001	< 0.001	< 0.001	< 0.010	< 0.005	< 0.001	<0.00017J	< 0.010
Calcium (mg/L)		400	405		391	433	427	390	390	382	367	347
Chromium (mg/L)		0.0011	0.00098	0.	0016J	< 0.002	0.0063J	< 0.020	< 0.010	0.00079J	0.0045	< 0.020
Hex. Chrom. (mg/L	.)	< 0.01	< 0.01	<	:0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Cobalt (mg/L)		0.00099	< 0.001	0.0)0089J	0.00072J	0.00054J	< 0.01	0.00026J	0.00025J	0.00048J	< 0.010
Copper (mg/L)		0.0158	0.014	0.	.0152	0.016	0.0171	0.0048J	0.0054J	0.0042	0.0144	0.0102J
Iron (mg/L)		4.34	4.75	2	4.53	4.52	4.37	3.89	3.63	3.39	3.16	2.91
Lead (mg/L)		0.00004	0.00004	0.0)0003J	< 0.001	< 0.001	< 0.010	< 0.005	< 0.001	0.00014J	< 0.010
Magnesium (mg/L)	1	367	370		353	381	388	356	361	355	342	323
Manganese (mg/L)		6.07	6.51	(6.12	7.03	7.09	6.07	2.54	4.26	0.0427	3.69
Mercury (mg/L)		0.00021	0.000022	<0	0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Nickel (mg/L)		0.0079	0.0079	0.	.0083	0.0021	0.0019	< 0.010	0.0018J	0.0014	0.0103	0.0061J
Potassium (mg/L)		21.5	19.7		17.4	21.6	20	21.60	23	20.3	22	26.1
Selenium (mg/L)		0.0154	0.0117	_	.0105	0.0032J	0.0038J	< 0.050	0.0047J	0.0011J	0.033	0.0051J
Silver (mg/L)		< 0.001	< 0.001		0.001	< 0.001	< 0.001	< 0.010	< 0.005	< 0.001	< 0.001	< 0.01
Sodium (mg/L)		700	1,850	_	,700	1,530	1,530	1,470	1,610	1,530	1,550	1,590
Thallium (mg/L)		< 0.001	< 0.001	_	0.001	< 0.001	< 0.001	< 0.010	< 0.005	< 0.001	< 0.001	< 0.010
Vanadium (mg/L)		< 0.001	0.00063	_)0049J	< 0.001	0.00056J	< 0.010	0.00045J	0.00037J	0.0119	0.00048J
Zinc (mg/L)		0.0343	0.146		0.108	0.0138	0.144	0.0178J	0.0178	0.0021	0.0058	< 0.020
	12-Jul-	05 28-Jul-	05 16-Au	g-05	7-Sep-05	29-Sep-05	5 26-Oct-05	29-Nov-05	18-Jan-06	1-Mar-06	5-Apr-06	5-Jun-06
MW-33A												
D.O. (mg/L)	0.16	0.88	2.59 (1	5.34)	1.23	1.2	1.02	0.62	1.18	7.47	11.1	1.96
ORP (mV)	-30.8	-86.9	16.9 (8	4.9)	4.7	130.7	32.2	-241.4	-107.6	37.2	179.1	36.6
Temp. (C)	24.15		(,	23.09	22.18	22.3	22.22	22.12	23.11	21.18	21.09
pН	7.14				7.92	6.9	7.2	7.38	7.1	7.23	5.7	7.4
Cond. (µmhos)	7,102	2 3,955	5 3,97	1	3,863	3,488	4,195	4,071	4,877	4,398	4,516	4,142
Ferrous Iron (mg/L)	0.6	0.8	0.4		0.0	0.0	0.3	0	0	0	NM	0

	12-Jul-05	28-Jul-05	16-Aug-05	7-Sep-05	29-Sep-05	26-Oct-05	29-Nov-05	18-Jan-06	1-Mar-06	5-Apr-06	5-Jun-06
MW-33A (cont'd)											
TOC (mg/L)	35.0	41.0	12.0	11	10.0	9.3	9	12		5	8.6
Sulfide (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Alkalinity (mg/L)	900.0	870.0	860.0	850	800.0	750.0	790	620	560	530	770
Chloride (mg/L)	120	110	110	120	100	98	96	100	96	94	92
Bromide (mg/L)	2.7	2.5	2.5	2.7	2.4	2.5	2.3	2.2	2	1.9	2
Nitrate (mg/L)	<0.10	< 0.10	<0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.6	0.62	1.9	1.3
o-Phosphate (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Sulfate (mg/L)	1,700	1,600	1,700	1,800	1,600	1,500	1,500	2,100	2,400	2,500	2,000
Aluminum (mg/L)	0.058	<0.2	<0.2	0.364	0.0161J	0.0325J	0.382J	<0.200	<0.200		0.0276J
Antimony (mg/L)	0.00058	< 0.002	0.0005J	0.0019J	0.00026J	0.00087J	0.0017J	0.0006J	0.00031J	0.00037J	0.00057J
Arsenic (mg/L)	0.0515	0.0757	0.0676	0.0488	0.0911	0.105	0.062	0.0628	0.0273	0.0355	0.0296
Barium (mg/L)	0.193	0.121	0.118	0.0779	0.129	0.155	0.229	0.0425	0.0386J	0.0624	0.0265J
Beryllium (mg/L)	< 0.001	< 0.001	< 0.002	< 0.001	< 0.001	< 0.005	< 0.003	< 0.001	< 0.001	< 0.001	< 0.004
Cadmium (mg/L)	< 0.001	< 0.001	< 0.001	0.00021J	< 0.001	< 0.005	0.0002J	0.000090J	0.00009J	0.0001J	0.00044J
Calcium (mg/L)	317	417	438	462	448	413	388	508	474		319
Chromium (mg/L)	0.00033	0.00098	0.0013J	< 0.002	0.00062J	<0.010	0.00056J	0.00041J	0.00025J	0.0021	<0.008
Hex. Chrom. (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt (mg/L)	0.0022	0.0022	0.0024	0.00086J	0.0022	0.002J	0.0014J	0.0012	0.00075J	0.0012	0.0008J
Copper (mg/L)	< 0.001	0.003	0.0036J	0.0155	0.0047	0.0031J	0.0094	0.0025	0.0083	0.0114	0.0206
Iron (mg/L)	0.25	0.399	0.204	0.396	0.0932J	0.0676J	< 0.10	< 0.10	< 0.100		< 0.10
Lead (mg/L)	0.0007	0.00035J	0.00053J	< 0.001	0.00047J	0.001J	< 0.003	0.00027J	0.00017J	0.00084J	< 0.004
Magnesium (mg/L)	114	139	148	153	151	140	132	161	162		133
Manganese (mg/L)	1.95	2.51	2.57	1.07	2.96	2.58	1.4	2.47	1.84	1.57	0.0549
Mercury (mg/L)	0.0001	<0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Nickel (mg/L)	0.0645	0.0696	0.0739	0.0277	0.0633	0.05	0.0412	0.0284	0.0147	0.0111	0.0187
Potassium (mg/L)	12.6	9.87	9.5	10.6	9.41	10.5	12.2	10.1	11.5J		16.2

	12-Jul-05	28-Jul-05	16-Aug-05	7-Sep-05	29-Sep-05	26-Oct-05	29-Nov-05	18-Jan-06	1-Mar-06	5-Apr-06	5-Jun-06
MW-33A (cont'd)											
Selenium (mg/L)	0.0094	0.0083	0.0078J	0.0391	0.0033J	0.0046J	0.0053J	0.0057	0.0065	0.0078	0.0244
Silver (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.005	< 0.003	< 0.001	< 0.001	< 0.001	< 0.004
Sodium (mg/L)	630	496	460	406	395	382	460	415	448		608
Thallium (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.005	< 0.003	< 0.001	< 0.001	< 0.001	< 0.004
Vanadium (mg/L)	0.00045	<00034	0.0035	0.0083	0.0022	< 0.005	0.0247	0.0031	0.0057	0.0191	0.0285
Zinc (mg/L)	0.038	0.0104	0.0186	0.108	0.0134	0.021	0.183	0.0015J	0.0024	0.0081	0.0058J
MW-33B											
D.O. (mg/L)	0.45	0.33	0.10 (1.80)	0.4	6.6	0.14	0.45	0.12	0.24	0.32	0.11
ORP (mV)	-71.4	-121.4	-58.4 (5.0)	-78.1	87.2	-0.4	-323.1	-169.7	-110.3	-98.8	-147.4
Temp. (C)	24.29	22.64	22.63 (20.32)	22.6	21.5	21.6	22.23	21.56	22.35	21.4	22.03
pН	7.1	7.15	7.75	8.32	7	7.2	7.39	7	7.13	6.5	7.11
Cond. (µmhos)	16,005	8,829	8,667	8,577	7,930	9,622	9,459	10,088	8,526	8,350	8,144
Ferrous Iron (mg/L)	2.8	2.5	4.0	4.0	2.7	4	4.3	4.4	4	2.5	3.2
TOC (mg/L)	13.0	29.0	7.8	7.7	8	7.4	7.1	8.2		8	7.3
Sulfide (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity (mg/L)	800.0	800.0	840	810	800	800	790	760	770	740	750
Chloride (mg/L)	210	190	180	190	190	200	200	200	150	170	170
Bromide (mg/L)	1.7	1.5	1.5	1.6	1.4	1.5	1.4	1.4	1.3	1.4	1.3
Nitrate (mg/L)	<0.10	< 0.10	<0.10	< 0.10	< 0.10	< 0.10	< 0.10	<0.10	< 0.1	<0.10	<0.10
o-Phosphate (mg/L)	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<0.50	<1.0	<1.0	<5.0
Sulfate (mg/L)	5300	5100	4800	4800	4900	4900	4800	5300	4500	4700	4900
Aluminum (mg/L)	0.0723	0.0486	0.217	0.0522	0.0422J	0.055J	0.0461J	<0.200	<0.200		<0.200
Antimony (mg/L)	0.00046	< 0.0004	< 0.002	0.00075J	0.00094J	< 0.020	0.00076J	0.00007J	< 0.002	0.00016J	< 0.020
Arsenic (mg/L)	0.0443	0.0574	0.0304	0.0569	0.059	0.0596	0.0574	0.0567	0.0601	0.0658	0.0519
Barium (mg/L)	0.145	0.111	0.112	0.135	0.144	0.145	0.0198	0.0239	0.0239	0.033	0.021J
Beryllium (mg/L)	< 0.001	< 0.001	< 0.002	< 0.002	< 0.002	< 0.01	< 0.005	< 0.001	< 0.001	< 0.001	< 0.010
Cadmium (mg/L)	< 0.001	< 0.001	< 0.001	< 0.002	< 0.002	< 0.010	< 0.005	< 0.001	< 0.001	< 0.001	<0.010
Calcium (mg/L)	381	393	350	422	405	371	356	390	370		354

	12-Jul-05	28-Jul-05	16-Aug-05	7-Sep-05	29-Sep-05	26-Oct-05	29-Nov-05	18-Jan-06	1-Mar-06	5-Apr-06	5-Jun-06
MW-33B (cont'd)											
Chromium (mg/L)	0.00038	<0.0015	0.00072J	< 0.004	< 0.004	<0.020	0.00037J	0.0026	0.00062J	0.00035J	<0.020
Hex. Chrom. (mg/L)	< 0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt (mg/L)	< 0.001	< 0.00091	0.00046J	0.00052J	0.00046J	< 0.010	0.00027J	0.00030J	0.0003J	0.0003J	< 0.010
Copper (mg/L)	0.0153	0.0138	0.0061	0.0156	0.0139	0.0088J	0.0058J	0.0047	0.0199	0.002J	0.0093J
Iron (mg/L)	3.78	4.86	4.97	5.46	5.42	5.06	4.98	5.42	5.22		4.69
Lead (mg/L)	< 0.001	< 0.00004	0.00023J	< 0.002	< 0.002	< 0.010	< 0.005	< 0.001	0.00009J	0.00023J	< 0.010
Magnesium (mg/L)	362	377	331	392	393	367	355	376	355		338
Manganese (mg/L)	5.72	6.17	3.11	6.37	7.34	6.34	2.86	7.45	6.37	6.8	5.5
Mercury (mg/L)	0.00012	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Nickel (mg/L)	0.0076	0.008	0.0042	0.0027	0.0019J	< 0.010	0.0024J	0.0021	0.0018	0.0014	0.0052J
Potassium (mg/L)	21	19.2	16.6	21.2	18.8	20.7	21.6	19.2	20.4		24.2
Selenium (mg/L)	0.0156	0.0117	0.0044J	0.0024	0.0042J	< 0.050	0.0038J	0.0014J	0.0026J	0.0025J	0.0042J
Silver (mg/L)	< 0.001	< 0.001	< 0.001	< 0.002	< 0.002	< 0.010	< 0.005	< 0.001	< 0.001	< 0.001	< 0.010
Sodium (mg/L)	1,800	1,860	1,670	1,610	1,550	1,530	1,600	1,540	1,510		1,550
Thallium (mg/L)	< 0.001	< 0.001	< 0.001	< 0.002	< 0.002	< 0.010	< 0.005	< 0.001	< 0.001	< 0.001	< 0.010
Vanadium (mg/L)	< 0.001	< 0.00048	0.00055J	< 0.002	< 0.002	< 0.010	0.00053J	0.00044J	0.00053J	0.00057J	0.00054J
Zinc (mg/L)	0.029	0.0183	0.0105	0.0268	0.0949	0.0521	0.132	0.0021	0.0035	0.0052	0.0053J
EW-1 (63 feet)											
D.O. (mg/L)	0.14	0.25	1.69 (4.03)	5.46	8.8	10.86	0.57	5.22	5.21	7.06	13.64 (DHP)
ORP (mV)	-86.8	-122.7	15.6 (26.1)	17.2	78.5	32.7	-277.8	-71.9	20.7	59.9	253 (DHP)
Temp. (C)	24.82	24.76	24.04 (20.79)	24.53	25.49	22.4	22.77	22.49	22.41	22.09	21.06 (DHP)
pН	7.34	7.28	7.7	8.06	7.4	7.5	7.46	7.2	7.29	6.7	7.56 (DHP)
Cond. (µmhos)	8,197	4,661	4,832	4,572	4,472	5,140	6,696	5,411	4,514	4,430	4,269 (DHP)
Ferrous Iron (mg/L)	0.6	2.1	0.0	0.0	0	0	0	0	0	0	0
TOC (mg/L)	24	40	16	13	13	12	8.1	14		9.9	6.9
Sulfide (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

	12-Jul-05	28-Jul-05	16-Aug-05	7-Sep-05	29-Sep-05	26-Oct-05	29-Nov-05	18-Jan-06	1-Mar-06	5-Apr-06	5-Jun-06
EW-1 (63 feet) (co	ont'd)										
Alkalinity (mg/L)	1,000	950	900	910	820	800	790	780	760	730	820
Chloride (mg/L)	81	72	78	85	80	77	100	87	87	83	99
Bromide (mg/L)	2.6	2.4	2.5	3.0	2.4	2.5	1.9	2.6	2.5	2.5	1.3
Nitrate (mg/L)	<0.10	< 0.10	<0.10	< 0.10	< 0.10	0.07J	0.89A3	2.3	2.5	3.2	0.41
o-Phosphate (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Sulfate (mg/L)	1,900	1,900	1,900	1,800	1,900	2,000	3,200	2,200	1,900	2,000	4,100
Aluminum (mg/L)	0.056	<0.2	<0.20	0.0262J	0.0351J	0.0434J	0.031J	<0.200	<0.200		<0.200
Antimony (mg/L)	0.00038	0.00046	< 0.001	0.0015J	0.0007J	0.0018J	0.00062J	0.00049J	0.00047J	0.00097J	< 0.020
Arsenic (mg/L)	0.0642	0.0713	0.0219	0.0452	0.0241	0.0181	0.0216	0.0146	0.014	0.0171	0.0157
Barium (mg/L)	0.0963	0.131	0.0901	0.28	0.16	0.168	0.14	0.0263	0.0264	0.0342	0.0343J
Beryllium (mg/L)	< 0.001	< 0.001	< 0.002	< 0.001	< 0.001	< 0.005	< 0.005	< 0.001	< 0.001	< 0.001	< 0.010
Cadmium (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.005	< 0.005	0.00015J	0.00018J	0.00006J	< 0.010
Calcium (mg/L)	331	317	288	343	319	297	364	321	299		376
Chromium (mg/L)	0.00034	0.00079	0.00038J	< 0.002	0.0005J	<0.010	<0.010	0.0017J	0.00090J	0.00023J	<0.020
Hex. Chrom. (mg/L)	<0.01	<.0002	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt (mg/L)	0.0011	0.0014	0.00091J	0.0018	0.0014	< 0.005	0.00087J	0.0012	0.0012	< 0.001	< 0.010
Copper (mg/L)	0.004	0.0063	0.0035	0.0167	0.0228	0.0238	0.0168	0.0213	0.0244	0.0205	0.0153J
Iron (mg/L)	2.52	1.71	0.136	<0.1	< 0.1	< 0.1	0.133	< 0.10	< 0.1		0.067J
Lead (mg/L)	0.00017	0.00022	0.00062J	0.00071J	0.00053J	< 0.005	< 0.005	0.00065J	0.00055J	0.00066J	< 0.010
Magnesium (mg/L)	137	136	127	154	155	155	255	158	151		290
Manganese (mg/L)	2.41	2	0.623	1.31	0.777	0.362J	1.94	0.428	0.361	0.293	2.05
Mercury (mg/L)	0.000044	< 0.0002	< 0.00020	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Nickel (mg/L)	0.0473	0.0578	0.0322	0.0622	0.0569	<0.0461	0.0284	0.0484	0.0463	0.0476	0.0121
Potassium (mg/L)	12.60	12.4	13.5	15.2	13.7	16.7	21.3	14.9	15.8		26.9
Selenium (mg/L)	0.0105	0.0088	0.006	0.0238J	0.032	0.0459	0.0307	0.0558	0.0406	0.0548	0.0129J
Silver (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.005	< 0.005	< 0.001	< 0.001	< 0.001	< 0.010

	12-Jul-05	28-Jul-05	16-Aug-05	7-Sep-05	29-Sep-05	26-Oct-05	29-Nov-05	18-Jan-06	1-Mar-06	5-Apr-06	5-Jun-06
EW-1 (63 feet) (co	nt'd)										
Sodium (mg/L)	801	768	671	637	665	679	1100	683	599		1290
Thallium (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.005	< 0.005	< 0.001	< 0.001	< 0.001	<0.010
Vanadium (mg/L)	< 0.001	0.00034	0.0037	0.0091	0.0138	0.0148	0.0148	0.0167	0.0141	0.0168	0.0122
Zinc (mg/L)	0.0082	0.0127	0.0126	0.13	0.0173	0.0915	0.032	0.0025	0.0028	0.0049	0.0112J
EW-1 (85 feet)											
D.O. (mg/L)	0.31	0.33	0.16 (0.82)	0.58	0.4	0.23	0.45	0.48	0.22	0.48	0.16
ORP (mV)	-79.5	-127	-55.4 (- 13.0)	-85.5	21.2	6.1	-310.6	-125.7	-79.6	12.8	-72.4
Temp. (C)	22.93	22.5	22.0 (20.15)	22.62	23.1	21.7	21.91	21.75	21.59	21.41	21.86
pН	7.23	7.19	7.83	8.16	7	7.2	7.37	7	7.11	6.6	7.08
Cond. (µmhos)	15,430	8,380	8,490	8,823	8,448	9,564	10,382	10,110	8,728	8,200	8,900
Ferrous Iron (mg/L)	4.2	4.0	NR	4.8	5.5	4.0	3.4	2.6	2.2	0.0	1.8
TOC (mg/L)	15	27	8	7.9	8.8	7.6	8.5	11		7.8	8.3
Sulfide (mg/L)	<1.0	<1.0	<1.0	<1.0	< 0.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity (mg/L)	810	800	840	810	780	800.0	780	790	790	810.0	750.0
Chloride (mg/L)	180	160	160	180	180	170	230	160	160	130	210
Bromide (mg/L)	1.6	1.4	1.5	1.5	1.5	1.6	1.7	1.5	1.6	1.5	1.6
Nitrate (mg/L)	< 0.10	< 0.10	<0.10	< 0.10	< 0.10	< 0.10	<0.10	<0.10	<0.10	0.71	<0.1
o-Phosphate (mg/L)	<1.0	<5.0	<5.0	<5.0	<5.0	<10.0	<1.0	<1.0	<1.0	<1.0	<5.0
Sulfate (mg/L)	4,800	4,700	4,800	4,800	5,400	4,400	5,400	5,000	4,700	4,600	5,500
Aluminum (mg/L)	0.075	<0.2	<0.020	0.0366J	0.0454J	0.0509J	0.0445J	<0.200	<0.200		<0.200
Antimony (mg/L)	0.00042	0.00044	< 0.001	0.00046J	0.00033J	< 0.020	< 0.010	0.0004J	0.00018J	0.0052	< 0.020
Arsenic (mg/L)	0.0723	0.072	0.065	0.0609	0.0513	0.0415	0.0542	0.0232	0.0197	0.018	0.0223
Barium (mg/L)	0.128	0.08	0.062	0.09	0.0851	0.0938J	0.0822	0.0407	0.0306	0.0368	0.0267J
Beryllium (mg/L)	<001	< 0.001	< 0.002	< 0.002	< 0.001	<0.010	< 0.005	< 0.001	< 0.001	< 0.001	< 0.010
Cadmium (mg/L)	<001	< 0.001	< 0.001	< 0.002	< 0.001	< 0.010	< 0.005	0.00009J	< 0.001	< 0.001	< 0.010
Calcium (mg/L)	367	354	315	386	386	354	394	391	369		380
Chromium (mg/L)	0.00039	0.00077	0.0005J	< 0.004	0.00044J	<0.020	<0.010	0.0015J	0.00035J	0.00022J	<0.020

(Continued)

	12-Jul-05	28-Jul-05	16-Aug-05	7-Sep-05	29-Sep-05	26-Oct-05	29-Nov-05	18-Jan-06	1-Mar-06	5-Apr-06	5-Jun-06
EW-1 (85 feet) (co	ont'd)										
Hex. Chrom. (mg/L)	<0.01	<0.01	< 0.0002	<0.01	<0.01	<0.010	<0.01	<0.01	< 0.01	<0.01	<0.01
Cobalt (mg/L)	0.00043	0.00069	0.00034J	0.00058J	0.00081J	< 0.010	< 0.005	0.0011	0.00082J	0.0033	0.0014J
Copper (mg/L)	0.0195	0.0165	0.0057	0.0158	0.0159	0.0062J	0.0049J	0.0065	0.016	0.0062	0.0108J
Iron (mg/L)	5.41	4.7	4.64	5.08	4.48	3.2	6.27	1.17	0.796		1.36
Lead (mg/L)	0.00004	0.00003	0.00007J	< 0.002	< 0.001	< 0.010	< 0.005	< 0.001	< 0.001	0.00012J	< 0.10
Magnesium (mg/L)	360	314	298	385	380	347	448	352	333		399
Manganese (mg/L)	5.79	5.18	2.77	6.25	6.73	5.42	3.41	4.74	4.93	4.8	5.05
Mercury (mg/L)	0.00023	< 0.0002	< 0.00020	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Nickel (mg/L)	0.0078	0.0122	0.006	0.0038	0.0074	0.0076J	0.0025J	0.0068	0.0071	0.0116).0078J
Potassium (mg/L)	16.2	17.2	15.2	20.3	18.1	19.9	23.6	20.1	20.2		28.9
Selenium (mg/L)	0.0151	0.0109	0.004	0.0031J	0.0076	0.0074J	0.0057J	0.0066	0.0072	0.0138	0.0066J
Silver (mg/L)	< 0.001	< 0.001	< 0.001	< 0.002	< 0.001	< 0.010	< 0.005	< 0.001	< 0.001	< 0.001	< 0.010
Sodium (mg/L)	1,710	1,630	1,410	1,530	1,460	1,350	1,740	1,360	1,370		15,550
Thallium (mg/L)	< 0.001	< 0.001	< 0.001	< 0.002	< 0.001	< 0.010	< 0.005	< 0.001	< 0.001	0.00008J	< 0.010
Vanadium (mg/L)	0.00039	0.00063	0.00051J	< 0.002	0.0044	< 0.010	0.0014J	0.0112	0.007	0.0171	0.0059J
Zinc (mg/L)	0.0396	0.0123	0.0079	0.0063	0.0086	< 0.020	0.0657	0.0023	0.0033	0.0076	0.0083J

°C = degrees Celsius

- DHP = downhole probe
- DO = dissolved oxygen
- J = estimated value
- mg/L = milligrams per liter
- mV = millivolt
- NM = not measured
- ORP = oxidation reduction potential
- TOC = total organic carbon
- μ mhos/cm = micromhos per centimeter

Note: DO, ORP, and temperature values shown in parenthesis measured with downhole probe.

TCE and 1,4-Dioxane Concentrations in Shallow and Deep Monitoring Wells Cooper Drum Company Superfund Site, South Gate, CA

Well ID	Initial TCE (July 2005) (mg/L)	Final TCE (June 2006) (mg/L)	Percentage Change	Initial 1,4-Dioxane (July 2005) (mg/L)	Final 1,4-Dioxane (June 2006) (mg/L)	Percentage Change
Shallow Wells						
EW-1 (63 ft bgs)	660	65	-90%	750	47	-94%
MW-33A	940	180	-81%	630	99	-84%
MW-20	520	110*	-79%	140	79*	-44%
Shallow Well Ave	rage		-83%			-74%
Deep Wells						
EW-1 (85 ft bgs)	55	29	-47%	51	9.4	-82%
MW-33B	39	25	-36%	1.4	1.0	NA
MW-20B	16	6.3*	-61%	0.5	2.2*	NA
Deep Well Averag	e		-48%			NA

* Final data for MW-20 and MW-20B are from March 2006 when oxidant injection into the nearest injection well was ceased.

ft bgs = feet below ground surface

mg/L = micrograms per liter

NA = Not applicable; initial concentrations were too low to allow a meaningful evaluation of changes

TCE = trichloroethene

Evaluation of Rebound in Shallow Monitor Wells Three Months After End of Pilot Study Cooper Drum Company Superfund Site, South Gate, CA

Well	сос	Initial Concentration July 2005 (µg/L)	Concentration in June 2006 (µg/L)	Percentage Change Since Start of Pilot study	Concentration in August 2006 (µg/L)	Percentage Change Since Start of Pilot study
EW-1 (63 ft)	TCE	660	65	-90%	120	-82%
EW-1 (63 ft)	1,4-Dioxane	750	47	-94%	250	-67%
MW-33A	TCE	940	180	-81%	130	-86%
MW-33A	1,4-Dioxane	630	99	-84%	74	-88%
MW-20	TCE	520	110*	-79%	140	-73%
MW-20	1,4-Dioxane	140	79*	-44%	71	-49%

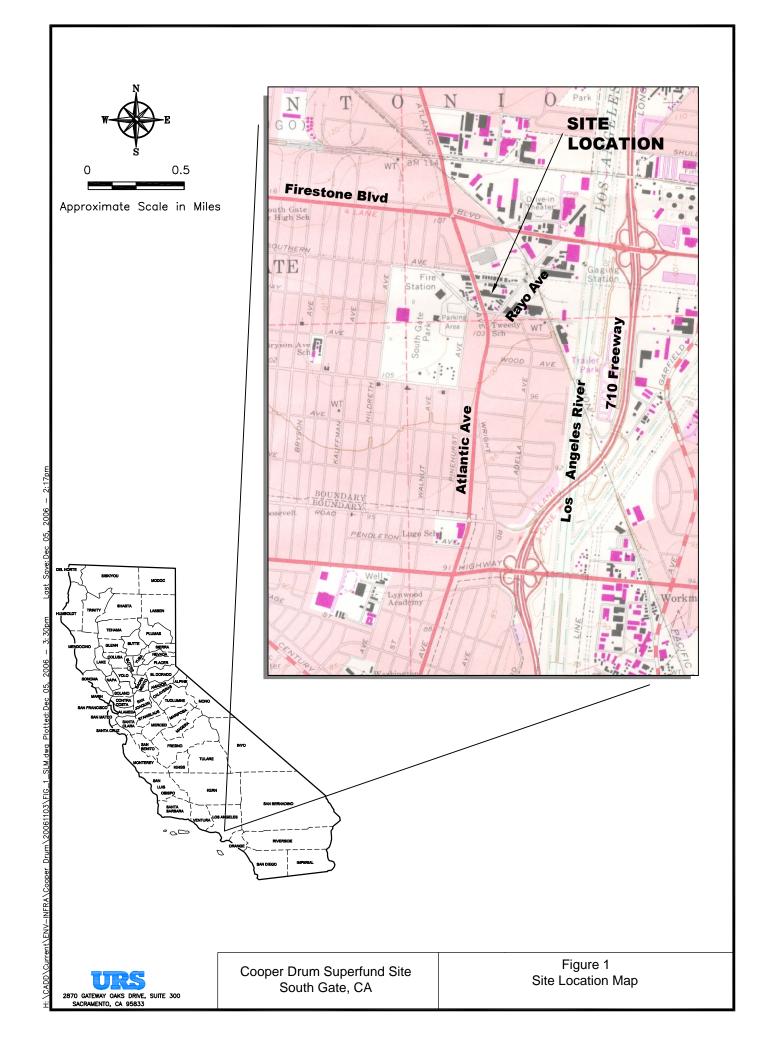
* Final data for MW-20 and MW-20B are from March 2006 when oxidant injection into the nearest injection well was ceased.

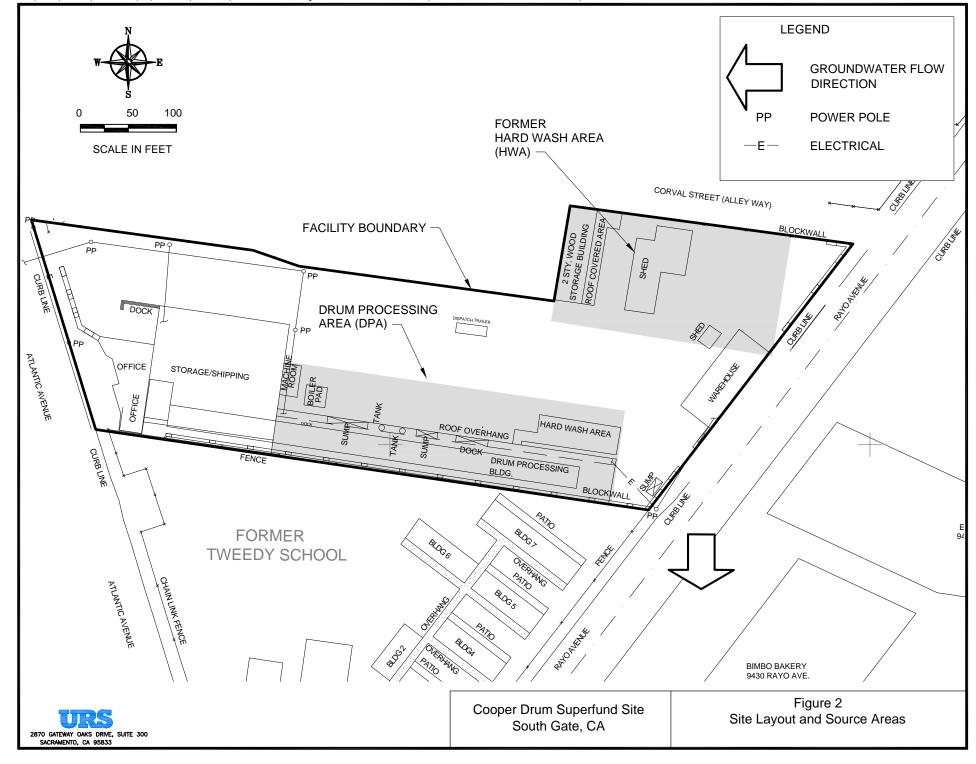
COC = contaminant of concern

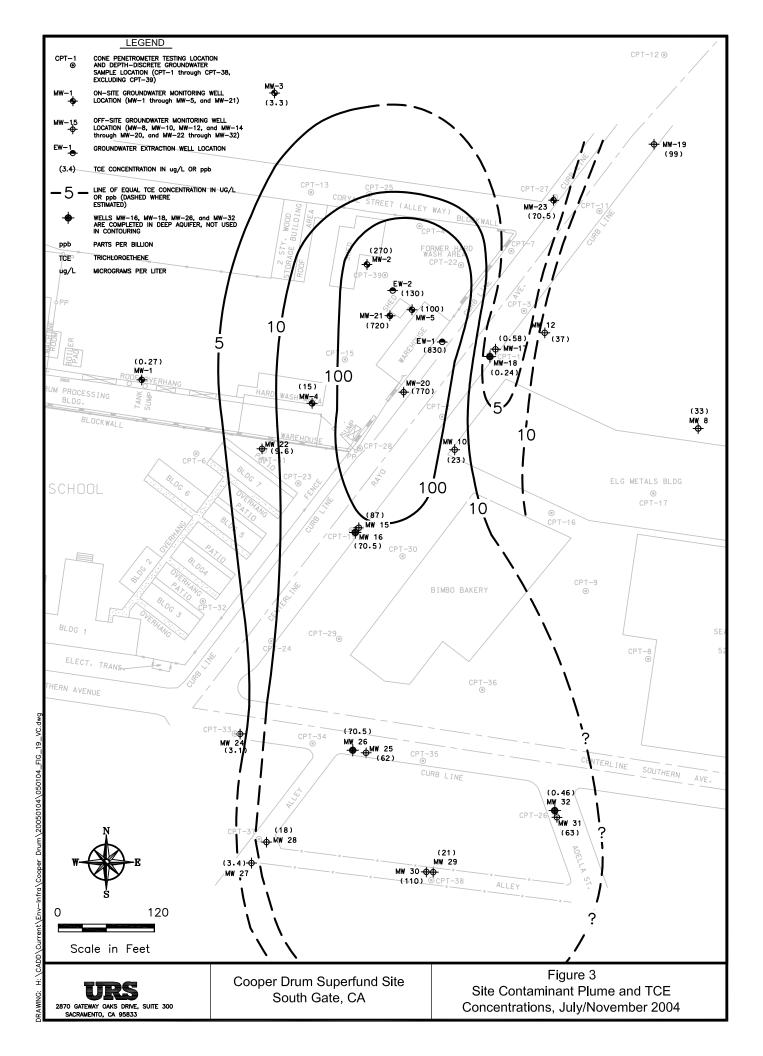
TCE = trichloroethene

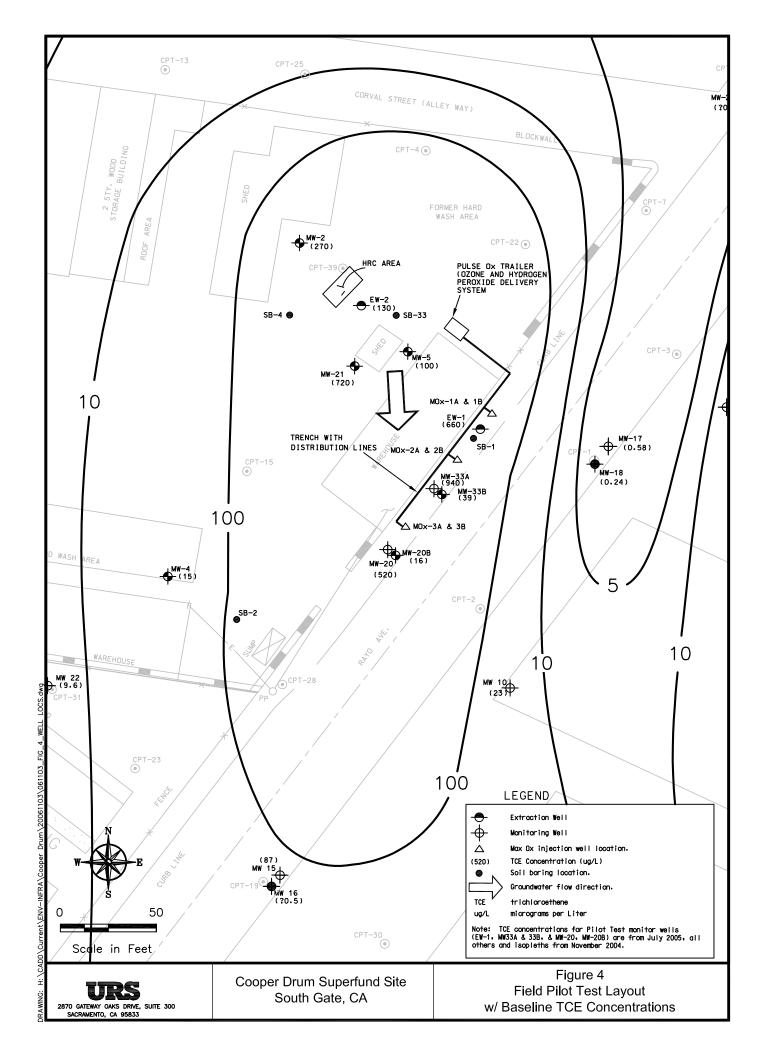
 $\mu g/L$ = micrograms per liter

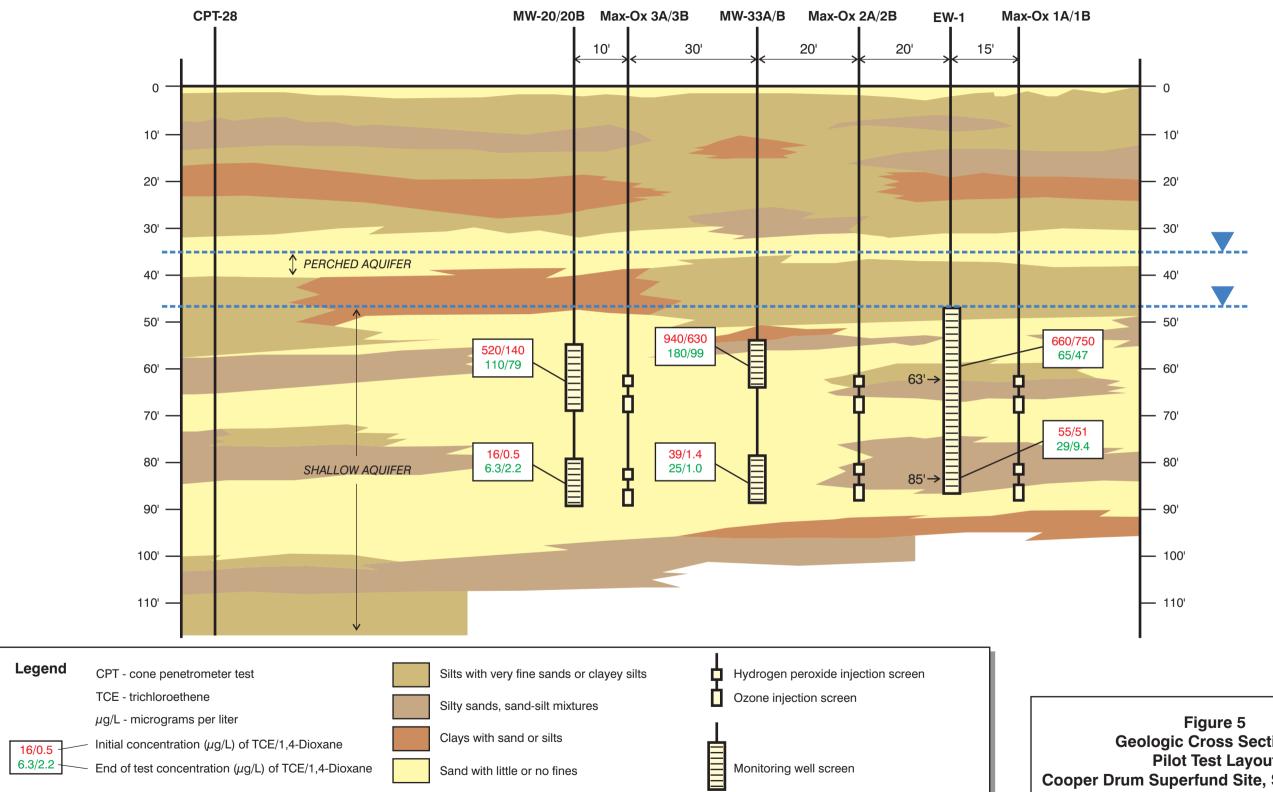
FIGURES





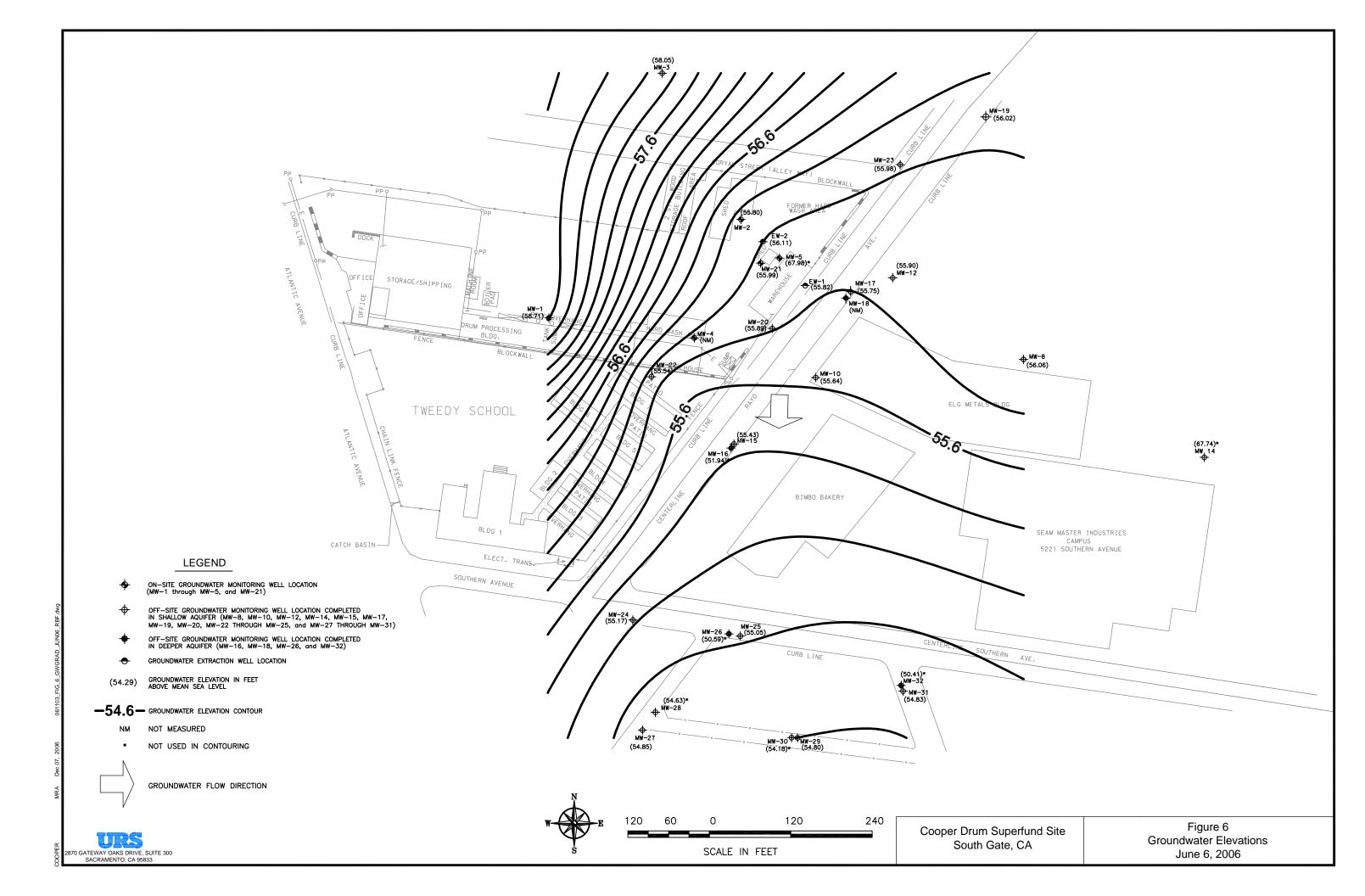


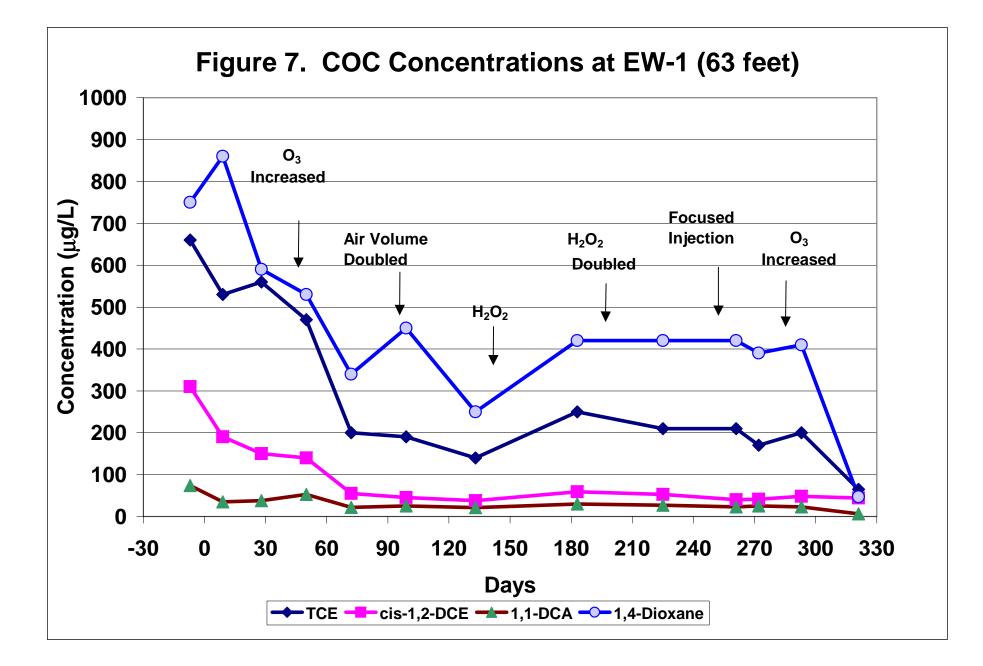


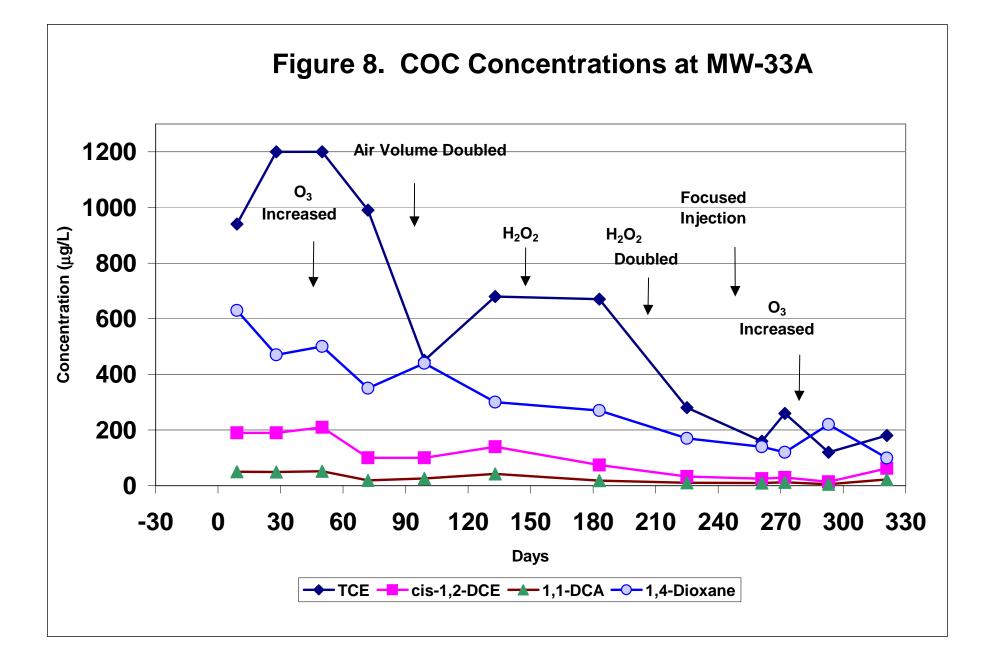


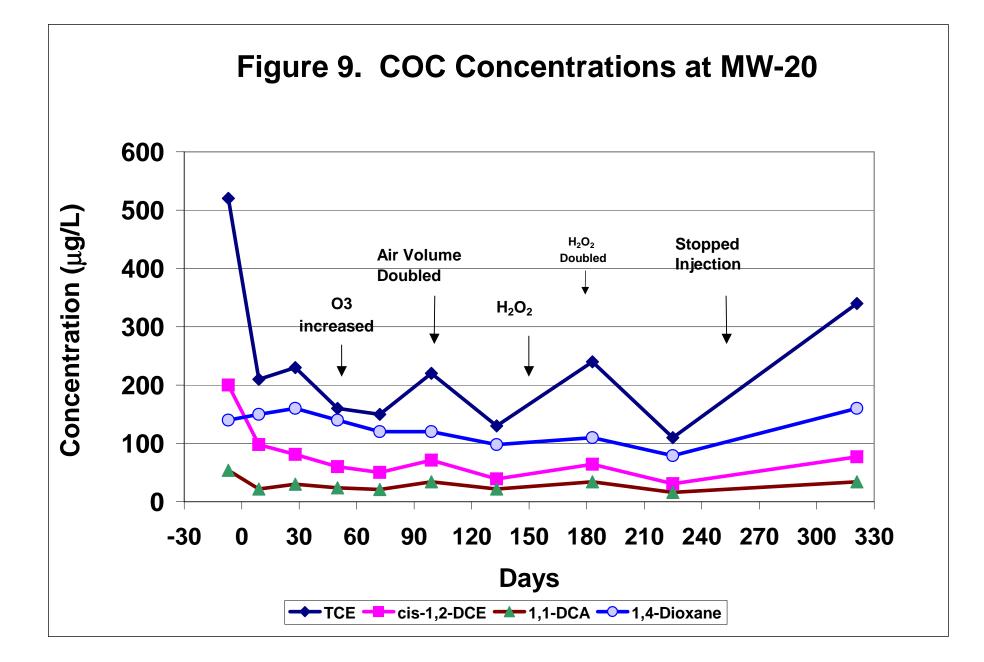
Cooper Drum\07-06-cross-section.cdr LCT 12.04.06 SAC

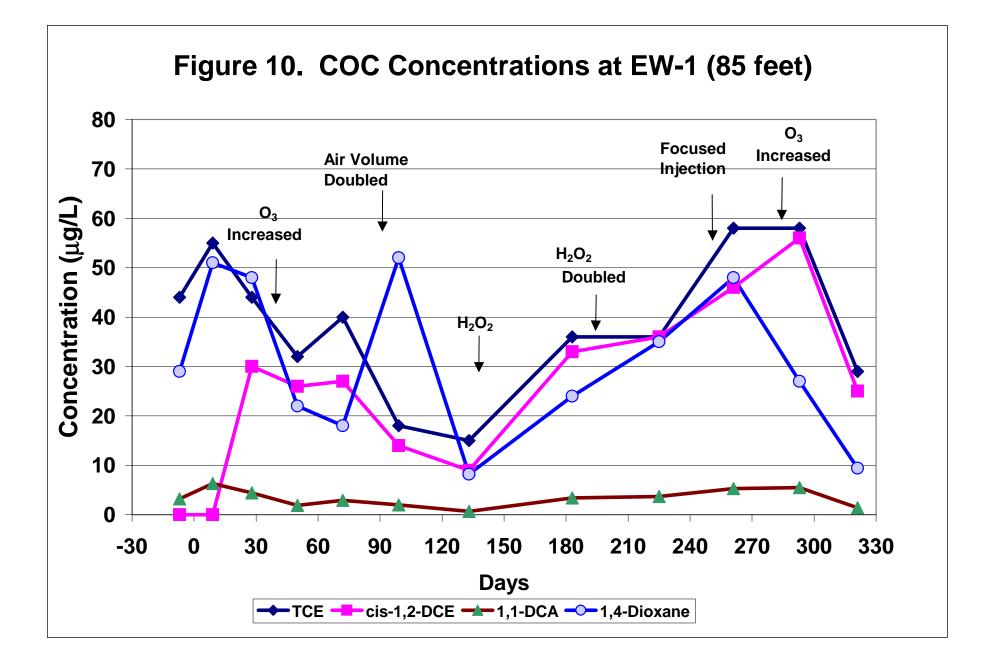
Figure 5 Geologic Cross Section of Pilot Test Layout Cooper Drum Superfund Site, South Gate, CA

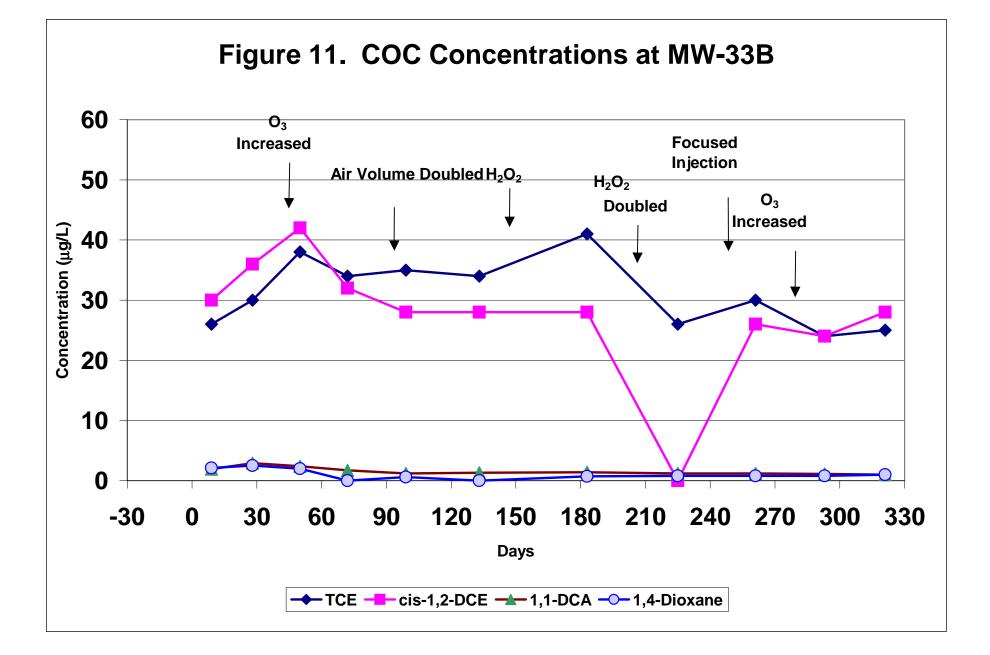


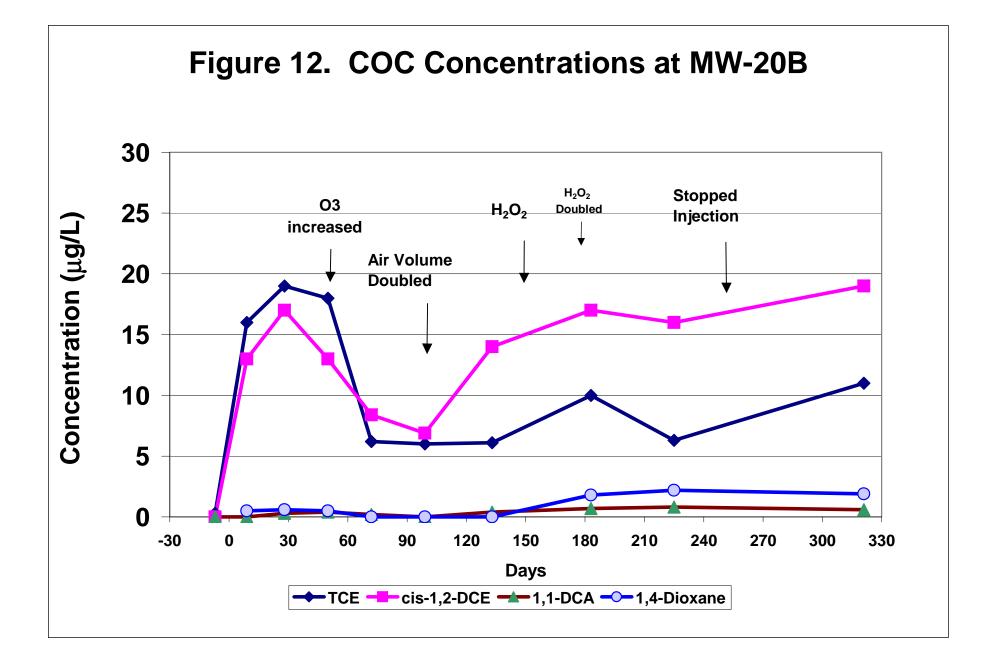


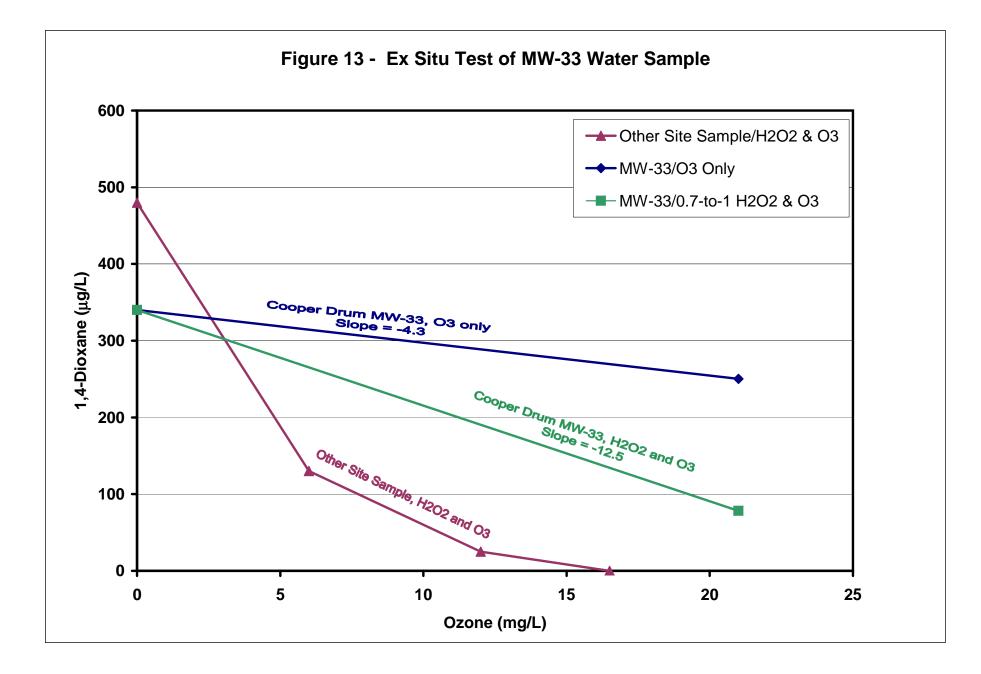


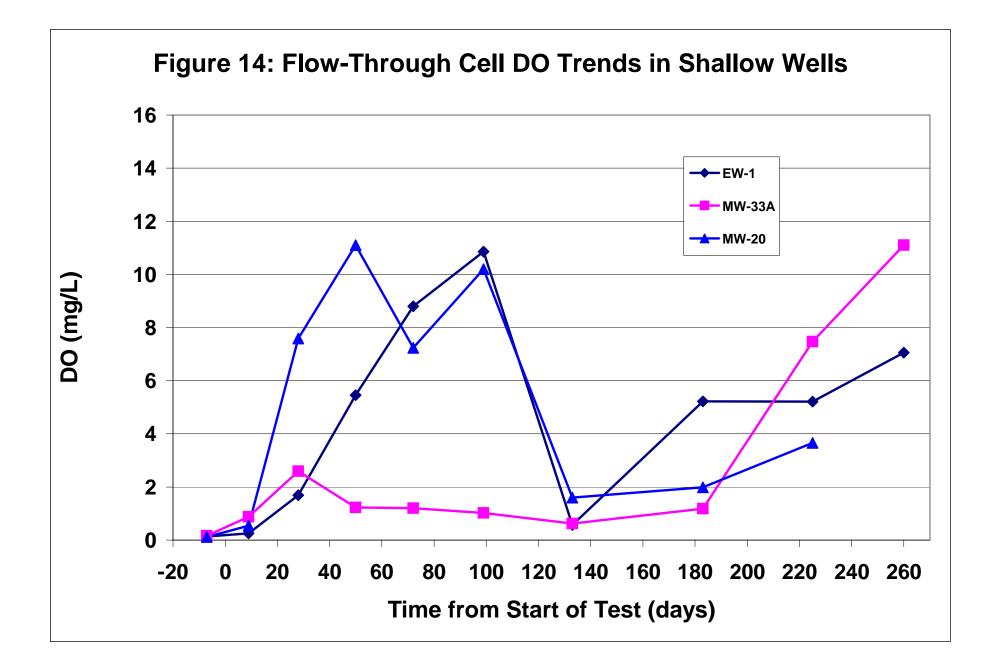


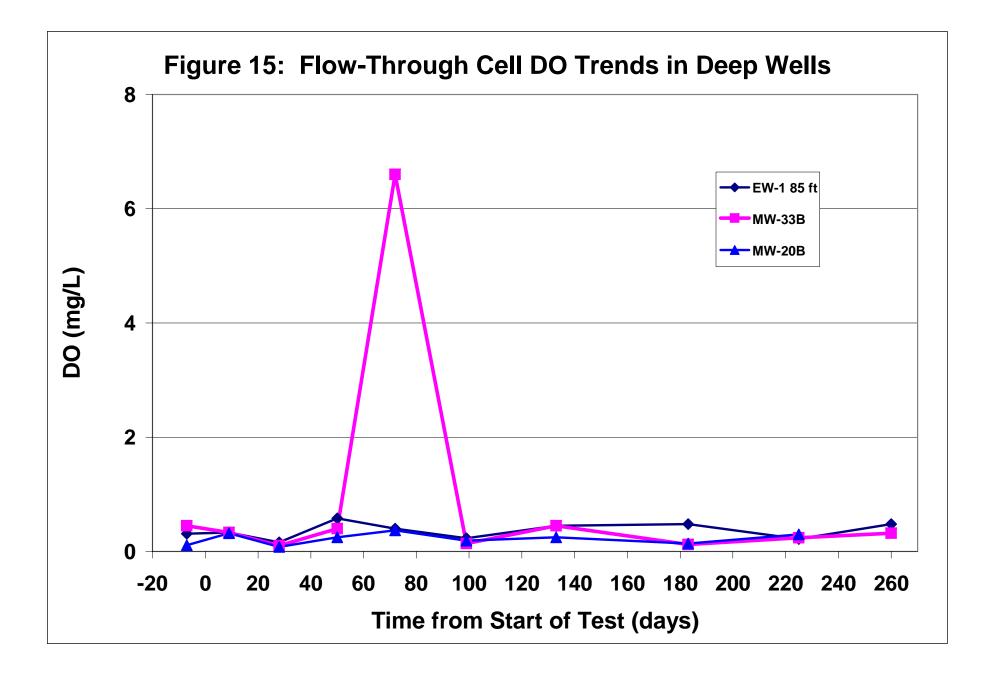


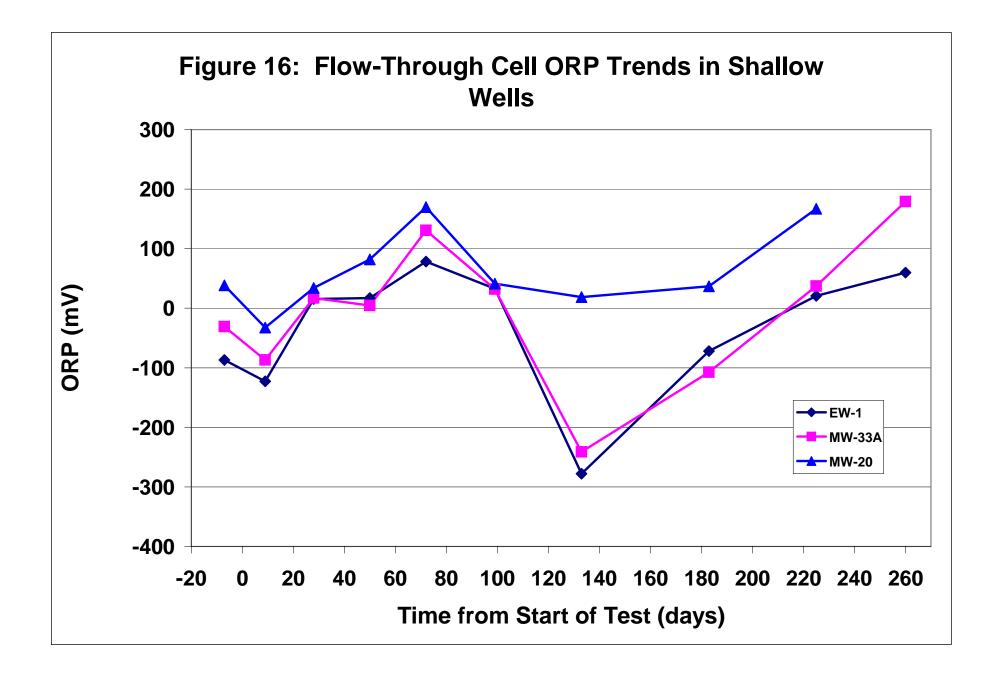


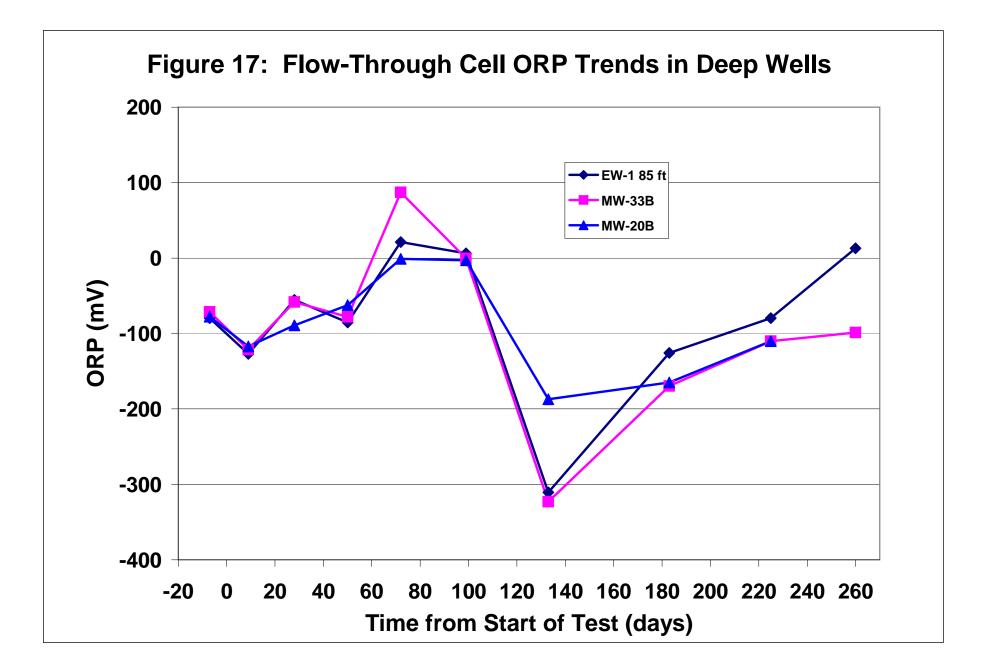


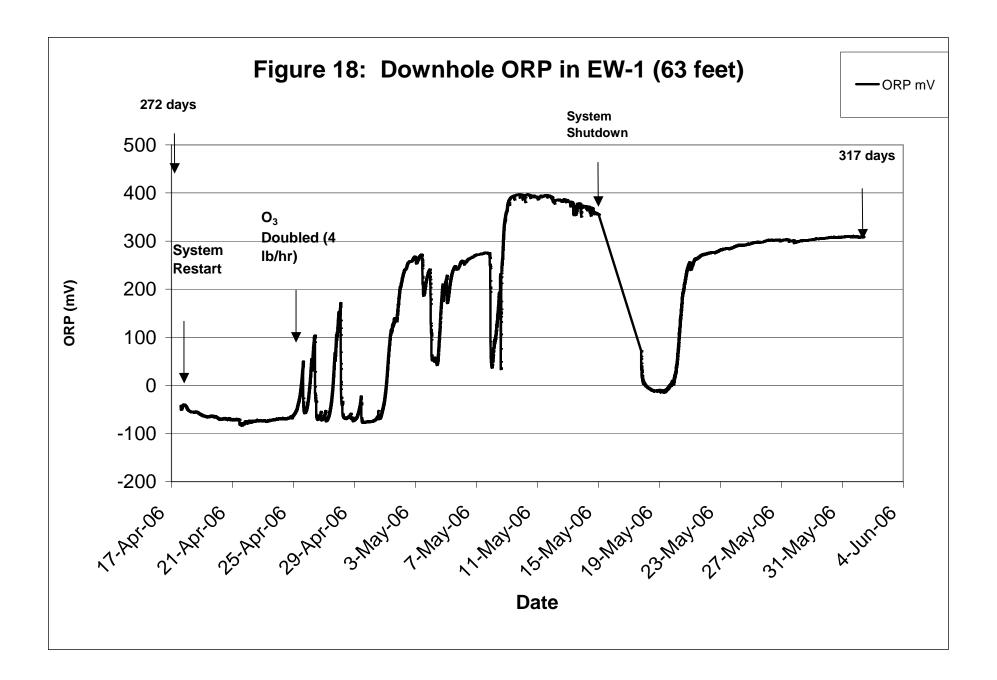


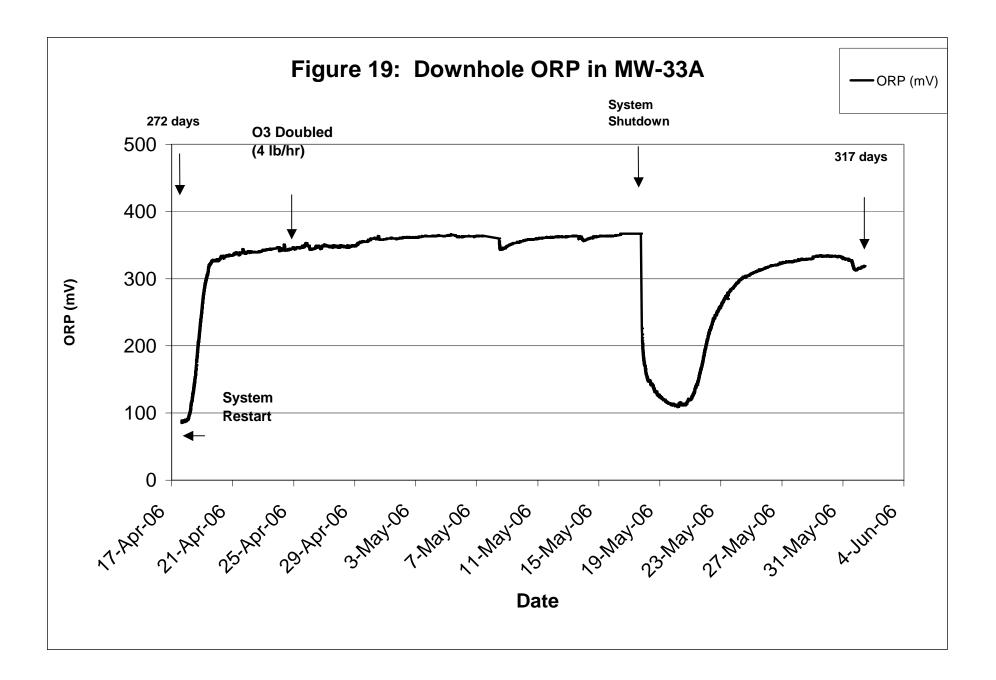












APPENDIX A

Bench-Scale Test Report

Report of Findings

Evaluation of Ozone and Peroxone for the Destruction of Dioxane

Cooper Drum

June 30, 2005

Submitted to

Don Gruber URS Corporation 2870 Gateway Oaks Drive, Suite 300 Sacramento, CA 95833

Submitted by Cindy G. Schreier, Ph.D. PRIMA Environmental 10265 Old Placerville Road, Suite 15 Sacramento, CA 95827

Cindy G. Schreier, Ph.D., Principal

Date

EXECUTIVE SUMMARY

Bench-scale treatability testing was conducted on soil SB-33 (collected from 55-77 feet) and groundwater EW-1 from the Cooper Drum site in Southgate, California to evaluate the ability of ozone and Peroxone (a mixture of ozone and hydrogen peroxide) to destroy dioxane. Site groundwater also contained trichloroethene (TCE) and other volatile organic compounds (VOCs), but these were of lesser concern because most are known to be degraded by Peroxone and or ozone. Tests were also conducted to evaluate the potential for ferrous iron, chelated iron, and olefins to enhance the effectiveness of ozone toward dioxane removal.

Bench-scale laboratory testing clearly demonstrated that treatment of soil and groundwater with ozone alone or with Peroxone (a mixture of ozone and H_2O_2) could destroy 1,4-dioxane as well as other VOCs. Complete removal of all COCs from the aqueous phase was achieved with all treatments. Additional tests confirmed that dioxane was also removed from the soil phase. No VOCs were detected in off-gases.

COC removal was due to destruction not volatilization. NO VOCs were detected in offgases from the ozone and Peroxone tests and dioxane was not removed from the aqueous phase by sparging with nitrogen, an inert gas.

Removal of dioxane by ozone alone was probably due to 'enhancement" of the ozone by iron, bicarbonate or other compounds naturally present in soil and groundwater. In tests conducted on DI water spiked with dioxane and various potential enhancers, dioxane was completely removed in all cases except when olefins were added. Thus, the addition of H_2O_2 as an enhancer may not be required during in situ applications.

Ozone and Peroxone affected several secondary water quality parameters including bromate, bromide, Cr(VI), vanadium, chromium (total), manganese, iron, nickel, selenium, barium, tungsten and nitrate. The direction of the change (an increase or decrease) was the same in most cases, but the magnitude often varied among the tests. Parameters affected by both ozone and Peroxone were bromate, chromium (total), manganese, iron, nickel, copper, barium, tungsten and nitrate. Parameters affected by either ozone or Peroxone were vanadium and selenium. Copper and chromium (total and Cr(VI)), were effect by ozone and one of the Peroxone tests.

The ozone demand of soil was approximately 3,000 mg O₃/kg soil.

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1.0 INTRODUCTION

Bench-scale treatability testing was conducted on soil SB-33 (collected from 55-77 feet) and groundwater EW-1 from the Cooper Drum site in Southgate, California to evaluate the ability of ozone and Peroxone (a mixture of ozone and hydrogen peroxide) to destroy dioxane. Site groundwater also contained trichloroethene (TCE) and other volatile organic compounds (VOCs), but these were of lesser concern because most are known to be degraded by Peroxone and or ozone. Tests were also conducted to evaluate the potential for ferrous iron, chelated iron, and olefins to enhance the effectiveness of ozone toward dioxane removal.

Peroxone, a mixture of ozone and hydrogen peroxide (H_2O_2) , is a strong oxidant that can destroy a wide range of organic compounds, including chlorinated solvents and dioxane. In principal, compounds may be completely mineralized to carbon dioxide (CO₂) and water (H₂O). Oxidation is believed to occur via the formation of hydroxyl and other radicals, which are even stronger oxidants than either ozone or H₂O₂ alone. Other compounds naturally present in water could also potentially react with ozone to generate hydroxyl radicals. These include iron (Bower, K. C. and C. M. Miller. "Filter Sand-Phosphate Buffer Effect on 2,4-Dinitrotoluene Ozonation," *J. Environ. Eng.* February **2002**, 131-136, and references therein), bicarbonate, and olefins (e.g. TCE).

Because ozone is a gas and H_2O_2 decomposes to form oxygen gas, *in situ* treatment via injection of Peroxone into the sub-surface could result in removal of volatile compounds by sparging rather than oxidation. Lab testing therefore addressed whether contaminant removal was due to destruction or volatilization.

Finally, Peroxone is a non-selective oxidizing agent that may react with soil and groundwater components in addition to target compounds. The most likely effects are oxidation of soil chromium to form Cr(VI), mobilization of metals (particularly manganese and arsenic), formation of nitrate (from reduced nitrogen species), formation of bromate (from bromide) and precipitation of dissolved iron.

The specific goals of this proposed bench-scale testing are

- estimate the ozone demand of soil;
- estimate the longevity of H_2O_2 in the presence of ozone,
- confirm removal of COCs and determine whether removal is due to volatilization or destruction,
- measure the effect of Peroxone on secondary water quality parameters including metals, Cr(VI), bromate and nitrate, and
- assess the potential of other naturally occurring compounds to enhance dioxane destruction by ozone.

2.0 EXPERIMENTAL PROCEDURES

Batch tests were conducted to meet the goals in Section 1. A column test was also considered to assess whether Peroxone could be effectively applied in the field, but preliminary tests indicated that such a test would not yield the desired information.

2.1 Soil and Groundwater Preparation

Thirteen (13) sleeves of soil SB-33 (depths ranging from 55 to 77) were received for testing on April 20, 2005. The soil was composited then analyzed for

- Volatile organic compounds (VOCs)
- Low-level dioxane
- Cr(VI)
- Metals (aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, thallium, tungsten, vanadium, and zinc)

Site groundwater (EW-1) was received for testing in two batches: 8 x 1L on April 21, 2005 and 8 x 1L on April 22, 2005. The water was used as received. Untreated water was analyzed for

- VOCs
- Low-level dioxane
- Bromide and bromate
- Cr(VI)
- Metals (aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, thallium, tungsten, vanadium, and zinc)
- nitrate

2.2 Ozone Demand

The ozone demand of soil was estimated using a method based on the "Ozone Demand" test described in *Standard Methods for the Examination of Water and Wastewater*, 19th *Ed.*

A small amount of soil (2 g) was added to 1L of ozone-saturated water, then the concentration of ozone will be measured over time using the indigo method. A control in which no soil was added was also performed. The soil ozone demand (SOD_{oz}) is taken to be the difference in ozone consumption in the presence and absence of site material. It was calculated according to the equation

$$SOD_{oz} = \{[O_3 Consumed]_{soil} - [O_3 Consumed]_{control}\} \times V/M$$
 Eqn. 1

where

 $\begin{array}{l} SOD = \mbox{ soil oxidant demand in mg } O_3 \mbox{ consumed/g soil } \\ [O_3 \mbox{ Consumed}]_{\mbox{control}} = \mbox{change in } O_3 \mbox{ concentration in the absence of soil in mg/L } \\ [O_3 \mbox{ Consumed}]_{\mbox{soil}} = \mbox{change in } O_3 \mbox{ concentration in the presence of soil in mg/L } \\ V = \mbox{ volume of ozonated water in } L \\ M = \mbox{ mass of soil in } g \end{array}$

2.3 Confirmation of COC Removal

To confirm that COCs are removed and estimate the amount of removal due to destruction versus volatilization, two sets of tests were conducted as shown in Table 1. The second set of tests was conducted to confirm the results of the first ozone test and to better assess possible loss of dioxane due to sparging. (Dioxane is highly soluble in water and does not easily volatilize upon sparging with a gas. However, to confirm that losses of dioxane in the original tests were due to destruction not volatilization, three additional tests, including one using inert nitrogen gas, were performed).

For each set of tests, soil, groundwater, and if appropriate 30%H₂O₂, were placed in a glass reactor. The reactors to be sparged were each fitted with a gas dispersion tube and vent for off-gases. The control reactors were sealed. All reactors were stirred with a magnetic stirrer. The reactors were sparged with nitrogen or ozone (26 mg/L in air for Set A tests, 31 mg/L in air for Set B tests) at a flowrate of 200 mL/minute for 3 hours. For Set A tests, off-gases were collected in 100-L Tedlar bags. The off-gases were analyzed for VOCs (except dioxane). The aqueous phase of Set A tests was analyzed for VOC and low-level dioxane; soil was not analyzed. For Set B tests, both soil and water were analyzed for low-level dioxane (but not VOCs).

Table 1. Initial Conditions for COC Removal Tests					
Test	Soil, g	Groundwater, mL	Initial H ₂ O ₂ *, %	Sparge Gas	
Set A Tests					
Control-A	100	1,000	0	None	
Ozone-A	100	1,000	0	Ozone	
Peroxone-Low	100	1,000	0.07	Ozone	
Peroxone-High	100	1,000	0.35	Ozone	
Set B Tests					
Control-B	100	1,000	0	None	
Nitrogen-B	100	1,000	0	Nitrogen	
Ozone-A	100	1,000	0	Ozone	

Table 1. Initial Conditions for COC Removal Tests

* obtained by adding 2.4-12 mL 30% H₂O₂

2.4 Evaluation of Other Potential Ozone "Enhancers"

Because dioxane was destroyed by ozone (as well as Peroxone) in Section 2.3 tests, additional tests were conducted to evaluate compounds naturally present in soil or groundwater that could potentially enhance the effectiveness of dioxane oxidation by ozone. These potential enhancers were ferrous iron, chelated iron, TCE (an olefin), bicarbonate. Most tests were conducted using 1L deionized water spiked with approximately 400 μ g/L 1,4-dioxane, since this enabled one compound at a time to be evaluated. Other tests used 1L site groundwater or 100 g site soil, since there may be some unidentified compound in either matrix that may enhance ozone's effectiveness. The tests are summarized in Table 2. The test procedures were similar to those for Section 2.3—that is, the water or soil was sparged with ozone (25 mg/L in air at 250 mL/min for about 3 hours), after which the aqueous was analyzed for low-level dioxane. When applicable, the soil was also analyzed.

Test	Soil, g	Water, mL	Enhancer	Sparge Gas
Control-C	None	1,000 mL Spiked DI ^a	None	Ozone
Ferrous Iron	None	1,000 mL Spiked DI	2 mg/L Iron ^b	Ozone
Chelated Iron	None	1,000 mL Spiked DI	2 mg/L Iron ^c	Ozone
Bicarbonate	None	1,000 mL Spiked DI	1000 mg/L as CaCO ₃	Ozone
Olefins	None	1,000 mL Spiked DI	500 ppb TCE^d	Ozone
GW Only	None	1,000 mL site GW ^e	None	Ozone
Soil	Site Soil	1,000 mL Spiked DI	None	Ozone

Table 2. Summary of Tests evaluating Ozone Enhancers.

^{*a*} DI water spiked with about 400 ppb 1,4-dioxane

^b Added as ferrous sulfate heptahydrate

^c Added as Grow-MoreTM agricultural iron (iron EDTA), 13% iron by weight

^d Water also spiked with ~ 100 μ g/LTCE (an olefin)

^e Site groundwater less settable solids.

2.5 Effect of Treatment on Secondary Water Quality

The effect of ozonation on secondary water quality parameters was determined by analyzing the aqueous phases from the Set A tests in Section 2.3 for bromide, bromate, Cr(VI), dissolved metals (Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Mo, Ni, Se, Ag, Tl, W, V, and Zn), nitrate, and pH.

2.6 Simulation of Peroxone Injection

A column test was to be conducted on site soil and groundwater to simulate the anticipated Peroxone injection procedure that will be used in the field and determine whether this procedure is effective using an apparatus similar to that in Figure 1. Because of the difficulty in designing such a test, a preliminary test using clean sand. DI water and indigo (a blue solution that is rapidly decolorized by ozone) in place of H2O2 was conducted. A two-inch diameter column made of clear PVC was filled with clean silica sand soil and DI water. Ozone was injected toward the bottom of the column, while indigo was added above the ozone injection point.

Despite extensive effort, it was difficult to disperse evenly the indigo or the ozone the sand column, though when the two reagents did mix, indigo was decolorized. Since it was

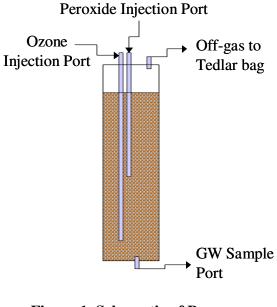


Figure 1. Schematic of Peroxone Column Test Apparatus

unknown whether this difficulty would be an issue in the field, it was concluded by PRIMA, URS and EPA personnel that a laboratory column test could not accurately demonstrate the field applicability of Peroxone injection. A column test using site soil and groundwater was therefore not performed. This simulation is discussed further in Section 3.

2.7 Analytical Procedures

The method for each analysis and the laboratory that performed the analysis are given in Table 3.

Table 5. Analytical Methods.					
Analyte	Method	Lab performing			
		test*			
COCs:					
VOCs	8260B	Alpha Analytical			
Low-level dioxane	8260B direct inject	Alpha Analytical			
Metals (Be, Al, V, Cr, Mn, Fe, Co, Ni,	ICP/MS	Alpha Analytical			
Cu, Zn, As, Se, Mo, Ag, Cd, Sb, Ba, W,					
Hg, Tl, Pb)					
Cr(VI)	EPA 7199/Hach**	Excelchem/PRIMA			
Nitrate	EPA 300	Excelchem			
Bromate and bromide	EPA 300	Columbia			
		Analytical			
pH	Probe	PRIMA			

Table 3. Analytical Methods.

* Alpha Analytical (Sparks, NV), PRIMA Environmental, or Excelchem (Roseville, CA), Columbia Analytical Services (Kelso,

WA)

** Hach DR 2010 Spectrophotometer and appropriate Hach kit reagents

3.0 RESULTS AND DISCUSSION

Bench-scale laboratory testing demonstrated that treatment of soil and groundwater with ozone alone or with Peroxone (a mixture of ozone and H_2O_2) could destroy 1,4-dioxane as well as other VOCs. Removal was due to destruction, not volatilization. Both Peroxone and ozone affected several secondary water quality parameters. In most cases, the direction of the change was the same, but the magnitude often differed. Treatment of soil and groundwater with ozone was as effective as treatment with Peroxone probably due to iron, bicarbonate and other compounds naturally present in soil and water , which acted as ozone "enhancers" in the same manner as did H_2O_2 .

3.1 Characterization of Untreated Soil and Groundwater

The concentrations of COCs and other parameters in untreated soil and groundwater are shown in Table 4. For clarity, only detected compounds are listed. Complete analytical reports are provided in the Appendix. Site soil contained 55 μ g/kg dioxane, while groundwater contained 720 μ g/L dioxane. No other VOCs were detected in soil. Some chlorinated ethenes and ethane were detected in groundwater—the most prominent were TCE (520 μ g/L) and cis-DCE (200 μ g/L).

Of the 21 metals tested, untreated groundwater contained detectable quantities of seven: manganese (2,700 µg/L), iron (2,400 µg/L), nickel (72 µg/L), arsenic (45 µg/L), molybdenum (130 µg/L), barium (39 µg/L), and tungsten (9.4 µg/L). All of these metals, as well as several others, were detected in soil. Groundwater contained 2,480 µg/L bromide and < 1.00 µg/L Cr(VI).

3.2 COC Removal / Mechanism of Removal

The results of the Set A tests are shown in Table 5, respectively. Complete analytical reports are provided in the Appendix. No VOCs were detected in the off-gases above the detection limit of $0.4 \mu g/L$.

The ozone and Peroxone tests were nearly identical. In the Set A tests, dioxane and all VOCs detected in untreated groundwater and in the control were removed to below their respective detection limits and no VOCs were detected in the off-gases. The only difference between the tests was the formation of a small amount of bromoform (1.4 μ g/L) in the ozone test. Because no VOCs were detected in the off-gases, VOC losses from the aqueous phase must be due to destruction, not volatilization.

Because dioxane is not easily removed from water by sparging, the loss of dioxane from the aqueous phase was assumed to be due to destruction. To test this hypothesis, a second set of tests (Set B tests) was conducted. This set of tests compared dioxane removal by ozone to dioxane removal by nitrogen, an inert gas. The results are shown in Table 6. Dioxane was completely removed from the ozone-sparged test, but was unaffected by sparging with nitrogen. Furthermore, dioxane was not detected in soil from the ozone-sparged test, confirming that removal of dioxane by ozone was due to destruction.

			Untreated
Analyte	Units	Untreated Soil	Groundwater
1,4-dioxane	ppb	55	720
1,1,-DCE	ppb	< 20	32
trans 1,2-DCE	ppb	< 20	7.6
1,1-DCA	ppb	< 20	48
cis-DCE	ppb	< 20	200
1.2-DCA	ppb	< 20	5.1
TCE	ppb	< 20	520
Bromate	μg/L	n.m.	< 25
Bromide	μg/L	n.m.	2,480
Cr(VI)	ppb	1.04	< 1.0
Metals	••		
beryllium	ppb	< 1,000	< 4
aluminum	ppb	19,000,000	< 200
vanadium	ppb	50,000	< 5
chromium (total)	ppb	120,000	< 5
manganese	ppb	540,000	2,700
iron	ppb	29,000,000	2,400
cobalt	ppb	17,000	< 5
nickel	ppb	190,000	72
copper	ppb	36,000	< 10
zinc	ppb	58,000	< 100
arsenic	ppb	4,000	45
selenium	ppb	< 1,000	< 5
molybdenum	ppb	< 1,000	130
silver	ppb	< 1,000	< 5
cadmium	ppb	< 1,000	< 5
antimony	ppb	3,400	< 5
barium	ppb	290,000	39
tungsten	ppb	< 1,000	9.4
mercury	ppb	< 200	< 1
thallium	ppb	< 1,000	< 5
lead	ppb	7,000	< 5
Nitrate	mg/L	n.m.	0.902
рН		n.m.	7.43

Table 4. Concentrations of COCs and Other Parameters in Untreated Materials.

Analyte	Units	Control-A	Ozone-A	Peroxone- Low-A	Peroxone- High-A
1,4-dioxane	μg/L	680	< 3	< 3	< 3
1,1,-DCE	μg/L	23	< 1	< 1	< 1
trans 1,2-DCE	μg/L	6	< 1	< 1	< 1
1,1-DCA	μg/L	39	< 1	< 1	< 1
cis-DCE	μg/L	160	< 1	< 1	< 1
1.2-DCA	μg/L	< 5	< 1	< 1	< 1
TCE	μg/L	420	< 1	< 1	< 1
Bromoform	μg/L	< 5	1.4	< 1	< 1

Table 5. Concentration of COCs in Set A Tests.

Table 6. Concentration of Dioxane in Set B Tests.

Test	1,4 Dioxane, ppb		
	Soil Groundwate		
Untreated	< 50	690	
Control-B	110	600	
Nitrogen-B	110	600	
Ozone-B	< 50	< 3	

3.3 Evaluation of Ozone Enhancers

Conventional wisdom states that ozone alone cannot destroy dioxane— H_2O_2 is required in order to generate hydroxyl radicals. However, the results presented in Tables 4 and 5 clearly demonstrate that sparging site soil and groundwater with ozone alone can destroy dioxane and reduce aqueous concentrations from about 690 µg/L to < 3 µg/L. This implies that other compounds naturally present in soil or groundwater can "enhance" the effectiveness of ozone in the same manner as H_2O_2 . To test this hypothesis, additional tests were performed. The results are shown in Table 7.

Test #	Test ID	1,4 Dioxane, ppb	
		Soil	Groundwater
n.a.	Untreated Spiked DI	n.a.	400
1	Control (no enhancer)	n.m.	98
3	Ferrous Iron	n.m.	< 3
7	Chelated Iron	n.m.	< 3
4	Bicarbonate	n.m.	< 3
5	TCE (Olefins)*	n.m.	69
6	GW Only	n.m.	< 3
8	Soil Only	< 50	< 3

 Table 7. Concentration of Dioxane in Ozone "Enhancer" Tests

Notes:

- n.a. = not applicable

- n.m. = not measured

- Initial TCE concentration in Test $5 = 69 \ \mu g/L$

- Test # provided to correlate Table 6 results with analytical reports provided in Appendix

Complete removal of dioxane was obtained in all of the tests except the test in which an olefin (TCE) was the "enhancer". Dioxane concentration was reduced in (but not completely removed from) the control, which was sparged with ozone but contained no enhancer. This confirms that iron (ferrous or chelated iron), bicarbonate (alkalinity) and possibly other, unidentified compounds can enhance the ability of ozone to destroy dioxane.

3.4 Effect of Peroxone and Ozone on Secondary Water Quality

The effect of ozone and Peroxone treatment on secondary water quality parameters is shown in Table 8. Treatment with ozone or Peroxone affected several parameters, including bromate, bromide, Cr(VI), vanadium, chromium (total), manganese, iron, nickel, copper, selenium, barium, tungsten and nitrate. The direction of the change (an increase or decrease) was the same in most cases, but the magnitude often varied among the tests.

				Peroxone- Peroxone-		
Analyte	Units	Control-A	Ozone-A			
-				Low-A	High-A	
Bromate	μg/L	< 25	232	46	78	
Bromide	μg/L	2,310	1,910	2,260	4,170	
Cr(VI)	ppb	< 1.00	9.98	< 10	< 10	
H2O2, residual	ppm	0	0.00	~ 400	~ 2,000	
Metals						
beryllium	ppb	< 4	< 4	< 4	< 4	
aluminum	ppb	< 200	< 200	< 200	< 200	
vanadium	ppb	27	30	130	160	
chromium (total)	ppb	< 5	12	< 5	6.6	
manganese	ppb	2,400	< 10	180	190	
iron	ppb	2,400	1,900	1,200	1,200	
cobalt	ppb	< 5	< 5	< 5	5.5	
nickel	ppb	66	29	18	26	
copper	ppb	30	40	26	79	
zinc	ppb	< 100	< 100	< 100	< 100	
arsenic	ppb	25	29	25	26	
selenium	ppb	7.0	18	7.4	9.6	
molybdenum	ppb	150	160	150	140	
silver	ppb	< 5	< 5	< 5	< 5	
cadmium	ppb	< 5	< 5	< 5	< 5	
antimony	ppb	< 5	< 5	< 5	< 5	
barium	ppb	31	19	18	16	
tungsten	ppb	10	< 5	< 5	< 5	
mercury	ppb	< 1	< 1	< 1	< 1	
thallium	ppb	< 5	< 5	< 5	< 5	
lead	ppb	< 5	< 5	< 5	< 5	
Nitrate	mg/L	< 0.5	29.2	38.7	15.6	
рН		7.37	8.15	8.16	8.20	

Table 8.	Effect of Ozone and	Peroxone on S	Secondary	Water Quality
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"ppb" = $\mu g/L$; "ppm" = mg/L

Parameters affected by both ozone and Peroxone were bromate, chromium (total), manganese, iron, nickel, copper, barium, tungsten and nitrate. Bromate increased from < $25 \ \mu g/L$ in the control to $232 \ \mu g/L$ in the ozone test and 46 to 78 $\mu g/L$ in the Peroxone tests. Nitrate increased from < 0.5 mg/L in the control to 15 to 39 mg/L in the ozone and Peroxone tests. Manganese decreased from 2,400 $\mu g/L$ in the control to < 10 $\mu g/L$ in the ozone test, but to only 180 to 190 $\mu g/L$ in the Peroxone tests. In contrast, the reduction in iron was more significant in the Peroxone tests than in the ozone test. Nickel concentrations decreased from 66 $\mu g/L$ to 18-29 $\mu g/L$, barium decreased from 31 $\mu g/L$ to 16-19 $\mu g/L$, and tungsten decreased from 10 $\mu g/L$ to < 5 $\mu g/L$.

Parameters affected by either ozone or Peroxone were vanadium and selenium. Vanadium increased from 27 μ g/L in the control to 130-10 μ g/L in Peroxone tests, but was not affected by ozone alone. In contrast, selenium increased from 7.0 μ g/L in the control to 18 μ g/L in the ozone test, but was not affected by Peroxone.

Copper and chromium (total and Cr(VI)), were effect by ozone and one of the Peroxone tests. Specifically, ozone and Peroxone-High increased the concentration of copper from $30 \ \mu g/L$ to $40-79 \ \mu g/L$, but the Peroxone-Low test had no effect. Similarly, Total Cr increased in the ozone and Peroxone-High tests, but not in the Peroxone-Low test. Cr(VI) was detected in the ozone test at 9.98 $\mu g/L$. Cr(VI) was not detected above the detection limit of $10 \ \mu g/L$ in the Peroxone-High test. (Note: the Cr(VI) results reported in Table 7 were measured using a Hach test kit. Analyses were also performed using EPA Method 7199, but the value for the Peroxone tests was much higher than total Cr values and Cr(VI) measurements made with the Hach kit and are therefore not reported. PRIMA Environmental has encountered this problem in the past when using EPA Method 7199 to analyze low pH samples containing residual peroxide.)

3.5 Soil Oxidant Demand (Ozone)

The concentration of ozone over time is shown in Figure 2 for the soil ozone demand test. The measured soil ozone demand, calculated from Eqn. 1, was approximately 3,000 mg O_3 /kg soil. The ozone applied in the Ozone-A test in Section 3.2 was 940 mg, which is about 3 times greater than the mass of ozone needed based on the measured SOD. This was sufficient to destroy all of the COCs, implying that a large excess of ozone is not required.

3.6 Simulation of Peroxone Injection

A column test was conducted in an attempt to determine whether ozone and H2O2 (the components of Peroxone) injected one above the other in the same well would mix in the subsurface and destroy dioxane. To observe the potential for mixing directly, a column test using clean white sand, DI water, ozone and indigo was performed. Indigo was used in place of H2O2 because indigo is a blue liquid that decolorizes quickly upon contact with ozone. White sand was used so the indigo could be easily observed.

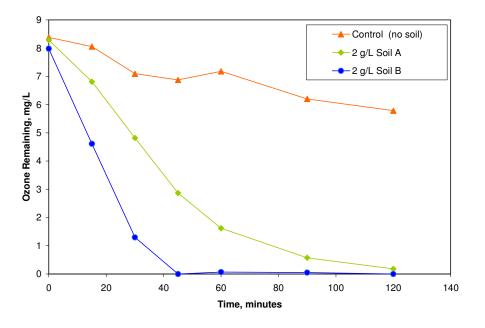


Figure 2. Soil Oxidant Demand (Ozone). Ozone Remaining.

The indigo was added to a ¹/₄-inch injection "well" about three inches above the ozone injection well. When air-pressure was applied to the indigo well, the indigo moved out into the sand column. However, once air-pressure was removed, the indigo was mostly sucked back into the well. Repeated applications of pressure resulted in only a little mixing between the indigo and the DI water within column.

Mixing between ozone and indigo was erratic. Application of ozone often resulted in channeling. If the channels were in the area of the indigo, then the indigo quickly decolorized. However, if the channels were away from the indigo, then the indigo persisted, suggesting that dissolution of ozone into the water and diffusion of ozone to the indigo was relatively slow. Varying the ozone flowrate and pressure caused the channels to shift, eventually enabling decolorization of indigo.

Because of the difficulties distributing ozone and indigo in this column test and because of the uncertainty about whether these problems would occur in the field, personnel from PRIMA Environment (Cindy G. Schreier), URS (Don Gruber and Venus Sadeghi), and USEPA (Michelle Simon), who were present when this column test was conducted, concluded that a column test could not accurately predict the effectiveness of the proposed field delivery system of Peroxone. Consequently, no column test was conducted using site soil, site groundwater and Peroxone.

4.0 ENGINEERING CONSIDERATIONS

Both ozone and Peroxone effectively destroyed 1,4-dioxane and other VOCs in site soil and groundwater. Some observations that should be taken into consideration when evaluating these technologies for full-scale application are provided.

Peroxone vs. Ozone. Although conventional wisdom indicates that ozone alone cannot destroy low-levels of dioxane, complete removal of dioxane to $< 3 \ \mu g/L$ was observed in when soil and groundwater were treated with ozone alone, as well as with Peroxone (ozone + H₂O₂). Additional tests indicate that iron, alkalinity (bicarbonate) and possibly other compounds naturally present in site soil and groundwater can enhance the effectiveness of ozone in a similar manner as H₂O₂. Therefore, at this site, ozone may be as effective at destroying COCs as Peroxone.

Ozone Demand. The results of the laboratory study can be used to estimate the size of the ozone generator needed for full-scale application. In this study, approximately 940 mg O_3 was applied to the soil-groundwater mixture, which was about 3 times the dose (300 mg O_3) required to meet the measured soil ozone demand. This dose resulted in complete removal of dioxane and all VOCs, but also resulted in the formation of 232 μ g/L bromate. A lower ozone dose may be able to achieve the same degree of COC removal without generating as much bromate.

Destruction vs. Volatilization. No VOCs were observed in off-gases from the ozone or Peroxone tests, implying that the VOCs were destroyed, not volatilized. Dioxane was not removed from water that was sparged with inert nitrogen gas, implying that dioxane was also destroyed by ozone and Peroxone.

Field vs. Laboratory Conditions. The concentrations and magnitude of changes in secondary water quality parameters may differ between the field and the laboratory due to differences in the reaction conditions. However, the laboratory data are useful as guides as to which parameters, if any, may be of concern in the field.

5.0 CONCLUSIONS

Bench-scale laboratory testing clearly demonstrated that treatment of soil and groundwater with ozone alone or with Peroxone (a mixture of ozone and H_2O_2) could destroy 1,4-dioxane as well as other VOCs. Complete removal of all COCs from the aqueous phase was achieved with all treatments. Additional tests confirmed that dioxane was also removed from the soil phase. No VOCs were detected in off-gases.

COC removal was due to destruction not volatilization. NO VOCs were detected in offgases from the ozone and Peroxone tests and dioxane was not removed from the aqueous phase by sparging with nitrogen, an inert gas.

Removal of dioxane by ozone alone was probably due to 'enhancement" of the ozone by iron, bicarbonate or other compounds naturally present in soil and groundwater. In tests conducted on DI water spiked with dioxane and various potential enhancers, dioxane was completely removed in all cases except when olefins were added. Thus, the addition of H_2O_2 as an enhancer may not be required during in situ applications.

Ozone and Peroxone affected several secondary water quality parameters including bromate, bromide, Cr(VI), vanadium, chromium (total), manganese, iron, nickel, selenium, barium, tungsten and nitrate. The direction of the change (an increase or decrease) was the same in most cases, but the magnitude often varied among the tests. Parameters affected by both ozone and Peroxone were bromate, chromium (total), manganese, iron, nickel, copper, barium, tungsten and nitrate. Parameters affected by either ozone or Peroxone were vanadium and selenium. Copper and chromium (total and Cr(VI)), were effect by ozone and one of the Peroxone tests.

The ozone demand of soil was approximately 3,000 mg O₃/kg soil.

Column tests (as described in this study) cannot accurately predict the effectiveness of proposed field application methods Peroxone injection.

APPENDIX B

Field Pilot Study Photographs



B-1. Bench Scale Test Setup



B-2. Bench Scale Test



B-3. Bench Scale Test Setup



B-4. Bench Scale Test (Attempted Column Test)



B-5. Pilot Test Monitor Wells



B-6. Pilot Test Max Ox Injection Well Installation (MOx-1A and -1B)



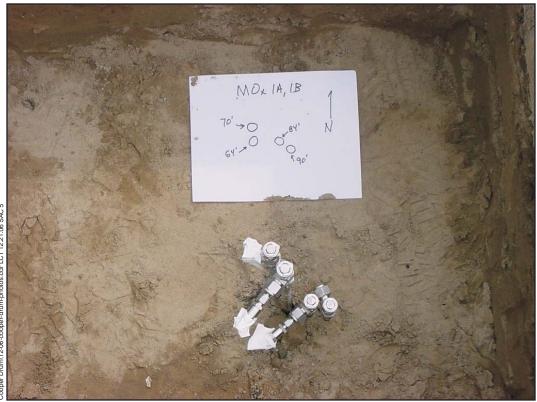
B-7. 3-Foot Ozone Injection Screen

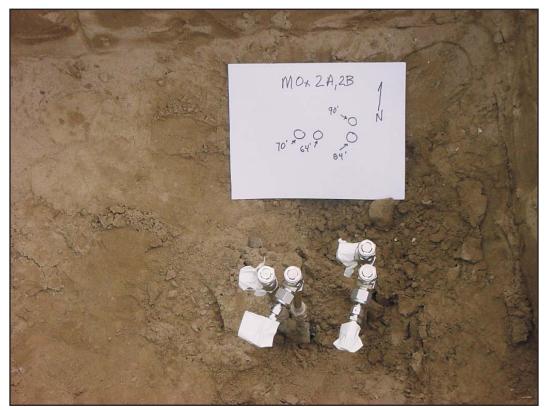


B-8. 1-Foot Hydrogen Peroxide Injection Screen



B-9. Injection Well Installation





B-11. MOx-2A and -2B)





B-13. Injection Well Vault Box



B-14. Pilot Test Trenching



B-15. Pilot Test Piping Connection to Pulse Ox Trailer



B-16. Applied Process Technologies (APT) Pulse Ox 100T Trailer



B-17. Pulse Ox 100 Chemical Oxidation System

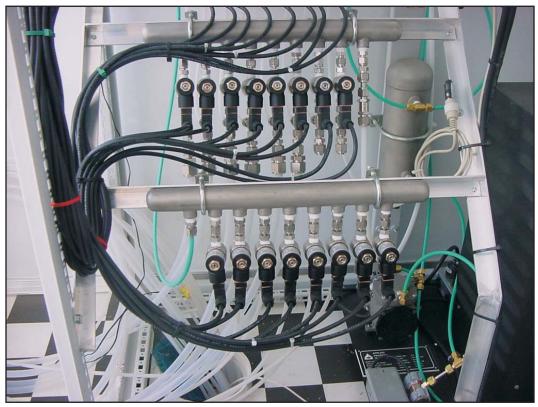


B-18. Pulse Ox 100 Chemical Oxidation System

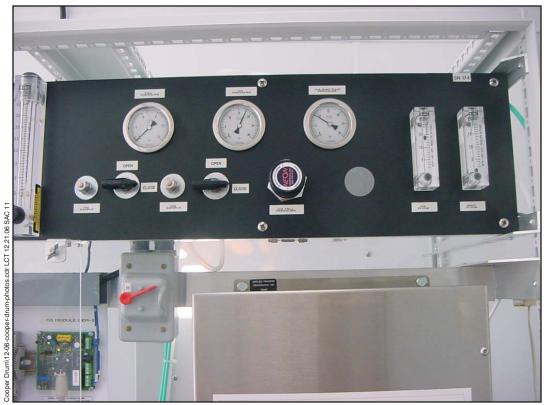


B-19. Operator Interface Terminal





B-21. Distribution Manifolds (8-Solenoid)



B-22. System Pressure and Air Flow Gauges



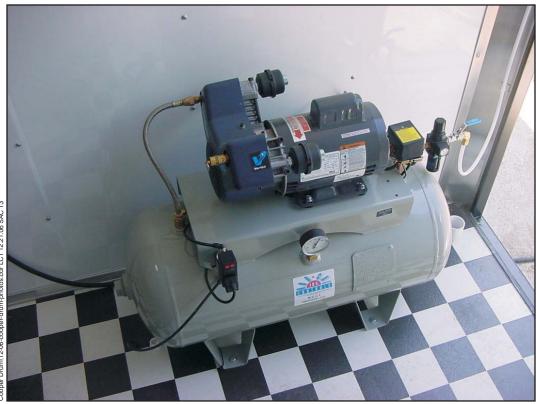
B-23. Oxygen Generator Pressure Swing Adsorption System



B-24. Ozone Generator



B-25. Hydrogen Peroxide Injection Skid



B-26. Air Injection Skid



B-27. Groundwater Sampling at Monitoring Well MW-20

APPENDIX C

Boring Logs and Well Completion Details

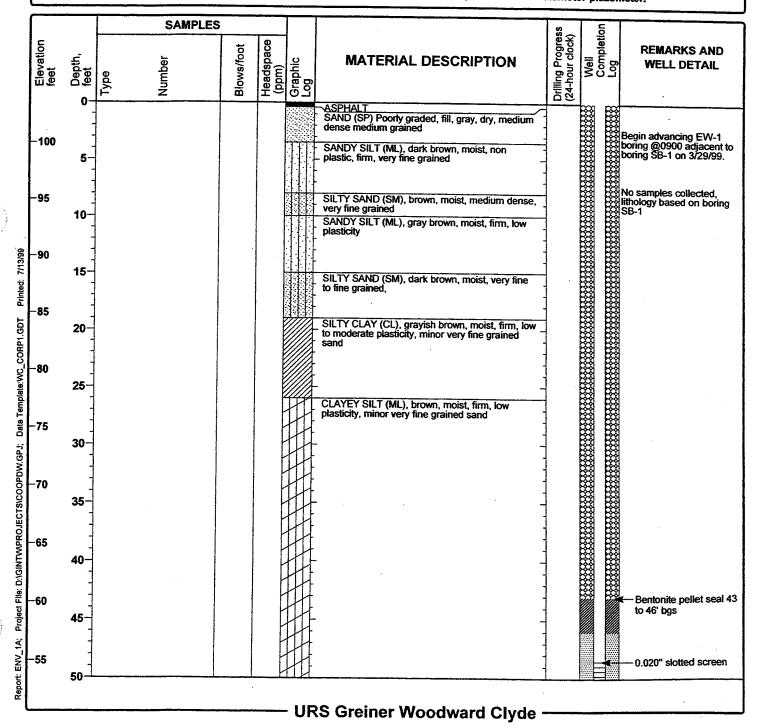
Project: Cooper Drum

Project Location: 9316 S. Atlantic Ave., South Gate, California Project Number: 53F4005900.02

Log of Boring EW-1

Sheet 1 of 2

Date(s) Drilled	3/29/99 - 3	3/29/99	Lo By	iged	JD Gonsalves	Checked By	
Drilling Method	Hollow S	tem Auger		l Bit e/Type 1	13.5-inch	Total Depth Drilled (feet)	92.0
Drill Rig Type	CME-95			ling ntractor	Gregg Drilling & Testing	Hammer Weight Drop (lbs/in.)	V
Groundwater Level (feet)	56		Da Me	e asured 3	N/29/99	Approx. Surface Elevation (feet)	103.6 MSL
Diameter of Hole (inches)	14-inch	Diameter of Well (inches) 6-i		e of I Casing	Schedule 40 PVC	Screen Perforation	0.020-inch
Type of Sand Pack	Monterey	#1C sand		e/Thicknes Seal(s)	^{is} Neat cement grout mixture		
Comments	Upon read	ching total depth, b	oring conver	ed to 6" d	liameter extraction well, nested	with 1" diameter piezon	notor

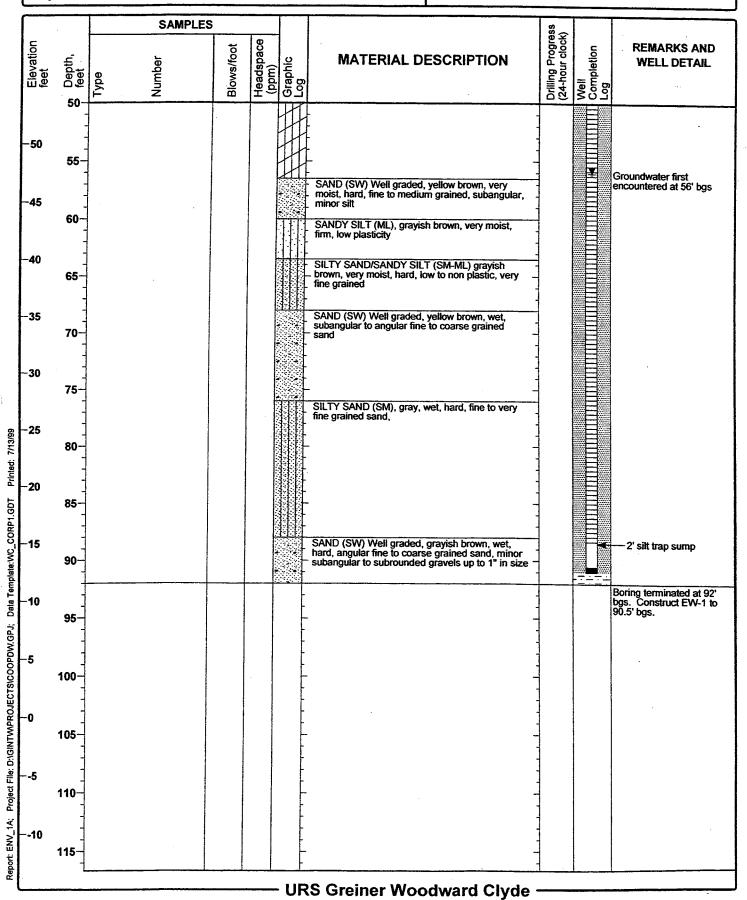


Project: Cooper Drum Project Location: 9316 S. Atlantic Ave., South Gate, California

Log of Boring EW-1

Project Number: 53F4005900.02

Sheet 2 of 2



Project: Cooper Drum

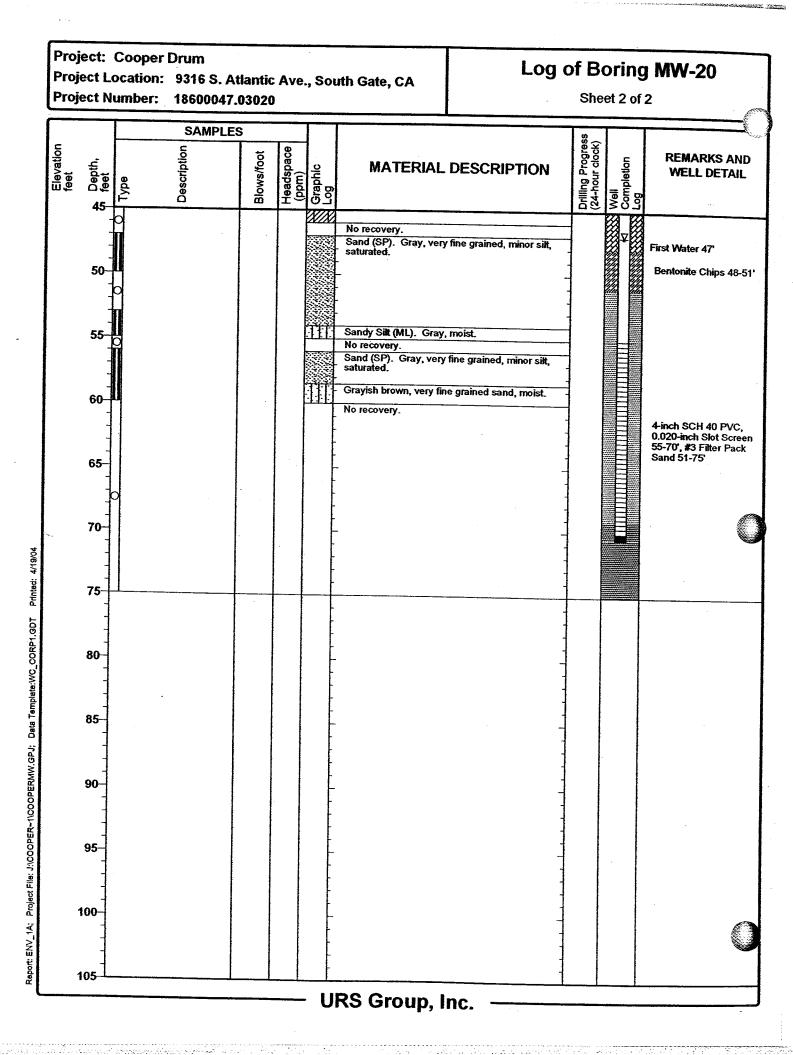
Project Location: 9316 S. Atlantic Ave., South Gate, CA Project Number: 18600047.03020

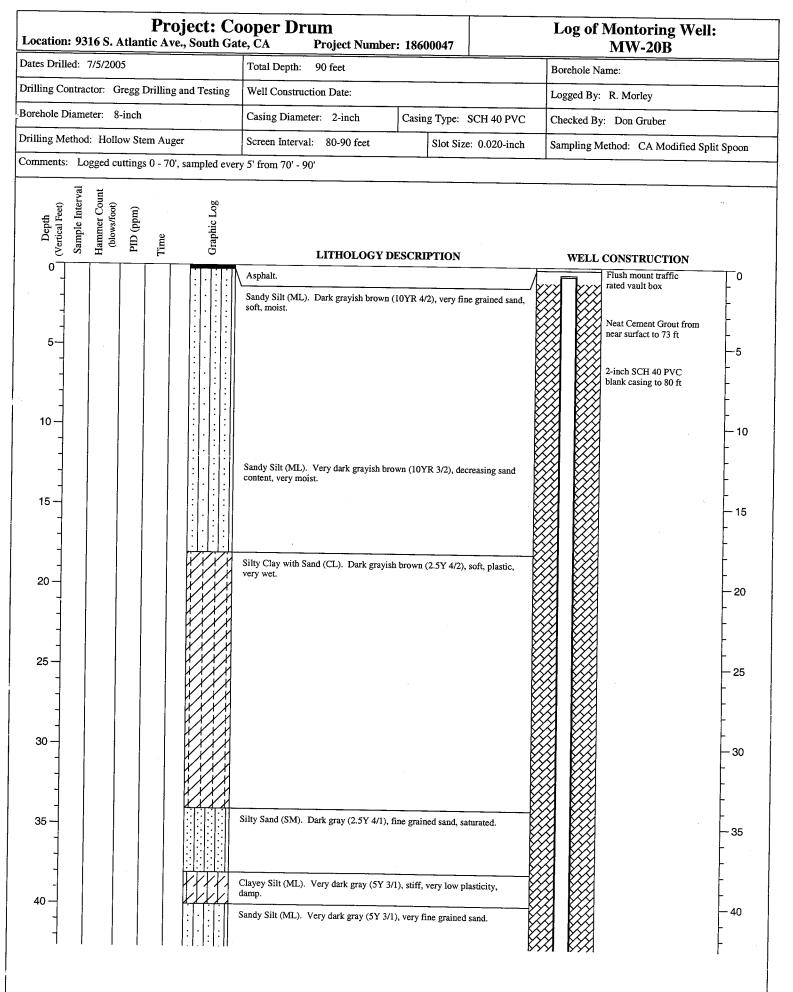
Log of Boring MW-20

Sheet 1 of 2

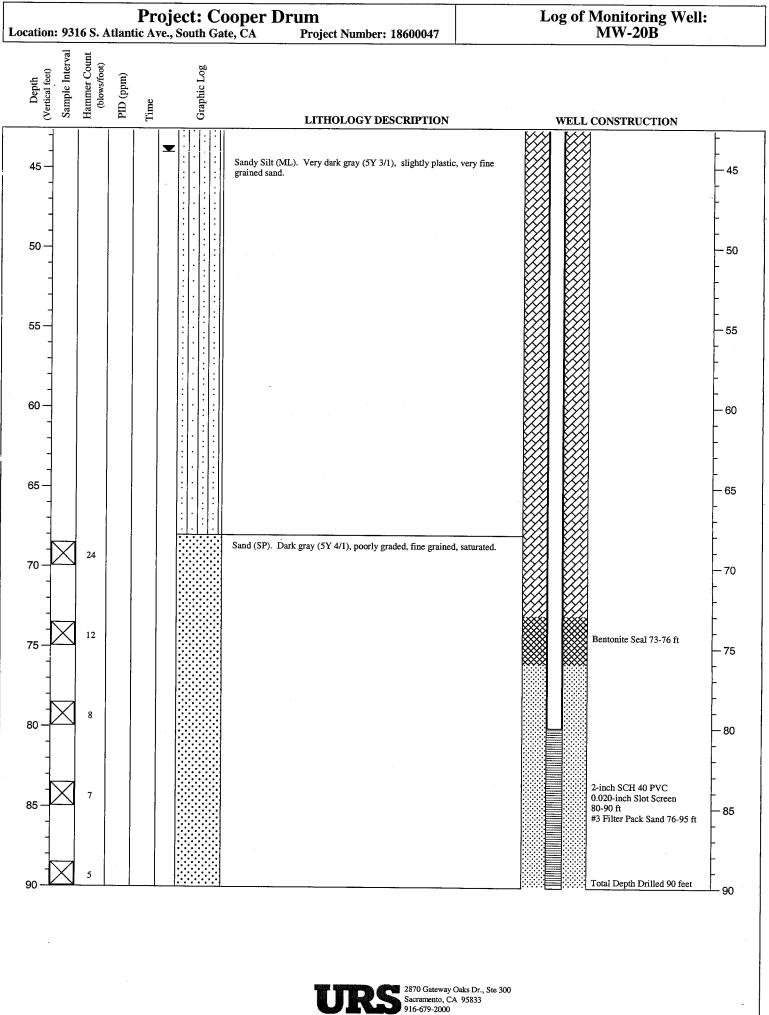
Date(s) Drilled	2/26/03 -	2/26/03 - 2/27/03			D. Gruber	Checked By	Don Gruber
Drilling Method	Hollow S	Hollow Stem Auger			ype 10-inch Total De Drilled (75.0
Drill Rig Type	CME-95			Drilling Contractor	Water Development Corp.	Hammer Weight/ Drop (lbs/in.)	
Groundwater Level (feet)				Date Measured		Approx. Surface Elevation (feet)	
Diameter of Hole (inches)	10-inch	Diameter of Well (inches)	4-inch	Type of Well Casing	SCH 40 PVC	Screen Perforation	0.020-inch
Type of Sand Pack	#3 Sand			Type/Thick of Seal(s)	ness Neat Cement Grout with 5%		
Comments	CME Con	tinuous Core -	5' barrel				·······

	SAMPLES	;				ss ()	5	
Elevation feet Depth,	Type Description	Blows/foot	Headspace (ppm)	Graphic Log	MATERIAL DESCRIPTION	Drilling Progress (24-hour clock)	Well Completion Log	
0-	ŕ ŏ	<u>ā</u>	Ĩ,	٢٩		24 24		seal (no lock)
-	0				Sand (SP). Gray, medium grained, poorly graded, dry.			12-inch flush mount traffic rated vault box
5-					Sandy Silt (ML). Dark brown, very fine grained, non plastic, slightly moist.			4-inch SCH 40 PVC to
					- - -			55'
10-					-			
6					Silty Sand (SM). Brown, very fine grained, slightly moist.			
Phinted: 4/19/04					Sandy Silt (ML). Grayish brown, low plasticity, very fine grained sand, moist.			
					very mie gramed sand, moist.			Neat Cement from near
раға 1907, 200- 20- 20- 20- 20- 20- 20- 20- 20- 20-					Silty Clay (CL). Grayish brown, low plasticity, minor very fine grained sand, moist.			surface to 48'
ate:WC_C					-			
ាំដាំ 25– ទ័ក ឆ្នាំត្រូវ -	-							
					Clayey Silt (ML). Grayish brown, low plasticity, minor fine grained sand, moist.			
З0 30 33 35 35					-			
					Sand (SP). Brown, poorly graded, minor silt, moist.			
- - 								
					Silty Sand (SM). Gray, very fine grained sand, saturated.			
					Sitty Clay (CL). Gray, low plasticity, minor fine grained sand, moist.			
ر ۲ 45					4			
12 45-1 8				- 1	RS Group, Inc.		GOL LAN	

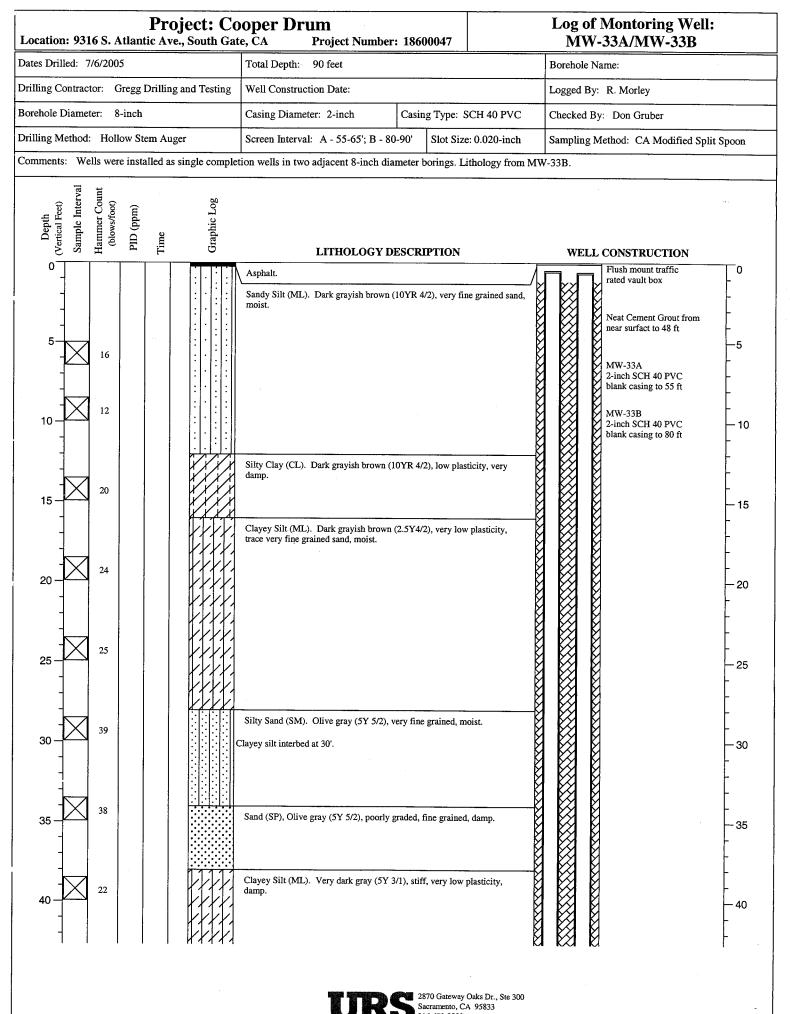




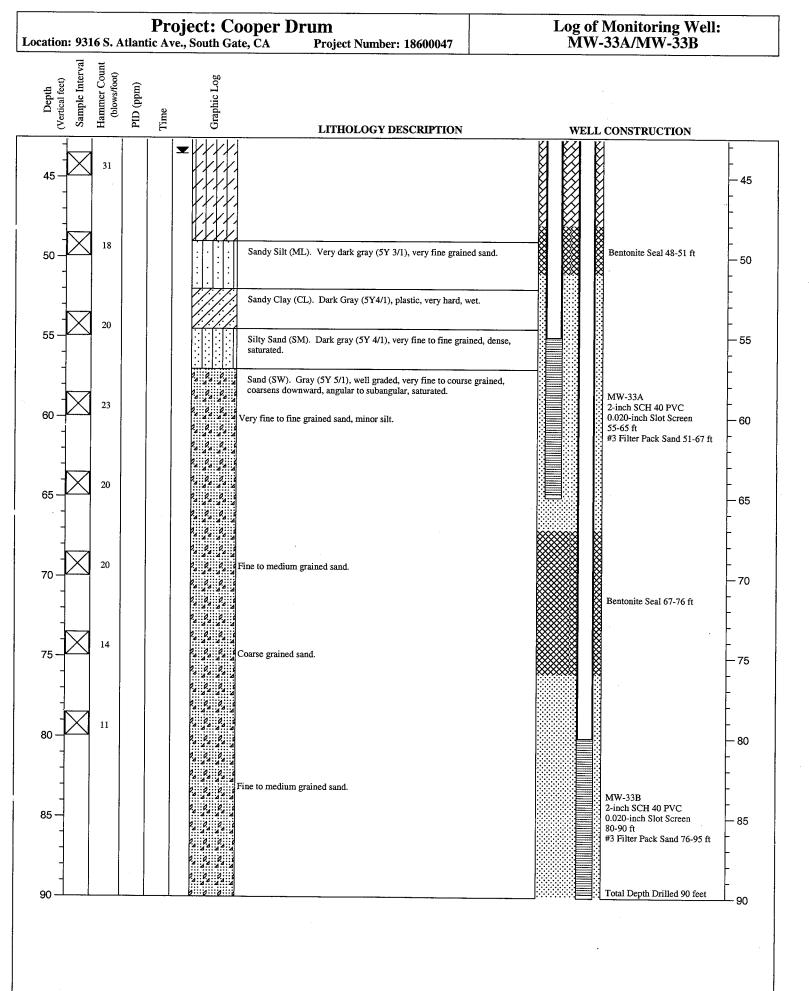




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916-679-2000





	All measurém	ents taken fro	Top.	of Casina I				Sar	nple ID		
		- *				,asıng ∐Gi	ound Level	Oty	. of Drilling Fluid	Lost	:
Well Numb	Per Mu	J - 33,	K WAY TOWN	Borehole E)iameter		n an			Purged <u>27,1</u>	3
	7/8/05		· · · · · · · · · · · · · · · · · · ·		ngth	1. St. 1.			elopment Meth	od	
Time Start	URS	End:			Depth (pre-dev	14					<u> </u>
					Depth (post-de					GROUNTOS Z"	
-	èr		1		er Level (ft.)	· · · ·				nent	
	Date	9	· · · · · · · · · · · · · · · · · · ·		Vater Column (F ···	EC Meter	ton130- V-10	
Well Diame	oter	211			/olume (gal.) _ us Vol. (gal.) _			Turi	bidity Meter	<u> </u>	
			<u>s</u>		uə voi. (gai.) _ //	1 V		Oth	er		
	s			Field	Parameters M	easured					1
Time	Amount Purged (gal)	MISCM	pH	Temp.	Turbidity	D.O.	SAL.	GPM W.L.	9.34	Comments Starter	Field Tech.
6.	6.0	3.23	7.24.	8.15	CAG	2.01	0.16	200/545	7. Ampin		
1:42	18	3.47	7.21	Z1.4	999	1.89	0.17		Baito		
1.48	77	3.49	7.72.	71.3	027	1-59	0.57	11/50.92	F,		
1:55	40	2.54	771	21.2.	103	1.53		11/553	<u></u>	······	
:05	60	3.58	7.21	21.2	59	1.62	0.17			· · · · · · · · · · · · · · · · · · ·	
$\frac{1}{2}$	80	3.59	7.71	5.15	48	1.71	DIT	11 /55.3	<u>+</u>		
-25-	100	3.61	1		40		0.17		·		
	100	J.e (7.21	21-Z.	41	1.82	0.11	17 11			- i
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NEGG		Ý		MO	NITORING WE	ELL DEVELOI	MENT LOG	· · · · ·	•	Page	of to
		۵. ۲							· · · · ·		
	All measurem	ents taken fro	m: 🔲 Top c	of Casing	Protective C	asing 🔲 Gi	ound Level	Sar	mple ID		·
	KAri.	1-221	2	·	n na ser Norden Norden			Qty	. of Drilling Fluid	Lost	:
Well Numb	$r = \frac{1}{7} \frac{1}{0}$	501	<u> </u>	Borehole D	iameter <u>*</u>		······································	Mir	imum Gal. to be	Purged 67-6	27
Date		3.4		Screen Len	gth			Dev	elopment Metho	d	
	1 1 10		<u></u>	Measured [epth (pre-dev	elopment)	88.32	>		····	
Client	Un	<u>S.:</u>		Measured D)epth (post-de	velopment)	10.41	Pur	ging Equipment	·	
Project	<u>.</u>		<u> </u>	Static Wate	r Level (ft.)	- 4	8.51	Wa	ter Level Equipm	ent	
Job Numbe	r			Standing W	ater Column (i	t.) 39	.81			HONBA U-	-10.
Installation	Date		· · · · · · · · · · · · · · · · · · ·			· · · · · · · · · · · · · · · · · · ·	(en la constantina de		•		
Well Diame		r(1 1					
· ·				and Alian Circa	1999-9-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-					· ·	
T :				Field F	Parameters Me	asured					
Time	Amount Purged (gal)	EC	рН	Ţemp.	Turbidity	DĩO.	SAL.	GPM W.L.		Comments	Field Tech.
1147	10	825	7.24	22.1	999	1.46	0.43	2:/49.30	Startes	Dung	, e
1152	20	8.32	7.20	21.6	372-	1.53	0.45	1/11	11.44	How	9
(57	30	8.32	7.20	21.6	113	1.47.	0.45	11/11	2.61		
103	120	8.39	7.18	21.3	26.	1.57	0.46	11/11		<u> </u>	
12	60	8.39.	7.17.	71.2.	17.	1.73	0.1110	11/11			
32	BO.	8.39	7.17.	5.15	X	1.50	0.46	hill.	N.	<u> </u>	
				CA C		/ 0 0					
						4	·	7		· · · ·	
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				FINAL	FIELD PARAM	ETER MEASU	REMENTS	·			<u>_</u>
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				MO	NITORING WI	ELL DEVELO	PMENT LOG	· ·	Page	of
	All measurén	nents taken fro		of Casing [Protective C	asing 🔲 G	round Level	Sar	nple ID	
Well Num		U-201							. of Drilling Fluid Lost	
1			,		iameter <u>*</u>	and the second second	and the second sec		imum Gal. to be Purged	7.
Time Start	:	_ End:	1		Depth (pre-dev		88.20	2		
	UNS		- -	Measured I	Depth (post-de		90.23	Pur	ging Equipment	
					r Level (ft.)	at	<u>B.32</u>		ter Level Equipment	
1. AND	er Date	1	\		ater Column (EC Meter	
Well Diame	eter	• •			olume (gal.) _				bidity Meter	
					4			Utn	er	· · · · · · · · · · · · · · · · · · ·
Time	Amount			Field	Parameters M	easured		T		
	Purged (gal)	EC	рН	Temp.	Turbidity	D.O.	SAL.	GPM W.L.	Comments	Field Tech.
0250	15	11.4	7.17.	223,	999	1.73	0.64		Startes Du	mon
0257	30.	115	7.17	21.9	999	1.61	0.65		ZUL	P.P.
0304	45	11-5	7:17	21.8	743	1.60	0.65		2	
03/2	70.	8.51	7.17.	21.7	614	1.52	0.45		4	
0323.	90	8.45	7.16	21.7	999	1.72	0.46			
0329,	102.	8-48	7.17.	21.7.	180	1.57	0.46			
0342.	130.	8.49	7.17	21.7	12	1.54	0.46			-
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			<u>.</u>	FINA	FIELD PARA	METER MEAS			· · · · · · · · · · · · · · · · · · ·	
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0.789

4.4

SITE LOCATION PROJECT NAME ooper Drum DATE DRILLED LING COMPANY DRILL RIG Jucen, Tim, Luis TOTAL DEPTH OF BORING (FT) Grego H12 **BORING DIAMETER (IN)** LOGGED BY HAMMER WEIGHT (LBS) 90 H-S-A K.M HAMMER DROP (IN) START TIME Cuttings PID (PPM) USCS SOIL GROUP DEPTH (FT) SAMPLE LOCATION TIME OF SAMPLE BLOWS PER 6 IN MUNSELL SAMPLE DESCRIPTION OF SUBSURFACE MATERIALS ID 3" Asphalt SURFACE CONDITIONS: SAND; tossidry; fine grain ; uniform Bilts SAND Brown; V.fmegrain; moist; uniform; no odor or staining Sandy Silt; Dark brown; soft; V.fine same silty CIAY with sand; soft; very wet; plastic; U. fine sands; olive brown CLAY - dark gray ; wet; soft; vorg plastic Same as above SKETCH OF BORING LOCATION MOV 2A,2B BORING NUMBER Page 1 of 3

PROJECT NAME SITE LOCATION Cooper Drum DRILL CREW DRILL RIG DRILLING COMPANY DATE DRILLED Brilling Method Drillmg + Tc St 149 DRILLING METHOD BORING DIAMETER (IN) 01/ IL 05 TOTAL DEPTH OF BORING (FT) HAMMER DROP (IN) H-G-A-10 HAMMER WEIGHT (LBS) EM STOP TIME START TIME Cuttings PID (PPM) USCS SOIL GROUP DEPTH (FT) SAMPLE TIME OF SAMPLE BLOWS PER 6 IN MUNSELL SAMPLE DESCRIPTION OF SUBSURFACE MATERIALS ID SURFACE CONDITIONS: Same as above i wet; med stiff: 35-Silty clay; Gray; slightly plastic; crubibly; damp; med stiff; Sandis SILT; SATUrated; soft = mushy; V. fine sands: Silty clay; soft; plastic; very damp; some v.fine savd Clayer Selt; saturated; - theke; gray Same as abour SKETCH OF BORING LOCATION MOx 24,2B BORING NUMBER URS Page 2 of 3

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Cooper Dram SITE LOCATION DRILL CREW an, Luis Tim DRILL RIG DRILLING COMPANY TUTAL DEPTH OF BORING (FT) GHC 9 9 07/11/05 DB BORING DIAMETER (IN) LOGGED B H- 5-A SAMPLING METHOD HAMMER WEIGHT (LBS) HAMMER DROP (IN) START TIME PID (PPM) USCS SOIL GROUP DEPTH (FT) SAMPLE LOCATION BLOWS PER 6 IN TIME OF SAMPLE MUNSELL COLOR SAMPLE DESCRIPTION OF SUBSURFACE MATERIALS ID SURFACE CONDITIONS: SAME AS Above Sandy Silt; Saturated; finegrain; Same as above. Silty sand; "saturated; very fine grain with med grains; Sandwith silt; very saturated (soups) fine grang) SKETCH OF BORING LOCATION bags Bentonit used 35 4 bags of #3 Sand MOy 24,2B BORING NUMBER URS Page 3_ of __3

Soper Drum SITE LOCATION G COMPANY A Drilling + Testing M-12 BORING DIAMETER (IN) DRILL CREW JUAN, TIM, LULS 07/11 ED BY 10 HAMMER WEIGHT (LBS) R. Morley AMPLING METHOD HAMMER DROP (IN) START TIME Cuttings USCS SOIL GROUP DEPTH (FT SAMPLE TIME OF SAMPLE BLOWS PER 6 IN MUNSELL OId (Mdd) SAMPLE DESCRIPTION OF SUBSURFACE MATERIALS ID 3 Asphalt SURFACE CONDITIONS: Silty SAND; fine grain; shahtly most. ight yellowish browb 25Y 613 2.55 very dark gray is h brown Silty SAND 5/2 increase in silt content; J. fine grain; uniform; damp. Clayey Silt; soft; crumbly; U. slightly plastic; moist; 11 V Same as above i increasin Clay content Sandy SILT; V. fine sands; slamp; 10 uniform; soft. Dork groy silty clay; soft; plastic; 2.55 4/1 damp; SKETCH OF BORING LOCATION 70' shallow 70' Deep Doep Shaller M Rayo BORING NUMBER MOX 3A. 3R URS Page L of 3 from HSA cuttonss,

SITE LOCATION Cooper Drum COOPER DILLING DRILLING COMPANY ORILLING COMPANY DRILLING METHOD HAMMER WEIGHT (LBS) CUTTINGS DATE DRILLED 07/11/05 M-12 TOTAL DEPTH OF BORING (FT) HAMMER DROP (IN) START TIME STOP TIME PID (PPM) USCS SOIL GROUP **DEPTH (FT)** SAMPLE TIME OF SAMPLE BLOWS PER 6 IN MUNSELL SAMPLE ID DESCRIPTION OF SUBSURFACE MATERIALS SURFACE CONDITIONS: as about Same SAND with sitt; Saturated; five grads 1005 e ; un form SANO with silt; saturated : fine to Hod grain; loose; uniform grains Sand: fine to med grain; saturated 10051 Sand: same as about SKETCH OF BORING LOCATION Sand 90 - 85' Bentonite 85784.5 Sava 84.5 - 81 Bentonite 81 - 71.80" #3SAND 71.00 -> 66.5 BORING NUMBER MOX 343B Page 3 of 3

PROJECT NAME SITE LOCATION DRILL RIG DRILL CREW DATE DR 07/1105 DRILLING METHOD H - S - A SAMPLING METHOD Cutting **BORING DIAMETER (IN)** TOTAL DEPTH OF BORING (FT) 10 Mortzs 90 HAMMER WEIGHT (LBS) HAMMER DROP (IN) START TIME PID (PPM) USCS SOIL GROUP DEPTH (FT) SAMPLE LOCATION TIME OF SAMPLE BLOWS PER 6 IN MUNSELL SAMPLE ID DESCRIPTION OF SUBSURFACE MATERIALS SURFACE CONDITIONS: Dark gravish brown Clay; plastic; med stiff; damp. 2.584/2 35. 1315 SAND with silt; fine grain j uniform; wet; 11 Sandy Silt; saturated; U.f.n. same as above : Saturated ; increase in silt concentration; slight increase in Gandsize to fine grain Same as about Silty clay : saturated; soft; plastic trace Sand (fune) SKETCH OF BORING LOCATION MOx 3A,3B BORING NUMBER $\mathsf{Page}\,\underline{\mathcal{P}}_{of}\,\underline{3}$ URS

9313 Rayo Ave PROJECT NAME SouthGate ooper Drum DRILLING COMPANY Grage Drilling + Testing DRILL RIG DATE DRILLED Juan, Tim, Luis TOTAL DEPTH OF BORING (FT) M-12 BORING DIAMETER (IN) 07/12/05 90 HAMMER DROP (IN) H-5-A AMPLING METHOD R. Morley HAMMER WEIGHT (LBS) START TIME cutting s USCS SOIL GROUP DEPTH (FT) SAMPLE TIME OF SAMPLE BLOWS PER 6 IN MUNSELL DIG (Mdd) SAMPLE ID DESCRIPTION OF SUBSURFACE MATERIALS 3" Asphalt SURFACE CONDITIONS: SAND: fine grain; moist; uniform. Very Darkgrayish brown Silty SAND; IOY 2 0845 3/2 V. fine grain; moist; uniform; Grayish brown Silty SAND; increase in silt 254 512 15 0850 content; v.fine sand; uniform; moist; 2.5Y Dark grayish brown Sandy SILT; 0853 4/2 Soft; moist; V. fine SAND; Very Dark groupish brown Clayey SILT; 2.5Y Soft; slightly plastic; damp: 3/2 258 Darkgrayish brown Silty CIAY; Soft 0908 412 Damp; very plastic; SKETCH OF BORING LOCATION MOx 1A,1B BORING NUMBER Page _____ of _____

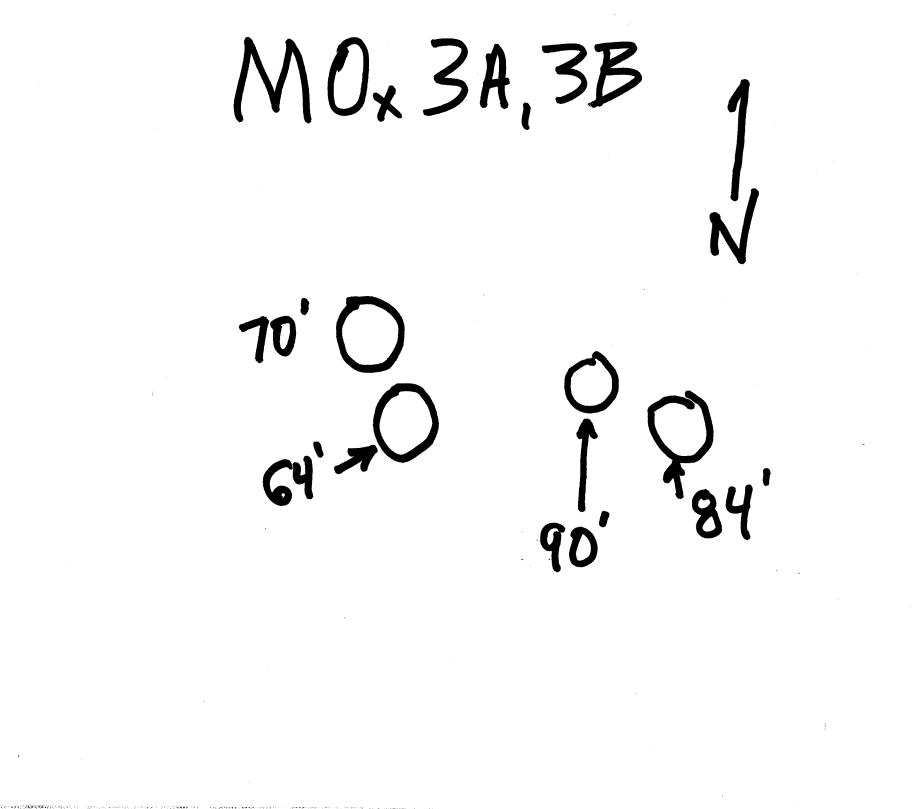
PROJECT NAME COOPER Drum DRILLING COMPANY Gregg Drilling DRILLING METHOD 9313 SITE LOCATION BRILL RIG______ DRILL CREW DATE DRILLED TOTAL DEPTH OF BORING (FT) H-12 BORING DIAMETER (IN) OGGED H-S-A SAMPLING METHOD R.M HAMMER WEIGHT (LBS) HAMMER DROP (IN) START TIME STOP TIME Cuttings USCS SOIL GROUP DEPTH (FT) SAMPLE TIME OF SAMPLE BLOWS PER 6 IN MUNSELL DID (MPG) SAMPLE DESCRIPTION OF SUBSURFACE MATERIALS ID 3" Asphalt SURFACE CONDITIONS: CLAY; med stiff; U. plastic; moist; 2.5Y 412 0815 Dark grayish brown 3⁵ Darkgreenish gray Same as above: Silty SAND; Saturated; fine grain; uniform. GLEY1 0845 4/105 Sandy Silt; fine grain; saturated; uniform grain; 11 Чø very dark greenish gray ; Sandy Clay; Gleyl 50 3/104 fine grain; saturated; ment; soft; 55 R Same as Above: Sandy Clayes Silt; slightly plastic; Saturated; very soft; fine grain sands 10 SKETCH OF BORING LOCATION BORING NUMBER MOx 1A, 1B URS Page 2 of 3

9313 Rayo Ave. South Gate JECT NAME Cooper Drur Drilling +Testin Juan, Tim, Luis M-12 BORING DIAMETER (IN) 27/12/05 10 toriec HAMMER DROP HAMMER WEIGHT (LBS) START TIME tings PID (PPM) USCS SOIL GROU DEPTH (FT SAMPLE TIME OF SAMPLE BLOWS PER 6 IN MUNSELL DESCRIPTION OF SUBSURFACE MATERIALS SAMPLE 3" AsphaMt SURFACE CONDITIONS: SAME AS ABOVE. r 61ey | 4/1 Sandy SILT : Dark greenish gray Sandysilt to silts sand; fine grain; uniform Sands Same as above. Silty SAND; Saturated; (slury-like) K loose; finegrain sands with medgrain Same as abour Same as above SKETCH OF BORING LOCATION 90'- 86-5- Sand #3 16.6-85- Bentomity Pellets 85- 80.5- SAND #3 80.5 - 72 - Bentomet & Relletz 72-66.5 - #3 Sand 66.5-65- Bentonity Pellets 65 - 60.5- SAND Benton te Pellet 60.5 - 58.5 MOY 1A,1B **BORING NUMBER** 58.5- Suiter Beutonite Chips Page 3 of 3

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Cooper Drum MaxOx well as built description

1-inch stainless steel, 0.020-inch V-slot screen 87 ft. to 90 ft , ¹/₂-inch O.D. stainless steel tubing 0 to 87 ft. #3 filter sand 86.5 ft to 90 ft bentonite pellets 85 ft to 86.5 ft 1-inch stainless steel, 0.020-inch V-slot screen 83 to 84 ft., ¹/₂-inch O.D. stainless steel tubing 0 to 83 ft. with metal brackets every 10 feet to surface #3 filter sand 81 ft to 85 ft. bentonite pellets 72 ft to 81 ft 1-inch stainless steel, 0.020-inch V-slot screen 67 ft. to 70 ft, ¹/₂-inch O.D. stainless steel tubing 0 to 67 ft. #3 filter sand 66.5 ft to 72 ft bentonite pellets 65 ft to 66.5 ft 1-inch stainless steel, 0.020-inch V-slot screen 63 to 64 ft., ¹/₂-inch O.D. stainless steel tubing 0 to 63 ft. with metal brackets every 10 feet to surface #3 filter sand 61 ft to 65 ft. bentonite pellets 58 ft to 61 ft. bentonite seal 2 ft to 58 ft.



MOX 2A,2B 90' 70' * 64' 1 \4'

MOx IA, IB

5 590'

70' >0 64'~

APPENDIX D

Field Data Sheets

						MO	NITOR WELL N	IO: <u>MW-20</u>
		Moni	tor We	II Samp	ling Data			
Project: Cooper Drum				•				
Location No:				Job No:	18600047.07)30		
	•							
Sampling Date: 0711205							Date:	
Sampling Method: Direct from ded	cated tubing			Weather:				
Sampling Time:								
WATER ELEVATION DATA				Product Obs:	Y	N		
Method of Measurement: Depth Sound	der Y N				luct:			
Other: Screened interval:	55 - 70)		ł	asurement:	Interface Probe	Ŷ	N
1) Well Casing Elevation (WCE)		ft	- :				,	
(from casing top as marked)								
2) Depth to Water Surface (DTW	48.60	ft		Well Dia	ameter (in)	<u>(</u>	Casing Volume (C	V)/ft (gals)
(from casing top as marked) 3) Well Depth (WD):	75				2 4		0.163 0.652	
(from casing top as marked)			-	l I	6		1.468	
4) Height of Water Column (H)		ft			D		CV = (23.49) x	
(from casing top as marked)				L	CV = :	3.14 [(D/2)/12 in.f	t] ² h (7.48 gal/cu.	Ft.)
WELL PURGE AND SAMPLING DA	<u>TA</u>			Purge Meth	od: <u>2"</u>	Grundfos subr	nersible pump	
Single Casing Volume of Water in W	'eil (VW)		_gals	Purge Date:	07 12 0	5	-	
(CV x H = VW) Number of Casing Volumes to Purge	(NC)		gals		• •	Ŷ	N	
Total Volume of Water to Purge (TV) (VW x NC = TC)			gais	Fe⁻ (mg/L):	1.0			
Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
Time Temp (C) (umhos) pH	(NTU)	(mV)	(mg/L)	(ft. bgs)	(L)	(L/min)	Phys. App.
0848 2313 9781	7.16	25	117.6	0.47	48.81	ØZ 480	BUS?	
0851 24.12 9871	7.16	45	104.8	0.47	48:74	0 43	4 909	
0854 24.05 9922	715	62	102.0	0.46	48.76	-066	.600	
0857 24.10 9970	7.14	67	97.)	0.36	48.78	.084	.100	
0900 2496 10010	7.14	70	88.]	0.27	48.78	,102	-609	
0903 24.67 10155		84	80.6	0.22	48.78	,120	.600	
0906 24.44 1025	5 7.14	105	68.8	0.17	48.77	-138	Goo.	
0909 24.41 1030K	7.14	124	61.9	0.16	48.77	.156	.600	
0912 24.33 1036	3 7.15	127	48.1	0.15	48.77	.174	.60Q	
0915 24.17 10420	5 7.15	138	38.6	0.12	48.71	•192	.660	
				ļ <u> </u>			<u> </u>	
				<u> </u>				
				· ·				
INSTRUCTIONS AND COMMENTS Purging/Sampling Remarks		((SA .					

بلايت والمتحد والمتحد والمتحد

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								MONI	FOR WELL NO	D: <u>MW-20B</u>
				Moni	tor We	ll Samp	ling Data			
Project: C	Cooper Drum	'n								
						Job No:	18600047.07	030		
	s): <u>37501</u>						SL/DG			
		12/05						·	Date:	
		t from dedicat								
NATER EL	EVATION DA	TA				Product Obs:	Y	N	. <u>.</u>	······································
	asurement:	Depth Sounder	Y N				luct:			
Other:	toniali		- 30-	n n n		1		Interface Probe	Y	N
	iterval: ing Elevation			f y>	-	Otner:				
	ing top as ma		· • · · · · · · · · · · · · · · · · · ·			L				
	Water Surfac		8.44	f	F	Well Dia	ameter (in)	<u>(</u>	Casing Volume (CV)/ft (gals)
-	ing top as ma	•	75 (12.01			2		0.163	
	th (WD): ing top as ma				-		4 6		0.652 1.468	
-	Water Colun	•		ft	t		D		CV = (23.49) x	
	ing top as ma	· / <u> </u>						3.14 [(D/2)/12 in.f	• •	
WELL PUR	GE AND SAM	MPLING DATA				Purge Meth	od:2"	Grundfos sub	mersible pum	1p
Single Casir	ng Volume of	Water in Well ((VW)		gals	Purge Date	07120	5		
	(CV x H = V	W)					1 1		- 	
Number of (Casing Volum	nes to Purge (N	C)		gals	Was Well P	Pumped Dry?	Ŷ	N	
Fotal Volum		Purge (TV)			gals	Fe ² (mg/L):	31	<u></u>		
	(VW x NC =	10)								
		Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
Time	Temp (C)	(umhos)	pH	(NTU)	(mV)	(mg/L)	(ft. bgs)	(L)	(L/min)	Phys. App.
1003	27.ST	15937	7.18	7(000	-14.8	0.22	48.66	.01500	0,50	
1006	22.25	15948			-27.7		48.63	·042	0.900'	
1059	22.95	16008	7.17		1	1	48.64	-069	8.4D	
612	23.00	16053	7.17			0.24	48.60	096	0.40	
1015	22.03	16091		7(00)			48.50	· 123	(· · · · · · · · · · · · · · · · · · ·
1018	23.05	16107	7.16	954	-59.5		48.57	.150	0.000	s.
bel	23.10	16107	7.16	721	-62.0	0.12	48.57	.177	0.900	
1024	25.05	16/10	7.1Z	357	-69.1	0.12	48.57	.2047	0.400	
1027	23.07	K-112	7.12	310	-74.1	0.11	48.57	.231	0.000	
	23.09	16104	7.14	214	72.1	0.11	48.57	.758	0.0.0	
1030					and the second	0.11	48.57	~~~~	1 1	
	23.12	16112	7.13	176	-117	0.11	40.24	•275	0.900	
1030	23.12		7.13	76	~11.1	0.11	40.24	• 4 10	0, 909	· · · · · · · · · · · · · · · · · · ·

								MON	ITOR WELL N	O:
				Moni	tor We	ll Samp	ling Data			
Braiaat:						·· - ···•				
I	Cooper Drum	<u> </u>				loh No:	18600047.070			
	s): <u>37502</u>							130		
		z 05						······································		
1 C C C C C C C C C C C C C C C C C C C	•	t from dedicate								
WATER ELI	EVATION DA	TA				Product Obs:	Y	N		·····
		Depth Sounder	Y N				duct:			
Other: Screened in			-				easurement:	Interface Probe	Y	N
		(WCE)		ft						
	ing top as ma		5/1							
1 .	Water Surfac ing top as ma	e (DTW4	5.04	ft		<u>Well Di</u>	ameter (in)	<u>(</u>	Casing Volume ((
1 .	th (WD):		P4.				2 4		0.163 0.652	
(from casi	ing top as ma	arked)			-		6		1.468	
	Water Colum ing top as ma	ın (H)	- <u>.</u>	ft			D OV-V		CV = (23.49) x	
(nom casi	ing top as ma	incu)	,			<u>.</u>	Cv = 3	3.14 [(D/2)/12 in.f	ıj n (7.46 gal/cu.	FL)
WELL PUR	<u>GE AND SAN</u>	IPLING DATA				Purge Meth	od:2" (Grundfos subr	nersible pump)
Single Casir		Water in Well (VW)		gals	Purge Date	07/12/	05	-	
Number of C	(CV x H = V) Casing Volum	w) les to Purge (NC	C)		gals	Was Well P	umped Dry?	Y	Ν	
Total Volum	e of Water to	Purge (TV)			oals	Fe ² (ma/L):	ي، ن			
	(VW x NC =		<u></u> .							
		Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
Time	Temp (C)	(umhos)	pH	(NTU)	(mV)	(mg/L)	(ft. bgs)	(L)	(L/min)	Phys. App.
1117	22.90	7476	7.21	71000	0.1	0.32	49.57	.024	·808	· · · · · · · · · · · · · · · · · · ·
1115	23.54	7353	7.18	71000	-17.2	0.40	49.40	.048	. 309	
1118	23.98	7317	7.17	815	-28.0	0.35	49.40	.018	·600	
11.51	24.09	7280	7.17	581	-31.7	0.29	49.43	·09 b	. 309	
1124	24.09	7240	7.16	428	-34.0	0.25	49.40	.120	.800	
1127	24.06	7203	7.16	357	-33.4	0.22	49.48	.144	,80g)	
1130	24.16	7172	7.15	166	-32.9	0.19	49.49	.168	.865	
1133	24.19	7153	7.15	163	-31.7	0.17	49.41	+192	- Config	
1136	24.15	7102	7.14	150	- 30.8	0.16	49.40	-216	.BorD	
										······································
,	L		. 1		I	L	<u>ا ا ا ا ا ا ا ا ا ا ا ا ا ا ا ا ا ا ا </u>			
	ONS AND CO			(1) A						*
Purging/San	npling Remar	ks <u>X</u> t	amp	e CB R	ŀ	. <u> </u>				÷

								MON	TOR WELL NO	D: <u>MW-33B</u>
				Moni	tor We	ll Samp	ling Data			
Project: C	ooper Drum									
1		,				Job No:	18600047.070	30		
1	s): <u>37503</u>					- ·	SL/DG		•	
Sampling Da	ate: 07/12	105):			
Sampling M	ethod: Direc	t from dedicate	d tubing	-		Weather:				
Sampling Ti	me:						mp. (F):			
	EVATION DA					Product Obs:		N		- k -
Method of Me Other:	asurement:	Depth Sounder	YN				duct: easurement:		Y	Ν
Screened in			-							N
		(WCE) 8	0-730	ft	۶.					
	ing top as ma	rked) e (DTW색K	1 (5	ft			ameter (in)		Casing Volume (
	ing top as ma		<u>y</u>	n		<u>weir Di</u>	2	7	0.163	
3) Well Dep	th (WD):	·			-		4		0.652	
	ing top as ma			ft			6		1.468	
1	ing top as ma	ın (H) irked)	····,	π			D CV = 3	.14 [(D/2)/12 in.f	CV = (23.49) x l] ² h (7.48 gal/cu.	
		IPLING DATA				Purge Meth	od:2" (Frundfos subr	nersible numr	
Single Casir	ng Volume of (CV x H = V)	Water in Well (VW)		_gals	Purge Date	:_07/12/05			
Number of (•	es to Purge (NC	>)(gals	Was Well F	Pumped Dry?	Y	N	
Total Volum	e of Water to	Purge (TV)		5	nais	$Fe^2 (mq/l)$	2.8			
	(VW x NC =				_ 90.0	· · · (g/=)				
		Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
Time	Temp (C)	(umhos)	pH	(NTU)	(mV)	(mg/L)	(ft. bgs)	(L)	(L/min)	Phys. App.
1213	24.43	15857	7.26	980	-47.9	2.31	48.70	·024	0.000	
1216	23.81	15656	7.19	759	-58.0	1.84	48,71	.048	0.800	
1219	24.07	15697	7.15	505	-63.2	1.60	48.70	.072	0.008	
1222	24.32	15807	7.13	400	-66.4	1.51	48.70	.096	0.000	
1225	Z4.50	15878	7.12	312	-66.4	1.32	48.70	,120	○ . පියනු	
1228	24.29	15919	7.11	272	-658	1,12	48.70		0.848	J.
1231	24.20	15930	7,10	238	-659	0.98	48.70	-168	6.8	
1234	24.31	15944	7.10	199	-65.9	0.87	48.70	.192	0.8	
1237	24.35	16008	7.10	156	-67.7	6.71	48.70	.216	0.0	
1240	24.16	16015	7.10	134	-68.1	0.63	48.70	,240	8.0	
1243	24.25	16020	7.10	95	-69.0	0.55	48.70	- 488	0.8	· · · · · · · · · · · · · · · · · · ·
124	24.22	16008	7.10	48	70.4	0.47	48.70	-288	øg	
1249	24.29	16005	7.10	78	-71.4	0.45	48.70	1312	0.9	
INSTRUCTI Purging/Sar	ONS AND Co	OMMENTS ks		85f4					· · · · · ·	

- A. A.

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									MONITOR	WELL NO: <u>F</u>W-1-
				Moni	itor We	ll Samp	ling Data			-
Project: <u>C</u>	Cooper Drum						·			
Location No	:					Job No:				
Sample No((s):					Sampler(s):	SL/ <u>DG</u>			
Sampling D	ate: 07/12	205				Reviewer(s)):		Date:	
Sampling M	ethod: Direc	t from dedicate	ed tubing	<u> </u>						
Sampling Ti	ime:									
	EVATION DA					Product Obs:	Ŷ	N		
		Depth Sounder	YN			Depth to Pro	duct:		V	
Other: Screened in			-					Interface Probe	Y	Ν
		(WCE)		fi		Outer				
	ing top as ma									
2) Depth to	Water Surface	e (DTW 49.	00	fi	Ł.	Well Di	ameter (in)	<u>(</u>	Casing Volume	(CV)/ft (gals)
•	ing top as ma	rked)	_				2		0.16	3
•	th (WD):		5		-		4		0.65	
	ing top as ma Water Colum			ft			6		1.46	
	ing top as ma			n			D CV = 3	3.14 [(D/2)/12 in.f	CV = (23.49) t] ² h (7.48 gal/cu	
WELL PUR	GE AND SAM	IPLING DATA				Purge Meth	od:2" (Grundfos subr	nersible pum	p
Sinale Casiı	na Volume of	Water in Well (VW)		cals	Purge Date	67/12	05		
	(CV x H = V\						umped Dry?		N	
	-						_		IN	
Total Volum	e of Water to (VW x NC =	Purge (TV) TC)		· · · · · · · · · · · · · · · · · · ·	gals	Fe ² (mg/L):	0.6			
Time	Temp (C)	Cond (umhos)	pН	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1420	25.75	14980	7.26	Z8	-61.5	0.29	49.11	0.021	0.8	
1429	23.98	11952	7.33	19	-68.3		49.11	0.048	0.8	
			11				·		1	
1432	24.65	BZZB	7.57		-79.5	0.25	49.11	570.0	0.8	· · · · · · · · · · · · · · · · · · ·
1435	24.6Z	8188	7.57		-81.8	0.23	49.11	0.096	Ø.S	
1438	24.65	<u>8182</u>	7:35	5	-81.5		49.11	0.120	0.8	
1441	24.82	8197	7.34	5	-86.0	0.14	49.11	0.144	0.8	
		-								
		<u>*</u>								
		<u></u>								
					1	[1		1	
INSTRUCTI	IONS AND CO	OMMENTS		0						
Purging/Sar	npling Remar	ks Pim	p set	<u>(v) 6</u>	OH.					
		· · · · · · · · · · · · · · · · · · ·	<u> </u>							

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MONITOR WELL NO: ______

Monitor	Well	Sam	pling	Data
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				WOII	lor we	n samp	ling Data			
Project: <u>Coo</u>										
Location No:						Job No:18600047.07030				
Sample No(s): <u>37503/37504</u>						Sampler(s):SL/ <u>DG</u>				
Sampling Date: 07 12 05						Reviewer(s): Date:				
Sampling Method: <u>Direct from dedicated tubing</u>						Weather: Ambient Temp. (F):				
Sampling Time	:					Ambient Te	mp. (F):		<u> </u>	
WATER ELEVATION DATA Method of Measurement: Depth Sounder Y N Other:							duct:			-•••
Other: Screened inter			- 48.5 -	88 5				Interface Probe		N
I) Well Casing					-	Other				
(from casing	top as mark	(ed)								
2) Depth to Water Surface (DTW44.60ft						Well Diameter (in) Casing Volume (CV)/ft (gals)				
(from casing top as marked) 3) Well Depth (WD):90.5						2			0.163 0.652	
(from casing top as marked)					•	6			1.468	
4) Height of Water Column (H)ft (from casing top as marked)						D CV = (23.49) x [(D/24) ²] CV = 3.14 [(D/2)/12 in.ft] ² h (7.48 gal/cu. Ft.)				
WELL PURGE						Purce Meth		Grundfos subr		
· · · · · · · · · · · · · · · · · · ·										<u> </u>
Single Casing Volume of Water in Well (VW) gals (CV x H = VW)						Purge Date	: 07/12/05		-	
Number of Casing Volumes to Purge (NC) gals						Was Well F	umped Dry?	Y	N	
Гotai Volume o (V	of Water to P W x NC = T				gals	Fe ² (mg/L):	4.2			
· · · ·		. .							-	:
,Time T	Temp (C)	Cond (umhos)	pН	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
N	22.56	16239	4.18	523	-74.8	0.61	49.10	0.024	0.8	<u> </u>
	Z-19	16265	7.15	256	-79.9	0.58	49.10	0.048	8.6	
	Z.40	16162	7.15	136	-83.8	0.59	49.10	0.072	0.8	
	2.66	16025	7.12	80	-86.8	0.58	49.10	0.096	0.8	
	2.89	15923	7.23	60	-74.2	0.49	49.10	0.120	0.8	
	2.91	15777	7.24	47	-75.6	0.35	49.10	0.144	0.8	
•	z.91	15577	7.23	\$3	-70.4	6.33	49.10	0.168	8.0	
	2.93	15450	7.23	39	-79.5	0.31	47.10	0.192	0.8	· · · · · · · · · · · · · · · · · · ·
										<u></u>
		<u></u>								
					· · · ·					
NSTRUCTION		MMENTS					••••••••••••••••••••••••••••••••••••••		••••••••••••••••••••••••••••••••••••••	
Purging/Sampli			set 6) 85 P					:	
· · · · ·		1								

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

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Project: (Cooper Drum									
-						Job No:	18600047.070)30		
	(s): <u>37508</u>			<u> </u>			SL/DG	/50	·····	
		28/65				• • • •			Date: 7/	ac las
		t from dedicate								
	EVATION DA	та			1	Product Obs:		N		
		Depth Sounder	Y N				duct:	IN		
			-				easurement:	Interface Probe	Y	N
Screened ir	nterval:		55 - 7		_	Other:				
		(WCE)		ft			· · · · · · · · · · · · · · · · · · ·			
(from cas	sing top as ma	ırked) e (DTW	49	67 "		\				
	Water Surfac		70	• 0 7_ft		<u>Well Di</u>	ameter (in)	<u>(</u>	Casing Volume	
•			75-7	0			(A)		0.16 0.65	
	sing top as ma		K		-		6		1.46	
		ın (H)		ft			D		CV = (23.49)	
(from cas	sing top as ma	rked)					CV = 3	3.14 [(D/2)/12 in.f	t] ² h (7.48 gal/cu	ı. Ft.)
VELL PUR	GE AND SAM	IPLING DATA				Purge Meth	od:2" (Grundfos subr	nersible pum	p
ingle Casi	ng Volume of	Water in Well (∨w)		gals	Purge Date:				
	(CV x H = V)	,								
1										
lumber of (Casing Volum	es to Purge (NC	(ز		gals	Was Well P	umped Dry?	Ŷ	Ċ	
								Ŷ	C	
		Purge (TV)						Y	Ċ	
	ne of Water to	Purge (TV) TC)			gals	Fe ² (mg/L):	0.0			
⁻otal Volum	ne of Water to (VW x NC =	Purge (TV) TC) Cond		Turbidity	gals	Fe ² (mg/L): D.O.	O.O	Removed	Flow Rate	Observations
otal Volum	ne of Water to (VW x NC = Temp (C)	Purge (TV) TC) Cond (umhos)	рН	Turbidity (NTU)	gais ORP (mV)	Fe ² (mg/L): D.O. (mg/L)	Uater Level (ft. bgs)	Removed	Flow Rate	Observations Phys. App.
Time	ne of Water to (VW x NC = Temp (C)	Purge (TV) TC) Cond (umhos) 5798	pH 7230	Turbidity (NTU)	gals ORP (mV) / \$ 3.0	Fe ² (mg/L): D.O. (mg/L) 7.38	0.0 Water Level (ft. bgs) -4/8.57	Removed	Flow Rate	
Time	ne of Water to (VW x NC = Temp (C) 22.46	Purge (TV) TC) Cond (umhos) 5798 5869	рН 7230 7-26	Turbidity (NTU) 7/000	gals ORP (mV) /530 /34.3	Fe ² (mg/L): D.O. (mg/L) 7.38 0.95	0.0 Water Level (ft. bgs) 4/8.57 4/8.65	Removed * (L) 2900 4.8	Flow Rate	
Time 0732 0735	e of Water to (VW x NC = Temp (C) 22.46 23.65	Purge (TV) TC) Cond (umhos) 5 798 5 869 5 869	рН 7230 7.26 7.23	Turbidity (NTU) 7/000 7/000	gals ORP (mV) 1530 134.3 118.2	Fe ² (mg/L): D.O. (mg/L) 7.38 0.95 0.98	O.O Water Level (ft. bgs) 48.57 48.65 48.73	Removed * (L) 2960 47.8 7.2 -	Flow Rate	
Time	e of Water to (VW x NC = Temp (C) 22.46 22.65 22.65 22.69	Purge (TV) TC) Cond (umhos) 5798 5809 5821 5820	рН 7.30 7.26 7.23 7.23	Turbidity (NTU) 7/000 7/000 7/000	gals ORP (mV) /530 /34.3 i/8.2 94.9	Fe ² (mg/L): D.O. (mg/L) 7.38 0.95 0.98 1.19	0.0 Water Level (ft. bgs) 48.57 48.65 48.73 48.70	Removed * (L) 2900 4.8	Flow Rate	
Time 0732 0735 0738	e of Water to (VW x NC = Temp (C) 22.46 23.65	Purge (TV) TC) Cond (umhos) 5 748 5 869 5 820 5 820 5 820	рН 7230 7.26 7.23	Turbidity (NTU) 7/000 7/000	gals ORP (mV) 1530 134.3 118.2	Fe ² (mg/L): D.O. (mg/L) 7.38 0.95 0.98	O.O Water Level (ft. bgs) 48.57 48.65 48.73	Removed * (L) 2960 47.8 7.2 -	Flow Rate	
Time 0732- 0735 0735 0735 0738	e of Water to (VW x NC = Temp (C) 22.46 22.65 22.69 22.79 23.11	Purge (TV) TC) Cond (umhos) 5798 5809 5821 5820	рН 7.30 7.26 7.23 7.23	Turbidity (NTU) 7/000 7/000 7/000	gals ORP (mV) /530 /34.3 i/8.2 94.9	Fe ² (mg/L): D.O. (mg/L) 7.38 0.95 0.98 1.19	0.0 Water Level (ft. bgs) 48.57 48.65 48.73 48.70 48.70 48.71 48.72	Removed (L) 24/60 4.8 7.2 9.6	Flow Rate	
	Temp (C) 22.46 22.65 22.69 22.79	Purge (TV) TC) Cond (umhos) 5 748 5 869 5 820 5 820 5 820	рН 7.30 7.26 7.23 7.23 7.23 7.24	Turbidity (NTU) 7/000 7/000 7/000 7/000	gals ORP (mV) 1530 1343 1182 949 748	Fe ² (mg/L): D.O. (mg/L) 7.38 0.95 0.95 0.98 1.19 1.09	0.0 Water Level (ft. bgs) 48.57 48.65 48.73 48.70 48.70 48.71	Removed (L) 24160 4.8 7.2 9.6 12.0	Flow Rate	
Time 0732- 0735 0735 0738 0738 0738 0741 0744 0744	e of Water to (VW x NC = Temp (C) 22.46 22.65 22.69 22.79 23.11	Purge (TV) TC) Cond (umhos) 5798 5869 5820 5820 5820 5820	рн 7.30 7.26 7.23 7.23 7.23 7.24	Turbidity (NTU) 7/000 7/000 7/000 7/000 7/000 7/000	gals ORP (mV) 1530 134.3 118.2 94.9 74.8 52.9	Fe ² (mg/L): D.O. (mg/L) 7.38 0.95 0.95 0.98 1.19 1.09 1.01	0.0 Water Level (ft. bgs) 48.57 48.65 48.73 48.70 48.70 48.71 48.72	Removed # (L) 24960 4 .8 7 .2 9 .6 1 .2.0 1 4.4	Flow Rate	
Time 0732 0735 0735 0735 0738 0738 0738 0738 0738 0730 0753	Temp (C) $(VW \times NC =$ Temp (C) 22.46 22.65 22.69 22.79 23.11 23.19	Purge (TV) TC) Cond (umhos) 5798 5809 5800 5800 5800 5820 5820 5820	рн 7.30 7.26 7.23 7.23 7.24 7.24 7.24 7.24	Turbidity (NTU) 7/000 7/000 7/000 7/000 7/000 7/000 550	.gals ORP (mV) 1530 134.3 118.2 94.9 74.8 52.9 39.3	Fe ² (mg/L): D.O. (mg/L) 7.38 0.95 0.98 1.19 1.09 1.01 0.91	0.0 Water Level (ft. bgs) 48.57 48.65 48.73 48.70 48.70 48.71 48.72 48.73	Removed (L) 24/60 4.8 7.2 9.6 12.0 14.4 16.8	Flow Rate	
Time 0732 0735 0735 0738 0741 0744 0750 0756	Temp (C) 22.46 22.65 22.69 22.69 22.69 22.69 22.79 23.11 23.19 23.24	Purge (TV) TC) Cond (umhos) 5798 5809 5820 5820 5820 5820 5821 5873	рН 7.30 7.23 7.23 7.23 7.24 7.24 7.24 7.24 7.24 7.26	Turbidity (NTU) >1000 1000 100 10000 10000 10000 10000 10000 10000 10000 10000 10000 10000 10	.gals ORP (mV) 1530 134.3 118.2 94.9 74.8 52.9 39.3 25.3	Fe ² (mg/L): D.O. (mg/L) 7.38 0.95 0.95 0.98 1.19 1.09 1.01 0.91 0.89	0.0 Water Level (ft. bgs) 48.57 48.65 48.73 48.70 48.71 48.72 48.73 48.73	Removed ★(L) 25160 4.8 7.2 9.6 12.0 14.4 16-8 19.2	Flow Rate	
Time 0732 0735 0735 0738 0738 0744 0744 0750 0756 0759	Temp (C) 22.46 22.65 22.69 22.69 22.69 22.69 23.11 23.11 23.19 23.24 3.24	Purge (TV) TC) Cond (umhos) 5798 5869 5820 5820 5820 5820 5820 5827 5873 5873	рН 7.30 7.26 7.23 7.23 7.24 7.24 7.24 7.24 7.24 7.26 7.26	Turbidity (NTU) 7/000 7/000 7/000 7/00 7/00 7/00 7/00	gals ORP (mV) 1530 134.3 118.2 94.9 74.8 52.9 39.3 25.3 16.1	Fe ² (mg/L): D.O. (mg/L) 7.38 0.95 0.95 0.98 1.19 1.09 1.01 0.89 0.89 0.82	0.0 Water Level (ft. bgs) 48.57 48.65 48.73 48.73 48.70 48.71 48.72 48.75 48.75 48.75	Removed # (L) 2900 4 .8 7 .2 9 .6 1 2.0 1 4.4 16 .8 19.2 2 .6	Flow Rate	
Time 0732 0735 0735 0735 0735 0735 0735 0740 0750	Temp (C) $(VW \times NC =$ Temp (C) 22.46 22.65 22.65 22.69 23.11 23.19 23.24 23.24 23.24 23.24 23.34	Purge (TV) TC) Cond (umhos) ≤ 798 ≤ 809 ≤ 809 ≤ 800 ≤ 8000 ≤ 8000 ≤ 8000 ≤ 8000 ≤ 8000 ≤ 80000 $\le 8000000000000000000000000000000000000$	PH 7.30 7.26 7.23 7.23 7.24 7.24 7.24 7.24 7.24 7.26 7.26 7.27 7.28	Turbidity (NTU) 7/000	.gals ORP (mV) 1530 134.3 118.2 94.9 74.8 52.9 39.3 25.3 16.1 4.6	Fe ² (mg/L): D.O. (mg/L) 7.38 0.95 0.95 0.98 1.19 1.01 1.01 0.91 0.89 0.82 0.75	0.0 Water Level (ft. bgs) 48.57 48.65 48.73 48.70 48.70 48.71 48.72 48.73 48.75 48.73	Removed () 24960 4.8 7.2 9.6 12.0 14.4 16.8 19.2 24.0	Flow Rate	

Importer Vertice Substrate Subs									MO	. NO: <u>MW-20</u>
TimeTemp (C)(umhos) pH (NTU)(my/L)(ft. bgs)(L)(L/min)Phys. App. $S\&11$ 33.40 $S\&08$ 72.9 280 -18.9 0.57 $4g$ 72 33.60 8 $Og1/4$ 33.43 $S\&70$ 7.30 242 -24.44 $0.5\&$ $4g$ 72 36.0 8 $Og1/7$ 23.49 $S\&63$ 7.30 $2/42$ -24.44 $0.5\&$ $4g$ 72 $3g.41$ 1 $O\&1/7$ 23.49 $S\&63$ 7.30 $1/7g$ -28.7 0.56 $4g$ 72 $3g.41$ 1 $O\&1/7$ 23.49 $S\&63$ 7.30 $1/7g$ -28.7 0.56 $4g$ 73 $3g.40$ 1 $O\&1/7$ 23.49 $S\&63$ 7.30 $1/7g$ -33.44 0.54 $4g$ 73 $3g.41$ 1 $O\&2.94$ $S\&63$ 7.30 $1/7g$ -33.44 0.54 $4g$ 73 40.8 1 $O\&2.94$ $3g.44$ $S\&63$ 7.30 $1/7g$ -33.44 0.54 $4g$ 73 40.8 1 $O\&2.94$ $3g.44$ $S\&63$ 7.30 $1/7g$ -33.44 0.54 $4g$ 73 40.8 1 0.66 $O\&2.94$ $3g.46$ 7.30 $1/2g$ -33.44 0.54 $4g$ 73 40.8 1 0.8 $O\&2.94$ $1/2g$ $S\&63$ 7.30 $1/2g$ -33.44 0.54 $4g$ 73 40.8 $1/2g$ 0.54 $4g$ 73 40.8 $1/2g$ 0.66 $1/2g$ $1/2g$ <th></th> <th></th> <th></th> <th>M</th> <th>lonitor</th> <th>Well Sa</th> <th>ampling</th> <th>Data (co</th> <th>ont.)</th> <th></th>				M	lonitor	Well Sa	ampling	Data (co	ont.)	
	Time	Temp (C)		pН						
08 4 $3.3.43$ 5870 7.30 2.42 $-2.4.44$ 0.58 48.73 36.00 $1000000000000000000000000000000000000$	0811		5868	7.29						
0817 2343 $S863$ 730 178 -28.7 0.56 48.73 39.4 $and constraints of the state stat$	0814	23.43	5870	7.30		-24.4				
0820 23.44 5867 7.30 $/92$ -32.4 0.54 48.73 40.8 Image: Section of the section	0817			7.30		-28.7				
Image: series of the series		23.44	5867	7.30	192	-32.4	0.54		40.8	
Image: Series of the series										
Image: Series of the series										
Image: series of the series										
Image: series of the series										
Image: series of the series										
Image: series of the series										· · · · · · · · · · · · · · · · · · ·
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Image: series of the series		-								
Image: series of the series										
Image: series of the series										
Image: Section of the section of th										
Image: Second										
Image: Second									· · · · · · · · · · · · · · · · · · ·	
Image: Second										
Image: Second										
Image: Second										
							· · ·			
									- 1-11	

Page 2 of 2

								MONI	OR WELL NO	: <u>MW-20B</u>
				Moni	tor We	li Samp	ling Data			
Project:C	Cooper Drum	1								
Location No						Job No:	18600047.070	30		
	s): <u>37509</u>						SL/ <u>DG</u>			
		128/05				Reviewer(s)):		Date: 7/2	8/05
		t from dedicate								
Sampling Ti	me:	128/05	- 09	<u>so</u>						
WATER EL	EVATION DA	TA				Product Qbs:	Ŷ	N	· · · · · · · · · · · · · · · · · · ·	
		Depth Sounder	YN			Depth to Proc				
Other: Screened in			-65 - 7	<u>10-80-4</u>	n	Method of Me		Interface Probe	Y	N
	-	(WCE)		••• <u> </u>		Oulei	······································	· · · ·		
	ing top as ma		•		1					
2) Depth to	Water Surfac	æ (DTW	48.	31		Well Dia	ameter (in)	<u></u>	asing Volume (C	CV)/ft (gals)
	ing top as ma	•					2		0.163	
	th (WD):		75- 0	10			4		0.652	
	ing top as ma Water Colum	arked) nn (H)		f			6 D		1.468 CV = (23.49) x	1(D/24) ² 1
	ing top as ma		,	.,			-	8.14 [(D/2)/12 in.f	tj ² h (7.48 gal/cu.	
WELL PUR	GE AND SAN	IPLING DATA				Purge Meth	od:2" (Grundfos sub	mersible pum	p
Single Casi		Water in Well (VW)		gals	Purge Date	7/2	8105	-	
Number of (CV x H = V) Casing Volum	W) nes to Purge (N(C)		gals	Was Well P	umped Dry?	Y		
	-		-							
Total Volum	e of Water to (VW x NC =	Purge (TV) TC)			gals	Fe ² (mg/L):	3.6	· · · · ·		
		•								
-	T	Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
Time	Temp (C)	(umhos)	pH	(NTU)	(mV)	(mg/L)	(ft. bgs)	<u>(L)</u>	(L/min)	Phys. App.
0917	22.06	8719	7.16	71000	- 68.4	0.40	48.40		1.0	
0920	22.38	8797	7.12	71000	-853	0.55	48.41	<u> </u>		
0923	20.46	8821	5.12	71000	-93.0	0.63	48.42	3		
	2253	8851		51000			48,43	Ч		
0929	22.28	8859	7.14	71000	-104.7	0.42	48.44	5		
0932	J2.CH	884	7.15	71000	-107.2	0.39	48.45	6		
0935	27.73	8915	7.15	537	-110.5		48.46	7		·
0938	22-66	8908	7.16	149	-113.7	0.34	48.45	8		
0941	22.61	8904	7.16		-1153	0.36	48.46	9	 	
0944	22.67	8914	7.16	104	-117.3	0.32	48.45	10	 	
						· · · · · ·	·			· · · · · · · · · · · · · · · · · · ·
								- -	· · ·	
				ļ	ļ		ļ		1 <u> </u>	
INSTRUCT	IONS AND C	OMMENTS			-					
Purging/Sar	mpling Rema	rks <u>Puw</u>	vp s	et (<u> </u>	85'				

								MON	ITOR WELL N	0: <u>MW-33A</u>
				Moni	tor We	II Samp	ling Data			
roject: <u>C</u>	ooper Drum									
ocation No	:					Job No:	18600047.070	30		
	s): <u>37510</u>					Sampler(s):	SL/ <u>DG</u>			
	ate:/			·		Reviewer(s)):		Date: 7/2	8/05
		from dedicate	d tubing			Weather:				
ampling Ti	me:	1100		<u>.</u>		Ambient Te	mp. (F):			
	EVATION DA					Product Obs:	-	N		
	asurement:	Depth Sounder	YN			Depth to Proc		laterfeet Darke	V	
Screened in	terval						easurement:	Interface Probe	Y	N
) Well Cas	ing Elevation	(WCE) <u>S</u>	5-65	ft						
(from cas	ing top as ma	rked)								
		e (DTW	18.70	ft			ameter (in)	<u>(</u>	Casing Volume (
•	ing top as ma th (WD):						2^{1}		0.163	
• •	ing top as ma				-		 6		0.652	
	• 1	n (H)		ft			D		CV = (23.49) ×	
(from cas	ing top as ma	rked)					CV = 3	.14 [(D/2)/12 in.f	t] ² h (7.48 gal/cu.	Ft.)
VELL PUR	GE AND SAM	PLING DATA				Purge Meth	od: 2" (Grundfos subr	nersible pum	0
ingle Cosi	a Volumo of	Mator in Mall A	84 ()		colo		7/28			
ingle Casil	rg Volume of (CV x H = VV	Water in Well (\ V)	v vv)		gais	rurge Date:	1/08	/03	~	
lumber of (Casing Volum	es to Purge (NC	;)		gals	Was Well P	umped Dry?	Y	\bigcirc	
otal Volum	e of Water to	Purge (TV)			aals	Fe ² (mo/L)	0.8			
	(VW x NC =			4.0. L		(
		Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
Time	Temp (C)	(umhos)	pН	(NTU)	(mV)	(mg/L)	(ft. bgs)	(L)	(L/min)	Phys. App.
1832	22.70	4088	7.21	>/000	-61.5	1.30	49.08	<u> (</u>	1.0	
035	22.77	39.43	7.19	293	-75.6	0.58	48.95	2		
1038	22.96	3953	7,19	324	-82.5	0.89	48.99	3		
1041	22.94	3950	7.19	201	-87.1	0.73	49.04	4		
1044	22.99	3956	7.18	318	-88.5	0.69	49.02	5		
1047	Z2.97	3954	7.16	142	- 87.4	066	419.00	6		
1050	22.96	3953	7.16	94	-87.0	0.70	49.02	7		
1053	22.99	3955	7.16	141	-86-9	0.88	49.05	8		
							· .			
									<u> </u>	
		<i>n.</i>								·
NSTRUCT	ONS AND CO									

))								MON	TOR WELL N	O: <u>MW-33B</u>
				Moni	itor We	ll Samp	ling Data			
Project: 0	Cooper Drum						-			
						Job No:	18600047.070)30		
1	(s): <u>37511</u>							•••		
Sampling D	ate:	7/28/05				Reviewer(s)):		Date: 7/2	28/05
1		t from dedicate				Weather:	, <u></u>	· · · · · · · · · · · · · · · · · · ·		
	ime:							•		
WATER EL	EVATION DA	<u>TA</u>				Product Obs:	Y Y	N		
		Depth Sounder	Y N				duct:			
Other: Screened in		80-	90					Interface Probe		N
		(WCE)		ft	:	Quiei		,		
(from cas	ing top as ma	rked)		~~		L				
		e (DTW	-18.4	<u> </u>	i		ameter (in)	<u>(</u>	Casing Volume (
	ing top as ma	rked)					2		0.163 0.652	
	ing top as ma			<u>-</u>	-		6		1.468	
4) Height of	Water Colum	in (H)	•1	ft			D		CV = (23.49) x	[(D/24) ²]
(from cas	ing top as ma	rked)					ÇV = 3	3.14 [(D/2)/12 in.f	t] ² h (7.48 gal/cu.	Ft.)
WELL PUR	GE AND SAM	IPLING DATA				Purge Meth	od:	Grundfos subr	nersible pump)
Single Casir	ng Volume of	Water in Well (VW)		aals	Purge Date	: 7/28	105		
	(CV x H = V)	(V)								
number of C	Jasing volum	es to Purge (NC	<i></i>		_gais	was well P	umped Dry?	Y	(\mathbb{N})	
Total Volum	e of Water to (VW x NC =	Purge (TV)			gais	Fe ² (mg/L):	2.5			
		10)								
Time	Temp (C)	Cond (umhos)	pН	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1137	22.01	8534	7.23		-96.0		48:55		1.0	·
1140	22.36	8711		283			48.56	ð		
1143	22.49			210	-111.7	0.48	48.56	3		
		8764	7.16							
1146	22.49		7.16	<i>2</i> 13	-116.4		48.58	4		
1149	22.61	883	7.15	206	-1920	0.36	48.59	5	-	· · · · · · · · · · · · · · · · · · ·
1152	22.64	8829	7.15	365	-121.4	0.33	48.58	6		
		······································								
							'			
								· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·
<u>.</u>	•		L		L	I	Ι	·····	<u> </u>	······································
INSTRUCTI	ONS AND CO	MMENTS			951					
Purging/Sar	npling Remar	ks Pum	p se	+ @	80					
				<u> </u>						

				Moni	tor We	II Sampl	ing Data			
roiect: C	ooper Drum					•	•			
						Job No:	18600047.070	30		
	s):37513						SL/DG			
		7/28/05						· · · · · · · · · · · · · · · · · · ·	Date: 7/	28/05
		from dedicate								
ampling Ti	me: <u>/4</u>	00				Ambient Ter	mp. (F):			
VATER ELI	EVATION DA	TA				Product Obs:	Y	N		
		Depth Sounder	Y N			Depth to Prod	luct:			
ther:	tonyoli	48.	5-08	c			asurement:	Interface Probe		Ν
		(WCE)				Other:		· · · · · · · · · · · · · · · · · · ·		
(from oco	ina tan aa ma	d(ad)								
) Depth to	Water Surface	e (DTW	18.89	ft			ameter (in)	<u>(</u>	Casing Volume (C	CV)/ft (gals)
	ing top as ma th (WD).	rked)					2 4		0.163 0.652	
	ing top as ma				-				1.468	
) Height of	Water Colum	n (H)		ft			D		CV = (23.49) x	
(from cas	ing top as ma	rked)					CV = ;	3.14 [(D/2)/12 in.f	t] ² h (7.48 gal/cu.	Ft.)
VELL PUR	GE AND SAM	PLING DATA				Purge Metho	od:2"	Grundfos subr	nersible pump	
ingle Casir	ng Volume of	Water in Well (/W)		gals	Purge Date:	7/28	05		
	$(CV \times H = VV)$	V)								
lumber of (Casing Volum	es to Purge (NC	;)		gals	Was Well P	umped Dry?	Y	Ń	
otal Volum	e of Water to	Purge (TV)			aals	Ee^2 (ma/L):	2.1			
	(VW x NC =			· · · · ·	- 9013	(mg/u).				
		0		T a anda 1,494	000		Materia -	Demai		Observe th
Time	Temp (C)	Cond (umhos)	pН	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1319	23.39	4573	7.30	,	-103.8	0.40	48.94	(10	
1322	23.98	4605	7.29	7	-111.6	0.37	48.95	a		
1325	24.36	4637	7.28	7	-115.5	0.34	48.94	M		
1328	24,44	4639	7.28	7	ſ	0.32	48.95	4		
1331	24.55	4645		6		0.27	48.96	5		
1334	24.62	4649	7.28	6	-121.6	0.25	48.95	4		
1337	24.76	4661	728	6	-122.7		48.96	7		
		- *								
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ISTRUCTI	ONS AND CO	MMENTS		د	63	r				

								М	ONITOR WEL	L NO: <u>EW-1-40</u>
				Moni	tor We	ll Samp	ling Data			
Project: (Cooper Drum							· · · · ·		
Location No	:					Job No:	18600047.070	30		
Sample No	(s): <u>37512</u>			_		Sampler(s)	SL/DG			
Sampling D	ate: 7/	28/05				Reviewer(s):		Date: 7/	28/05
Sampling M	lethod: Direc	t from dedicate	d tubing			Weather:				
	ime:						mp. (F):			
	EVATION DA					Product Obs	Y	N	· · · · · · · · · · · · · · · · · · ·	
		Depth Sounder	Y N			•	duct:			
	toniali		-	00 E				Interface Probe		N
		(WCE)		88.5 ft	-	Other:				
	ing top as ma			i*						····
2) Depth to	Water Surfac	e (DTW	48.	89 ft		Well Di	ameter (in)		Casing Volume	(C\/)/ft (gais)
	ing top as ma			· · · · · · · · ·			2	-	0.16	
3) Well Dep	th (WD):		90.5		-		4		0.65	2
	ing top as ma	•					6		1.46	
		n (H)		ft			D		CV = (23.49)	
(nom cas	ing top as ma	(rkeu)				-	CV = 3	.14 [(D/2)/12 in.1	tj"h (7.48 gal/cu	I. Ft.)
WELL PUR	GE AND SAM	IPLING DATA				Purge Meth	od:2" (Grundfos subr	nersible pum	p
Single Casi		Water in Well (√W)		gals	Purge Date	7/28/	05	-	
Number of ((CV x H = V) Casing Volum	w) es to Purge (NC	>)		gals	Was Well F	umped Dry?	Y		
Total Volum	e of Water to	Purge (TV)			gals	Fe ² (mg/L):	4.0	•		
	(VW × NC =									
T	T (0)	Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
Time	Temp (C)	(umhos)	pH	(NTU)	(mV)	(mg/L)	(ft. bgs)	(L)	(L/min)	Phys. App.
1239	27.25	8821	7.21	40	-1010	0.75	48.85)	<i>i</i> .0	
1242		8627	7,20	14	-112,8	0.39	48.90	2		
1245	22.40	8592	7.19	23	-117.5	0.46	48.89	3		
1248	22.55	8561	219	35	-121.0	0.45	48.90	4		
1251	22.50	8456	7.19	15	-124.6	0.39	48.91	5		
1254	22.55	8380	7.19	14	-1270	0.33	48.91	6		
										·····
		-h								
									<u> </u>	
		DMMENTS ks	\sim	ist 1	৯ ৯০	1				
arging/oar	nping Remar	na <u>f</u> 0.77	<u> </u>							

				Moni	4 o y 14/ o		line Data			NO: <u>MW-20</u>
					tor we	II Sampi	ing Data	l		
							18600047.070			
	s): <u>37516</u> ate: 8 /	16/05		<u>·</u>					Data	
		t from dedicate	ad tubing							
		ØN S								
oumpling n							пр. (г.). <u></u>			<u> </u>
	EVATION DA					Product Obs:	Y	N		41.0
	asurement:	Depth Sounder	YN				luct:	latería e Decha	V	
			- 55 - 7(D			asurement:	Interface Probe	ř	N
		(WCE)		ft	•					
	ing top as ma		110	e .						
(from casi	ing top as ma	e (DTW rked)					ameter (in) 2	<u>C</u>	asing Volume 0.16	
3) Well Dep	th (WD):			0	-		4		0.65	
(from casi	ing top as ma	rked)					6		1.46	_
	Water Colum ing top as ma	n (H) rked)		ft			D CV=1	3.14 [(D/2)/12 in.ft	CV = (23.49) 1 ² h (7.48 cal/c	••• ••
\							Uv = 0	היד נ <i>נטובוי</i> זב ווו.ונ	j n (r.+o ya/c	u. r
NELL PUR	GE AND SAM	IPLING DATA				Purge Metho		<u>Grundfos subm</u>		
Single Cosi		14/atas in 14/atl /						ORP	- De	pan bel
ongie Casif	IG VOIUME OF (CV x H = V)	Water in Well (' N)	v vv)		gais	Purge Date:		213.7		0 19.75
Number of C	•	es to Purge (NC	C)		gals	Was Well P	umped Dry?	Y207,5		5 21.44
.						Fe ² (mg/L):	$n \wedge$	203.	5 6	
i otai voium	e of Water to (VW x NC =	Purge (TV) TC)	<u> </u>		gals	Fe⁻ (mg/L):	0.0	<u>& v v v</u>	, G	3 <i>13.0</i> •8
Time	Temp (C)	Cond (umhos)	pН	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed	Flow Rate (L/min)	Observations Phys. App.
0743		tart 1	T · ·		63'	(119/2)	48.10		•8	
0746		_	9.18	427	46.9	10.89	<i>t</i>	2400		
6749			8.15	330	40.7		48.09	4800		
					36.4					
6752		5212	8.12	296		· · · · ·	48.09			
0755	72.99	5230	8.09	277	35.6	8.84	48.07	9600		
0758	23.02	5295	8.03	194	35.0	7.99	48.00	12,000		
0801	22.99	5296	8.01	170	34.5	8.08	47.95	14,400		
0804	22.95	5260	8.02	94	34.5	8.19	47.94	16,800		
0807	23.00	5148	8.13	39	35.8	8.13	48.00	19,200		
	23.05	5176	8.02		35.1	8.90	47.99	21.600		
0810	22.94						47.92			
0810	ו השועיניה ו	5211	7.95	25	33.9			24,000		OZI Valve On
0813			7.93	43	34.0	7.59	47.93	26,400		
0810 0813 0816	22.96	5269	1.13	•						
0813		5769	1.13							
0813	22.96	······	1.13						Oz	= 0,0 mg/L
0813 0816 NSTRUCTI		OMMENTS		et @	63				03	= 0,0 mg/L

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Project				WON	IOI WE	II Samp	ming Data	L		
-Tujeci	Cooper Drun	<u>n</u>								
ocation N	o:	·				Job No:	18600047.07	030		
Sample No	o(s): <u>37517</u>		-			Sampler(s)	:SL/ <u>DG</u>			
Sampling [Date:	8/16/05				Reviewer(s	3):		Date:	
Sampling N	Method: Dire	ct from dedicat	ed tubing	1				,,		
Sampling 1	lime:	0940								
	LEVATION D					Product Obs	: Y	N		
		Depth Sounder	Y N			Depth to Pro				
	nterval:		- 8 69 - 9	00				Interface Probe	Y	N
	sing Elevation			50	Ħ.	Ourier:		. ,	······································	`
	sing top as m	arked)				<u> </u>				· · · · · · · · · · · · · · · · · · ·
	Water Surface		18,19	5	f	Well D	iameter (in)	<u>C</u>	asing Volume (C	CV)/ft (gals)
	sing top as m	•	**	20			2		0.163	
	pth (WD): sing top as m				-		4 6		0.652	
	of Water Colur			f	t		o D		1.468 CV = (23.49) x	
	sing top as m			·				3.14 [(D/2)/12 in.ft		
<u>/ELL PUF</u>	RGE AND SA	MPLING DATA				Purge Meth	nod: <u>2" (</u>	Grundfos subr	nersible pum	p Poun
										- Depth T
ingle Cas	Ing Volume of (CV x H = V	f Water in Well (W)	(VW)		gals	Purge Date	:		•	
lumber of	•	nes to Purge (N	C)		gals	Was Well F	oumped Dry?	Y	N	85 20
		Ū (•.		00 0
otal Volun		Purge (TV)			gals	Fe ² (mg/L):	3.4			736
	(VW x NC =	TC)								A. J. L
		Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
Time	Temp (C)	(umhos)	pН	(NTU)	(mV)	(mg/L)	(ft. bgs)	n(L)	(L/min)	Phys. App.
0858	P	UMP .	star	ted					.8	
			0 14	-1000	-90.1	0.00	48,15	2400		
2901	21.32	8414	8.1	1.000		0.00	1 42121			
	21.32	<u>8414</u> 8480	8.05			0.20	48,15	4800		··· ,
0904		8480	, , ,		-93.5					······································
0901 0904 0907 0910	21.69	8480 8596	8.05	71000 7/600	-93.5	0.20	48.15	4800		· · · · · · · · · · · · · · · · · · ·
0904 0907	21.69	8480 8596	8.05 7.95	71000 7/000	_93.5 -93.0	0.20	48,15 48.16	4800		
0904 0907 0910	21.69 22.15 22.54	8480 8596 8666	8.05 7.95 7.89	7/000 7/000 870 427	-93.5 -93.0 -95.4	0.20 0.17 0.13 0.10	48.15 48.16 48.29	4800 7200 9600		
0904 0907 0910 0913 0916 0919	21.69 23.15 23.54 23.01 23.92 23.92 23.82	8480 1596 8666 8769 8769 8769	8.05 7.95 7.89 7.82 7.79 7.79	71000 71000 870 427 460 426	-93.5 -93.0 -95.4 -95.5 -92.9	0.20 0.17 0.13 0.10 0.10	48,15 48.16 48.29 48.27	4800 72.00 9600 12,000		
0904 0907 0910 0913 0916 0919	21.69 23.15 23.54 23.01 23.92 23.92 23.82	8480 1596 8666 8769 8769 8768 8768	8.05 7.95 7.89 7.82 7.79	71000 71000 870 427 460 426	-93.5 -93.0 -95.4 -95.5 -92.9	0.20 0.17 0.13 0.10 0.10 0.10	48.15 48.16 48.29 48.27 48.25	4800 7200 9600 12,000 14,400		
0904 0907 0910 0913 0916 0919 0919	21.69 22.15 22.54 23.92 22.92 22.82 22.82 22.82	8480 1596 8666 8769 8769 8768 8771 8793	8.05 7.95 7.89 7.82 7.79 7.79	7/000 7/000 870 427 460 420 198	-93.5 -93.0 -95.4 -95.5 -92.9 -91.8	0.20 0.17 0.13 0.10 0.10 0.10 0.09	48,15 48.16 48.29 48.27 48.25 48.30	4800 72.00 9600 12,000 14,400 16,800		
0904 0907 0910 0913 0916	21.69 22.15 22.54 23.01 23.92 23.92 23.92 23.92 23.92	8480 1596 8666 8769 8769 8768 8768	8.05 7.95 7.89 7.82 7.79 7.79 7.77	7/000 7/000 870 427 460 420 198 239	-93.5 -93.0 -95.4 -95.5 -92.9 -91.8 -91.0	0.20 0.17 0.13 0.10 0.10 0.10 0.10	48,15 48.16 48.29 48.27 48.25 48.30 48.35	4800 72.00 12,000 14,400 16,800 19,200 21,600		
2904 2907 2907 2910 2913 2916 2919 2919 2922	21.69 22.15 22.54 23.01 23.92 23.92 23.92 23.92 23.92	8480 1596 8666 8769 8769 8768 8771 8793	8.05 7.95 7.89 7.82 7.79 7.79 7.77 7.75 7.72	7/000 7/000 870 427 460 420 198 239	-93.5 -93.0 -95.4 -95.5 -92.9 -91.8 -91.8 -91.0 -86.8	0.20 0.17 0.13 0.10 0.10 0.10 0.10 0.09 0.09	48.15 48.16 48.29 48.27 48.25 48.25 48.30 48.32	4800 72.00 9600 12,000 14,400 16,800 19,200		

								MONI	TOR WELL N	0: <u>MW-33A</u>
				Monit	tor Wel	I Sampl	ing Data			
^{>} roject: C	ooper Drum	·								
ocation No	:					Job No:	18600047.070	30		
Sample No(s): <u>37518</u>					Sampler(s):	SL <u>/DG</u>			
Sampling Da	ate: <u>8</u>	116/05				Reviewer(s)	;		Date:	
Sampling M	ethod: <u>Direc</u>	from dedicate	d tubing			Weather:				
Sampling Tir	me:	1050				Ambient Ter	np. (F):			
۰ <u>NATER ELI</u>	EVATION DA	TA				Product Obs:	Y	N		
lethod of Me	asurement:	Depth Sounder	YN				luct:			
Other:								Interface Probe	Y	Ν
	terval: ing Elevation			ft		Other:		<u> </u>		
(from casi	ing top as ma	rked)								
2) Depth to '	Water Surface	e (DTW <u>4</u> -	7.38	ft		Well Dia	imeter (in)	C	asing Volume	(CV)/ft (gals)
	ing top as ma	rked)					2		0.16	3
• •	th (WD):		5				4		0.65	
	ing top as ma	rked) n (H)		ft			6 D		1.46 CV = (23.49)	
	ing top as ma		.	n				0.14 [(D/2)/12 in.ft	• •	••• ••
、		·····,						• • • • • • • • • • • • • • • • • • •		·····
NELL PUR	GE AND SAM	IPLING DATA				Purge Metho	od: 2" (<u>Grundfos subm</u>	nersible pum	p de e
								· ·	~	Pre-pure
Single Casir	ng Volume of (CV x H = V)	Water in Well (\	/vv)	·····	gais	Purge Date:	· · · · · · · · · · · · · · · · · · ·	,	<u>v</u>	ounhole;
Number of (•	es to Purge (NC)		gals	Was Well P	umped Dry?	Y	N 07	W: 60.00
	Ū	• •			-				Đ	0.: 15.34
Fotal Volum		Purge (TV)			gals	Fe ² (mg/L):	0.4		01	ep: 84.9
	(VW x NC =	TC)					· .		77	·c): 21.04
		Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
Time	Temp (C)	(umhos)	pН	(NTU)	(mV)	(mg/L)	(ft. bgs)	∧~(L)	(L/min)	Phys. App.
1017	57	ont Pu	mp						_8	
1020	22.73	3894	7.83	71000	10:7	5.17	48.15	2400		
1023	23.89	3992	7.68	71000	14.2	4.28	48.50	4800		
1026	22.82	3910	767	71000	164	3.56	48.33	7200		
1029	73.08	3938	7.56	702	18.7	1.79	48.25	9600		
1032	23.10	3949	7.55	914	19.0	1.45	48.20	12.000		
1035	26.14	4193	7.56	>1000	16.5	218	48.20	14,400		
1038	25.35	4126	7.58	71000	16.1	2.12	48.22	16,800		
1041	22.57	3926	7.60	71000	154	3.20	48.40	19,200		
1044	22.54	3912	7.58	916	17.4	2.87	48.42	21,600		
1047	22.70	3922	7.52	756	17.9	2.42	48.39	24,000		
1050	22.70	3971	7.58	750	16.9	2.59	48.38	26,400		
										3z = almg/L
		OMMENTS							•	· 、 () ~



					,			MON	TOR WELL N	IO: <u>MW-33B</u>
				Moni	itor We	II Samp	ling Data			
Project:	Cooper Drum	1	·.				•			
1						Job No:	18600047.070)30		
	(s): <u>37519</u>						:SL <u>/DG</u>			
	ate: 8								Date:	
		t from dedicate	ed tubina	<i>a</i>				· · · · · · · · · · · · · · · · · · ·		
	ime:			· · · · · · · · · · · · · · · · · · ·						
WATER EL	EVATION DA	TA				Product Obs	: Y	N	···· · · ·	~ .
Method of Me	easurement:	Depth Sounder	Y N				duct:			
Other:			-					Interface Probe	Y	Ν
		80 - 90			-	Other:				
1	sing Elevation sing top as ma	(WCE)		ft						
		e (DTW		ft	ł	Well Di	ameter (in)			
	sing top as ma	orkod)			•	<u>vveii Di</u>	2	<u> </u>	asing Volume (0.16	
	oth (WD):	. 9	<u>`0</u>		_		4		0.65	
	ing top as ma	anceay					6		1.46	в
· · ·		וח (H)		ft			D		CV = (23.49)	
(from cas	sing top as ma	arked)					CV = 3	0.14 [(D/2)/12 in.ft] ² h (7.48 gal/cu	. Ft.)
WELL PUR	GE AND SAN	IPLING DATA				Purge Meth	od: <u>2" (</u>	Grundfos subn	nersible pum	p
Single Casi		Water in Well (∨w)		gais	Purge Date	:			Downhole:
Number of (V = H X VC) Casing Volum	W) les to Purge (N0	ור		aolo			V		oth: 85.00
	Casing Volum	ies to Fulge (inc	-)		gais	was well r	Pumped Dry?	Y		
Total Volum	ne of Water to	Purge (TV)			gals	Fe ² (mg/L):	4.0		10	°C): 20,32
	(VW x NC =	TC)								P: SOMV
				-						0.1. 1.80mg/L
Time	Temp (C)	Cond (umhos)	рH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed m(L)	Flow Rate (L/min)	Observations Phys. App.
1128	54	4	MP				(<u> </u>	•8	1135.74pp.
(13)	21.56		8.08	442	-38.8	0.22	48.50	7400		· · · · · · · · · · · · · · · · · · ·
1134	21.74	8387	7.95	384	40.4		48.51	4200		
1137	27.23	8505	7.87	248	-46.5	0.20	418.50	7200		• - 635 - 10 0
1140	22.46	8601	7.85	226	-51.5	0.16	48.51	9600		
1143	22,56	8646	7.81	194	~54.7	0.12	48.49	12,000		
1146	2962	8663	778	197	-58.6		48.47	14,400		
1149	22.63	8667	7.75	188	-58.4	0.10	48.48	16,800		
										· · · · · · · · · · · · · · · · · · ·
			-	·		·				
NOTO									•	
Purging/Ser	UNS AND CO	MMENTS ks	10 c-	+ 0	851					
unging/oan	nping Remar		VT NG							

T(CC): 20.32 ORP: -30.1 MV D.O.: 1.01 mg/L Depth: 85'

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roiect: C	ooper Drum									
						Job No:	18600047.070	30		
	s): <u>37520</u>					_	SL/ <u>DG</u>			
		8/16/05	· · · · · · · · · · · · · · · · · · ·						Date:	·····
		t from dedicate								· · · · · · · · · · · · · · · · · · ·
	me:									· · · · · · · · · · · · · · · · · · ·
	EVATION DA					Product Obs:		N		ана на селото на село На селото на
	asurement:	Depth Sounder	YN			Depth to Proc		Interface Probe	Y	N
creened in	terval:		48.5 - 1	88.5		I	asurement.		ř	N
Well Cas	ng Elevation	(WCE)		ft	-		······································	· · · · · · · · · · · · · · · · · · ·		
	ing top as ma Water Surfac	irked) 4	8.83	a						
•	ing top as ma			ft		<u>Well Dia</u>	a <u>meter (in)</u> 2	<u>(</u>	Casing Volume 0.16	·····
			<u>90.5</u>				4		0.65	
•	ng top as ma						6		1.46	
	Water Colum ing top as ma	nn (H)	,	ft			D CV-3	.14 [(D/2)/12 in.f	CV = (23.49)	
1.0.000							UV - 3	. יד ננטוצוי וצ וח.ו	-j ii (7.40 gal/Cl	u. i ⁻ L)
ELL PUR	<u>GE AND SAM</u>	IPLING DATA				Purge Metho	od: 2" 0	Frundfos subr	nersible pum	<u>1p</u>
ngle Casir		Water in Well (/W)		gals	Purge Date:			-	Pro-Durae
umbor of ((CV x H = V)		~		eala			V	N	Pre-purge Awnhole: ():20.79
	asing volum	es to Purge (NC	·)		gais	was well P	umped Dry?	Y	N TO	():20.79
otal Volum	e of Water to	Purge (TV)			gals	Fe ² (mg/L):	0.0	·	OR	P: 26.1 mV
	(VW x NC =	TC)							0.0): 4.03 mg/L
		Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	th: 63 Observations
Time	Temp (C)	(umhos)	pH ,	(NTU)	(mV)	(mg/L)	(ft. bgs)	f~(L)	(L/min)	Phys. App.
1314	5	tart P	MP					· · · · · · · · · · · · · · · · · · ·	-8	
1317	22.80	4275	7.96	20	8.9	1.87	48.83	2400	ļ	
1320	23.71	4342	7.81	12	13.2	1.79	48.83	4800		
1323	23.95	4371	7.79	10	12.6	1.92	48-82	7200		
(326	23.99	4380	774	11	14.8	1.77	48.83	9600		
1329	24.17	4391	7.72	10	14.9	1.76	48.83	12.000		
1332	24.04	4832	7.70	10	15.6	1.69	48.83	14,400		
					• • • •	,			1	
					.					
							/		ļ ,	
,				·····	ļ	, <u>, , , , , , , , , , , , , , , , , , </u>			ļ	
		· · · · · · · · · · · · · · · · · · ·								
		L	L	,		·			·	
	ONS AND CO								(1)	7= 0.0 mg

Note: A complete list of containers and analyses used can be found in the associated sa and an estimate of the total valume of water removed. Water measurements should be re POST - PVR GET(C) : 21.15 CRP : 78.5 mV D.8. : 4.40 Depth : 63

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MONITOR W	/ELL NO:	EW-1-90'
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Monitor Well Sampling Data	M	onitor	Well	Sami	olina	Data
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									TOR WELL NO	D:EW-1-90'
				Mon	itor We	II Samp	ling Data			
Project:	Cooper Drum),					· · · · · · · · · · · · · · · · · · ·			
_ocation No	:			-		Job No:	18600047.070	30		
	(s): 37521 _					Sampler(s):	\$L <u>/DG</u>			
Sampling D	ate:	8116105				Reviewer(s):	·	Date:	
		t from dedicat	ed tubing			Weather:	·····			
Sampling Ti	ime:	1240		<u> </u>			mp. (F):			
	EVATION DA					Product Obs:		N		A
	easurement:	Depth Sounder	YN			Depth to Proc		laterfe en Decke	N	
	iterval:	18.5 - 88.5	-				easurement:	Interface Probe		Ν
		(WCE)		f	t -			· · · · · · · · · · · · · · · · · · ·		
	ing top as ma		(a a)							
2) Depth to (from case)	Water Surfac	e (DTW	18.81	f	t	<u>Well Di</u>	ameter (in)	<u>(</u>	Casing Volume (
3) Well Dep	th (WD):	urked) 90,5					2		0.163 0.652	
-	ing top as ma	irked)		······································	-		6		1.468	
		nn (H)		ft			D		CV = (23.49) x	
(from cas	ing top as ma	irked)					CV = 3	8.14 [(D/2)/12 in.f	t] ² h (7.48 gal/cu.	Ft.)
VELL PUR	GE AND SAM	IPLING DATA				Purge Meth	od:2" (Grundfos subr	nersible pump)
		Water in Well (vw)		_gals	Purge Date:		·····	- 0	- Pre-purge
	(CV x H = V		~							
vumber of C	asing volum	es to Purge (NO	(ز	<u> </u>	gais	Was Well P	umped Dry?	Y		Tec]: 20.15
lotal Volum	e of Water to	Purge (TV)			aals	Fe ² (ma/L):			0	RP:-13.0mV
	(VW × NC =					(3 -/ .			í L).0.: 0.82 mg/L lepth: 85
		Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	, Observations
Time	Temp (C)	(umhos)	pH _	(NTU)	(mV)	(mg/L)	(ft. bgs)	<u>м(L)</u>	(L/min)	Phys. App.
1234	Stai	nt Pum	<u>р</u>						.8	
1237	21.93	8423	8.11	23	-404	0.31	48.80	2400		
1240	22.44	8490	187	(3	-42.8	0.28	48.80	4800		
1243	22.69	8567	7.85	15	-47.9	0.24	48.79	7200		
1246	22.63	8608	7.85	14	-51.5	0.25	48.80	9600		
1249	22.72	8562	7.84	11	-53.2	0.22	48.80	19,000		
1252	22.90	8490	7.83	9	-55.4	0.16	48.81	14,400		
		····			1					
	· · ·	· · · · · · · · · · · · · · · · · · ·			 					
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			L		I	·······	L		<u>_</u>	
ISTRUCTI		MMENTS	1		@ 85		I <u>I</u>		L,L_	

								MO	NITOR WELL I	NO: <u>MW-20</u>
				Moni	tor We	II Samp	ling Data	1		
Project:(Cooper Drum						-	· ·		
						Job No:	18600047.07	030		
		,							· · · ·	
					_					
		t from dedicat								
		· · · · · · · · · · · · · · · · · · ·	······							
WATER FI	EVATION DA	ТА				Product Obs	Y	N		
		Depth Sounder	Y N				duct:			
Other:			_			Method of M	easurement:	Interface Probe	Y	Ν
					-	Other:				
		(WCE)		f1					· · ·	·
	sing top as ma Water Surfac	rked) e (DTW4	8 03	5		Wall D	ameter (in)		Caeing Volume //	
	sing top as ma			N		<u>vveii Di</u>	ameter (in) 2	. <u>(</u>	Casing Volume (0 0.163	
			70		_		.4		0.652	
(from cas	ing top as ma	rked)		•			6		1.468	
		nn (H)		ft			D		CV = (23.49) x	
(from cas	sing top as ma	arked)					CV =	3.14 [(D/2)/12 in.f	t] ² h (7.48 gal/cu.	Ft.)
WELL PUR	GE AND SAM	PLING DATA				Purge Meth	od: <u>2"</u>	Grundfos subr	nersible pump)
Single Casi	ng Volume of	Water in Well	(VW)		_gals	Purge Date	:	· · ·	_	
	(CV x H = V	Ŵ)							-	
Number of	Casing Volum	es to Purge (N	C)	· · · · · ·	_gals	Was Well F	umped Dry?	Y	Ν.	
Total Volum	no of Water to	Purge (TV)			aolo	Fe ² (mg/L):	0.0			
	(VW x NC =				gais	re (ilig/L).				
	*	Quad			000		141-1-1		—	
Time	Temp (C)	Cond (umhos)	pН	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
0710	Z1.86	5000	7.14	275	128.1	14.81	4748	2.4	.8	47.78
0713	22.54	5074	7.19	181	115.8	14.52	47.68	4.8	.8	
0716	22.74	5086	7.35	92	104.8	15-18	47.75	7.2	- 8	
0719	22.81	5084	7.35	80	98.8	12.40	47.87	9.6	. 8	
0722	22.88	5096	7.32	64	93.3	10.97	47.90	12.0	· 8	
0725	22.86	5107	7.31	53	89.4	11.89	47.85	14-4	• 8	
0728	22.84	5126	7.12	74	87.1	11.78	47.83	i\$.8	. శ	
0731	22.88	5167	7.27	123	84.1	11.37	47.85	i9.2	- 8	
0734	22.86	5790	7.15	111	81.8	11.11	47.65	A1. 8	.B	
					[-
· · · · ·	·		•	•••• •••	· · · ·		• • • • • • • • • • • • • • • • • • •		4 I	<u> </u>

Purging/Sampling Remarks _____Pump @ 63 ft.__

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

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								MONIT	OR WELL NO	: <u>MW-20B</u>
-				Monit	tor Wel	li Sampi	ling Data			
Proiect: C	ooper Drum					-	-			
·						Job No:	18600047.070	30		
	s): <u>37527</u>									
	ate: 9/7/05				*	• • • •		······································		
		t from dedicate	ed tubina		• •					
							······································			
	<u>EVATION DA</u>					Product Obs:		N		
		Depth Sounder	YN				luct: easurement:	Interface Probe	v	N
Other: Screened in	iterval:		80 - 9	0						. 11
	ing Elevation			f	1					
(from cas	ing top as ma	irked)								
		e (DTW	5.01	f		<u>Well Dia</u>	a <u>meter (in)</u> 2	<u>C</u>	asing Volume (
1 .	ing top as ma th (WD):		90				4		0.163	
1 [·]	ing top as ma			·····	-		6		1.468	
1 ' '	Water Colum			ft	t		D		CV = (23.49) x	
(from cas	ing top as ma	arked)					CV = 3	8.14 [(D/2)/12 in.fl] ² h (7.48 gal/cu.	Ft.)
WELL PUR	<u>GE AŅD SAŅ</u>	IPLING DATA				Purge Meth		<u>Grundfos sub</u>	mersible pum	<u> </u>
Single Casi	-	Water in Well (VW)		gals	Purge Date	:		- ·	
Number of	CV x H = VV) Casing Volum	W) ies to Purge (N	ור		aale	Was Well P	umped Drv?	Y	N	
	caoing voian				9010			•		
Total Volum	ne of Water to	Purge (TV)		<i></i>	gals	Fe ² (mg/L):	3.0	· · · · · · · · ·		
	(VW x NC =	TC)					4			
		Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
Time	Temp (C)	(umhos)	pН	(NTU)	(mV)	(mg/L)	(ft. bgs)	(L)	(L/min)	Phys. App.
28080	21.17	8260	6.66	71000	-47.7	0.77	48.40	2.4	- 8	
0811	21.99	8421	6.84	71000	-50.1	0.45	48.38	4.8	- 8	
0814	22.2)	8472	6.94	71000	-52.6	0.75	48.38	7.2	.8	
0817	22.25	8493	7.05		-55.4	0.45	48.38	٩.6	.8	
	22.57	8554	7.15		-57.8	0.33	48.39	12.0	.8	
0820			<u> </u>			0.31	48.39			
0823	22.61	8564	6.95	399	-58.4			14.4	~8 	
0826	22.61	8576	7.15		-60.1	0.29	48.39	162	.8	······
0829	22.71	8591	7.18	255	-61.7	0.28	48.37	19.2	.8	
0832	22.62	8586	7.29	174	-62.4	0.25	48.37	21.6	- 8	
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Purging/Sampling Remarks _____Pump @ 85 ft._

								MON		D: <u>MW-33A</u>
				Moni	tor We	ell Samp	ling Data			
Project:	<u>Coope</u> r Drum						-			
						Job No:	18600047.070	30		
							SL/ <u>DG</u>			·····
		· · · · · · · · · · · · · · · · · · ·):			
		t from dedicate			-					
							mp. (F):			
WATER EL	EVATION DA	ТА				Product Obs	: Y	N		
Method of Me	easurement:	Depth Sounder	Y N				duct:			
Other:			-				easurement:			Ν
	iterval:	(WCE)	· · · · · ·	#	<u>-</u>	Other:		·	· · · · · · · ·	
	ing top as ma			<u> </u>		L				
		e (DTW 47	.55	ft		Well Di	ameter (in)	(Casing Volume (C	CV)/ft (gals)
	ing top as ma			······································			2	2	0.163	· · · · · · · · ·
					-		4		0.652	
	ing top as ma			•			6		1.468	
	Water Colum	in (H)		ft			D . CV≞a		CV = (23.49) x	
(nom cas	ang iop as ma					L	UV = 3	8.14 [(D/2)/12 in.f	ıj ii (7.46 gal/cü.	FL.)
<u>NELL PUR</u>	<u>GE AND SAN</u>	IPLING DATA				Purge Meth	iod: <u> 2" (</u>)
Single Çasi	-	Water in Well (∨w)		gals	Purge Date	:		-	
Number of (CV x H = V) Casing Volum	N) es to Purge (N(2)		aals	Was Well F	umped Dry?	Y	N	
								·		
Total Volum	e of Water to (VW x NC =	Purge (TV) TC)	···· .		gals	Fe ² (mg/L):	0.0			
	• • • • • • •	- /								
Time	Temp (C)	Cond (umhos)	pН	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
091 8	24.30	3157	7.75	7(000	19.2	3.25	48.00	24	0.2	1 Hys. App.
0921	24.58	3784	1.70	71000	19.0	3.08	48.02	4.8	0.3	
	1 1	,	7.70	741	17.8	2.90	48.18			·······
0974	24.69	4004				2.21		7.8	1.0	
<u>1975</u>	24.52	3979	7.70		16.4	2.29	48.22	10.8	1.0	
0930	24.17	3151		572	13.Z		48.24	13.8	1.0	
0933	22.5B	3786	7-91	192	11.3	0.74	48.24	16.8	·	
0936	22.77	3824	7.92		7.1	0.85	48.25	19.8	1.0	
0939	22.46	3851	7.92	220	6.0	1.41	48.25	22.8	1.0	
6942	23.03	3862	7.92	164	5.5	1.53	48.26	25.8	1.0	
0945	23.01	3863	7.92	112	4.7	1.23	48.26	28.	1.0	
						L				
						<u> </u>				
				ļ						
NSTRUCT	IONS AND CO	OMMENTS								
	mpling Remar		p @ 60 ft.							

								MON	ITOR WELL NO	D: <u>MW-33B</u>
				Moni	itor We	II Samp	ling Data			
Project:	Cooper Drum			•						
_ocation No	o:					Job No:	18600047,070	30		· · · · · · · · · · · · · · · · · · ·
Sample No	(s): <u>37529</u>					Sampler(s):	SL <u>/DG</u>	,,		<u> </u>
Sampling D	Date:9/7/05				_	Reviewer(s):		Date:	
Sampling M	Aethod: Direc	t from dedicate	<u>ed tubing</u>			Weather: _			·	
Sampling T	"ime:					Ambient Te	mp. (F):			
Aethod of M		Depth Sounder					duct:			
Screened in	nterval:	80 - 90						Interface Probe		N
		(WCE)		fi	-					
	sing top as ma		: 0							
		e (DTW 48	.62	fi	t	<u>Węll Di</u>	ameter (in)	<u>(</u>	Casing Volume (
	sing top as ma						2		0.163	
	pth (WD): sing top as ma				- :		6		0.652 1 <i>.</i> 468	
•	• ·	in (H)		ft			D		CV = (23.49) x	
	sing top as ma		<u></u>				CV = 3	3.14 [(D/2)/12 in.f		
WELL PUF	RGE AND SAM	IPLING DATA				Purge Meth	lod: <u>2" (</u>	<u>Grundfos subr</u>	mersible pump)
Single Casi	ing Volume of (CV x H = V)	Water in Well ((VW)	·	_gals	Purge Date	:	· · · · · · · · · · · · · · · · · · ·	-	
Number of	•	es to Purge (N	C)		_gals	Was Well F	Pumped Dry?	Y	N	
Total Volun	ne of Water to (VW x NC =	Purge (TV) TC)			_gals	Fe ² (mg/L):	4.0			
	()									
Time	Tomp (C)	Cond		Turbidity	ORP (m)()	D.O.	Water Level	Removed	Flow Rate	Observations
Time	Temp (C)	(umhos)	pH	(NTU)	(mV)	(mg/L)	(ft. bgs)	(L) 3	(L/min)	Phys. App.
1019	21.92	8271	8.36	191	-79.4	T	48.52	_	1.0	
1022	22.24	8405	8.32	166	-78.0	0.86	48.54	6	1.0	
1025	22.51	8512	8.50	158	-77.1	0.48	48.54	9	1.0	
1028	22.63	8557	8.31	165	-77.5	0.44	48.54	12	1.0	
1031	22.63	8577	8.32	160	-78.1	0.40	48.54	15	1.0	
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			<u> </u>		<u> </u>	<u> </u>	<u> </u>			
NSTRUCT	TIONS AND CO									
^o urging/Sa	ampling Remar	rksPum	ıp @ 85 ft.		· · · · · · · · · · · · · · · · · · ·			······		
		······			<u> </u>					

								M	ONITOR WELL	NO: <u>EW-1</u>
				Moni	tor We	ll Samp	ling Data			
Project: <u>C</u>	ooper Drum									
Location No	:					Job No:	18600047.070	30		
						Sampler(s):	SL/DG			
		5							Date:	
Sampling M	ethod: Direct	t from dedicate	ed tubing					•		
WATER ELI	EVATION DA	TA				Product Obs	Y	<u>/</u>		
	-	Depth Sounder				Depth to Pro	duct:			
								Interface Probe		Ν
	terval:		48.5 -		-	Other:			<u> </u>	
	ing Elevation ing top as ma	(WCE)		π		L				
2) Denth to	Mater Surface	e (DTW <u>18</u>	77	ff		Well Di	ameter (in)		Casing Volume (C	"\/)/ft (cals)
	ing top as ma		<u> </u>	n		<u>vven Di</u>	2	7	0.163	<u>, v //it (yais)</u>
			<u>90.5</u>		_	1	4		0.652	
(from cas	ing top as ma	rked)			-		6		1.468	
		n (H)		ft			D		CV = (23.49) x	
(from cas	ing top as ma	rked)					CV = 3	.14 [(D/2)/12 in.f	ť] ² h (7.48 gal/cu.	Ft.)
WELL PUR	GE AND SAM	IPLING DATA				Purge Meth			nersible pump	
Single Casir	ng Volume of	Water in Well (VW)		gals	Purge Date	:			
	(CV x H = V)	N)								
Number of (Casing Volum	es to Purge (NO	C)	·····	gals	Was Well F	Pumped Dry?	Y	N	
T -4-137-1		B				F = 2 (//)	P.O			
i otal volum	(VW x NC =	Purge (TV)		· · · · · · · · · · · · · · · · · · ·	gais	Fe (mg/L):		· · · · · · · · · · · · · · · · · · ·		
	(*** * *** -	10)								
Time	Temp (C)	Cond (umbos)	고님		ORP (mV)	D.O.	Water Level	Removed	Flow Rate (L/min)	Observations
	Temp (C)	(umhos)	pH	(NTU)	1	(mg/L)	(ft. bgs)	(L)	TÌ. ÉT	Phys. App.
1152	23.15	6706	8.08	12	÷	3.45	48,73	3	1.0	
1155	24.00	4596	8.04	7	-25.9	+ · · · · ·	48.73	ک	10	- <u>-</u>
1158	24.32	4562	7.97	6	-0.3	5.54	48.80	9	1.0	
1201	24.65	4582	7.95	_ 	9.9	5.52	48.82	IZ	1.0	a a sur a
1204	24.72	4587	7.96	7	13.6	5.57	48.82	15	1.0	
1207	24.61	4575	8.06	7	16.0	5.55	48.82	18	1.0	· · · · · · ·
1210	24.53	4572	8.06	7	17.2	5.40	48.82	21	1.0	
				ļ,		· · · · · · · · · · · · · · · · · · ·				
2. 2. * 1										
1 										
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INSTRUCT	IONS AND CO	<u>OMMENTS</u>								

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Purging/Sampling Remarks ____Pump @ 63 ft_

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Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

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$\begin{array}{c c c c c c c c c c c c c c c c c c c $									MONI	TOR WELL NO	:EW-1-90'	
Project: Cooper Drum Location No:					Moni	tor We	II Samp	ling Data	1			
Location No:	Project (Cooper Drum					•.	-			1 1. - 1. - 1.	
Sample No(s):37531							Job No:	18600047.07	030		· · · · ·	
Sampling Date:97/105											····	
Sampling Method: Direct from dedicated tubing Weather: Sampling Time: Ambient Temp. (F): WATER ELEVATION DATA Product Obs: Y N Method of Measurement: Depth Sounder Y N Other: Gradient Streamed Interval: 1) Well Casing Elevation (WCE) ft (from casing top as marked) 2) Depth to Water Surface (DTW <u>48.7.7.2</u> ft (from casing top as marked) 2 2) Depth to Water Surface (DTW <u>48.7.7.2</u> ft (from casing top as marked) 2 4) Height of Water Column (H) ft (from casing top as marked) CV = (23.14 ((D/2)/12 in.ft) ² h (7.48 gal/cu. Ft.) WELL PURGE AND SAMPLING DATA Purge Method: 2" Grundfos submersible pump Single Casing Volume of Water in Well (VW) gals Purge Date:								-		Date:		
Sampling Time: Ambient Temp. (F): WATER ELEVATION DATA Method of Measurement: Depth Sounder Y N Other: Generating Elevation (WCE) (from casing top as marked) ft 2) Depth to Vater Surface (DTW <u>48.72</u> ft Method of Measurement: (from casing top as marked) 2 3) Well Depth to Water Surface (DTW <u>48.72</u> ft Method of Measurement: (from casing top as marked) 2 3) Well Depth two Product: 2 (from casing top as marked) 4 4) Height of Water Column (H)ft 6 (from casing top as marked) 2 4) Height of Water Column (H)ft ft (from casing top as marked) 9 Single Casing Volume of Water in Well (VW) gals Purge Method: 2* Grundfos submersible pump Single Casing Volumes to Purge (NC) gals Purge Date:						-			•			
WATER ELEVATION DATA Method of Measurement: Depth Sounder Y N Other:				v								
Method of Measurement: Depth Sounder Y N Other:	Sampling 1	ime:	······································				Amplent i e	mp. (+):	·, ·, ·····			
Other:	WATER EL	EVATION DA	<u>TA</u>				Product Obs	Y Y	N	· · · · · · · · · · · · · · · · · · ·		
Screened interval: <u>48.5 - 88.5</u> 1) Well Casing Elevation (WCE)ft(from casing top as marked)ft2) Depth to Water Surface (DTW 43.772 (from casing top as marked)ft3) Well Depth (WD):0.163(from casing top as marked)44) Height of Water Column (H)ft(from casing top as marked)ft(from casing top as marked)CV = (23.49) x [(D/24) ²](from casing top as marked)CV = 3.14 [(D/2)/12 in.ft) ² h (7.48 gal/cu. FL)WELL PURGE AND SAMPLING DATAPurge Method:Single Casing Volume of Water in Well (VW)gals(CV x H = VW)galsNumber of Casing Volumes to Purge (NC)gals(VW x NC = TC)CondCondTurbidityTimeTemp (C)(umhos)pH(NTU)(mV)(mV)(ft. bgs)(L)(L/min)Phys. App.111372.4638.448.15179-79.20.6948.92(i)(48.92(i)(48.92(i)(48.92(i)(1.0)(iii)27.9638.148.15179-79.20.6048.92(i)(48.92(i)(48.92(i)(i)(ii)(48.92(iii)(48.92(iii)(48.92(iii)(48.92(iii)(48.92(iiii)(1.0)(iiii)<	1			Y N								
1) Well Casing Elevation (WCE)ft (from casing top as marked) 2) Depth to Water Surface (DTW <u>48.72</u> ft (from casing top as marked) 3) Well Depth (WD):ft (from casing top as marked) 4 0.652 6 1.468 D $CV = (23.49) \times [(D/24)^2]$ (from casing top as marked) 4 0.652 6 1.468 D $CV = (23.49) \times [(D/24)^2]$ ($CV = 3.14 [(D/2)/12 in.ft]^2h (7.48 gal/cu. Ft)$ WELL PURGE AND SAMPLING DATA WELL PURGE AND SAMPLING DATA WELL PURGE AND SAMPLING DATA Single Casing Volume of Water in Well (VW) gals ($CV \times H = VW$) Number of Casing Volumes to Purge (NC) gals Total Volume of Water to Purge (NC) gals Total Volume of Water to Purge (TV) gals Time Temp (C) (umhos) pH (NTU) (mV) (mg/L) (ft. bgs) (L) (L/min) Phys. App. 1113 72.46 8781 8.07 217 -67.7 0.84 48.89 3 1.0 1116 7.7.96 8814 8.15 179 77.7.2 0.60 48.972 6 1.0	Other:	ton/ol:	0 E 00 E	-							N mana	
(from casing top as marked)2) Depth to Water Surface (DTWft (from casing top as marked)3) Well Depth (WD):0.1634) Height of Water Column (H)64) Height of Water Column (H)ft(from casing top as marked)4) Height of Water Column (H)ft(from casing top as marked)4) Height of Water Column (H)(from casing top as marked)4) Height of Water Column (H)(from casing top as marked)WELL PURGE AND SAMPLING DATAWell Diameter (in)(CV × H = VW)Number of Casing Volumes to Purge (NC)gals(CV × NC = TC)CondTotal Volume of Water to Purge (TV)gals(WW × NC = TC)CondTimeTemp (C)(umhos)pH(NTU)(mV)(mg/L)(ft. bgs)(L)(L)(L)(L)(L)(min)(ft	- .	Other:	, ,				
2) Depth to Water Surface (DTW48.72ft (from casing top as marked) 0.163 3) Well Depth (WD):				, ,	·		L				· · · · ·	
(from casing top as marked)20.1633) Well Depth (WD):				8.72	ft	i	<u>Well D</u>	ameter (in)	<u>(</u>	Casing Volume (C	V)/ft (gals)	
(from casing top as marked)4) Height of Water Column (H)ft(from casing top as marked)6UELL PURGE AND SAMPLING DATASingle Casing Volume of Water in Well (VW) gals(CV x H = VW)Number of Casing Volumes to Purge (NC) gals(CV x H = VW)Number of Water to Purge (NC) gals(VW x NC = TC)CondTimeTemp (C)(umhos)pH(NTU)(mV)<									-			
4) Height of Water Column (H)ft (from casing top as marked) $U = (23.49) \times [(D/24)^2]$ $U = (23.49) \times $				·····		-	1	4			1. 1. 1. 1. 1. 1.	
(from casing top as marked) $CV = 3.14 [(D/2)/12 in.ft]^2h (7.48 gal/cu. Ft.)$ WELL PURGE AND SAMPLING DATAPurge Method: 2" Grundfos submersible pumpSingle Casing Volume of Water in Well (VW) galsPurge Date:(CV x H = VW)Number of Casing Volumes to Purge (NC) galsPurge Date:Total Volume of Water to Purge (TV) galsCondTurbidity ORPD.O.Water LevelRemoved Flow RateObservationsTime Temp (C)(umhos)pHIII 32.2.46§7813.05III 4III 579.20.6048.92CondTurbidityORPD.O.Water LevelRemovedFlow RateObservationsTime Temp (C)(umhos)pH(NTU)(mV)III -67:20.844.8.9531.0III 579.20.604.8.926III 627.4687.818.0.71.11 <th colspa<="" td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-</td><td></td><td></td><td></td></th>	<td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>-</td> <td></td> <td></td> <td></td>								-			
WELL PURGE AND SAMPLING DATA Purge Method: 2" Grundfos submersible pump Single Casing Volume of Water in Well (VW) gals Purge Date:					ft				2 1/ [/D/2)/42 :- 4			
Single Casing Volume of Water in Well (VW) galsSingle Casing Volume of Water in Well (VW) galsPurge Date:Number of Casing Volumes to Purge (NC) galsWas Well Pumped Dry?YNTotal Volume of Water to Purge (TV) gals $Fe^2 (mg/L)$: 4.9 (VW x NC = TC)CondTurbidityORPD.O.Water LevelRemovedFlow RateObservationsTimeTemp (C)(umhos)pH(NTU)(mV)(mg/L)(ff. bgs)(L)(L/min)Phys. App.111372.4687818.07217-67.20.8448.6931.0111672.0688148.15179-79.20.6048.9261.0		ang top as ma	incu)				L	CV =	3. 14 [(U/2)/12 IN.I	y 11 (7.46 gal/cu. 1	,	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	WELL PUR	GE AND SAM	IPLING DATA				Purge Meth	od: <u>2"</u>	Grundfos subr	nersible pump	· · .	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Single Casi	ng Volume of	Water in Well ((VW)		_gals	Purge Date	;	· · · · · · · · · · · · · · · · · · ·	-	·	
Total Volume of Water to Purge (TV) galsFe ² (mg/L): 4.8 (VW x NC = TC)CondTurbidityORPD.O.Water LevelRemovedFlow RateObservationsTimeTemp (C)(umhos)pH(NTU)(mV)(mg/L):4.8111372.4687818.07217-67:70.8448.9931.0111372.4687818.07217-67:70.8448.9931.0111672.3688148.15179-79:70.6048.9261.0		(CV x H = V)	N)							-		
$(VW \times NC = TC)$ $\begin{array}{c c c c c c c c c c c c c c c c c c c $	Number of (Casing Volum	es to Purge (No	C)		gals	Was Well F	Pumped Dry?	Y	N		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Total Value	o of \/-++-	Duran (T) ()			~~!~	E a ² ()	4.0				
Cond Turbidity ORP D.O. Water Level Removed Flow Rate Observations Time Temp (C) (umhos) pH (NTU) (mV) (mg/L) (ff. bgs) (L) (L/min) Phys. App. 1113 ZZ.46 8781 8.07 217 -67.2 0.84 48.99 3 1.0 1116 ZZ.96 8814 8.15 179 -79.2 0.60 48.92 6 1.0	i otal volum	IN W ater to	TC)			gais	ге (mg/L):	<u> </u>				
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		(*** × 110 -	,									
1113 22.46 8781 8.07 217 -67.2 0.84 48.89 3 1.0 1116 22.06 8814 8.15 179 -79.2 0.60 48.92 6 1.0			Cond		Turbidity	ORP	D.Q.	Water Level	Removed	Flow Rate	Observations	
1116 22.06 8814 8.15 179 -79.2 0.60 48.92 6 1.0	Time	Temp (C)	(umhos)	pН	(NTU)	(mV)	(mg/L)	(ft. bgs)	(L)	(L/min)	Phys. App.	
	1113	22.46	8781	8.07	217	-67.2	0.84	48.89	3	1.0		
119 22.44 8865 7.98 189 -81.2 0.60 48.92 9 40	1116	22.06	8814	8.15	179	79.2	0.60	48.92	6	1.0	-	
	1119	ZZ.44	8865	7.98	189	-81.2	0.60	48.92	9	10		
1122 22.58 8877 8.07 193 -84.1 0.68 48.92 12 1.0	1122	22.58	6677	8.07	193	-84.1	0.68	48.92	12	1.0	· · · · ·	
1125 22.58 8867 8.06 190 -84.5 0.60 48.90 15 1.0			8867	8.06		-84.5	0.60	T	15	1.0		
1128 22.62 8823 8-16 162 -855 0.58 48.90 18 1.0				8.16	162	-85.5	0.58	<u> </u>	1	1.0		
	_							T	1			
			<u> </u>			1	<u>†</u>		<u> </u>	+		
							<u> </u>			+		
								+		<u> </u>		
						 	<u> </u>				<u>.</u>	
						ļ	ļ		ļ	ļ		
				- I			·		L	L		

Purging/Sampling Remarks ____Pump @ 85 ft_

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

Page _____ of _____

								MON	IITOR WELL N	IO: <u>MW-20</u>
				Moni	itor We	II Samp	ling Data	к . I		
Project: _	Cooper Drum	L								
Location No):					Job No:	18600047.07	030	_	
						Sampler(s):	SL/ <u>DG</u>			
		5			_			· · · · ·	Date:	
Sampling M	lethod: Direc	t from dedicate	ed tubing							
Sampling Ti	ime:									
VATER EL	EVATION DA	TA		* : ·		Product Obs:	Y	N		
		Depth Sounder				Depth to Proc	luct:			
Other:	·····	· · · · ·		_		Method of Me		Interface Probe	Y	Ν
					-	Other:				
	ing Elevation	(WCE)	<u> </u>	n	I.					
	Water Surfac		7.76	ft	t	Well Dia	ameter (in)	C	asing Volume (C	V)/ft (gals)
	ing top as ma						2	<u>×</u>	0.163	
	· · ·		70	. <u>.</u>	-	1	4		0.652	
	ing top as ma	•					6		1.468	
	Water Colum	nn (H)	· · · · · · · · · · · · · · · · · · ·	ft			D		$CV = (23.49) \times$	
(nom cas	ing top as ma	arked)					CV = 1	3.14 [(D/2)/12 in.ft	⁻ h (7.48 gal/cu.	Ft.)
VELL PUR	GE AND SAN	IPLING DATA				Purge Meth	od: <u>2"</u>	Grundfos subm	ersible pump	
Single Casi		Water in Well (∨w)		_gals	Purge Date:	·	· · · · · · · · · · · · · · · · · · ·		·
lumber of (CV x H = V) Casing Volum	W) les to Purge (N(2)		als	Was Well P	umped Dp/2	Y	N	
	basing volum			·						
otal Volum	e of Water to (VW x NC =	Purge (TV) TC)	······································	· · · · · · · · · · · ·	_gals	Fe ² (mg/L):	0.0	<u> </u>		
	(-								
Time	Temp (C)	Cond (umhos)	pН	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
0418	22.22	4675	7.5	-248	140.6	18.25	1	231	0.3	· · · · · ·
0921	22.54	4717	7.5	191	132.6	17.59	47.85	183.4	0.8	
0424	22.77	4748	7.5	130	184.1	10.45	47.93	3.68.6		
0427	22.77		7.4	<i>q</i> 8	184.3		47.44	4.9 103		• · · · ·
0430	22.76	4744	7.4	1.8	183.5		47.46	5.2 1246		
0433	22.80	4828	7.3	54	181.3	11.41	4797	10 13.34	0.8	
0436	22.77	4445	7.3	43	1785	9.38	48.00	6.8 17.74		
09 39	22.74	4841	7.3	34	175.3	9.36	48.00	X.10 2014		
0942	22.73	4420	7.4	32	170.0	7.24	48.00	3 4 22,5L	0.45	
									·	
							·			
	نــــــــــــــــــــــــــــــــــــ			L	1	·	L	I	LL.	

Purging/Sampling Remarks _____Pump @ 63 ft.____

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

Page _____ of ___

								MONI	FOR WELL NO	D: <u>MW-20B</u>
				Monit	tor We	II Sampl	ling Data			
Project: C	ooper Drum					•.	•			
	•	Ļ			· · · · · · · · · · · · · · · · · · ·	Job No:	18600047.070	30		
								<u></u>		
		· · · · · · · · · · · · · · · · · · ·								
		t from dedicat			•			· · · · · · · · · · · · · · · · · · ·		
				·				······		
VATER ELI	EVATION DA	ТА				Product Obs:	Y	N		
		Depth Sounder	Y N				luct:			
Other:						Method of Me	asurement:	Interface Probe		Ν
Creened in	terval:		80 - 9			Other:				
(from cas	ing Elevation	(WCE)	2 2	!					· .	
) Depth to	Water Surfac	arked) e (DTW <u>41</u>	.97	f		Well Dia	ameter (in)		Casing Volume (CV)/ft (gals)
(from cas	ing top as ma	arked)					2	-	0.163	
			90	······	-		4		0.652	
(from cas	ing top as ma	urked) in (H)					6 D		1.468	-
	ing top as ma				L			3.14 [(D/2)/12 in.f	CV = (23.49) x tl ² h (7.48 gal/cu.	
·	0,							<u> </u>	<u></u>	· · · · · · · · · · · · · · · · · · ·
ELL PUR	<u>GE AND SAN</u>	IPLING DATA				Purge Meth	od: <u>2"</u>	<u>Grundfos sub</u>	mersible pum	
		Water in Well ((VW)		gals	Purge Date:	·		_	
	CV x H = V) Casing Volum	/v) ies to Purge (N	C)		nals	Was Well P	umped Dry?	Y	N	
	Sasing Volum		•/		guio			•		
otal Volum	e of Water to (VW x NC =	Purge (TV)			gals	Fe ² (mg/L):	4.0			
	(111 × 110	,								
Time	Temp (C)	Cond (umhos)	рH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1020	2255	7434	7.1	338	35.5		48.08	5	1	Phys. App.
1025	22.91	4051	1.1	228	27.0	10,00	48.06	ブ島		•
	<i>'</i>		\rightarrow							
1029	23.08	4064	7.1	122	192	0.72	46.04	11		
1031	23.20	<u> 2104</u>	7.(84	15	0.60	4803	14		
1034	23.24	4114	7.1	100	9.9	0.44	48.03	17		
1037	23.24	3124	7.1	53	6.8	0.46	48 03	20		·····
1040	23.23		7.1	45	2.5	0.42	418.03	23	1	
1043	23.32	31410	7.1	33	-1.1	0.37	46.03	26		
						 				·
			.			1				
			<u> </u>							
NSTRUCT	ONS AND C	OMMENTS								
urging/Sar	npling Remai	ks Pu	mp @ 85	ft						

								MON	ITOR WELL	NO: <u>MW-33</u> A	<u>.</u>
				Mon	itor We	ll Samp	ling Data)			
Project:	Cooper Drum	1			- 						
						Job No:	18600047.070	030			
							:SL/DG	1			
		5			_				Date:		• • • • •
Sampling N	lethod: Direc	t from dedicat	ed tubing			Weather: _	clear				••••
Sampling T	ime:					Ambient Te	mp. (F): <u>(و</u> ج	5°P			
		<u>ATA</u> Depth Sounder	Ý N				: Y duct:		· · · · · · · · · · · · · · · · · · ·		· · · ·
Screened in	nterval:	55 - 65								N	
1) Well Cas	sing Elevation	(WCE)		fi							-
(from cas	sing top as ma	arked)	1 10								***
	Water Surfac sing top as ma	ce (DTW_47	18	fi	t .		ameter (in)	9	Casing Volume		
						н. 1917 - Ал	2 4		0.1		• •
	sing top as ma			•••••	-		6		1.4		
		nn (H)		ft			D		CV = (23.49)		
(from cas	sing top as ma	arked)			•		_CV = 3	3.14 [(D/2)/12 in.1	ft] ² h (7.48 gal/c	:u. Ft.)	
WELL PUR	GE AND SAM	PLING DATA	•			Purge Meth	iod: <u>2"</u>	Grundfos subr	mersible pur	np	
Single Casi		Water in Well (VW)		gals	Purge Date	·	<u></u>	_		
Number of	(CV x H = V Casing Volum	w) les to Purge (N	C)	÷* .	gals	Was Well F	Pumped Dry?	Y	N		
Total Volum	ne of Water to	Purge (TV)			als	Fe ² (ma/L):	0.0				
	(VW x NC =										
		Cond		Turbidity	ORP	D.O.	Materia avai	Democrat	Elsus Data	~	•
Time	Temp (C)	(umhos)	pH ,	•	(mV)	(mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observati Phys. Ap	
0623	224B	3462	7.0	450	14(0.0	2.4	44,55	6	1.5/	High Silt	
0828	22.06	3458	7.0	197	134.4	1.10	48.45	6.5	1.5	denne	
0331	22.13	3472	7.0	91	135.2	1-3	48.57	\$.0	1.5	dia	
0374	22.12	34710	10.9	82	133.1	1-4	48.50	9.5	1.5		
0837	22.15	3482	le.A	42	132.4	1.3	48.49	11-0	1.5		•
0340	22.14	3488	64	67	130.7	1.2	46.50	12.5	1.5		••••
					ļ						
											:
		· · · ·								1	
				· · ·							
			<u> </u>		<u> </u>					· · · · ·	
	1									<u> </u>	
	IONS AND CO	,,									
arging/3a	oping Renal	rorum	p @ 60 ft.								

MONITOR WELL NO: ____MW-33B

Page _ l _ of _ l

Monitor	Well	Sampling	Data
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Draigat: C	Conor Drum			$(1,1) \in \{1,2\}$							
	ooper Drum					lah Mar	49600047.07				
							18600047.070		<u></u>		
	s): <u>37539</u>						:SL <u>/DG</u>				· •·••• • ·
	-	5						· · · · · · · · · · · · · · · · · · ·			
Sampling M	ethod: Direc	t from dedicate	ed tubing			Weather: _		· · · · · · ·			
Sampling Ti	me:					Ambient Te	mp. (F):				
	EVATION DA			×		Product Obs		N		1 m. m.	
Method of Me Other:	48.21	Depth Sounder	YN				duct: easurement:	Interface Probe	Y		
		80 - 90					easurement.			N	
		(WCE)		ft	•			<u> </u>			
	ing top as ma					I					
	Water Surfac	-		ft		Well D	ameter (in)	(Casing Volume (CV)/ft (gals)	
	ing top as ma	·					2	-	0.163		
3) Well Dep							4		0.652	2	
(from cas	ing top as ma	rked)					6		1.468	3	
Height of	Water Colum	ın (H)		ft			D		CV = (23.49) >		
(from cas	ing top as ma	rked)					CV = :	3.14 [(D/2)/12 in.1	t] ² h (7.48 gal/cu.	. Ft.)	
WELL PUR	GE AND SAM	IPLING DATA				Purae Meth	nod: 2"	Grundfos subr	nersible pumi	. .	
				1997 - 1997 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -		<u> </u>	· · · · · · · · · · · · · · · · · · ·				
Single Casii		Water in Well (VW)	;	gals	Purge Date		,	-		
Number of ((CV x H = V) Casing Volum	w) es to Purge (N	C)		gals	Was Well F	Pumped Dry?	Y	N		
						- 2 / "	2.7				
lotal Volum		Purge (TV)			gals	Fe ⁻ (mg/L):	<u>a</u> ;[· · · · · · · · · · · · · · · · · · ·			
	(VW x NC =	10)									
Time	Temp (C)	Cond (umhos)	pН	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observat Phys. A	
0730	20.78	7720	4.4	140	135.4		48.37		11 mm		<u>PP'</u>
0733	21.36	7880	7.0	119	107.2	9.0	48.34	6 7		·	
0706	21.47	7905	7.0	54	101.1	7,2	445.30	6 3			
0709	21.52	7919	7.6	30	94.9	7.6	48.24	12 4		·	
0742	21.45	7917	7.0	30	A0-6	7.5	48.32	15 \$			
0745	21.52	7930	7.0	4	47.2	6.6	48:32	18 1			
			1			1					
			+				+	· · · · · · · · · · · · · · · · · · ·			
				•			1				

							•	М	ONITOR WELL	NO: <u>EW-1</u>
				Moni	tor We	ll Samp	ling Data			
Project: C	ooper Drum					-	-			ž
						Job No:	18600047.070	30		
	s): <u>37540</u>						SL/DG			
)5							Date:	
		from dedicat								
									······································	
			•			· · · · · · · · · · · · · · · · · · ·				
	EVATION DA	IA Depth Sounder	YN			Product Obs:	Y duct:	N		ton a
		•	I IN					Interface Probe	Y	Ν
creened in	terval:		48.5 -	88.5						
		(WCE)	<u> </u>	ft						
	ing top as ma				1 4					
		e (DTW		ft		<u>Well Di</u>	ameter (in)	-	Casing Volume (C	V)/ft (gals)
	ing top as ma th (WD):	rked)	90.5				2 4		0.163	
	ing top as ma				-		6		1.468	
) Height of	Water Colum	n (H)		ft			D		CV = (23.49) x	., ,,
(from cas	ing top as ma	rked)					CV = 3	8.14 [(D/2)/12 in.	ft] ² h (7.48 gal/cu.	Ft.)
VELL PUR	GE AND SAM	IPLING DATA				Purge Meth			nersible pump	
ingle Casir	ha Volume of	Water in Well (WW)		aals	Purge Date	•			
	(CV x H = V)				- 30.00				_	
lumber of (Casing Volum	es to Purge (N	C)(gals	Was Well F	umped Dry?	Y	N	
						_ 2	0.0)		
otal Volum	e of Water to (VW x NC =	Purge (TV)		·····	gals	Fe ⁻ (mg/L):		·,		
	(*** × 10 -	10)								
		Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
Time	Temp (C)	(umhos)	pH .	(NTU)	(mV)	(mg/L)	(ft. bgs)	(L)	(L/min)	Phys. App.
1210	24.84	4465	7.4	4	77.5	A.25	48.60	2	0.8	····
1213	25.51	4481	7.4	Ц	74.5	9.4	418-61	4.4	0.8	
1216	25.71	4443	7.4	ы	79.1	9.0	48.60	6.3	0.8	
12M	25.46	4469	7.4	4	78.9	9.0	48.510	9.2	0.9	موسقي محروف والم
1222				4						
1-06	25.44	4472	7.4		78.5	8.8	48.00	F1. 10	0.8	· · · ·
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					-					
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									┥───┤-	
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9				·····	· · · · ·	A 11				
• 1 •	· ·					<u> </u>	┨┈────┤		<u> </u>	····
	ONS AND CO									
urging/Sar	npling Remar	ksPump	@ 63 ft						<u> </u>	, ·

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Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

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of

		•		1		*		MON	TOR WELL NO	:EW-1-	90'
				Moni	itor We	ell Samp	ling Data				-11 di - 12 -
Project:	<u>Sooper Drum</u>	1								· 1	
No. 10 al						Job No:	18600047.070	30			
							:SL/ <u>DG</u>				•
Sampling Da	ate:9/29/	05			_	Reviewer(s):		Date:		
		t from dedicat				Weather: _					
Sampling Ti	me:					Ambient Te	emp. (F):				
	EVATION DA					Product Obs		N		A.W. 11	
Other:		Depth Sounder	YN			Depth to Pro Method of M		Interface Probe	Y	N	ů
Screened in	terval:				- -				•	:	• • • •
	ing Elevation			ft			· · · · · · · · · · · · · · · · · · ·				
(trom casi 2) Depth to	ing top as ma Water Surfac	e (DTW	2.63	fl		Mall Di	ameter (in)				
	ing top as ma			·		<u>vven p</u>	2		Casing Volume (C 0.163	<u>,ν)/π (gais)</u>	
· · ·	th (WD):		<u>. </u>		_		4		0.652		د بارد به بد ارد ۱۰۰ اد این اینده این به بورهناف اد
•	ing top as ma	•		ft			6		1.468		
	ing top as ma	nn (H) arked)		π			D CV = 3	14 [(D/2)/12 in	CV = (23.49) x ft] ² h (7.48 gal/cu. l		• •
,		,									
WELL PUR	<u>GE AND SAN</u>	<u>IPLING DATA</u>				Purge Meth	od: <u>2" 0</u>	Frundfos sub	mersible pump		•
Single Casir	ng Volume of	Water in Well ((VW)		gals	Purge Date	:				
e ^l s	(CV x H = V	W)							-		and in a second
Number of C	Casing Volum	es to Purge (N	C)		gals		Pumped Dry?	Y	Ν		
Total Volum	e of Water to	Purge (TV)			gals	Fe ² (mg/L):	5.5				
	(VW x NC =										
		Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observ	etiona -
Time	Temp (C)	(umhos)	pH .	(NTU)	(mV)	(mg/L)	(ft. bgs)	(L)	(L/min)	Phys.	
1124	22.92	4541	7.0	ii ii	60.7	7.3	45.57	ч	1		n an an Araba an Arab Araba an Araba an Arab
1129	22.41	8580	7.3	7	54. <u>4</u>	0.4	44,54	7	1		
1132	23.04	4554	7.D	(2	42.4	0.5	48.51	10	1		
1135	23.17	8531	7.6	5	32.1	0.4	48.56	13			at sets a
1138	23.12	8496	7.0	4	26.8	0.4	48.56	ILe	1	· · ·	
1141	23.10	8448	7.0	4	21,2	0.4	48,54	19	1		н не 1.111 -
-										96 - 1 1	
										·	
	ONS AND C							·····	<u>.</u>		

n in stan for

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								MOM	NITOR WELL N	IO: <u>MW-20</u>
				Moni	tor We	II Sampl	ing Data			
oiect: C	ooper Drum					•	- .			
						Job No.	18600047.070	30		
									· · · · · · · · · · · · · · · · · · ·	
		5				• • • •			Date:	
					•					
· · · -	5	from dedicate								
impling Lir	ne:					Amplent Ter	np. (⊢):			
	VATION DA		Ô			Product Obs:		N		
		Depth Sounder	S N		:	Depth to Prod			X	
	erval:		55 - 70	n		Method of Me	asurement:	nterface Probe	Y	N
		(WCE)		ft	•			<u> </u>		
	ng top as mai	rked)		n		L				
		e (DTW	48.03	7 ft		Well Dia	meter (in)	<u>_</u>	Casing Volume (C	V)/ft (gals)
(from casi	ng top as ma	rked)		0 67			2		0.163	
	h (WD):		-70 ()	8.82			4		0.652	
	ng top as mai			~			6		1.468	(D/D4) ² 1
-		n (H) rked)		ft			D $CV = 3$	14 [(D/2)/12 in fi	CV = (23.49) x t] ² h (7.48 gal/cu.	
្រាហា casi	ng top as ma	incu)							ין יו (י.דט אַמוּטע.	
ELL PURC	GE AND SAM	PLING DATA				Purge Metho	od:2" @	irundfos subn	nersible pump	
ngle Casin	a Volume of	Water in Well (VW)		gals	Purge Date:	······································			
	(CV x H = VV						. <u></u>		-	
		es to Purge (NC	>)		gals	Was Well P	umped Dry?	Y	Ν	
10. 1						2	<u>ክ</u> ክ			
		Purge (TV)			gals	Fe ² (mg/L):	0.0			
:	(VW x NC =	TC)					• •			
2		Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
Time	Temp (C)	(umhos)	рH	(NEU)	(mV)		(ft. bgs)	(L)	(L/min)	Phys. App.
1733	20.6	4970	7.5	154	37.9		47.95	(=) 		· · · · · · · ·
736	21.6	5043	7.5	140	38.3	13.6	47.85	3	1	
				107	40.0	1245	47.75	6		
0739	22.0	5165	7.5		1	12.45		<u> 6 </u> 9		* <u>* *</u> .
0742	22,1	5175	7.5	63	40.8	12.40			┼╴┦╶┼	
0745	22.3	5170	7,5	43	41.0	12.19	47.85	12		
748	22,2	5206	7.5	36	41,4	10.20	49.90	15		
					<u> </u>	· ·			ļ	
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					ļ	ļ				<u> </u>
STRUCTI		OMMENTS	•							

معكريا بالجاد بمعتقلهم

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								MONI	FOR WELL NO): <u>MW-20B</u>
				Moni	tor We	ll Sampl	ing Data			
Project: <u>C</u>	ooper Drum				XX 1.181					
						Job No:	18600047.070	30		
						Sampler(s):	SL/DG			
		5):		Date:	
	_	t from dedicate			-					
						Ambient Ter	mp. (F):			
WATER EL	EVATION DA	TA				Product Obs:	Y	N		
		Depth Sounder	୭			-	luct:			
	ton cole						asurement:		Y	N
		(WCE)		<u></u>	- A	Outer:		······		
(from casi	ing top as ma	rked)				L				
2) Depth to 1	Water Surfac	e (DTW	48.1	<u>5</u>	F.	Well Dia	ameter (in)	(Casing Volume (CV)/ft (gals)
(from case)	ina ton ae ma	rkod)					2		0.163	
			-90 -	0.00	-		4		0.652	
•	ing top as ma Water Colum	irked) in (H)		f	t		6 D		1.468 CV = (23.49) x	-
	ing top as ma			'	•			.14 [(D/2)/12 in.f	• •	••• •
		IPLING DATA				Purge Meth	od: 2" (Grundfos sub	mersible pum	מו
Single Casir	ng Volume of	Water in Well (VW)		gals	Purge Date:	·		-	
	(CV x H = V)							V	м	
Number of C	Casing Volum	es to Purge (N			gais		umped Dry?	Y	N	
Total Volum	e of Water to	Purge (TV)			aals	Fe ² (mg/L):	3.4			
	(VW x NC =							۰,	•	
		Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
Time	Temp (C)	(umhos)	pН	(NTU)		(mg/L)	(ft. bgs)	(L)	(L/min)	Phys. App.
0327	21.0	9264	7.3	71000	8.2	0.34	48.15	3	1	
1830	21.0	1272	7.3	971	6.7	0.24	48.09	6	Ì	
0833	21.7	9417	7.3	\$43	2.8	0.16		9		
0836	21.8	9441	7.3	382	1.7	0,25	48.05	12		
0839	21.9	9466	7.3	263	0.7	0.23	48.04	15		
841	21.9	9468	7,3	176	-1.1	0.22	48.04	18		
0845	21.9	7495	7.3	113	-2.2	0.71	48.04	21		. <u> </u>
0848	ə1.9	9495	7.3	77	-3.1	0.19	49.04	<u>24</u>	\mathbf{V}	
						1				
									1	
						· ·				
								······		
			L	I	I				11	
INSTRUCT	IONS AND C	OMMENTS								
Purging/Sar	npling Rema	rksPu	mp @ 85	ft					·	
							S			

								MONI	TOR WELL NO	: <u>MW-33A</u>
				Moni	tor Wel	ll Sampl	ing Data			
Project: C	ooper Drum						_			
	•					Job No:	18600047.070	30		
	s): <u>37548</u>					Sampler(s):	SL/DG			
)5							Date:	· · · · · · · · · · · · · · · · · · ·
		-			-					
		from dedicate								
Sampling Til	me:	<u>.</u>				Amplent Ter	np. (+):			
	EVATION DA		A			Product Obs:	Y	N		
		Depth Sounder	y N			•	luct:			
Other:			•			Method of Me		Interface Probe	Y	N
	terval:				-	Other:				
		(WCE)		π						
(Irom casi	ing top as ma Water Surface	rked) e (DTW_ 48 .	60	ft		Mall Di-	ameter (in)	~	asing Volume (C	V//ft (cals)
	ing top as ma		0~	n			2	7	asing volume (C	v jnt (gais)
	th (WD):	-	63.80	,			- 4		0.652	
	ing top as ma				-		6		1.468	
		n (H)		ft			D		CV = (23.49) x	(D/24) ²]
	ing top as ma						CV = 3	.14 [(D/2)/12 in.f] ² h (7.48 gal/cu. l	Ft.)
WELL PUR	GE AND SAM	IPLING DATA				Purge Meth			nersible pump	
Single Cart	aa \/oh				aala	Burge Data		<u>``</u>		·
Single Casir	rg volume of (CV x H = V)	Water in Well (\ N)	v v v)		gais	Furge Date:				
Number of (es to Purge (NC	3)		aals	Was Well P	umped Dry?	Y	N	
Total Volum	e of Water to	Purge (TV)			gals	Fe ² (mg/L):	0.3			
	(VW x NC =	TC)				· .				
		Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
Time	Temp (C)	(umhos)	pН	(NTU)	(mV)	(mg/L)	(ft. bgs)	(L)	(L/min)	Phys. App.
0924	20.9	4075	73	703	29.9	1.88	48.26		1	
0927	21.5	4106	7.2	193	31.5	1.02	48.38	3	1	
0930	22.0	4147	7.2	152	31.9	1.19	48.25	6		
0933	22.1	4163	7.2	136	32.2	1.18	48.25	9		1
0936	22,2	4174	7.2	80	31.9	0,94	48.25	12		
0939	22.2	4185	7.2	81	32.2	1.04	48.25	15	│ /	
0942	22.3	4195	7.2	80	32.2		48.25	18		
076	2.5.0	(דוד	Til	00	<u> </u>	/. v =	10.00	10		
							·			
		. •								
								<u></u>		· · · · · · · · · · · · · · · · · · ·
					1	<u> </u>				· · · · · · · · · · · · · · · · · · ·
l		L	I	L	L	<u>I</u>	I.,			
INSTRUCT	IONS AND CO	OMMENTS		đ						

Purging/Sampling Remarks _____Pump @ 60 ft.__

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

Page _____ of _____

	· .		Moni	tor We	II Sampl	ing Data			
						ing bata			
					•	J			
						18600047.070			
: <u>37549</u>			<u>.</u>		• • • •	SL/DG			·
	5							Date:	
hod: <u>Direct</u>	from dedicate	d tubing			Weather:				· · · · · · · · ·
e:	<u> </u>				Ambient Ten	np. (F):			
		3			Product Obs:	Y	N	· · · · · · · · · · · ·	
	Depth Sounder	۶¢ N			-				
									N
			ft		Otner				
a ton as mar	ked)								
ater Surface	(DTW	48.3	Տ _{ft}		Well Dia	meter (in)	<u>(</u>	Casing Volume (C	V)/ft (gals)
	kad)					2	_	0.163	
		0.50				4		0.652	
					1	-		1.468	(T)
			ft				14 1/0/01/40 :~ 4		
g top as mar	Kea)					UV = 3	. 14 [(D/Z)/12 IN.T	y n <u>(</u> ∕.40 ya⊮cu. I	L. j
E AND SAM	PLING DATA				Purge Metho	od: 2" 0	Frundfos subr	nersible pump	
	Mataz in Molt A	AAD		aala	Purge Date:				
		/ • •)		yais	Fulge Date.			-	
		3)		gals	Was Well Pi	umped Dry?	Y	N	
						1			
				gals	Fe ² (mg/L):	7.0			
(VW x NC = "	TC)								
	Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
Temp (C)	(umhos)	pН	(NTU)	(mV)	(mg/L)	(ft. bgs)	(L)	(L/min)	Phys. App.
20.3	9196	7.2	153	31.9	1.26	48.29	~	1	•
20,9	9396	7.3	122	16.2	0.24	48.35	3		
21.4	9518	7.3	146	8.6	0.22	48.33	6		
21.5	9570	7.3	158	5.7	0.20	48.31	9		
21.5	9589	7.3	99	3.1	6.17	48.26	12		
21.6	9610	73	68	1.4	0.16	48.33	15		
21.6	9584	72	42	0.3	0.13	48.33	18		
21-6	9622	7.2	34	-0.4	0.14	4833	21		
			·	<u> </u>	1	 M. 			
				ļ					
								1.0	
		<u> </u>			L	· · · ·		<u> </u>	
	VATION DAT surement: g Elevation (g top as mar vater Surface g top as mar vater Column g top as mar vater Column g top as mar E AND SAM Volume of V CV x H = VV asing Volume of Water to VW x NC = Temp (C) 20.3 2.0.9 21.5 21.5 21.5 21.6 21.6 21.6	VATION DATAsurement:Depth Soundergrval: $80 - 90$ g Elevation (WCE)gg top as marked)/ater Surface (DTWg top as marked)g Volume of Water in Well (Note: the top of Water in Well (Note: the top of Water to Purge (TV)CV x H = VW)asing Volumes to Purge (TV)VW x NC = TC)CondCondTemp (C)(umhos) 20.3 919.6 21.4 951.8 21.5 95.89 21.6 95.84	VATION DATA surement: Depth Sounder N svrai: 80 - 90 g g top as marked) 48.3 ° g top as marked) 48.3 ° g top as marked) 90.3 ° g top as marked) 90.0 ° G top	surement: Depth Sounder N erval: 80 - 90 ft g top as marked) 48.3 \$ ft g top as marked) 90.30 g top as marked) ft g top as marked) 90.30 Yater Column (H) ft g top as marked) ft g top as marked) 60 E AND SAMPLING DATA 90 g Volume of Water in Well (VW)	VATION DATA surement: Depth Sounder \bigcirc N struit: 80-90 g Elevation (WCE) ft g top as marked) 49.3 \$\screwtleftyff g top as marked) 90.30 g top as marked) gals cVx H = VW) gals g Volume of Water in Well (VW) gals cV x H = VW) gals of Water to Purge (NC) gals of Water to Purge (TV) gals vW x NC = TC) Cond Turbidity ORP Temp (C) (umhos) pH (NTU) (mV) \$\overline{2}\$ 91.96 7.3 122 16.2 \$\overline{3}\$ 91.96 7.3 125 5.7 \$\overline{3}\$ 91.96 7.3 155 5.7 \$\overline{3}\$ 95.90 7.3 155 5.7 \$\overline{3}\$ 95.97	VATION DATA surement: Depth Sounder \bigcirc N Product Obs: Depth to Prod Method of Me Other: mrval: 80-90 ft g top as marked) 48.3 S ft g top as marked) 90.30 ft (WD): 90.30 ft g top as marked) 90.30 ft (WD): 90.30 ft g top as marked) 91.30 Purge Date: CV × H = VW) gals Purge Date: g Volume of Water in Well (VW) gals Fe² (mg/L): yW × NC = TC) gals Fe² (mg/L): VW × NC = TC) gals Fe² (mg/L): Quarket to Purge (TV) gals GRP D.O. Temp (C) (umhos) pH (NTU) (mV) (mg/L) Q.9 9.9 7.3 12.2 16.2 0.24	VATION DATA surement: Depth Sounder \bigcirc N rval: 80 - 90 g Levation (WCE) ft g top as marked) 48.3 \$\screwthinks g top as marked) 90.3 0 (WD): 90.3 0 g top as marked) 90.3 0 g top as marked) 90.3 0 (WD): 90.3 0 g top as marked) 90.0 g top as marked)	VATION DATA surement: Product Obs: Y N irvat: 80 - 90 \bigcirc N g top as marked) \bigcirc \bigcirc N g top as marked) \bigcirc \bigcirc \bigcirc E AND SAMPLING DATA Purge Method: $_$ $2"$ g volumes to Purge (NC) gals Purge Date: $_$ \bigcirc VW x NC = TC) gals Fe^2 (mg/L): \cancel \cancel \bigcirc	VATION DATA surgement: Depth Sounder \bigcirc N rval: 80-90 g Elevation (WCE) ft g top as marked) 90.30 g top as marked) 90.40 g top as marked) 90.40 g top as parked 90.10

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MONITOR	WELL	NO:	_EW-1-

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Page ____

Monitor	Well	Samp	ling	Data

cation No:											
cauon no.		4					8600047.0703		·····		
ample No(s	s):3755 /					Sampler(s): _	SL/ <u>DG</u>		·		
ampling Da	nte:10/26/	05				Reviewer(s):			Date:		
mpling Me	ethod: Direct	from dedicate	d tubing			Weather:					
ampling Tir	me:					Ambient Ten	np. (F):				
	VATION DAT		_			Product Obs:	Y	N			
		Depth Sounder	Y N				uct: asurement: I		v	N	
	haminali Al	8.5 - 88.5					asurement. I		•	11	
		WCE)		ft							
	ng top as mar	rked)			1						
-	Nater Surface		48.70	ft		Well Dia	meter (in)	<u>(</u>	asing Volume (CV)/ft (gals)	
(from casi	ng top as mar	rked)	9050				2		0.163 0.652		
	th (WD): ing top as mar					6 1.468					
		n (H)		ft			D		CV = (23.49) x		
	ing top as mai						CV = 3.	14 [(D/2)/12 in.f] ² h (7.48 gal/cu.	Ft.)	
ELL PUR	GE AND SAM	PLING DATA				Purge Metho	od:2" G	rundfos subr	nersible pump)	
anla Oas'	a Volumo of l	Water in Well (V	<u>////</u>		nals	Purge Date:					
ngie Casil	CV x H = VV				gais	Turge Date.			-		
umber of (es to Purge (NC	;)		gais	Was Well Pi	umped Dry?	Y	· N		
otal Volum	e of Water to (VW x NC =	Purge (TV) TC)			gals	Fe ² (mg/L):	0.0				
Time	Temp (C)	Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations	
		(umhos)	pH	(NTU)	(mV)	(mg/L)	(ft. bgs)		(L/min)	Phys. App.	
1227	20.7										
<u> </u>	20.7	(umhos) 4964 4997	рн 7,5 7,6		(mv) 25.9 28.9			(L)			
1230	21.1	4964	7.8	11	25.9	12.14	49.77 48.72	(L)			
1230		4964 4997	7.8 7.6	11	25.9 28.9	12.14 11.12 10.83	49.77 48.72	(L) 			
1230 1233 1236	21.1 21.9	4964 4997 5086	7.8 7.6 7.6	11 16 15	25.9 28.9 30.2	12.14 11.12 10.83	49.77 48.72 48.68	(L) 			
1230 1233 12 36 1239	21.1 21.9 22.3	4964 4997 5086 5132	7.3 7.6 7.6 7.6	11 16 15 15	25.9 18.9 30.2 31.5	12.14 11.12 10.83 10.73 10.86	49.77 48.72 48.68 48.70	(L) 			
1230 1233 12 36 1239	21.1 21.9 22.3 22.4	4964 4997 5086 5132 5143	7.8 7.6 7.6 7.6 7.5	11 16 15 15 15	25.9 18.9 30.2 31.5 32.4	12.14 11.12 10.83 10.73 10.86	49.77 48.72 48.68 48.70 48.70 48.70	(L) 			
1230 1233 12 36 1239	21.1 21.9 22.3 22.4	4964 4997 5086 5132 5143	7.8 7.6 7.6 7.6 7.5	11 16 15 15 15	25.9 18.9 30.2 31.5 32.4	12.14 11.12 10.83 10.73 10.86	49.77 48.72 48.68 48.70 48.70 48.70	(L) 			
1230	21.1 21.9 22.3 22.4	4964 4997 5086 5132 5143	7.8 7.6 7.6 7.6 7.5	11 16 15 15 15	25.9 18.9 30.2 31.5 32.4	12.14 11.12 10.83 10.73 10.86	49.77 48.72 48.68 48.70 48.70 48.70	(L) 			
1230 1233 12 36 1239	21.1 21.9 22.3 22.4	4964 4997 5086 5132 5143	7.8 7.6 7.6 7.6 7.5	11 16 15 15 15	25.9 18.9 30.2 31.5 32.4	12.14 11.12 10.83 10.73 10.86	49.77 48.72 48.68 48.70 48.70 48.70	(L) 			
1230 1233 12 36 1239	21.1 21.9 22.3 22.4	4964 4997 5086 5132 5143	7.8 7.6 7.6 7.6 7.5	11 16 15 15 15	25.9 18.9 30.2 31.5 32.4	12.14 11.12 10.83 10.73 10.86	49.77 48.72 48.68 48.70 48.70 48.70	(L) 			
1230 1233 12 36 1239	21.1 21.9 22.3 22.4	4964 4997 5086 5132 5143	7.8 7.6 7.6 7.6 7.5	11 16 15 15 15 15	25.9 18.9 30.2 31.5 32.4	12.14 11.12 10.83 10.73 10.86	49.77 48.72 48.68 48.70 48.70 48.70	(L) 			
	21.1 21.9 22.3 22.4	4964 4997 5086 5132 5143	7.8 7.6 7.6 7.6 7.5	11 16 15 15 15	25.9 18.9 30.2 31.5 32.4	12.14 11.12 10.83 10.73 10.86	49.77 48.72 48.68 48.70 48.70 48.70	(L) 			
1230 1233 12 36 1239	21.1 21.9 22.3 22.4	4964 4997 5086 5132 5143	7.8 7.6 7.6 7.6 7.5	11 16 15 15 15 15 15 15 15 15 15 15	25.9 18.9 30.2 31.5 32.4	12.14 11.12 10.83 10.73 10.86	49.77 48.72 48.68 48.70 48.70 48.70	(L) 			

MONITOR	WELL	NO:	EW-1

Page _____ of _____

Monitor	Well	Sampling	Data
MOINTOL	44211	Jamping	Data

	ooper Drum									
ocation No:						Job No:	18600047.0703	0		.
		[Sampler(s):	SL <u>/DG</u>			
	•	05				Reviewer(s):		<u> </u>	Date:	
		from dedicate								
						Ambient Ten	np. (F):			
	VATION DAT		\sim			Product Obs:	Y	N		
		Depth Sounder	Ϋ́Ν				uct: asurement: li		Y	N
her:	erval:		48.5 - 8	88.5						, ,
		(WCE)								
(from casi	na ton as mai	rked)								
Depth to V	Water Surface	e (DTW	48.1	ftft			meter (in)	<u>C</u>	asing Volume (C	V)/ft (gals)
(from casi	ng top as mai	rked)					2 4		0.163 0.652	
3) Well Depth (WD): 90.5						4. 6		1.468		
(from casing top as marked) 4) Height of Water Column (H)ft						D		CV = (23.49) x	[(D/24) ²]	
	ng top as ma						CV = 3.	14 [(D/2)/12 in.fi	l] ² h (7.48 gal/cu.	Ft.)
ELL PURC	GE AND SAM	IPLING DATA				Purge Metho	od: 2" G	rundfos subn	nersible pump	
ingle Casin	ng Volume of	Water in Well (√W)	· · · · · · · · · · · · · · · · · · ·	gals	Purge Date:	·····		-	
	$(CV \times H = VV)$	N)								
umber of C	Casing Volum	es to Purge (NC)		gals	Was Well P	umped Dry?	Ŷ	N	
							11 0			
otal Volum	e of Water to (VW x NC =	·			gals		4.0			Observations
otal Volumo			рН	Turbidity (NTU)	gals ORP (mV)	Fe ² (mg/L): D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
	(VW x NC =	TC) Cond (umhos)	рН	Turbidity (NTU)	gals	D.O.	Water Level (ft. bgs)	Removed	Flow Rate (L/min)	
Time	(VW x NC = Temp (C) 20.3	TC) Cond (umhos) 9041	рН 7.2	Turbidity (NTU)	gals ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed	Flow Rate (L/min)	
Time 111 % 112 1	(VW x NC =	TC) Cond (umhos)	рН 7,2 7,2	Turbidity (NTU)	gals ORP (mV) 30.4	D.O. (mg/L) 2.62 0.38	Water Level (ft. bgs) 46.72	Removed (L)	Flow Rate (L/min)	
Time 111 3 1121 1124	(VW x NC = Temp (C) 20.3 20.6	TC) Cond (umhos) 9041 9525	рН 7.2	Turbidity (NTU) 15 14	gals ORP (mV) 30.4 18.3 12.4	D.O. (mg/L) 2.62 0.38	Water Level (ft. bgs) 48.72 48.84 49.79	Removed (L) 3	Flow Rate (L/min)	
Time 1118 1121 1124 1124	(VW x NC = Temp (C) 20.3 20.6 21.2	TC) Cond (umhos) 9041 9525 9583 9581	рН 7,2 7,2 7,2	Turbidity (NTU) 15 14 14	gals ORP (mV) 30.4 18.3	D.O. (mg/L) 2.62 0.38 0.31	Water Level (ft. bgs) 48.72 48.84 49.79	Removed (L) 3 6	Flow Rate (L/min)	
Time 1118 1121 1124 1127 1130	(VW x NC = Temp (C) 20.3 20.6 21.2 21.5	TC) Cond (umhos) 9041 9525 9583	рН 7.2 7.2 7.2 7.2 7.2	Turbidity (NTU) 15 14 14 14 14	gals ORP (mV) 30,4 18.3 12.4 8.6	D.O. (mg/L) 2.62 0.38 0.31 0.21	Water Level (ft. bgs) 48.84 48.84 49.79 49.77	Removed (L) 3 6 9	Flow Rate (L/min)	
Time 1118 1121 1124 1127 1130	$(VW \times NC = Temp (C)20.320.621.521.521.5$	TC) Cond (umhos) 9041 9525 9533 9581 9581 9574	рн 7.2 7.2 7.2 7.2 7.2 7.2	Turbidity (NTU) 15 14 14 14 13	gals ORP (mV) 30.4 18.3 12.4 8.6 7.1	D.O. (mg/L) 2.62 0.38 0.39 0.21 0.24	Water Level (ft. bgs) 48.72 48.84 49.79 49.79 49.77 48.78	Removed (L) 3 6 9 12	Flow Rate (L/min)	
Time 1118 1121 1124 1127 1130	$(VW \times NC = Temp (C)20.320.621.521.521.5$	TC) Cond (umhos) 9041 9525 9533 9581 9581 9574	рн 7.2 7.2 7.2 7.2 7.2 7.2	Turbidity (NTU) 15 14 14 14 13	gals ORP (mV) 30.4 18.3 12.4 8.6 7.1	D.O. (mg/L) 2.62 0.38 0.39 0.21 0.24	Water Level (ft. bgs) 48.72 48.84 49.79 49.79 49.77 48.78	Removed (L) 3 6 9 12	Flow Rate (L/min)	
Time 1118 1121 1124 1127 1130	$(VW \times NC = Temp (C)20.320.621.521.521.5$	TC) Cond (umhos) 9041 9525 9533 9581 9581 9574	рн 7.2 7.2 7.2 7.2 7.2 7.2	Turbidity (NTU) 15 14 14 14 13	gals ORP (mV) 30.4 18.3 12.4 8.6 7.1	D.O. (mg/L) 2.62 0.38 0.39 0.21 0.24	Water Level (ft. bgs) 48.72 48.84 49.79 49.79 49.77 48.78	Removed (L) 3 6 9 12	Flow Rate (L/min)	
Time 1118 1121 1124 1127 1130	$(VW \times NC = Temp (C)20.320.621.521.521.5$	TC) Cond (umhos) 9041 9525 9533 9581 9581 9574	рн 7.2 7.2 7.2 7.2 7.2 7.2	Turbidity (NTU) 15 14 14 14 13	gals ORP (mV) 30.4 18.3 12.4 8.6 7.1	D.O. (mg/L) 2.62 0.38 0.39 0.21 0.24	Water Level (ft. bgs) 48.72 48.84 49.79 49.79 49.77 48.78	Removed (L) 3 6 9 12	Flow Rate (L/min)	
Time 1118 1121 1124 1127 1130	$(VW \times NC = Temp (C)20.320.621.521.521.5$	TC) Cond (umhos) 9041 9525 9533 9581 9581 9574	рн 7.2 7.2 7.2 7.2 7.2 7.2	Turbidity (NTU) 15 14 14 14 13	gals ORP (mV) 30.4 18.3 12.4 8.6 7.1	D.O. (mg/L) 2.62 0.38 0.39 0.21 0.24	Water Level (ft. bgs) 48.72 48.84 49.79 49.79 49.77 48.78	Removed (L) 3 6 9 12	Flow Rate (L/min)	
Time	$(VW \times NC = Temp (C)20.320.621.521.521.5$	TC) Cond (umhos) 9041 9525 9533 9581 9581 9574	рн 7.2 7.2 7.2 7.2 7.2 7.2	Turbidity (NTU) 15 14 14 14 13	gals ORP (mV) 30.4 18.3 12.4 8.6 7.1	D.O. (mg/L) 2.62 0.38 0.39 0.21 0.24	Water Level (ft. bgs) 48.72 48.84 49.79 49.79 49.77 48.78	Removed (L) 3 6 9 12	Flow Rate (L/min)	

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

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MONITOR WELL	NO:	MW-20
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Monitor	Well Sar	npling Da	ata
MOTILOI			~~~

				monne	01 110.		ing Data			
·	ooper Drum	· · · · · · · · · · · · · · · · · · ·								
							18500147.0703			
Sample No(s): <u>37556</u>						Sampler(s):	SL/ <u>DG</u>			
Sampling Da	ite:11/29/0	5					:			
• •		from dedicate				Weather:		<u> </u>		
Sampling Tir	ne:			·		Ambient Te	mp. (F):	. <u></u>		
	EVATION DAT asurement:	T <u>A</u> Depth Sounder	Y N				duct:			<u> </u>
Other:							easurement:		Y	Ν
						Other:				
		(WCE)		π						
(from casi	ng top as mar	e (DTW	8.02	ft		Well Di	ameter (in)		Casing Volume (C	:V)/ft (gals)
(from casi	ing top as mai	ked)					2	-	0.163	
3) Well Depth (WD):70							4		0.652	
(from casing top as marked)						6		1.468		
· -				ft		D CV = (23.49) x [(D/24) ²] CV = 3.14 [(D/2)/12 in.ft] ² h (7.48 gal/cu. Ft.)				
(from casi	ing top as mai	rked)				L	CV = 3	14 [(U/2)/12 IN.T	y 11 (7.46 gai/cu.	Fu)
WELL PUR	GE AND SAM	PLING DATA				Purge Meth	od:2" G	rundfos subr	nersible pump	:
Single Casing Volume of Water in Well (VW) ga					gals	Purge Date	·		-	
	(CV x H = VV	V)								
Number of C	Casing Volum	es to Purge (NC	C)		gals	Was Well F	Pumped Dry?	Y	N	
Total Volum	e of Water to	Purge (TV)			gals	Fe ² (mg/L):	0.0			
	(VW x NC =									
Time	Temp (C)	Cond us	рН	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
0724	Stort p	1600							3-081.8	
			7.37	240	175.9	2.03	48.05	× 24	.8	
0727	20.52	5245			· · · ·				.3	
0730	21.19	5313	7.38	210	158.7	1.88	48.05	×4,8	++	
0733	21.84	5400	7.39	177	130.2	1.32	48.06	· 72	.?	
0736	22.19	5452	7.40	163	100.1	1.78	48.06	.96	.8	· · · · · · · · · · · · · · · · · · ·
0739	22.52	5490	7.41	165	68.2	1.72	48.06	13.0	. 8	
0742	12.35	5495	7.42	144	48.7	1.70	48.06	14#	.8	
0745	22.39	5498	7.42	116	32.2	1.68	48.01	1648	.9	
0748	22.41	5496	7.42	117	184	1.62	48.01	192	8.	······
									8	······································
0751	22.48	5500	7.43	87	18.8	1.60	48:01	3.til	0	
					ļ				<u> </u>	
	1		1							-
L			_ I	L	<u> </u>	<u>.I</u>	L			

Purging/Sampling Remarks _____Pump @ 63 ft.

								MONIT	OR WELL NO	D: <u>MW-20B</u>
				Monit	or Wel	l Sampl	ing Data			
Project: C	ooper Drum					-	_			
						Job No:	18500147.070	30		
							SL/DG			
		5):			
		from dedicate								
eenipinig in				<u>.</u>	_	T				
	EVATION DA					Product Obs:		N		1
		Depth Sounder	YN			Depth to:Prod	luct: asurement:	Interface Probe	Y	N
	terval:		80 - 9	0						
		(WCE)		f						
(from casi	ing top as ma	rked)	170.		-					
		e (DTW	44.90	f	а. А	Well Dia	ameter (in)	<u>c</u>	asing Volume (0.163	
(from casing top as marked) 3) Well Depth (WD):90							2 4		0.652	
3) Well Depth (WD): 90 (from casing top as marked)							6		1.468	
(form casing top as marked) ft D $CV = (23.49) \times [(D/24)^2]$ (from casing top as marked) $CV = 3.14 [(D/2)/12 in ft]^2h (7.48 gal/cu. Ft.)$										
(from cas	ing top as ma	irked)			1		CV = 3	.14 [(D/2)/12 in.f] ^c h (7.48 gal/cu	. Ft.)
WELL PUR	WELL PURGE AND SAMPLING DATA Purge Method: <u>2" Grundfos submersible pump</u>									
Single Casir	na Volume of	Water in Well (VW)		aals	Purge Date	:			
	$(CV \times H = V)$	N)								
Number of (Casing Volum	es to Purge (N	C)				umped Dry?	Y	N	
Total \/olum		Purge (TV)			als	$Ee^2 (mg/l)$	2.8			
total volum	VW x NC =				9010	10 (119/2).				
	•									
	- (0)	Cond	m	Turbidity	ORP (mV)	D.O.	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
Time	Temp (C)			(NTU)	(mv)	(mg/L)		(=)	.8	
0820	Stort p	U I						7.1		- 1
0923	20.96	8844	7.29	71000	-62.4	0.31	47.90	~24	- 8	Odor
CAZE	20.61	8924	7.32	742	-72.6	0.39	47.90	<u>~4.8</u>	S.	
0829	21.54	7087	7.34	394	-1z1.1	0.36	69.74	12	.8	
0832	21.89	9167	7.35	291	-140.1	0.30	47.89	46	.3	
6935	21.96	9202	7.35	196		0.28	49.89	1120	.8	
	21.95		7.36			0.27	47.89	144	.8	
JANH1	22.07	9244	7.36	94	-172.9		47.89	168	18	
0844	ZZ.11		7.3	68	-187.1		•	192	.8	
0847	1	9248	7.34		-	0.25	47.92	•		·····
001+	22.16	9244	4.28	60	2.1011	0.25	4794	21.6	,8	
										· · · · · · · · · · · · · · · · · · ·
	<u> </u>						<u> </u>			·····
L	L					L	1		<u> </u>	

Purging/Sampling Remarks _____Pump @ 85 ft.__

MONITOR WELL NO:	<u>MW-33A</u>
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Monito	r Well	Sam	olina	Data
		Quilip	9 I I I M	

				Monit	tor Wel	I Samp	ling Data			
Project:	ooper Drum									
Location No:						Job No:	18500147.070	30		
Sample No(s	s): <u>37558</u>					Sampler(s):	SL <u>/DG</u>			
Sampling Da	ate:11/29/0)5				Reviewer(s)	:		Date:	
Sampling Me	ethod: Direct	from dedicate	d tubing	<u></u>		Weather:				
Sampling Tin	ne:					Ambient Te	mp. (F):			
	EVATION DA	<u>TA</u> Depth Sounder	v N				Y	Ν		•••
						-		Interface Probe	Y	N
Screened int	terval:					Other:				
		(WCE)	\$	ft						
	ng top as ma		.62							
	Nater Surface	·	.02	ft		<u>Well Di</u>	ameter (in)	<u>(</u>	asing Volume (0.163	
	ng top as ma h (WD):						2		0.652	
3) Well Depth (WD): (from casing top as marked)							6		1.468	6
4) Height of	Water Colum	n (H)		ft			D .		CV = (23.49) x	
(from casi	ng top as ma	rked)					CV = 3	8.14 [(D/2)/12 in.f	t] ² h (7.48 gal/cu.	Ft.)
WELL PURC	<u>GE AND SAN</u>	IPLING DATA				Purge Meth	od:2" (Grundfos subr	nersible pump	<u>) </u>
Single Casin	ng Volume of	Water in Well (\	/W)		gals	Purge Date	•		-	
	(CV x H = V)	N)								
Number of C	Casing Volum	es to Purge (NC	;)		gals	Was Well F	umped Dry?	Y	N	
T-4-1 \ /-1		Purge (TV)			aala	E_{0}^{2} (mg/l):	<u>D.D</u>			
	(VW x NC =				yais	re (mg/c).				
	(,								
		Cond AS/C		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
Time	Temp (C)	(umhos)	pH	(NTU)	(mV)	(mg/L)	(ft. bgs)	(L)	(L/min)	Phys. App.
19 PIG	Start 1	<u></u>					8		.8	
422	21.35	4020	7.43	361	-118.4	2.32	49.65	2.4	.8	
0025	21.48	4023	7.40	406	-160.5	0.79	49.65	4.8	.8	
14 28	22.85	4129	7.41	344	- 184.0	1.26	4835	7,2	.8	
DISI	23.24	4162	7.42	248	-182.8	1.48	48.35	9.6	-8	
1934	23.90	4231	7.41	108	- 181.9	1.80	48.57	17.0	.8	
1037	24.09	4228	7.45	45	-165-8	1.50	48.43	14.4	.8	
1940	22.56	4098	7.37	44	-205.0	0.64	48.71	16.8	.8	
q 43	22.27	4076	7.37	31	-732.9	0.51	48.72	19.2	.8	·
1046	22.22	4071	7.38	33	-241.4	0.62	48.72	29.6	.8	
							+			
ļ	L	· · · · · · · · · · · · · · · · · · ·	I		<u> </u>	L	J		1	

Pump @ 60 ft. Purging/Sampling Remarks

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

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MONITOR WELL NO:	MW-33B
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Monitor Well Sampling Data	Monito	r Well	Sampling	Data
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				Moni	tor we	li Samp	ling Data			
Project: <u>C</u>	ooper Drum	<u>.</u>			<u></u>			_		
Location No	:					Job No:	18500147.070	30		
Sample No(s): <u>37559</u>					Sampler(s)	SL <u>/DG</u> _			
Sampling Date:11/29/05						Reviewer(s):		Date:	
Sampling M	ethod: Direc	t from dedicate	ed tubing			Weather:			<u></u>	
Sampling Ti	me:						mp. (F):			
	EVATION DA	TA Depth Sounder	YN			Product Obs	: Y duct:	N		
						· · · · · ·		Interface Probe	Y	N
Screened in	terval:	<u>80 - 90</u>				Other:				
		(WCE)		ft						
(from casi	ng top as ma	arked)	~ `~				· · · ·			
		e (DTW4	8.15	ft		Well Di	ameter (in)	<u>(</u>	Casing Volume (C	
	ing top as ma						2		0.163	
3) Well Depth (WD):							4 6		0.652 1.468	
, , , , , , , , , , , , , , , , , , ,					D		CV = (23.49) x			
	ing top as ma							.14 [(D/2)/12 in.f	t] ² h (7.48 gal/cu.	
WELL PUR	<u>GE AND SAN</u>	IPLING DATA				Purge Meth	od:2" (Grundfos subr	nersible pump	•
Single Casir	na Volume of	Water in Well (VW)		gals	Purge Date	:			
Single Casing Volume of Water in Well (VW) (CV x H = VW)					30.0		• •• •• •• •• •• ••		-	
Number of C	asing Volum	nes to Purge (NO	C)		gals	Was Well F	umped Dry?	Y	N	
						Fe ² (mg/L):	42			
Total Volum	e of Water to (VW x NC =	Purge (TV) TC)			gals	Fe ² (mg/L):	10			
Time	Temp (C)	Cond	с м рН	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1016	Stort	4							.8	· · · · · · · · · · · · · · · · · · ·
		pune		11-7	747.0		10.50	• `		
1019	21.01	9032	7.38	113	-227.9	0-62	48.12	2.4	8	·
1022	21.56	9162	7.38	96	-264.9	0.82	48.12	4.8	.8	
1025	22.03	9305	7.38	84	-282.8	0.62	48.12	7.2	.8	1
1028	22.27	9405	7.40	94	-305.1	0.48	48.12	9.6	.8	
1031	22.30	943Z	740	100	-328.9	047	48.12	12.0	.8	
1034	22.23	9459	7.39	103	-323.1	0.45	48.12	144	.8	
10.5-1	427-0		,,	125	363+1		-10.12	1 1 -)		
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									 	·····
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Pump @ 85 ft.

Purging/Sampling Remarks _

								M	ONITOR WELL	NO: <u>EW-1</u>	
				Moni	tor We	ll Samp	ling Data				
Project: C	Cooper Drum	1									
Location No:						Job No: 18500147.07030					
Sample No(s):											
Sampling Date:11/29/05									Date:		
Sampling Method: Direct from dedicated tubing											
Sampling Time:											
Camping II		• · · ·								<u></u>	
WATER ELEVATION DATA							Y	N		tra a	
Method of Measurement: Depth Sounder Y N							duct:				
Other:								Interface Probe		N	
Screened interval: 48.5 - 88.5 1) Well Casing Elevation (WCE) ft						Other:					
	ing top as ma				•					· ·	
		ce (DTW4	18.65	ft	t	Well Di	ameter (in)	· · · (Casing Volume (C	V)/ft (gals)	
(from casing top as marked)						2			0.163		
3) Well Depth (WD): 90.5						4			0.652		
(from casing top as marked) 4) Height of Water Column (H)ft							6		1.468		
	ing top as ma			n			D CV = 3	14 f(D/2)/12 in f	CV = (23.49) x t] ² h (7.48 gal/cu. l		
	ing top do mi	antou)							g ii (7.40 ga/oa.1		
WELL PUR	<u>GE AND SAI</u>	MPLING DATA				Purge Meth	od: <u>2" (</u>	Grundfos subr	nersible pump		
Single Casing Volume of Water in Well (VW) gals						Purge Date:					
(CV x H = VW)											
Number of (Casing Volun	nes to Purge (No	C)		_gals	Was Well P	umped Dry?	Y	N		
Total Valum		Durge (T)()			aala	$Eo^2 (ma/l)$	6.0	`			
rotar volum	(VW x NC =	> Purge (TV) : TC)			_yais	re (my/c).		/			
	(
Cond pfcm Turbidity ORP					D.O.	Water Level	Removed	Flow Rate	Observation	าร	
Time	Temp (C)	(umhos)	рН	(NTU)	(mV)	(mg/L)	(ft. bgs)	(L)	(L/min)	Phys. App	·
N55	Stort	purge						····	,8		
1158	21.26	6490	748	15	-2941.9	0.76	48.57	2.4	.8		
1201	21.81	6540	748	14	-747.1	0.62	48.58	4.8	,8		
1204	22.50	6641	7.46	13	-269.1	0.61	48.58	7.2	. 8		
1207	22.77	6696	7.46	13		0.67		9.6	.8		
1007	100.41	~616	11.16	1.0	1 517.0	0.99.7	40.00	1.0		· · · · ·	
			<u> </u>		1					. <u>.</u>	
		<u> </u>									
	<u> </u>								<u>↓</u> ↓.		
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	<u> </u>										
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Purging/Sampling Remarks ____Pump @ 63 ft_

MONITOR WELL NO: ____EW-1-90'_

Monitor	Well	Same	olina	Data
		••••••		

				WOH	lor we	n Samp	ing Data			
Project: <u>C</u>	ooper Drum	· · · · · · · · · · · · · · · · · · ·								
Location No:						Job No:	18500147.07	30	-	
Sample No(s):37561/3	87562 (dup)			-	Sampler(s):	SL/ <u>DG</u>			
Sampling Da	ate:11/29	/05			-	Reviewer(s)	:		Date:	
Sampling Me	ethod: Direc	<u>t from dedicate</u>	d tubing			Weather:			- ·	
Sampling Ti	me:					Ambient Te	mp. (F):		· · · · · · · · · · · · · · · · · · ·	
Method of Me Other: Screened in	terval: <u>4</u>	Depth Sounder 8.5 - 88.5				Method of Me	duct: easurement:	N Interface Probe		N
		(WCE)		ft						
	ng top as ma Nater Surfaci	rked) e (DTW 48	.65	ft	1	Well Di	ameter (in)		Casing Volume	
	ng top as ma			,''		<u>wen Die</u>	2	2	0.16	
	h (WD):						4		0.65	
	ng top as ma	•					6		1.468	
	Water Colum ng top as ma	n (H)		ft			D		CV = (23.49)	
(nom casi	ng top as ma	ikeu)			ł		Cv = .	3.14 [(D/2)/12 in.f	tj⁻n (7.48 gal/cu	. Ft.)
	GE AND SAM	IPLING DATA				Purge Meth	od:2" (Grundfos subr	nersible pum	p
Single Casin	a Volume of	Water in Well (\	/W)		aals	Purge Date:				- <u></u>
	(CV x H = VV	N)				-			-	
Number of C	asing Volum	es to Purge (NC	:)		gals	Was Well P	umped Dry?	· Y	N	
	e of Water to (VW x NC =	Purge (TV) TC)		<u>_</u>	gals	Fe ² (mg/L):	3.4			
Time	Temp (C)	Cond <u>MS/c</u> (umhos)	м рН	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1110	Stort	<u>, ,</u>					<u>(</u>]		.8	
1113	21.25	100165	740	7 1000	-219.4	0.51	48.68	z.4	.8	
			, I		i					
1116	Z1.28	100208	7.41	160	-266.4		48.68	4.8	-8	
1/19	21.69	100301	7.39	52	-293,5	0.64	48.68	7.2	-8	
1122	21.85	100358	7.38	19	-309.5	0.49	48.68	9.6	.8	
1125	z1.91	100382	7.57	14	-310.6	3	48.67	12.0	18	
										·
										1
		·····								
							L			
INSTRUCTIO	ONS AND CO	OMMENTS								

Purging/Sampling Remarks _____Pump @ 85 ft_

1.11

MONITOR WELL NO: _____MW-2__

Page _____ of ___

Monitor We	11	Sampling	Data
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				Mon		oump	ing Data			
Project: <u>C</u>	ooper Drum									
Location No:	:MW-	2				Job No:		_18500147.070)30	·····
		_37566				Sampler(s)	\$L <u>/DG</u>			
Sampling Da	ate:1	1/29/05				Reviewer(s):		Date:	
Sampling Me	ethod: Direct	t from dedicate	d tubing			Weather:				
Sampling Tir	me:	·				Ambient Te	mp. (F):			
		<u>TA</u> Depth Sounder	YN				duct:	N Interface Probe	v	
Screened inf	terval:	50-82 ft	-				easurement.		•	i N
		(WCE)								
(from casi	ng top as ma	rked)								
		e (DTW 41	.6-	ft		<u>Well Di</u>	ameter (in)	<u>(</u>	Casing Volume (C	CV)/ft (gals)
(from casi 3) Well Dept	ng top as ma	rked)					2 4		0.163	
	ing top as mai	rked)					6		1.468	
4) Height of	Water Colum	n (H)		ft			D		CV = (23.49) x	•• • •
(trom casi	ng top as ma	гкеа)					CV = :	5.14 [(D/2)/12 in.f	t] ² h (7.48 gal/cu.	rī.)
WELL PURC	<u>GE AND SAM</u>	IPLING DATA				Purge Meth	od:2" ·	Grundfos subr	nersible pump	
	ng Volume of ' (CV x H = VV	Water in Well (W)	VW)		gals	Purge Date	:			<u></u>
	•	es to Purge (NO	C)		gals	Was Well F	Pumped Dry?	Y	N	
	e of Water to (VW x NC =	Purge (TV) TC)			gals	Fe ² (mg/L):	J.4			
Time	Temp (C)	Cond is (umhos)	е-л рН	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1240	Start P	∿∩6₽ .							18	
1243	20.52	10343	7.32	8	-278.z	0.58	50.07	24	.8	
1246	21.10	10927	7.31	5	-300.6	0.58	49.94	48	.8	
1249	21.65	08011	7.30	5	-325.4	0.36	49.95	7.2	.8	
1252	21.78	11129	7.30	5	-348.9		49.95	9.6	18	
1755	21.90	11149	7.30	5	-357.2		49.95	12.0	.8	
							1			
										·····
										<u></u> ,
							<u> </u>			
INSTRUCTI	ONS AND CO	OMMENTS	, I	· · · · · · · · · · · · · · · · · · ·		L	<u> </u>		▲	
Purging/San	npling Remar	ks	<u></u>	Pump @	65 ft			·	<u> </u>	

MONITOR WELL NO: ____EW-2_

	ooper Drum								20	
							01/00			
		37569					SL/DG		Data	
		1/29/05								
		from dedicate				Weather:		· · · · · · · · · · · · · · · · · · ·	•	
Impling Tir	ne:			<u>.</u>		Ambient Ten	וף . (F):		·····	<u> </u>
	EVATION DAT	<u>A</u> Depth Sounder	V N		-	Product Obs: Depth to Prod	Y uct:	N		
					1	Method of Me	asurement:	nterface Probe	Y	Ν
reened in	terval:	38.5-78.5 ft	-							
		WCE)								
	ng top as mar									
Depth to \	Nater Surface	(DTW	48.55	ft			meter (in)	<u>(</u>	Casing Volume (
	ng top as mar						2		0.163	
-							4 6		0.652 1.468	
	ng top as mar Water Colum	кеа) n (H)		ft			D		CV = (23.49)	
	ing top as mar							.14 [(D/2)/12 in.1	• •	•••
ELL PUR	<u>GE AND SAM</u>	PLING DATA				Purge Metho	od:2" (Grundfos subi	mersible pum	<u>p</u>
nale Casir	na Volume of V	Water in Well (VW)		gals	Purge Date:				·····
	(CV x H = VV	V)								
umber of (Casing Volume	es to Purge (NO	C)		gals	Was Well P	umped Dry?	Y	N	
otal Volum	e of Water to (VW x NC =	Purge (TV) TC)			gals	Fe ² (mg/L):	0,0			
	(111 × 110	,	•							
Time	Temp (C)	Cond US	см рН	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1324	Stort Pu	····		(.8	
		0	7.47	5	-341.1	0 49	48.94	2.4	.8	Odor
327	Zo.42	6286		-			48.96	4.8	.8	-200
330	20.69	6290	747	5	-369.1					·····
333	21.32	6372	7.47	4	-394.3		48.96	7.2	8.	
336	21.60	6411	747	4	-404.1	0.25	48.96	9.6	-8	
								· · · · · · · · · · · · · · · · · · ·		
										a destruction
							-	··		_1
	-									
									-	· · · · · · · · · · · · · · · · · · ·
				<u> </u>	L	1			1	
		*s		Pump @						

MONITOR WELL NO: ____MW-21_

Monitor Well Sampling Dat	wonitor	well	Sam	pling	Data
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cation No:MW-21	Proiect: C	ooper Drum						ing Data			
smple Nole:							Job No:		18500147.070)30	
mpling Date:											
Impling Method: Direct from dedicated tubing Weather:											
ampling Time:											
ATER ELEVATION DATA ATER ELEVATION DATA Inder dessurement: Product: N Depth Sounder Y N here model interval: SE-75 ft. Method of Measurement: Interface SProbe Y N Depth to Water Surface CIVM QL:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1:1											
sthod of Measurement: Depth Sounder Y N her:									······································		
her:				YN							
Well Casing Elevation (WCE)	ther:			-						Y	Ν
(from casing top as marked)							Other:				
Depth to Water Surface (DTW					π						
(from casing top as marked) 2 0.68 Well Depth (WD): 0.652 0.652 Height of Water Column (H)				19	£1		144 11 12				
Well Depth (WD):			·	<u>ידי</u>	π		<u>Well Di</u>		<u>(</u>		V)/ft (gals)
(from casing top as marked)			induj								
Height of Water Column (H)			rked)			-					
(from casing top as marked) CV = 3.14 [(D/2)/12 in.H] ^b h (7.48 gal/cu, Ft) ELL PURGE AND SAMPLING DATA Purge Method: 2" Grundfos submersible pump ngle Casing Volume of Water in Well (VW) gals Purge Date:	-	- ·	•		ft						[(D/24) ²]
ngle Casing Volume of Water in Well (VW)gals Purge Date:								CV = 3	3.14 [(D/2)/12 in.1		
(CV x H = VW) gals Was Well Pumped Dry? Y N stal Volume of Water to Purge (NC) gals Fe ² (mg/L): 2.0 (W × NC = TC) Time Temp (C) Cond/MS/cm Turbidity ORP D.O. Water Level Removed Flow Rate Observations Time Temp (C) Cond/MS/cm Turbidity ORP D.O. Water Level Removed Flow Rate Observations Time Temp (C) Cond/MS/cm Turbidity ORP D.O. Water Level Removed Flow Rate Observations Time Temp (C) Cond/MS/cm Turbidity ORP D.O. Water Level Removed Flow Rate Observations Time Temp (C) Cond/MS/cm Turbidity ORP D.O. Water Level Removed Flow Rate Observations Time Temp (C) Cond/MS/cm Time Temp (C) Cond/MS/cm Time Temp (C) Observations Flow Flow Flow Flow	<u>/ELL PUR</u>	GE AND SAM	PLING DATA				Purge Meth	od:2" (Grundfos subr	nersible pump	
(CV x H = VW) gals Was Well Pumped Dry? Y N stal Volume of Water to Purge (NC) gals Fe ² (mg/L): 2.0 (W × NC = TC) Time Temp (C) Cond/MS/cm Turbidity ORP D.O. Water Level Removed Flow Rate Observations Time Temp (C) Cond/MS/cm Turbidity ORP D.O. Water Level Removed Flow Rate Observations Time Temp (C) Cond/MS/cm Turbidity ORP D.O. Water Level Removed Flow Rate Observations Time Temp (C) Cond/MS/cm Turbidity ORP D.O. Water Level Removed Flow Rate Observations Time Temp (C) Cond/MS/cm Turbidity ORP D.O. Water Level Removed Flow Rate Observations Time Temp (C) Cond/MS/cm Time Temp (C) Cond/MS/cm Time Temp (C) Observations Flow Flow Flow Flow	ingle Casi	ng Volume of	Water in Well (∨w)		gals	Purge Date	:			
stal Volume of Water to Purge (TV) gals Fe ² (mg/L): 2.0 (W x NC = TC) Time Temp (C) (umhos) pH Turbidity ORP (MTU) (mV) (mg/L) (ft. bgs) (L) (Umin) Phys. App. HIT Start purge (TV) 0A4 Africa Start purge (TV) PH (NTU) (mV) (mg/L) (ft. bgs) (L) (Umin) Phys. App. HIT Start purge / 0A4 Africa Start purge / 0A4 Africa Start purge / Observations Phys. App. HIT Start purge / Observations / Africa Start purge / Observations Phys. App. HIT Start purge /		(CV x H = VV	V)								
(WW × NC = TC) Time Temp (C) Cond/AS/cn Turbidity ORP D.O. Water Level Removed Flow Rate Observations 11me Temp (C) (umhos) pH (NTU) (mV) (mg/L) (ft. bgs) (L) (Umin) Phys. App. 417 Ster+ punce - <td< td=""><td>umber of (</td><td>Casing Volume</td><td>es to Purge (NO</td><td>C)</td><td></td><td>gals</td><td>Was Well F</td><td>Pumped Dry?</td><td>Y</td><td>Ν</td><td></td></td<>	umber of (Casing Volume	es to Purge (NO	C)		gals	Was Well F	Pumped Dry?	Y	Ν	
Time Temp (C) (umhos) pH (NTU) (mV) (mg/L) (ft. bgs) (L) (L/min) Phys. App. 417 Stert pung -8	otal Volum					gals	Fe ² (mg/L):	2.0			
10 10 10 11 145 39 -211-2 0.44 47.80 2.4 .8 422 20.98 5517 7.44 30 -336.1 0.80 49.80 4.9 .8 421 21.75 5545 7.44 30 -336.1 0.65 48.80 7.2 .9 422 21.75 5545 7.44 21 -348.1 0.65 48.80 7.2 .9 429 21.79 5520 7.44 26 -357.9 0.58 48.80 9.6 .8 429 21.79 5520 7.44 26 -357.9 0.58 48.80 9.6 .8 10 10 10 10 10 10 10 10 10 11 10 10 10 10 10 10 10 10 12 10 10 10 10 10 10 10 10 10 14 10 10 10 10 10 10 10 <	Time	Temp (C)									Observations Phys. App.
4Z0 Z0.57 5731 7.45 39 -3(1.7 0.44 47.80 2.4 .8 473 20.98 5517 7.44 30 -336.1 0.80 48.80 4.9 .8 472 21.75 5517 7.44 30 -336.1 0.80 48.80 7.2 .9 472 21.75 5515 7.44 21 -348.1 0.65 48.80 7.2 .9 479 21.79 5520 7.44 26 -357.9 0.58 48.80 9.6 .8 479 21.79 5520 7.44 26 -357.9 0.58 48.80 9.6 .8 479 21.79 5520 7.44 26 -357.9 0.58 48.80 9.6 .8 470 1 1 1 1 1 1 1 1 470 1 1 1 1 1 1 1 1 471 1 1 1 1 1 1 1 1	417	Stert pu	(NQ							-8	
472 20.98 5517 7.44 30 -336.1 0.80 48.80 44.9 .6 426 21.75 5545 7.44 21 -348.1 0.65 48.80 7.2 .9 429 21.79 5520 7.44 26 -357.9 0.58 48.80 9.6 .8 429 21.79 5520 7.44 26 -357.9 0.58 48.80 9.6 .8 429 21.79 5520 7.44 26 -357.9 0.58 48.80 9.6 .8 429 21.79 5520 7.44 26 -357.9 0.58 48.80 9.6 .8 420 48.80 9.6 .8 <td></td> <td></td> <td>0</td> <td>3.45</td> <td>39</td> <td>-311.2</td> <td>0.94</td> <td>47.80</td> <td>2.4</td> <td>.8</td> <td></td>			0	3.45	39	-311.2	0.94	47.80	2.4	.8	
426 21.75 5545 7.44 21 -348.1 0.65 48.80 7.2 .9 429 21.79 5520 7.44 26 -357.9 0.58 48.80 9.6 8 429 21.79 5520 7.44 26 -357.9 0.58 48.80 9.6 8 429 21.79 5520 7.44 26 -357.9 0.58 48.80 9.6 8 420 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	423					1		the second	4.9	.8	
429 21.79 5520 744 26 -357.9 0.58 48.80 9.6 .8				7.44	71						······································
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	161				0		0.08	10,00			
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		II		<u> </u>		I	1				
urging/Sampling RemarksPump @ 65 ft	<u>NSTRUCT</u>	IONS AND CO	<u>DMMENTS</u>								
	urging/Sa	mpling Remar	ks		Pump @	65 ft					
									····		

MONITOR	WELL NO:	MW-5
MONTOR	WELLING.	C-VVIVI

	Monitor	Well San	npling Data
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Sampling Method: Sampling Time: VATER ELEVATIC Method of Measureme Other: Screened interval:) Well Casing Elev (from casing top 2) Depth to Water S (from casing top 3) Well Depth (WD) (from casing top 4) Height of Water of (from casing top WELL PURGE ANI Single Casing Volu (CV x Number of Casing Volu (VW x Time Tem)	3756 7 11/29/05 hirect from dedication int: Depth Sounder 30-75 ft ation (WCE)s marked) urface (DTW s marked) olumn (H)s marked) SAMPLING DATA he of Water in Well = VW) olumes to Purge (I	tted tubing	ft ft ft	_gals _gals	Sampler(s): Reviewer(s) Weather: Ambient Te Product Obs: Depth to Prod Method of Me Other: <u>Well Dia</u> Purge Meth Purge Date Was Well P	SL/DG mp. (F): Y duct: easurement: ameter (in) 2 4 6 D CV = 3	N Interface Probe	P30 Date: Y Casing Volume (C 0.163 0.652 1.468 CV = (23.49) x t] ² h (7.48 gal/cu. nersible pump	N <u>((D/24)²]</u> Ft.)
Sampling Date: Sampling Method: Sampling Time: VATER ELEVATIC Method of Measureme Other: Screened interval:) Well Casing Elev (from casing top 2) Depth to Water S (from casing top 2) Depth to Water S (from casing top 4) Height of Water O (from casing top 4) Height of Wate	11/29/05 <u>Prinect from dedica</u> <u>NDATA</u> nt: Depth Sounder <u>30-75 ft</u> ation (WCE) s marked) urface (DTW s marked) s marked) s marked) <u>SAMPLING DATA</u> ne of Water in Wel = VW) olumes to Purge (TV)	1 (VW)	ft ft	_gals _gals	Reviewer(s) Weather: Ambient Tei Product Obs: Depth to Proo Method of Me Other: <u>Well Dia</u> Purge Meth Purge Date Was Well P): mp. (F): duct: easurement: ameter (in) 2 4 6 D CV = 3 cod: cv = 3	N Interface Probe	Y Y Casing Volume (C 0.163 0.652 1.468 CV = (23.49) × i] ² h (7.48 gal/cu. nersible pump	N : <u>V)/ft (gals)</u> [(D/24) ²] Ft.)
Sampling Method: Sampling Time: VATER ELEVATIO Method of Measureme Other: Screened interval: Well Casing Elev (from casing top Depth to Water S (from casing top Well Depth (WD) (from casing top Well Depth (WD) (from casing top Well Depth (WD) (from casing top WELL PURGE ANI Single Casing Volu (CV x Number of Casing Volu (VW x	N DATA nt: Depth Sounder 30-75 ft ation (WCE) s marked) urface (DTW s marked) olumn (H) s marked) SAMPLING DATA ne of Water in Wel = VW) olumes to Purge (TV)	tted tubing	ft ft	_gals _gals	Weather: Ambient Ter Product Obs: Depth to Prod Method of Me Other: <u>Well Dis</u> Purge Meth Purge Date Was Well P	mp. (F): Y duct: easurement: ameter (in) 2 4 6 D CV = 3 rod: Pumped Dry?	N Interface Probe	Y <u>Casing Volume (C</u> 0.163 0.652 1.468 CV = (23.49) x <u>1</u> ² h (7.48 gal/cu. <u>nersible pump</u>	N <u>V)/ft (gals)</u> [(D/24) ²] Ft.)
ampling Time: <u>VATER ELEVATIC</u> lethod of Measurement ther: creened interval:) Well Casing Elev (from casing top) Depth to Water S (from casing top) Well Depth (WD (from casing top) Height of Water of (from casing top <u>VELL PURGE ANI</u> Single Casing Volu (CV x Jumber of Casing Volu (VW x <u>Time</u> Tem	A DATA at: Depth Sounder 30-75 ft ation (WCE)	Y N S S S 4 (VW)	ft ft ft	_gals _gals	Ambient Ter Product Obs: Depth to Prod Method of Me Other: Well Dia Purge Meth Purge Date Was Well P	mp. (F): Y duct: easurement: ameter (in) 2 4 6 D CV = 3 rod: Pumped Dry?	N Interface Probe	Y <u>Casing Volume (C</u> 0.163 0.652 1.468 CV = (23.49) x t] ² h (7.48 gal/cu. nersible pump	N <u>:V)/ft (gals)</u> [(D/24) ²] Ft.)
VATER ELEVATION lethod of Measurement iscreened interval:) Well Casing Elev (from casing top) Depth to Water S (from casing top) Well Depth (WD) (from casing top) Height of Water of (from casing top VELL PURGE ANII Single Casing Volu (CV x Jumber of Casing Top Total Volume of Water (VW x	N DATA nt: Depth Sounder 30-75 ft ation (WCE) s marked) urface (DTW s marked) olumn (H) s marked) S marked) olumn (H) s marked) s marked) olumn (H) s marked) olumn s marked) s mark	Y N 5.84 (VW)	ft ft ft	_gals _gals	Product Obs: Depth to Prod Method of Me Other: <u>Well Dia</u> Purge Meth Purge Date Was Well P	Y duct: easurement: ameter (in) 2 4 6 D CV = 3 nod: 2 " C 2 cv = 3	N Interface Probe	Y <u>Casing Volume (C</u> 0.163 0.652 1.468 CV = (23.49) x <u>1</u> ² h (7.48 gal/cu. <u>nersible pump</u>	N <u>:V)/ft (gals)</u> [(D/24) ²] Ft.)
Aethod of Measureme Other:	at: Depth Sounder <u>30-75 ft</u> ation (WCE) s marked) urface (DTW s marked) s marked) olumn (H) s marked) <u>SAMPLING DATA</u> the of Water in Wel = VW) olumes to Purge (TV)		ft	_gals _gals	Depth to Proc Method of Me Other: <u>Well Dia</u> Purge Meth Purge Date Was Well P	duct: easurement: 2 4 6 D CV = 3 nod: 2 nod: 2 " C	Interface Probe	Casing Volume (C 0.163 0.652 1.468 CV = (23.49) x t] ² h (7.48 gal/cu. nersible pump	<u>:V)/ft (gals)</u> [(D/24) ²] Ft.)
Other:	30-75 ft ation (WCE) s marked) urface (DTW s marked) s marked) s marked) s marked) SAMPLING DATA the of Water in Wel = VW) olumes to Purge (TV)		ft	_gals _gals	Method of Me Other: <u>Well Di</u> Purge Meth Purge Date Was Well P	easurement: ameter (in) 2 4 6 D CV = 3 rod: 2" (2" ())))))))))))))))))))))))))))))))))))	Interface Probe	Casing Volume (C 0.163 0.652 1.468 CV = (23.49) x t] ² h (7.48 gal/cu. nersible pump	<u>:V)/ft (gals)</u> [(D/24) ²] Ft.)
Creened interval:) Well Casing Elev (from casing top) Depth to Water S (from casing top) Well Depth (WD) (from casing top) Height of Water (from casing top VELL PURGE ANI Single Casing Volu (CV x Sumber of Casing V otal Volume of Water (VW x	30-75 ft ation (WCE) s marked) urface (DTW s marked) s marked) olumn (H) s marked) <u>SAMPLING DATA</u> ne of Water in Wel = VW) olumes to Purge (TV)	\$5.84 ≤	ft	_gals _gals	Other: Well Dia Purge Meth Purge Date Was Well P	ameter (in) 2 4 6 D CV = 3 rood:	<u>(</u> 1.14 [(D/2)/12 in.f Grundfos subr	Casing Volume (C 0.163 0.652 1.468 CV = (23.49) x t] ² h (7.48 gal/cu. nersible pump	<u>:V)/ft (gals)</u> [(D/24) ²] Ft.)
) Well Casing Elev (from casing top) Depth to Water S (from casing top) Well Depth (WD) (from casing top) Height of Water (from casing top / <u>ELL PURGE ANI</u> ingle Casing Volu (CV x lumber of Casing V otal Volume of Wa (VW x	ation (WCE) s marked) urface (DTW s marked) s marked) s marked) s marked) SAMPLING DATA the of Water in Wel = VW) olumes to Purge (TV)	\$5.84 ≤	ft	_gals _gals	Purge Meth Purge Date Was Well P	2 4 6 D CV = 3 rod:CV = 3	.14 [(D/2)/12 in.f Grundfos subr	0.163 0.652 1.468 CV = (23.49) x t] ² h (7.48 gal/cu. nersible pump	[(D/24) ²] Ft.)
Depth to Water S (from casing top Well Depth (WD) (from casing top Height of Water (from casing top (<u>ELL PURGE ANI</u> ingle Casing Volu (CV x umber of Casing Volu total Volume of Wa (VW x	urface (DTW s marked) olumn (H) s marked) SAMPLING DATA ne of Water in Wel = VW) olumes to Purge (IV)	<u>\</u> I (VW) NC)	ft	_gals _gals	Purge Meth Purge Date Was Well P	2 4 6 D CV = 3 rod:CV = 3	.14 [(D/2)/12 in.f Grundfos subr	0.163 0.652 1.468 CV = (23.49) x t] ² h (7.48 gal/cu. nersible pump	[(D/24) ²] Ft.)
(from casing top Well Depth (WD (from casing top Height of Water (from casing top / <u>ELL PURGE ANI</u> ingle Casing Volu (CV x umber of Casing V otal Volume of Wa (VW x	s marked) s marked) olumn (H) s marked) SAMPLING DATA ne of Water in Wel = VW) olumes to Purge (I er to Purge (TV)	<u>\</u> I (VW) NC)	ft	_gals _gals	Purge Meth Purge Date Was Well P	2 4 6 D CV = 3 rod:CV = 3	.14 [(D/2)/12 in.f Grundfos subr	0.163 0.652 1.468 CV = (23.49) x t] ² h (7.48 gal/cu. nersible pump	[(D/24) ²] Ft.)
Well Depth (WD (from casing top) Height of Water (from casing top) <u>/ELL PURGE ANI</u> ingle Casing Volu (CV x umber of Casing V otal Volume of Wa (VW x	s marked) olumn (H) s marked) SAMPLING DATA ne of Water in Wel = VW) olumes to Purge (IV)	<u>\</u> I (VW) NC)		_gals _gals	Purge Date	4 6 D CV = 3 nod: : Pumped Dry?	Grundfos subr	0.652 1.468 CV = (23.49) x t] ² h (7.48 gal/cu. I nersible pump	Ft.)
(from casing top Height of Water (from casing top / <u>ELL PURGE ANI</u> ingle Casing Volu (CV x umber of Casing V otal Volume of Wa (VW x	s marked) olumn (H) s marked) SAMPLING DATA ne of Water in Wel = VW) olumes to Purge (I er to Purge (TV)	<u>\</u> I (VW) NC)		_gals _gals	Purge Date	D CV = 3 nod:C	Grundfos subr	CV = (23.49) x t] ² h (7.48 gal/cu. nersible pump	Ft.)
) Height of Water (from casing top VELL PURGE ANI ingle Casing Volu (CV x lumber of Casing V iotal Volume of Wa (VW x	olumn (H) s marked) SAMPLING DATA ne of Water in Wel = VW) olumes to Purge (I er to Purge (TV)	<u>\</u> I (VW) NC)		_gals _gals	Purge Date	CV = 3 rod:C	Grundfos subr	tj ² h (7.48 gal/cu. I	Ft.)
VELL PURGE ANI Single Casing Volu (CV x Jumber of Casing V Total Volume of Wa (VW x	SAMPLING DATA ne of Water in Wel = VW) olumes to Purge (I er to Purge (TV)_	- I (VW) NC)		_gals _gals	Purge Date	rod: 2" (: Pumped Dry?	Grundfos subr	nersible pump	
ingle Casing Volu (CV x lumber of Casing V otal Volume of Wa (VW x Time Tem)	ne of Water in Wel = VW) olumes to Purge (I er to Purge (TV) _	- I (VW) NC)		_gals _gals	Purge Date	: Pumped Dry?	Y	-	
ingle Casing Volu (CV x lumber of Casing V otal Volume of Wa (VW x	ne of Water in Wel = VW) olumes to Purge (I er to Purge (TV) _	- I (VW) NC)		_gals _gals	Purge Date	: Pumped Dry?	Y	-	
(CV x lumber of Casing ' otal Volume of Wa (VW x Time Tem	= VW) olumes to Purge (I er to Purge (TV) _	NC)		_gals	Was Well P	Pumped Dry?	Y	N	
umber of Casing Total Volume of Warking (VW x	olumes to Purge (l							N	
otal Volume of Wa (VW x Time Tem)	er to Purge (TV) _							N	
(VW x			· · · ·	_gals	Fe ² (mg/L):	0.0.			
(VW x									
	Cond	0 <i>I</i> .	Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
	Cond (C) (umhos)	усм	(NTU)	(mV)	(mg/L)	(ft. bgs)	(L)	(L/min)	Phys. App.
1459 Sta	<u> </u>			T				18	
	+ Purge		170	71.1	1.05	36.36	2.4	.8	
1507. 20.		7.62	120	-3)11					· · · · · · · · · · · · · · · · · · ·
1505 ZO.	3335	7.62	70	-328.1	1.12	36.35	4.8	-8	
1508 20.	9 3368	7.60	29	-336.7	0.98	36.36	4.2	.8	
1511 20.		7.60	20	-739.0	0.92	36.36	9.6	18	
								1	• • • • • • • • • • • • • • • • • •
154 21.	2 3389	7.60	18	-333,2	1.00	36.35	iz.0	-8	
									·
				+			·		
								┼───┤-	
		-							

MONITOR WELL NO: _____MW-20

Monitor Well	Sampli	ng Data
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Project: <u>Co</u>	oper Drum										
		20				Job No:	18500147.07	030			
							:SL/ <u>DG</u>			<u>.</u>	
		06									
		t from dedicate			_						
-											
VATER ELE	VATION DA	TA				Product Obs	Y	N			
		Depth Sounder	<u>м</u> (duct:				
ther:			- 55 - 7	0			easurement:	Interface Probe	Y	N	
		(WCE)			_ t						
(from oppin	a ton oo ma	rkod)									
Depth to W	/ater Surfac		(17	f	t	<u>Well Di</u>	ameter (in)	<u>(</u>		e (CV)/ft (gals)	
-	ig top as ma (WD)·	irked)	70			1	2 4		0.1 0.6		
•	ig top as ma						6	15 - 15 - 17	1.4		
•		nn (H)		ft		D $CV = (23.49) \times [(D/24)^2]$					
(from casin	ig top as ma	irked)					CV =	3.14 [(D/2)/12 in.f	l] ² h (7.48 gal/c	cu. Ft.)	
ELL PURG	E AND SAM	IPLING DATA				Purge Meth	od: <u>2"</u>	<u>Grundfos subn</u>	<u>nersible pur</u>	np	
	y Volume of CV x H = V	Water in Well (VW)		_gals	Purge Date	1 18 0	ما			
		es to Purge (NO	C)		_gals	Was Well P	umped Dry?	Y	Ν		
	of Water to VW x NC =	Purge (TV) TC)			_gals	Fe ² (mg/L):	O.D				
		Oand		م الله المالية الم				Dama a d	-	e	
	Temp (C)	Cond (umhos)	рН	Turbidity (NTU)	ORP (mV)	(mg/L)	Water Level	(NML	Flow Rate (L/min)	Observations Phys. App.	
	21.26	5259	7.3	245	43.5		3423		- 9mc	·	
733 2	21.83	5374	7.3	151	13.3	0.48	15	5	11	1. 	
736 2	21.93	5119	7.3		-5.8	0.36	41.23	8100	((₁		
	21.91	5448	7.3		-14.9	0.26	47.19	10800	i •		
742 7	21.90	5432	7.3		-72.0	0.26	46.80	12500	(1		
	12.02	5370	7.3		-33.1	0.23	46,51	15200	.i t		
748 .	22,13	5078	1.3		-3,8	1.61	46.65	17900	• • • •		
	22.29	4983	7.3	46	18.7	2.44	46.88	20600	ve		
	22.22	5000	7.3	28	59.3	4.12	16.99	23300	+ 1		
ראי	22.11	5205	7.3	16	36.8	1.99	46.97	26000	ιl		
								<u>.</u>		and the second s	
								19		· · · · · ·	
ISTRUCTIO			ישביים. 10 @ 63 ft			51	avic son	during	pura	e e	
					•		•			· · · · · · · · · · · · · · · · · · ·	

								MON	TOR WELL N	IO: <u>MW-20B</u>
				Mon	itor We	ell Sam	pling Dat	a		
Project:	Cooper Dru	<u>m</u>			,					
Location N	lo:MW-20	B			_	Job No:	18500147.0	7030		
Sample N	o(s): <u>37572</u>								1.4. ·	
		06			_				Date:	
Sampling	Method: Dire	ct from dedica	ted tubin	<u>a</u>						
Sampling	Time:			. <u> </u>						
	LEVATION D	ATA Depth Sounder	YN			Product Ob Depth to Pr	s: Y oduct:	N		
Other:							leasurement:		Y	N
	interval:		80 -		fi	Other:			··	
·	ising top as m	, , , <u>, , , , , , , , , , , , , , , , </u>		-	_D7	L				
	Water Surfa		47.0	59	f	Well	Diameter (in)		Casing Volume	(C)1)#t (mate)
(from ca	ising top as m	arked)			- -	TTOIL	2	<u>r</u>	Casing Volume 0.16	
	pth (WD):		90	·····			4		0.65	
	sing top as m						6		1.46	8
	sing top as m	mn (H) arked)			n	1	D	0 14 10 00 140 5	CV = (23.49)	
		,						3.14 [(D/2)/12 in.f		
	IGE AND SA	MPLING DATA						Grundfos sub	mersible pun	
Single Cas	ing Volume o (CV x H = V	f Water in Well W)	(VW)	•	_gals	Purge Date	e: 118	06		<u></u>
lumber of		nes to Purge (N	C)		_gals	Was Well	Pumped Dry?	Y	N	
							· .	•		
otal Volur		Purge (TV)			_gals	Fe ² (mg/L)	: <u> 41</u>			
	(VW x NC =	: IC)								
		Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
	Temp (C)	(umhos)	рН	(NTU)	(mV)	(mg/L)	(ft. bgs)	HML	(L/min)	Phys. App.
0836	20,78	9803	7.2	865	-133,2	0.81	41,15	3000	1	
2839	21.51	9972	7.1	599	-145.7	0.35	47.60	6000	4	
1842	21.51	9980	7.1	423	-154.0		47.62	9000		•
2845	21.67	10015	7.1	246	-160.6		+7.63	12,000		
848	21.88		7.1	135	-160.5	<u> </u>	47.63	15000	t t	
851	21.82	10054	7.1	105	-163.8	0.15	47.62	18,000		•
	21.98			<u> </u>	-164.8					
	21.10	10000			-161.0	0.11		21,000	1	
<u></u>					<u> </u>					
							[1			
						-				
						· · ·				

Purging/Sampling Remarks _____Pump @ 85 ft._

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

Monitor Well Sampling Data

Project:	Cooper Drum	1				-				
		A			-	Job No:	18500147.07	030		
		*******):SL <u>/DG</u>			
1		/06			_		s):			
		t from dedicat								
					,		emp. (F):			
WATER EL	EVATION DA	TA	÷.			Product Obs	s: Y	N		
]		Depth Sounder	Y N			Depth to Pro	oduct:			
							leasurement:	Interface Probe	Y	N
		<u>55 - 65</u>		4	-	Other:				
(from cas	ing ton as ma	(WCE)	_							
2) Depth to	Water Surfac	xe (DTW	6.38	fi	•	Well D	iameter (in)		Casing Volume	
(from cas	ing top as ma	arked)	0	,	•		2 2	-	0.16	
					_		4	0.65		
	ing top as ma					1	6	8		
		nn (H)		ft			D		CV = (23.49)	•• ••
(from cas	ing top as ma	arked)				L	CV = :	3.14 [(D/2)/12 in.	t] ^z h (7.48 gal/cu	ı. Ft.)
WELL PUR	<u>GE AND SAN</u>	IPLING DATA				Purge Meth	nod: <u>2"</u>	<u>Grundfos subr</u>	<u>mersible pum</u>	p
Single Casi		Water in Well (VW)		gais	Purge Date	: 11810	9.0	•	
Number of	(CV x H = V Casing Volum	vv) ies to Purge (N(C)		gals	Was Well F	ı Pumped Dry?	Y	N	
	-				-		• •			
Total Volum	e of Water to (VW x NC =	Purge (TV) TC)			gals	Fe ² (mg/L):	0.0			
		Orad		Turk tatta	000			- -		
Time	Temp (C)	Cond (umhos)	pН	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed L_(L)ML	Flow Rate (L/min)	Observations Phys. App.
D933	21.57	4830	7.1	179	-92.8	1.03	41.95	3000		
0936	21,96	4870	7.(228	-95.9	1,31	46.98	6	i 4	· · · · · · · · · · · · · · · · · · ·
0939	22.15	1888	7,1	190	-98.2	1.21	46,97	9	ч	
0942	Z2.13	4884	7.1	225	-104.5	1.37	46.97	12	11	
0945	22.05	4877	7.	176	-107.4	1.21	46.98	15	st	
0948	22.14	4884	7.1	167	-106.6	1.21	46.96	18		· ·
0951	22,12	4877	7.1	141	-107.6	1.18	46.90	21	•(
								· · · · · · · · · · · · · · · · · · ·		
			<u> </u>					12.6		
		- · · · · · · · · · · · · · · · · · · ·						<u> </u>		м <u>же</u> и
										······
				<u> </u>		•			<u>I</u>	,
NSTRUCT	ONS AND CO	<u>JMMENTS</u>								

Purging/Sampling Remarks _____Pump @ 60 ft._

								MO	NITOR WELL N	NO: <u>MW-33B</u>
				Mon	itor We	ell Sam	pling Data	a		
Project:	Cooper Drur	<u>n</u>								
ocation 1	No:MW	/-33B				Job No:	18500147.07	030		
Sample No	o(s): <u>37574</u>					Sampler(s	s):SL <u>/DG</u>			
Sampling (Date:01/18	/06				Reviewer(s):		Date:	·
ampling I	Method: Dire	ct from dedicat	ed tubing	<u> </u>					_	
ampling 1	lime:						'emp. (F):			
	LEVATION D					Product Ob	s: Y	N		
		Depth Sounder	Y N				oduct:			
	nterval:	80 - 90					Measurement:	Interface Probe	Y Y	N
		(WCE)			_ t	Other:		a		
	sing top as m	ordroal)			•					
	Water Surfa		7.6	<u> </u>	t	<u>Well</u> C	Diameter (in)		Casing Volume (CV)/ft (gals)
	sing top as m	•					2		0.163	
							4		0.652	
	sing top as ma f Water Colur	arked) mn (H)		fi			6 D		1.468	
-	sing top as ma			1			D CV=	3.14 [(D/2)/12 in	CV = (23.49) x ft] ² h (7.48 gal/cu.	
	• ·						0,		iij ii (7.40 gavea.	1
ELL PUF	GE AND SA	MPLING DATA				Purge Met	hod:2"	<u>Grundfos sub</u>	mersible pump	<u>) </u>
ngle Casi		f Water in Well ((VW)		_gals	Purge Date	ə:		_	
umber of	(CV x H = V Casing Volum	w) nes to Purge (N(C)		_gals	Was Well	Pumped Dry?	Y	N	
					-		• •			
otal Volun	ne of Water to = VW x NC)	> Purge (TV) : TC)			_gals	Fe ² (mg/L)	4.4			
		Cond		Turbidity	ORP	D. O .	Water Level	Domovod	Eleve Dete	O
Time	Temp (C)	(umhos)	pН	(NTU)	(mV)	(mg/L)	(ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
029	21.18	9841	7.1	100	-147.8	0.23	47.90	3		
032	21.70	10006	7.0	133	-1564	0.17	4185	6	4	
030	21.89	10100	7.0	172	-161.7	0.12	47.80	9		
038	21.77	10/07	7.0	165	-162.8	0.12	47.85	(2	e1	
241	22.04	10176	7.0	104	-168.4	D.11	47.86	IS	(1	
D44	21.80	10061	7.0	63	-168.7	0.12	47.86	8	(1	
747	21.56	10088	7,0	41.	169.7	0.12		21		
							ļ			
•										
							ļ			
	· · ·									
	ONS AND CO									2 2
ging/Sar	npling Remar	κsPump	o @ 85 ft.							

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								M	IONITOR WELL	NO: <u>E</u>	<u>W-1</u>
				Mon	itor We	ell Samp	ling Data				
Project:	Cooper Drum					۲					
EW-1					۰.	Job No:	18500147.07)30			_
Sample No	(s): <u>37575</u>			_		Sampler(s)	:SL <u>/DG</u>				
Sampling E	Date:01/18	3/06				Reviewer(s	s):		Date:		
Sampling N	lethod: Direc	t from dedicate	d tubing			Weather:					
VATER EL	EVATION DA	ТА				Product Obs	: Y	N			
		Depth Sounder	Y N				duct:				
Other:			-			Method of M	easurement:	Interface Probe	Y	1	N
				88.5		Other:					
-	-	(WCE)		f	t						
(from cas	sing top as ma	arked) e (DTW	40 1	2							
			1)16	<u>>_</u> f	t	<u>Well D</u>	iameter (in)		Casing Volume (C	V)/ft (gals)	
	sing top as ma	likeu)	90.5				2 4		0.163 0.652		
	sing top as ma						6		1.468		
-	• •	nn (H)		ft	t		D		CV = (23.49) x	[(D/24) ²]	
	sing top as ma						CV = :	3.14 [(D/2)/12 in.	ft] ² h (7.48 gal/cu. l		_
VELL PUF	IGE AND SAM	<u>IPLING DATA</u>				Purge Meth	nod: <u>2"</u>	Grundfos sub	mersible pump		
Single Cas	-	Water in Well (VW)		_gals	Purge Date	:		_		
1	$(CV \times H = V)$,				14/ 14/-W F					
Number of	Casing Volum	es to Purge (NC	い		_gais			Y	· N		
Total Volum	ne of Water to	Purge (TV)			ale	Fe ² (ma/l):	_00				
	(VW x NC =				_ yuis	ιο (mg/ε).					
	,										
		Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observ	vations
Time	Temp (C)	(umhos)	pH	(NTU)	(mV)	(mg/L)	(ft. bgs)	(L)	(L/min)	Phys.	. Арр.
207	21.28	5259	7.2	٢	-69.1	5.93	48.14	3	1		
1210	22.01	5345	7.2	6	-68.9	5.57	48.20	þ	°(- 	
213	22.19	5368	7.2	7	-68,4	5,48	48.21	<u>า</u>	P 4		
1216	22.36	5392	7.2	7	-69.8	5.37	48.19	12	•(
1219	22.46	5405	7,2	7	-70.8	5.29		(5	11		
222	22.49	5411	7,2	6	-71.9	5,22		is	:1		
					<u> </u>						
							ļ		<u>↓ </u>		
							· · · · ·				
					<u> </u>				<u> </u>		
							ļ				

MONITOR WELL NO: ____EW-1-90'__

Monitor Well Sampling Data

		1-90ft			-		18500147.07		· · · · · · · · · · · ·	
		37577 (dup,MW			-	Sampler(s)	:SL <u>/DG</u>			· · · · · · · · · · · · · · · · · · ·
ampling Date	:01/18	/06			<u> </u>	Reviewer(s):		Date:	<u> </u>
mpling Meth	od: Direc	t from dedicate	ed tubing			Weather: _				
ampling Time	:					Ambient Te	mp. (F):			
ATER ELEV	ATION DA	TA				Product Obs	Y	N		•••
	urement:	Depth Sounder	Y N				duct:			
her:			-					Interface Probe	Y	Ν
reened inter					-	Other:				
		(WCE)		fi						
(from casing	top as ma	e (DTW	48.2	3 #		14/-II D			<u> </u>	
(from casing			131-	_ / ii		<u>vveii Di</u>	ameter (in) 2		Casing Volume ((
• •	•						4		0.163 0.652	
(from casing					-		6		1.468	
-		in (H)		ft			D		CV = (23.49) x	[(D/24) ²]
(from casing		• •						3.14 [(D/2)/12 in.1		
ELL PURGE	AND SAM	IPLING DATA				Purge Meth	od: <u>2"</u>	<u>Grundfos subr</u>	nersible pump	·
		Water in Well (vw)		gals	Purge Date	118	06	-	
•	VxH=VV					M	, ,		••	
Number of Casing Volumes to Purge (NC) g							umped Dry?	Y	N	
tal Volume o	f Water to	Purge (TV)			nale	Fe ² (mg/L):	2.6			
	$W \times NC =$				gais	re (my/⊾):				
	-									
		Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
	emp (C)	(umhos)	рН	(NTU)	(mV)	(mg/L)	(ft. bgs)	(L)	(L/min)	Phys. App.
· · · · · · · · · · · · · · · · · · ·	0.55	10027	7.0	3	-96.3		48.11	3		
	1,18	10251	7.0	<u> </u>	-106.1	1.06	48.18	6.	1	· · · · · · · · · · · · · · · · · · ·
129 2	-1.49	10220	7.0	5	-114.1	0.77	18.27	9	1	24
	(1.56	10153	7.0	<u> </u>		7	48.26	12	1	
	1.68	10163	7.0	6		0.53	48.23	15		
<u>38 z</u>	1.75	10110	7.0	6	-125,7	0.48		18	1	
								-		,
							·		<u>├</u>	
										<u>, </u>
										<u></u>

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

. .

MONITOR WELL NO: _____MW-20___

Monitor Well Sampling Data

Project: C	ooper Drum										
		20				Job No:	18500147.070)30	1		
Sample No(s):3	7581					SL/ <u>DG</u>			,	
					_):				
Sampling M	ethod: Direc	t from dedicate	ed tubing								
Sampling Ti	me:C	750				Ambient Te	mp. (F):				
NATER ELE	EVATION DA	TA				Product Obs:	: Y	N			
		Depth Sounder (Y N			Depth to Pro					
				~				Interface Probe	Y	N	
		(WCE)				Otner:					
	ng top as ma				-				_		
		e (DTW	46.83	f	t j	<u>Well Di</u>	ameter (in)	.:	Casing Volume	(CV)/ft (gals)	
	ng top as ma		70				2		0.16		
	ng top as ma	rked)			_	4 0.652					
•	• •	in (H)		ft		6 1.468 D CV = (23.49) x [(D/24) ²]					
(from casi	ng top as ma	rked)					CV = 3	3.14 [(D/2)/12 in.			
	GE AND SAM	IPLING DATA				Purge Meth	od:2" (Grundfos sub	mersible pum		
ingle Casin	ig Volume of	Water in Well (VW)		_gals	Purge Date	3-1-06				
-	(CV x H = V)	(∕)			-	•			_		
umber of C	asing Volum	es to Purge (NO)		_gals	Was Well P	umped Dry?	Y	N		
	e of Water to (VW x NC =	Purge (TV)			gals	Fe ² (mg/L):	0.0				
		10)									
Time	Temp (C)	Cond (umhos)	рН	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.	
0753	20.51	4713	7.48	454	229.2	7.02	47.10	3	1		
0156	2636	4769	7.49	376	208.5	5.95	47.11	6	1		
0759	21.78	4809	7.47	276	193.1	4.56	47.13	9			
5802	21.86	4821		217	182.5	4.20	47.17	12	,		
7805	21.99	4820	7.45	157	174.6	3.96	47.22	15			
⊅ <i>8</i> ô8	22.04	4808	7.45		170.8	1 A A		18	(
0811	22.03	4807	7.45	117	169.4	3.83	47.28	21	1		
0814	22.03	4803	7.44		167.0	3.66	47.29	24	1		
2551								••••••••••••••••••••••••••••••••••••••			
0828	21.83	41712	20.84	238	288.7	21.19				•.	
0832	21.96		21.97		395	19.73					
	#10-10					1-1-1-2		· · · · · · · · · · · · · · · · · · ·			
									<u> </u>		
					l			· · · · · ·		<u> </u>	
NSTRUCTIO	ONS AND CO	<u>DMMENTS</u>							7		
	pling Remark		np @ 63 fi	t					\ .		
	0.	=0,0		Collec	ched V	OC San	ple nw	-70 0	55-		
		· · · · · ·					· · · · · · · · · · · · · · · · · · ·		×		

Note: A complete list of containers and analyses used can be found in the associated sample log.	The final row of readings should list the time sampling was of	completed
and an estimate of the total valume of water removed. Water measurements should be re		

1								MONI	TOR WELL N	O: <u>MW-20B</u>
				Moni	tor We	ll Samp	ling Data	l		
Brojecti (•	5			
I		<u>) </u>				lab Nor	18500147.07			
1										<u></u>
· ·		32								
1		1/06			-					
		t from dedicate								
Sampling T	me:					Ambient Te	mp. (r)			
	EVATION DA					Product Obs:		N		
		Depth Sounder	YN				duct:		Y	N
Other:			80 - 9	90			easurement:	Interface Probe	T	N
1		(WCE)			– fi			· · · · · · · · · · · · · · · · · · ·		
(from cas	ing top as ma	arked)								
1 ' '	Water Surfac		7.43		f	<u>Well Di</u>	ameter (in)	<u>(</u>	Casing Volume (
	sing top as ma	arked)	00				2		0.163 0.652	
	sing top as ma				-		6		1.468	
	Water Colun			f	it		D		CV = (23.49) :	x [(D/24) ²]
(from cas	sing top as ma	arked)					CV =	3.14 [(D/2)/12 in.f	t] ² h (7.48 gal/cu	. Ft.)
WELL PUR	GE AND SAM	MPLING DATA				Purge Meth	od:2"	Grundfos sub	mersible pun	<u>10</u>
Single Casi		Water in Well (vw)		_gals	Purge Date	:		_	· · · · · · · · · · · · · · · · · · ·
Number of (V = H X VO) Casing Volum	W) nes to Purge (N(~)		asie	Was Well P	umped Drv?	Y	N	
Number of V	Casing Volun	ics to r urge (re			_ 90.0			•		
Total Volum	ne of Water to	Purge (TV)			gals	Fe ² (mg/L):	3.0			
	(VW x NC =	TC)								
		Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
Time	Temp (C)	(umhos)	рН	(NTU)	(mV)	(mg/L)	(ft. bgs)	(L)	(L/min)	Phys. App.
0856	2034	9490	7.32	*1000	-137.3	0.35	47.63	3	1	
0859	20.64	8486	7.33	1000	-138.5	0.34	47,53	G	$\left \right $	
0902	21.31	8491	7.33	436	-143.6	0.39	47.51	9	1	
0905	21.70	8508	231	387	-150.1	0.04	47.51	12	.1	
Ogos	22.06	8519	7.29	251	-136.9	0.68	47.52	15	.1	
0911	22.30	8516	7.28	1416	-133.6	0.46	47.53	18	` i `	
0914	22,41	8516	7.27	97	-126.2	0.39	47.53	21	I I	· · · · ·
	22.47		7.27	82			47.52		1	
	22044					-	47.52		(
		8493					47.52	30		
L,	•			<u> </u>	•				• • • • • •	······································

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks _____Pump @ 85 ft._

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

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MONITOR WELL NO: ____MW-33A

Monitor Well Sampling Data

Project: <u>C</u>						Job No:	18500147.070	30		
		/06				• • •	0 <u></u>			
		from dedicate								
Sampling 11	ne:					Amplentier	np. (r):			······································
WATER ELE		TA Depth Sounder	YN			Product Obs: Depth to Prod	Y	Ν		
Other:		Depth Counder	• •					Interface Probe	Y	N
		55 - 65				Other:				
		(WCE)		ft						
(from casi	ng top as mai	rked)	1701							
2) Depth to V	Vater Surface	e (DTW4	17.91	ft		-	umeter (in)	<u>(</u>	Casing Volume	
(from casi	ng top as mai	rked)					2		0.16	
		64.03					4		0.65 1.46	
•	ng top as mai			ft			6 D		1.40 CV = (23.49)	-
, °	ng top as mai	n (H) rked)		n				3.14 [(D/2)/12 in.f		
	ng top do ma	(100)						- <u>tv_</u> /	·	
WELL PURC	E AND SAM	PLING DATA				Purge Metho	od: <u>2" (</u>	Grundfos subr	nersible pum	ID
-	g Volume of ' (CV x H = VV	Water in Well (\	/W)		gals	Purge Date:			-	
		es to Purge (NC)	<u>.</u>	gals	Was Well P	umped Dry?	Y	Ν	
		Purge (TV)			gals	Fe ² (mg/L):	0.0			
	(VW x NC =	10)								
Time	Temp (C)	Cond (umhos)	pН	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1008	21.79	4377	7.28	574	19.6	11.55		5	1	silty
1011	21.82	4380	7.22		11.3	9.57	47.54	8	1	sitte
1014	21.96	4321	7.20		32.3	9.19	47.54	10	,	
							47.55		1	
1017	22.53				<u>33. 4</u>	5.87		14		· · · · · · · · · · · · · · · · · · ·
1024	22 00	- recall			665	7.85	41.55	21		
1024	22.89								1	
1027	22.97		7.22		<u>6305</u>		47.55	24		
1030	22.94	4392		706	45.6	7.57	47.55	27	1	·
1033	22.93	4404	7.23	534	42.0	7.50	41.55	30	1	
1036	23.11	4398	7.23	504	37.2	7.47		33	1	
					· ·					
1										

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks _____Pump @ 60 ft.

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

MONITOR WELL	NO:	MW-33B
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Monitor Well Sampling Da	N	Ionitor	Well	Sam	pling	Data
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Project:	Cooper Drum			mon		in earnp	ing Date	•		
		-33B				Job No.	10500147.07			
		-558 17584					<u>18500147.07</u>	030		
		_3/1/06								
-		t from dedicate								
		a moni dedicati								
Sampling n	<u></u>					Amplentite	mp. (F)			
		TA Depth Sounder	Y N				duct:		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	····
		80 - 90	-				easurement:		Y	N
		(WCE)		fi	- t					
(from cas	ing top as ma	irked)				.				
		e (DTW	47.70	2f	t	Well Dia	ameter (in)		Casing Volume ((CV)/ft (gals)
	ing top as ma	•					2		0.163	
· ·	th (WD): ing top as ma				_		4 6		0.652	
	• •	in (H)		ft			D		1.468 CV = (23.49) x	
	ing top as ma			n				3.14 [(D/2)/12 in.t	• •	•• / •
WELL PUR	GE AND SAM	IPLING DATA				Purge Meth	od: <u>2"</u>	Grundfos subr	nersible pum	p
Single Casir	ng Volume of	Water in Well (VW)		_gals	Purge Date:				
-	(CV x H = V)	N)			- •	-			-	
Number of C	Casing Volum	es to Purge (NC	C)		_gals	Was Well P	umped Dry?	Y	N	
Total Volum	e of Water to (VW x NC =	Purge (TV) TC)			_gals	Fe ² (mg/L):	4.0			
Time	Temp (C)	Cond (umhos)	pН	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1117	20.92	8350	7.14	515	-84.7	0.33	47.69	3	1	
120	21.38	8370	7.13	341	-104.7	0.23	47.66	G		
1123	21.61	8400	7.13			0.45		9		
1126	21.85	8424		203			47.70	•		
			7.13		-105.1			12		
1129	22.04	8454				0.32		15	·	
1132	22.26	8467	7.13	136		0.28	47.00	18	1	
135	22038	8495	7.13	117	-109.0	0.24	47.70	21	1	
138	22.35	8526	7.13	129	-110.3	0.24	47,70	24	1	
		··· · · ·						· · · · · · · · · · · ·		
							<u>`</u>		-	
			LI							

INSTRUCTIONS AND COMMENTS

Purging/Sampling Remarks _____Pump @ 85 ft._

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

2010/02/02 12:02

MONITOR WELL NO: _____EW-1

Monitor Well Sampling Data

EW-1						Job No:	18500147.070	30		
Sample No(s): 37	7585		_		Sampler(s):	SL/ <u>DG</u>			
		1/06				Reviewer(s)			Date:	
		from dedicate				Weather:				
						Ambient Ter	np. (F):			
VATER EL	EVATION DAT	<u>ГА</u>				Product Obs:	Y	N		
lethod of Me	asurement:	Depth Sounder	Y N			Depth to Prod	uct:			
						Method of Me		nterface Probe		N
					-	Other:				
-	ing Elevation ((WCE)		n			·			
) Denth to '	Water Surface	e (DTW	480	ft		Well Dia	meter (in)	(Casing Volume (CV)/ft (gals)
	ing top as mai			·			2	-	0.163	
			90.5				4		0.652	:
	ing top as mai						6		1.468	
	Water Colum ing top as mai	n (H) rked)		ft			D CV = 3	14 [(D/2)/12 in.f	CV = (23.49) x tj ² h (7.48 gal/cu.	
	<u>GE AND SAM</u>	PLING DATA				Purge Metho	od: <u>2" G</u>	rundfos subr	nersible pump	<u>) </u>
										<u></u>
ingle Casir	-	Water in Well (vw)		gals	Purge Date:			-	
lumber of (CV x H = VV) Casing Volum	V) es to Purge (NC	3)		nals	Was Well P	umped Dry?	Y	N	
	Sasing Volum	es to Fulge (NC	·)							
otal Volum	e of Water to (VW x NC =	Purge (TV)			gals	Fe ² (mg/L):	0,0			
		10)								
Time	Temp (C)	Cond (umhos)	pН	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1248			7.33	16	9.8	5.70	c18.19	3		
1251	21.73	<u>4497</u> 4508	7.30		14.1	5.50	48.20	6		
1254	22.01	4509	7.29		16.6			9		
1257	22.44	4512	7.29	21	19.4		418.20	12_		
1300	22.43	4513	7.30](18.9	5.29	48.20	15		
1303	22.41	4514	7,29		20.7	5.21	48.20	18	$\frac{1}{1}$	· .
	11001	1911	7,00	11		0.41	10.00	/ 0	<u>↓ </u>	·
105										
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MONITOR WELL NO: ____EW-1-90'__

Monitor Well	Sampling	Data
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Project:	Cooper Drum									
		1-90ft				Job No:	18500147.07	130		
		6					:SL <u>/DG</u>			· · · · · · · · · · · · · · · · · · ·
		/06								
		t from dedicat								
							mp. (F):			
							p. (i)		·······	
Method of Me Other:		Depth Sounder	_				: Y duct: easurement:	N Interface Probe	Y	N
		8.5 - 88.5			-	Other:				
11		(WCE)			ſ					
) Depth to	Water Surface	rked) e (DTW_40	11	f	н	Well Di	ameter (in)		Casing Volume	(0)()(#)(=====
(from cas	ing top as ma	rked)	t	••••••••••••••••••••••••••••••••••••••		Wenton	2		Casing volume 0.16	
	oth (WD):				_		4		0.65	
	ing top as ma	•					6		1.46	
	ing top as ma	n (H) rked)		ft			D CV - 3		CV = (23.49) ; [t] ² h (7.48 gal/cu	
							Uv = 0	. 14 [(∪/2)/12 IN.	ng n (7.48 gai/cu	. <u>FL)</u>
		PLING DATA				Purge Meth	od: <u>2" (</u>	<u>Grundfos sub</u>	mersible pum	p
ingle Casi		Water in Well (VW)		gals	Purge Date:			_	
lumber of ((CV x H = VV Casing Volume	v) es to Purge (N0	C)	a	gals		umped Dry?	Y	N	
otal Volum	e of Water to (VW x NC = ⁻	Purge (TV) TC)			gals	Fe ² (mg/L):	2.7			
Time	Temp (C)	Cond (umhos)	рН	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1213	20.95	8720	7.11	129	-58.9	0.36	48.07	3	1	
1216	21.24	8732	7.11	n	-65.6	0.31	48.00	6	L L	
1219	21.39	8744	7.11	13		0.45		9		
1222	21.57	8780	7011	10			48.00	12		
1225	21.56	8731	7.11	12		0.26		15		
1228	21.59	8728	7.11	13	-79.6		48.00	· · · · · · · · · · · · · · · · · · ·	(
	21.37	0120	78.0	13	1.0	0.00	-18.00	18		
·									┞────┤	
	1									

Purging/Sampling Remarks ____Pump @ 85 ft_

MONITOR WELL	NO:	MW-2
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Monitor Well Sampling Data

	Cooper Drun	n								
-		/W-2				Job No.				
		591):SL <u>/DG</u>			
		/06								
		ct from dedicat			-					
							emp. (F):			······································
ATER EL	EVATION DA	<u>\TA</u>				Product Obs	s: Y	N		
		Depth Sounder	Y N			Depth to Pro	oduct:			
							leasurement:	Interface Probe		N
		0-82 ft			<u> </u>	Other:				
	sing top as ma	• •			τ					
		xe (DTW	19.25	f	4	Wall D	iameter (in)		0	
	ing top as ma				•	<u>vven D</u>	2		Casing Volume 0.16	
		·			_		4		0.16	
	ing top as ma	•				ŀ	6		1.46	
	Water Colum	nn (H) arked)		ft	:		D		CV = (23.49)	x [(D/24) ²]
		IPLING DATA				Purge Meth		3.14 [(D/2)/12 in. Grundfos subi		
ngle Casi	na Volume of	Water in Well (VWI		nale		nod:	4(a		
	(CV x H = V)				_yais	Furge Date	•		_	
umber of (es to Purge (NO	C)		_gals	Was Well F	Pumped Dry?	Y	N	
otal Volum	e of Water to (VW x NC =	Purge (TV)			_gals	Fe ² (mg/L):	2.0			
	(,								
Time	Temp (C)	Cond (umhos)	рН	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
0750	19.56	10323	7.11	30	-104.0	2.67	49.57	3	1	
0753	19.63	10292	7.11	32	-1/3.1	2.64	49.57	6	1	
0756	19.70	10273	7.10	33	-117.9	2.96	49.57	٩	1	
754	19.76	10091	7.11	39	-116.3	404	49.57	12_	1	
7802	19.81	10049	7.11	35	-1180	4.03	49.57	15	1	
805	19.80	10006	7.11	32	-120.0	3.94	49.57	18	1	
							<u> </u>		┟────┤	
			1				<u>├</u> ──── <u></u>			
	DNS AND CO									

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

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Spler View

MONITOR WELL NO: _____MW-3_

Page _____ of _____

Monitor Well Sampling Data

Location No:	Project:C	ooper Drum									
sample No(s):37592 Sampler(s):SL <u>DG</u> ampling Date:3206 Reviewer(s): Date:	•		W-3			_	Job No:				
Sampling Date:							Sampler(s)	SL/DG			
Sampling Method: Direct from dedicated tubing Weather: Ambient Temp. (F): Sampling Time: Ambient Temp. (F): Ambient Temp. (F): MATER ELEVATION DATA Product Obe: Y N Aethod of Measurement: Depth to Product: N Depth to Product: N Depth to Water Surface (DTW $4G$. 35 ft Method of Measurement: Interface Probe Y N Depth to Water Surface (DTW $4G$. 35 ft Method of Measurement: Interface Probe Y N Differ:		-					-				
Sampling Time: Ambient Temp. (F): WATER ELEVATION DATA dethod of Measurement: Depth Sounder Y N Depth Values Ambient Temp. (F): WATER ELEVATION DATA dethod of Measurement: Depth Sounder Y N Depth Values N Depth Values Streened Interval: 52-73.5 ft (from casing top as marked) N Depth Values Differ: Method of Measurement: Interface Probe Y N Depth Values (from casing top as marked)	• •								•		
Implete do Measurement:Depth Sounder Y N There.Uhere.Depth Sounder Y N Uthere.Uhere.Depth to Product:Method of Measurement:Interface ProbeStreened Interval: $52.73.5 \text{ ft}$ U) Well Casing Elevation (WCE)ft(from casing top as marked)ftDopth to Water Surface (DV) $4G.36$ (from casing top as marked)ft(from casing top as marked)20) Well Depth (WD):ft(from casing top as marked)6(from casing top as marked)ft(from casing top as marked)ftVELL PURGE AND SAMPLING DATAPurge Method:Single Casing Volume of Water in Well (VW)gals(CV X H = VW)galsVurber of Casing Volumes to Purge (NC)gals(WW x NC = TC)galsTimeTemp (C)(untos)pH(NTU)(mV)(mV)(mgL)(114/8)20.371135221.2513737.482.6-57431.9448.2015521.2513737.482.6-57431.9448.2015521.2513697.46115421.0313697.461154<											· · · · · ·
tethod of Measurement: Depth Sounder Y N Depth of Measurement: Depth Sounder Y N Depth of Measurement: Depth of Measurement: Interface Probe Y N Other:	VATER ELE		TA				Product Obs	Y	N		
Since and interval: <u>52-73.5 ft</u> Other:				Y N			Depth to Pro	duct:		w.	for an and
) Well Casing Elevation (WCE)ft (from casing top as marked)) Depth to Water Surface (DTW <u>46.55</u> ft (from casing top as marked)) Well Depth (WD): (from casing top as marked)ft 2 0.163 4 0.652 6 1.468 D CV = (23.49) x((D/24) ²] CV = 3.14 ((D/2)/12 in.ft] ² h (7.48 gal/cu. Ft.) VELL PURGE AND SAMPLING DATA Single Casing Volume of Water in Well (VW) gals (CV x H = W) Number of Casing Volumes to Purge (NC) gals (CV x H = W) Number of Casing Volumes to Purge (NC) gals Time Temp (C) (umhos) pH (NTU) (mV) (mV) (m2) (ft. bgs) (L) (L/min) Phys. App. 114'8 20.37 [38'9 7.52 3.7'' 3.4' 9 115'5 21.25 137'3 7.4'8 2.26 7.5''.3 1.94' 48.20 0.55 3.0 115'6 21.22 [3 70 7.4'6 1] -52.3 1.7'' 48.20 0.55 3.0 115'6 21.22 [3 70 7.4'6 1] -52.3 1.7'' 48.20 0.55 4.5' 115'6 21.03 [36'9 7.52 1'' -4''8.6 [.96 4.5' 1.5' 1.5' 115'6 21.03 [36'9 7.52 1'' -4''8.6 [.96 4.5' 1.5' 1.5' 1.5' 115'6 21.03 [36'9 7.52 1'' -4''8.6 [.96 4.5' 1.5' 1.5' 1.5' 115'6 21.03 [36'9 7.52 1'' -4''8.6 [.96 4.5' 1.5' 1.5' 1.5' 1.5' 1.5' 1.5' 1.5' 1	/ther:			-			Method of M	easurement:	Interface Probe	Y	N
Well Diameter (in) Casing Volume (CV)/ft (gals) (from casing top as marked) 0 0 Depth to Water Surface (DTWG.3 ft (from casing top as marked) 0 0 Well Deim(WD): 0 (from casing top as marked) 1468 0 Well Deim(WD): 1468 0 Well Deim(WD): 0 (from casing top as marked) ft 1 Well Deim(WD): 1468 0 CV = (23.49) x [(D/2/12] int[⁺ h (7.48 gal/cu, Ft)] VELL PURGE AND SAMPELING DATA Purge Method: (CV x H = VW) gals Iumber of Casing Volume of Water in Well (VW) gals (CV x H = VW) gals Vurge Date: 0 (VW x NC = TC) gals Time Temp (C) gals Time Temp (C) (mHos) 114 § 20.37 13.84 2.12.25 13.73 7.4/8 2.6 "5443 1.94 115 5 21.225 13.73 115 2 2.25 7.446 115 2 1.369 7.42 115 2 <t< td=""><td></td><td></td><td></td><td></td><td></td><td>-</td><td>Other:</td><td></td><td></td><td></td><td></td></t<>						-	Other:				
) Depth to Water Surface (DTW <u>46.36</u> ft (from casing top as marked)) Well Depth (WD):	•	+			ft						
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $				c 3C	а					Ossiss Mature (010/61/0-010
Well Depth (WD): 4 0.652 (from casing top as marked) 1.468 1.468) Height of Water Column (H) ft 0 CV = (22.49) × [(D/24) ²] (from casing top as marked) V CV = (22.49) × [(D/24) ²] CV = (22.49) × [(D/24) ²] //ELL PURGE AND SAMPLING DATA Purge Method: 2" Grundfoe submersible pump: Water Column (H) //ELL PURGE AND SAMPLING DATA gals Purge Method: 2" Grundfoe submersible pump: Water Column: //ELL PURGE AND SAMPLING DATA gals Purge Method: 2" Grundfoe submersible pump: Water Column: //ELL PURGE AND SAMPLING DATA gals Purge Date:				2.35	π		<u>weil Di</u>		-	_	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	•		-								
Height of Water Column (H)ft ft D $CV = (23.49) \times [(D/24)^2]$ (from casing top as marked) VELL PURGE AND SAMPLING DATA Purge Method:Grundfee submersible pump- Water (Market Column) VELL PURGE AND SAMPLING DATA Purge Method:Grundfee submersible pump- Water (Market Column) gals Single Casing Volume of Water in Well (VW) gals gals Purge Date: (CV x H = VW) gals Purge Date: (CV x H = VW) gals Fe² (mg/L): (VW x NC = TC) gals Fe² (mg/L): Time Temp (C) (umhos) pH (NTU) (mV) (NTU) (mV) (mg/L) (ft. bgs) (L) 112/8 20.37 1389 7.52 3.449		· · –				-		-			
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	•	• •			ft			-			
Single Casing Volume of Water in Well (VW)gals Purge Date: (CV x H = VW) gals Was Well Pumped Dry? Y N iumber of Casing Volumes to Purge (NC)gals Fe ² (mg/L): $D_1 J_2$ N iotal Volume of Water to Purge (TV)gals Fe ² (mg/L): $D_1 J_2$ Observations Time Temp (C) (umhos) pH (NTU) (mV) (mg/L) (ft. bgs) (L) (L/min) Phys. App. 114/8 20.377 1389 7.52 3.449 3.449 $ -$									3.14 [(D/2)/12 in.	• •	
$\begin{array}{c} (CV \times H = VW) \\ lumber of Casing Volumes to Purge (NC)gals Was Well Pumped Dn? Y N \\ \text{otal Volume of Water to Purge (TV)gals Fe2 (mg/L): 0 \cdot 2 (VW × NC = TC) \\ \hline \\ $	ELL PURC	E AND SAM	IPLING DATA				Purge Meth	od: <u>2"</u>	<u>Grundfes sub</u>	mersible pum	Watera
Iumber of Casing Volumes to Purge (NC)gals Was Well Pumped Dry? Y N otal Volume of Water to Purge (TV)gals $Fe^2 (mg/L)$: $D_1 J_2$ (VW x NC = TC) $Fe^2 (mg/L)$: $D_1 J_2$ Time Temp (C) $(umhos)$ pH (NTU) (mV) $D.O.$ Water Level Removed Flow Rate Observations 114/8 20.37 1389 7.52 3.449 (L) (L/min) Phys. App. 114/8 20.37 1389 7.52 3.449 $S.49$ (L) (L/min) Phys. App. 115 21.25 1373 7.418 2.6 -574.3 1.44 48.19 0.554 1.55 1156 21.22 (13.70) 7.46 11 -52.3 $i.744$ 48.20 0.55 3.0 1154 21.03 (1369) 7.46 11 -53.2 1.51 418.22 0.55 $6_0 O$ 1202 20.77 1369 7.46 10 -53.2 1.51 418.24 0.55 7.5				VW)		gals	Purge Date	:			
$ (VW \times NC = TC) $ $ \begin{array}{c c c c c c c c c c c c c c c c c c c $		•	,	>)		gals	Was Well F	umped Dry?	Y	N	
$ (VW \times NC = TC) $ $ \begin{array}{c c c c c c c c c c c c c c c c c c c $							3	A 7			
TimeTemp (C)(umhos)pH(NTU)(mV)(mg/L)(ft. bgs)(L)(L/min)Phys. App.114820.3713897.52 $\overline{3.49}$ $\overline{3.49}$ $\overline{-900}$ $$						gals	Fe ² (mg/L):	UIF		· .	
1148 20.37 1389 7.52 3.49 3.49 3.49 i - stop purge to reposition pump - 1 1.55 21.25 1373 7.48 2.6 -54.3 1.94 48.19 0.54 1.5 1155 21.25 1373 7.48 2.6 -54.3 1.94 48.19 0.54 1.5 1156 21.22 1370 7.46 11 -52.3 1.74 48.20 0.55 3.0 1154 21.03 1369 7.52 11 -48.6 1.96 21.22 0.55 6_{00} 1154 21.03 1369 7.52 11 -48.6 1.96 21.22 0.55 6_{00} 1202 20.77 1369 7.46 10 -53.2 1.51 48.22 0.55 6_{00} 1205 20.72 1369 7.46 10 55.3 2.30 48.24 0.5 7.5			Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
1148 20.37 1389 1.52 3.449 3.449 3.449 i - stop punge to reposition pump -	Time	Temp (C)	(umhos)	pH	(NTU)		(mg/L)	(ft. bgs)	<u>(L)</u>	(L/min)	Phys. App.
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	1148	20.37	1389	7.52			3.49				MI
1155 21.25 1373 7.48 2.6 -54.3 1.94 48.19 0.54 1.5 1156 21.22 1370 7.46 11 -52.3 1.74 48.20 0.55 3.0 1159 21.03 1369 7.52 11 -48.6 1.96 48.10 0.55 4.5 1202 20.77 1369 7.46 10 -53.2 1.51 48.22 0.55 6_00 1205 20.72 1369 7.46 11 -55.3 2.30 48.24 0.5 7.5	Î	- sto	o purget	O re	positio	n our	2-				
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	1155			1 1				48.19	0.56	1.5	
1202 20.77 1369 7.46 10 -53.2 1.51 48.22 0.5 6.0 1205 20.72 1369 7.46 11 -55.3 2.30 48.24 0.5 7.5	1156	21.22	1370	7.46	11	- 52.3	1.74	48.20	0.5	3.0	
1205 20.72 1369 7.46 11 -55.3 2.30 48.24 0.5 7.5	1159	21.03	1369	7.52	1/	-48.6	1.96	4820	0.5	4.5	
	1202	20.77	1369	7.46	10	-53.2	1.51	418.22	0.5	6.0	
1208 21.07 1370 7.45 10 -596 1.15 48.24 0.5 9.0			1369	7.46	Ц	-55.3	2.30	· · · · · · · · · · · · · · · · · · ·	0.5	7.5	
Image: Sector	1208	21.07	1370	7.45	10	- 59.6	1.15	48.24	0.5	9.0	
Image: Second										<u> </u>	
					·						
										┼───┼	
				L							

Purging/Sampling Remarks _____

___Pump at 65 ft____

MONITOR \	NELL	NO:	MW-21
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N	1	onitor	Well	Sam	plina	Data
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roject:	Cooper Drun	L								
ocation No	o:N	IW-21	·····			Job No:				
		93								
ampling C)ate:3/2/	06			-			:		·····
		t from dedicat								
ampling T	ime:									
ATER EL	EVATION DA	TA				Product Obs	: Y	N		
		Depth Sounder	Y N				duct:			
							easurement:	Interface Probe	Y	Ν
		<u>5-75 ft</u> (WCE)		f	<u>-</u>	Other:				
	sing top as ma	• •		······································	·					
		e (DTW_ <u>4</u> 4	8.42	f	t	Well Di	ameter (in)	<u> </u>	Casing Volume	(CV)/ft (nais)
	ing top as ma						2		0.16	
					_		4		0.65	2
	ing top as ma Water Colum	rked) in (H)		. 4			6		1.46	
	ing top as ma			1			D CV =	3.14 [(D/2)/12 in.	CV = (23.49) ftl ² h (7.48 gal/c)	
						<u> </u>				
ELL PUR	<u>GE AND SAM</u>	IPLING DATA				Purge Meth	od: 2 "	Grundfos sub	mysible pum	D tubik
	na Volumo -f	Motor in Mall (1.040						1/21	D tubergy
iyie Casil	ng volume of (CV x H = V)	Water in Well (N)	vvv)		_gals	Purge Date	:		(-	
mber of (es to Purge (N	C)		cals	Was Well P	umped Dry?	Y	N ·	
					-					
al Volum	e of Water to (VW x NC =	Purge (TV) TC)			gals	Fe ² (mg/L):	1.0			
		, A ,								
Time	Temp (C)	Cond (umhos)	рH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations
040	20.23	8446	7.07		-100-8			3		Phys. App.
1043	20.35	8382	7.05	53	-107.1	0.50	48.46	6		
1046	20.36	8332	7.06			0.51	48.47	9	1	
1049		8329	7.06	36	-120.3	0.28	48.47	12	1	
1052	20.53	92-92-1	7.05	36	-121.0	0.37	48.47	15		
1055	20.48	8279	7.05	40		0.36	48.47	18	1	
		· · · · · ·					10.7		╞┈──┤	
			<u>├</u> ───┤						┞────┤	
	T				ala di seconda di se Seconda di seconda di se					
									┟────┤	
		······································							┟────┤	
<u>I</u>	··L									
STRUCTIC	ONS AND CO									
		s								

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Section of the

Mer.

MONITOR WELL NO: ____EW-2_

Monitor Well	Sam	pling	Data
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	Cooper Drum									
		W-2			-	Job No:				
		94				Sampler(s):	SL/DG		_	
Sampling D	ate:3/2/	06				Reviewer(s):		Date:	
Sampling M	ethod: Direc	t from dedicate	ed tubing							
	EVATION DA					Product Obs:	Y	N		
		Depth Sounder	Y N				duct:			
	tonyal: 3	8.5-78.5 ft				Method of Me Other:	easurement:	Interface Probe	Y	N
		(WCE)			_ !					
(from cas	ing top as ma	rked)				L				
2) Depth to	Water Surfac	e (DTW	18.15	fi	t	Well Di	ameter (in)	<u>(</u>	Casing Volume	(CV)/ft (gals)
	ing top as ma						2		0.16	3
	th (WD):				-		4		0.65	
	ing top as ma Water Colur	arked) an (H)		ft			6 D		1.46 CV - (22.40)	
	ing top as ma			n				3.14 [(D/2)/12 in.f	CV = (23.49) il ² h (7.48 gal/ci	
、										. 1
WELL PUR	GE AND SAN	IPLING DATA				Purge Meth	od: _2"-	Grundfos sub l	tersible pum	p-Watzrq
Single Casir	-	Water in Well (VW)		_gals	Purge Date:	·			
Number of (CV x H = V) Casing Volum	W) es to Purge (N0	<u>.</u> }		ale	Was Wall P	umped Dry?	Y	N	
	Jasing Volum	es to i uige (ive			gais				1.	
Total Volum	e of Water to (VW x NC =	Purge (TV) TC)			gals	Fe ² (mg/L):	0,0			
		. .								
Time	Tomp (C)	Cond	~U	Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
Time	Temp (C)	(umhos)	pH	(NTU)	(mV)	(mg/L)	(ft. bgs)	(L) ?	(L/min)	Phys. App.
<u>0903</u> 0906		<u>5848</u> 5852	7.24	44		0.83	48.69	6	31	
	20.31		7.24				48.70			
0909	20.26	5842	7.24	53	-262.1	0.55	48.70	9	(· · · · · · · · · · · · · · · · · · ·
0912	20.29	5846	7.24	41	-264.9	0.45	48.70	12	1	
0915	20.30	5842	7.24	40	-27.4	0.45	48.70	15	(
0918	20.33	5844	7.23	38	-280.3	0.40	48.70	13	1	
	•									
										· · · · · · · · · · · · · · · · · · ·
			╉──┤			 				
			<u> </u>							
										······
	L		L _ l				· · · · ·			· · · · ·
INSTRUCTI	UNS AND CO	<u>JIVIIVIEIN I S</u>								
		ks		P	ump at 65 f	ít				

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

								MON		NO: <u>MW</u>	-33A
				Monit	tor We	il Sampl	ing Data	a			· .
roject:	Cooper Drum						, -				
•						Job No:	18500147 07	030			
		596				Sampler(s):				·	
-		4/5/06							 Date:	· · · · · ·	
		t from dedicate									·
ampling 11	ime:					Ambient ren	np. (r.)				<u> </u>
VATER EL	EVATION DA	ТА	_			Product Obs:	Y	N	<u> </u>		···
ethod of Me	easurement:	Depth Sounder	У́ N			Depth to Prod	uct:				
ther:			-			Method of Me		Interface Probe	Y	۰.	Ν
	nterval:			ft		Other:					2
•	sing Elevation sing top as ma			n							
•	Water Surface		47. 46	ft		Well Dia	imeter (in)		Casing Volume	(CV)/ft (gals)	<u> </u>
	sing top as ma	irked)					2		0.16		
	oth (WD):		2.71				4		0.65		• • •
	sing top as ma			. م			6		1.46	-	
	f Water Colum sing top as ma	nn (H)		ft			D CV=	3.14 [(D/2)/12 in	CV = (23.49) ftl ² h (7.48 gal/c		
					-			Grundfos sub Watera 06			
		Purge (TV) TC) Cond		Turbidity	gals	Was Well Pr Fe ² (mg/L): _	M/M Water Level	Y	N 	-	ervations
otal Volum	ne of Water to	Purge (TV) TC)		Turbidity (NTU)	gals	Fe ² (mg/L): _ D.O. 	NM	Y	- Flow Rate (L/min)	-	ervations /s. App.
otal Volum	ne of Water to (VW x NC =	Purge (TV) TC) Cond		Turbidity	gals	Fe ² (mg/L): _	M/M Water Level	Y	- Flow Rate	-	
Time	ne of Water to (VW x NC = Temp (C)	Purge (TV) TC) Cond		Turbidity (NTU) 255 439	ORP (mV) 167.7	Fe ² (mg/L): D.O. (mg/L) [0.38 (1.10	N/M Water Level (ft. bgs) 47.49	Y Removed (L) 7 6 12	- Flow Rate (L/min)	-	
Time	ne of Water to (VW x NC = Temp (C) 20.89 21.44	Purge (TV) TC) Cond (umhos) 4495 4505	₽H 5.5 5.5	Turbidity (NTU) 255 439	ORP (mV) 167.7	Fe ² (mg/L): D.O. (mg/L) [0.38 (1.10	N/M Water Level (ft. bgs) 47.49	Y Removed (L) 7 6 12	- Flow Rate (L/min)	-	
Time 1102 1105 1108	ne of Water to (VW x NC = Temp (C) 20.89 21.44 21.20	Purge (TV) TC) Cond (umhos) 4495 4505 4505	₽H 5.5 5.5 5.5	Turbidity (NTU) 255 439 300	orp (mV) 167.7 174.3	Fe ² (mg/L): D.O. (mg/L) 10.88 11.10 11.24	N/M Water Level (ft. bgs) 47.49 47.49 47.49	Y Removed (L) 7 6 72 7 8	- Flow Rate (L/min)	-	
Time 1102 1105 1108	ne of Water to (VW x NC = Temp (C) 20.89 21.44	Purge (TV) TC) Cond (umhos) 4495 4505	₽H 5.5 5.5	Turbidity (NTU) 255 439	orp (mV) 167.7 174.3	Fe ² (mg/L): D.O. (mg/L) [0.38 (1.10	N/M Water Level (ft. bgs) 47.49	Y Removed (L) 7 6 12 18	Flow Rate (L/min)	-	
Time 1102 1105 1108	ne of Water to (VW x NC = Temp (C) 21.444 21.44 21.20 21.18	Purge (TV) TC) Cond (umhos) 4495 4505 4505 4519 4516	PH 5.5 5.5 5.5 5.7	Turbidity (NTU) 255 439 300 183	gals ORP (mV) 167.7 174.3 178.2 179.1	Fe ² (mg/L): D.O. (mg/L) /0.3 /1.10 //.2 //.1	N/M Water Level (ft. bgs) 47.49 47.49 47.49 47.49	Y Removed (L) 7 6 72 7 8 7 8 7 8 7 8 7 8 7 8 7 7	Flow Rate (L/min)	-	
Time 1/02- 1/05- 1/08 1/11	ne of Water to (VW x NC = Temp (C) 21.444 21.44 21.20 21.18	Purge (TV) TC) Cond (umhos) 4495 4505 4505 4519 4516	PH 5.5 5.5 5.5 5.7	Turbidity (NTU) 255 439 300	orp (mV) 167.7 174.3	Fe ² (mg/L): D.O. (mg/L) /0.3 /1.10 //.2 //.1	N/M Water Level (ft. bgs) 47.49 47.49 47.49 47.49	Y Removed (L) 76 72 78 24 27	Flow Rate (L/min)	-	
Time 1102 1108 1111 1454	the of Water to $(VW \times NC =$ Temp (C) 10.89 21.44 1.20 1.18 20.85	Purge (TV) TC) Cond (umhos) 4495 4505 4505 4519 4516 4516 4516	pH <u>5.5</u> 5.5 5.7 7,4	Turbidity (NTU) 255 439 300 183 71000	orp (mV) 167.7 174.3 178.2 178.2 178.5	Fe ² (mg/L): D.O. (mg/L) 10.88 11.10 11.24 11.11	N/M Water Level (ft. bgs) 47.49 47.49 47.49 47.49	Y Removed (L) 76 72 78 24 27	Flow Rate (L/min)	-	
Time <u>1102</u> <u>1108</u> <u>1108</u> <u>1111</u> <u>1454</u> <u>1454</u>	Temp (C) 10.89 21.44 21.20 21.78 21.78 21.85 21.04	Purge (TV) TC) Cond (umhos) 4495 4505 4505 4516 4516 4516 4516	PH <u>5.5</u> <u>5.5</u> <u>5.7</u> <u>7.4</u> <u>7.2</u>	Turbidity (NTU) 255 439 300 183 71000 71000 71990	gals ORP (mV) 167.7 174.3 174.3 174.3 174.3 174.5 57.5	Fe ² (mg/L): D.O. (mg/L) 10.88 11.10 11.24 11.11 17.37 16.69	N/M Water Level (ft. bgs) 47.49 47.49 47.49 47.49 47.49 47.49 47.49	Y Removed (L) 76 72 76 73 77 30	Flow Rate (L/min)	-	
Time 1/02 1/05 1/08 1/11 1/54 1/50	the of Water to $(VW \times NC =$ Temp (C) 20.89 21.44 21.44 21.20 21.18 20.85 21.04 31.08	Purge (TV) TC) Cond (umhos) 4495 4505 4505 4519 4516 4516 	PH <i>S.S</i> <i>S.S</i> <i>S.S</i> <i>S.7</i> <i>7.4</i> <i>7.0</i>	Turbidity (NTU) 255 439 300 1E3 71000 71000	gals ORP (mV) 167.7 174.3 174.3 174.3 174.1 37.5 51.5 60.5	Fe ² (mg/L): D.O. (mg/L) 10.88 11.10 11.24 11.11 17.37 16.69 15.38	N/M Water Level (ft. bgs) 47.49 47.49 47.49 47.49 47.49 47.49 47.49	Y Removed (L) 7 6 72 7 7 30 33	Flow Rate (L/min)	-	
Time <i>I102_</i> <i>I105</i> <i>I108</i> <i>I111</i> <i>I111</i> <i>I1500</i>	Temp (C) 10.89 21.44 21.20 21.78 21.78 21.85 21.04	Purge (TV) TC) Cond (umhos) 4495 4505 4505 4516 4516 4516 4516	PH <u>5.5</u> <u>5.5</u> <u>5.7</u> <u>7.4</u> <u>7.2</u>	Turbidity (NTU) 255 439 300 183 71000 71000 71990	gals ORP (mV) 167.7 174.3 174.3 174.3 174.1 37.5 51.5 60.5	Fe ² (mg/L): D.O. (mg/L) 10.88 11.10 11.24 11.11 17.37 16.69	N/M Water Level (ft. bgs) 47.49 47.49 47.49 47.49 47.49 47.49 47.49	Y Removed (L) 76 72 76 73 77 30	Flow Rate (L/min)	-	
Time 1/02- 1/05- 1/08 1/11 1/54 1/57 1/500	the of Water to $(VW \times NC =$ Temp (C) 20.89 21.44 21.44 21.20 21.18 20.85 21.04 31.08	Purge (TV) TC) Cond (umhos) 4495 4505 4505 4519 4516 4516 	PH <i>S.S</i> <i>S.S</i> <i>S.S</i> <i>S.7</i> <i>7.4</i> <i>7.0</i>	Turbidity (NTU) 255 439 300 1E3 71000 71000	gals ORP (mV) 167.7 174.3 174.3 174.3 174.1 37.5 51.5 60.5	Fe ² (mg/L): D.O. (mg/L) 10.88 11.10 11.24 11.11 17.37 16.69 15.38	N/M Water Level (ft. bgs) 47.49 47.49 47.49 47.49 47.49 47.49 47.49	Y Removed (L) 7 6 72 7 7 30 33	Flow Rate (L/min)	-	
Time 1/02 1/05 1/08 1/11 1/54 1/50	the of Water to $(VW \times NC =$ Temp (C) 20.89 21.44 21.44 21.20 21.18 20.85 21.04 31.08	Purge (TV) TC) Cond (umhos) 4495 4505 4505 4519 4516 4516 	PH <i>S.S</i> <i>S.S</i> <i>S.S</i> <i>S.7</i> <i>7.4</i> <i>7.0</i>	Turbidity (NTU) 255 439 300 1E3 71000 71000	gals ORP (mV) 167.7 174.3 174.3 174.3 174.1 37.5 51.5 60.5	Fe ² (mg/L): D.O. (mg/L) 10.88 11.10 11.24 11.11 17.37 16.69 15.38	N/M Water Level (ft. bgs) 47.49 47.49 47.49 47.49 47.49 47.49 47.49	Y Removed (L) 7 6 72 7 7 30 33	Flow Rate (L/min)	-	
Time 1/02 1/05 1/08 1/11 1/454 1/454 1/500	the of Water to $(VW \times NC =$ Temp (C) 20.89 21.44 21.44 21.20 21.18 20.85 21.04 31.08	Purge (TV) TC) Cond (umhos) 4495 4505 4505 4519 4516 4516 	PH <i>S.S</i> <i>S.S</i> <i>S.S</i> <i>S.7</i> <i>7.4</i> <i>7.0</i>	Turbidity (NTU) 255 439 300 1E3 71000 71000	gals ORP (mV) 167.7 174.3 174.3 174.3 174.1 37.5 51.5 60.5	Fe ² (mg/L): D.O. (mg/L) 10.88 11.10 11.24 11.11 17.37 16.69 15.38	N/M Water Level (ft. bgs) 47.49 47.49 47.49 47.49 47.49 47.49 47.49	Y Removed (L) 7 6 72 7 7 30 33	Flow Rate (L/min)	-	
Time 1102 1108 1111 1454	the of Water to $(VW \times NC =$ Temp (C) 20.89 21.44 21.44 21.20 21.18 20.85 21.04 31.08	Purge (TV) TC) Cond (umhos) 4495 4505 4505 4519 4516 4516 	PH <i>S.S</i> <i>S.S</i> <i>S.S</i> <i>S.7</i> <i>7.4</i> <i>7.0</i>	Turbidity (NTU) 255 439 300 1E3 71000 71000	gals ORP (mV) 167.7 174.3 174.3 174.3 174.1 37.5 51.5 60.5	Fe ² (mg/L): D.O. (mg/L) 10.88 11.10 11.24 11.11 17.37 16.69 15.38	N/M Water Level (ft. bgs) 47.49 47.49 47.49 47.49 47.49 47.49 47.49	Y Removed (L) 7 6 72 7 7 30 33	Flow Rate (L/min)	-	
Time 1/02 1/05 1/08 1/11 1/454 1/454 1/500	the of Water to $(VW \times NC =$ Temp (C) 20.89 21.44 21.44 21.20 21.18 20.85 21.04 31.08	Purge (TV) TC) Cond (umhos) 4495 4505 4505 4519 4516 4516 	PH <i>S.S</i> <i>S.S</i> <i>S.S</i> <i>S.7</i> <i>7.4</i> <i>7.0</i>	Turbidity (NTU) 255 439 300 1E3 71000 71000	gals ORP (mV) 167.7 174.3 174.3 174.3 174.1 37.5 51.5 60.5	Fe ² (mg/L): D.O. (mg/L) 10.88 11.10 11.24 11.11 17.37 16.69 15.38	N/M Water Level (ft. bgs) 47.49 47.49 47.49 47.49 47.49 47.49 47.49	Y Removed (L) 7 6 72 7 7 30 33	Flow Rate (L/min)	-	
Time 1/02 1/05 1/08 1/11 1/454 1/454 1/500	the of Water to $(VW \times NC =$ Temp (C) 20.89 21.44 21.44 21.20 21.18 20.85 21.04 31.08	Purge (TV) TC) Cond (umhos) 4495 4505 4505 4519 4516 4516 	PH <i>S.S</i> <i>S.S</i> <i>S.S</i> <i>S.7</i> <i>7.4</i> <i>7.0</i>	Turbidity (NTU) 255 439 300 183 71000 71000 71000 71000	gals ORP (mV) 167.7 174.3 174.3 174.3 174.1 37.5 51.5 60.5	Fe ² (mg/L): D.O. (mg/L) 10.88 11.10 11.24 11.11 17.37 16.69 15.38	N/M Water Level (ft. bgs) 47.49 47.49 47.49 47.49 47.49 47.49 47.49	Y Removed (L) 7 6 72 7 7 30 33	Flow Rate (L/min)	-	

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								MON	ITOR WELL N	0: <u>MW-33B</u>	
				Moni	tor We	II Samp	ling Data				
Project C	ooper Drum										
		33B			<u>.</u> .	Job No:	18500147.070	30			
		7		••			SL/ <u>DG</u>				
		06):				
		t from dedicate		-	-		··				-
		t nom dedicate					mp. (F):				
				<u></u>							
	EVATION DA		3			Product Obs:		N		···· .	
		Depth Sounder	У N				duct: easurement:		~	N	
Screened in	iterval:	80 - 90	-				easurement.			1N -	
	ing Elevation			f	- t		-				
(from cas	ing top as ma	rked)		*		B					
2) Depth to	Water Surfac	e (DTW	<u>47.16</u>	f	t	Well Di	ameter (in)		Casing Volume (CV)/ft (gals)	
-	ing top as ma	irked)	- in				2		0.163		
	oth (WD):		5.40		-	1	4		0.652		
	ing top as ma	urked) 1n (H)		а			6 D		1.468 CV = (23.49) >		
	ing top as ma			IL				3.14 ((D/2)/12 in.)	(7.48 gal/cu		
(110111-000	ing top do mo	intou)				L					
WELL PUR	GE AND SAM	IPLING DATA				Purge Meth	od:2" (Grundfos sub	nersible pum	p	: ,;
							. <u></u>			·	
Single Casi		Water in Well (∨W)		_gals	Purge Date	· · · · · · · · · · · · · · · · · · ·		-		
Number of (CV x H = V)	vv) les to Purge (NC			asie	Was Wall F	umped Dry?	Y	N		
	casing volum	les to Fuige (NC	·)		_gais		· · /	- '			
Total Volum	ne of Water to	Purge (TV)			_gals	Fe ² (mg/L):	<u> </u>				
	(VW x NC =						-				
		. ·		.		P 0	14/-1			o	
Time	Tomp (C)	Cond	-	Turbidity		D.O.	Water Level	Removed	Flow Rate (L/min)	Observatio Phys. Ap	
Time		(umhos)		(NTU) 07	(mV)	(mg/L)	(ft. bgs)	(L) 2		Filys. Ap	<u>p.</u>
1212	20.30	8086	6.5	87	-46-7			3			
1215	20.77		6.5	98	- <i>14. L</i>	6.23	47.33	6			
1218	21.01	8273	6.5	109	-87.5	0,55	47.43	9			
1221	21.19	8302		142	-920		4743	12			
	21.21	8350		116		_	47.43	15			
						0.17	4 7.17		┼┦ ──┤	·	
1227	21.40	8350	6.5	91	-98.8	0,32	47.83	18			<u> </u>
									-		
				<u> </u>	+	1					
	<u> </u>						<u> </u>				. <u> </u>
			<u> </u>		ļ		ļ	· · · · ·			
								. <u></u>			
										1	
, ¹	- 1 ,	I	_	1							
	IONS AND C										
Purging/Sa	mpling Remai	rksPum	p @ 85 ft	•		·····					
				· · ·							.

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Monitor	Well Sa	mpling Data
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	o: FW-1	1-53'				Job No:	18500147.070	30		
Sample No		501			-					
		/5/06							Date:	
		t from dedicat			_					
VATER EI	LEVATION DA	TA				Product Obs	Y	N		
		Depth Sounder	γ N				duct:	-		
			_				easurement:		Y	N
					_	Other:		·····		
	-	(WCE)		f	t					
	sing top as ma			-						
		xe (DTW	····	f	τ	<u>Well Di</u>	ameter (in)		Casing Volume (C	
	sing top as ma oth (WD)	arkeo)	82				2 4		0.163	
	sing top as ma		<u> </u>				4 6		0.652 1.468	
	+ -	nn (H)		ft			D		CV = (23.49) x	
	sing top as ma	. ,						.14 [(D/2)/12 in.	ft] ² h (7.48 gal/cu.	
VELL PUF	RGE AND SAM	<u>MPLING DATA</u>				Purge Meth	od:2" (arundfos sub	mersible pump)
Single Cas	ing Volume of	Water in Well ((VW)		_gals	Purge Date		·····	_	
	(CV x H = V	,								
lumber of	Casing Volum	nes to Purge (No	C)		gals	Was Well P	umped Dry?	Y	Ν	
otal Volun	ne of Water to (VW x NC =	Purge (TV) TC)			_gals	Fe ² (mg/L):	0.0	2		
		Cond		Turbidity	ORP	D.O.	Water Level	Demound		
Time	Temp (C)	(umhos)	pH.	(NTU)	(mv)	(ma/L)		Removed (L)	Flow Rate (L/min)	Observations Phys App
-			1/0	(NTU)	(mV)	(mg/L)	(ft. bgs)	(L)	(L/min)	Observations Phys. App.
1409	2.1.26	(umhos) 4349 4330	6.9	11	523	11.89		(L) 3		
1409		4349	1/0		52.3 57.2				(L/min)	
1409 1412	21.26	4349 4330	6.9	 0 0	52.3 57.2 54.5	11.89 12.43 12.51	(ft. bgs) 47.97 47.97 47.97	(L) 3	(L/min)	
1409 1412 1415 1418	2.1 .26 21.60 21.80 21.79	4349 4330 4326	6.9 6.9 6.9	 0	523 57.2 64.5	11.89 12.43	(ft. bgs) 47.97 47.97 47.97 47.97 47.97	(L) 3 6 9	(L/min)	
1409 1412 1415 1418	2.1.26 21.60 21.80	4349 4330 4326 4322	6.9 6.9 6.9 6.9 6.9	 0 0	52.3 57.2 64.5 68.6	11.89 12.43 12.51 12.52	(ft. bgs) 47.97 47.97 47.97	(L) 3 6 9 12	(L/min)	
1409 1412 1415 1418	2.1 .26 21.60 21.80 21.79	4349 4330 4326 4322	6.9 6.9 6.9 6.9 6.9	 0 0	52.3 57.2 64.5 68.6	11.89 12.43 12.51 12.52	(ft. bgs) 47.97 47.97 47.97 47.97 47.97	(L) 3 6 9 12	(L/min)	
1409 1412 1415 1418	2.1 .26 21.60 21.80 21.79	4349 4330 4326 4322	6.9 6.9 6.9 6.9 6.9	 0 0	52.3 57.2 64.5 68.6	11.89 12.43 12.51 12.52	(ft. bgs) 47.97 47.97 47.97 47.97 47.97	(L) 3 6 9 12	(L/min)	
1409 1412 1415 1418	2.1 .26 21.60 21.80 21.79	4349 4330 4326 4322	6.9 6.9 6.9 6.9 6.9	 0 0	52.3 57.2 64.5 68.6	11.89 12.43 12.51 12.52	(ft. bgs) 47.97 47.97 47.97 47.97 47.97	(L) 3 6 9 12	(L/min)	
1409 1412 1415 1418	2.1 .26 21.60 21.80 21.79	4349 4330 4326 4322	6.9 6.9 6.9 6.9 6.9	 0 0	52.3 57.2 64.5 68.6	11.89 12.43 12.51 12.52	(ft. bgs) 47.97 47.97 47.97 47.97 47.97	(L) 3 6 9 12	(L/min)	
1409 1412 1415 1418	2.1 .26 21.60 21.80 21.79	4349 4330 4326 4322	6.9 6.9 6.9 6.9 6.9	 0 0	52.3 57.2 64.5 68.6	11.89 12.43 12.51 12.52	(ft. bgs) 47.97 47.97 47.97 47.97 47.97	(L) 3 6 9 12	(L/min)	
1409 1412	2.1 .26 21.60 21.80 21.79	4349 4330 4326 4322	6.9 6.9 6.9 6.9 6.9	 0 0	52.3 57.2 64.5 68.6	11.89 12.43 12.51 12.52	(ft. bgs) 47.97 47.97 47.97 47.97 47.97	(L) 3 6 9 12	(L/min)	
<u>1409</u> 1412 1415 1418	2.1 .26 21.60 21.80 21.79	4349 4330 4326 4322	6.9 6.9 6.9 6.9 6.9	 0 0	52.3 57.2 64.5 68.6	11.89 12.43 12.51 12.52	(ft. bgs) 47.97 47.97 47.97 47.97 47.97	(L) 3 6 9 12	(L/min)	
1409 1412 1415 1418	2.1 .26 21.60 21.80 21.79	4349 4330 4326 4322	6.9 6.9 6.9 6.9 6.9	 0 0	52.3 57.2 64.5 68.6	11.89 12.43 12.51 12.52	(ft. bgs) 47.97 47.97 47.97 47.97 47.97	(L) 3 6 9 12	(L/min)	

				Moni	tor We	ll Sampl	ing Data			
Project: C	ooper Drum					•	-			
-roject: <u>C</u> EW-1		<u> </u>				Job No:	18500147.0703	0		
	s): 37599						SL/DG			
		5/06							Date:	
		t from dedicate								
		та				Product Obs:	Y	N	· · ·	
lethod of Me	asurement:	Depth Sounder	Ø N			Depth to Prod	uct:	· <u> </u>		
)ther:	· · · · · · · · ·			00 E		Method of Me		nterface Probe		N
		(WCE)			-	Other:			A Brian and a	
•	ing top as ma									
		e (DTW		ft		Well Dia	imeter (in)	<u>(</u>	Casing Volume (C	CV)/ft (gals)
	ing top as ma		_				2		0.163	
			90.5		-		4		0.652	4
	ing top as ma Water Colum	urked) 1n (H)		ft			6 D		1.468 CV = (23.49) x	[(D/24) ²]
	ing top as ma			IL			-	14 [(D/2)/12 in.f	t] ² h (7.48 gal/cu.	
VELL PUR	<u>GE AND SAM</u>	IPLING DATA				Purge Metho	od: <u>2" G</u>	rundfos subr	nersible pump	
Vinala Or-i		Mator in Mal	0.000		asle					
ingle Casir	ng Volume of CV x H = V	Water in Well	(***)		Jais	Purge Date:	<u></u>		-	1 S.
lumber of (ies to Purge (N	C)		gals	Was Well P	umped Dry?	Y	Ν	4 1 4 - 1 -
							00			
otal Volum	e of Water to (VW x NC =	Purge (TV)			gals	Fe ² (mg/L):	0.0			
	(*** ****	10)								4 a.c. 1
Time	Temp (C)	Cond (umhos)	pH .	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1332	20.79	4525	69	9	22.0	1	47.97	3		
1335	21.27	4441	6.8	7	31.4	7.57	47.97	6		
1 338	21.95	4433	6.7	7	42.6	7.39	47.97	9		
	22.02	4423	6.7	6	47.5	7.38	17.97	12		
1341										
	1	4429	6.7	6	52.8	7.27	47.97	15		
1344	22.16	4429 4430	6.7 67	6	52.8 56.7	7.27 7.28	47.97 47.97		+	
1344 1347	22.16 22.12	4430	6.7	6 6 6	56.7	7.28	47.97	18		
1344 1347	22.16			666						
1344 1347	22.16 22.12	4430	6.7		56.7	7.28	47.97	18		
1344 1347	22.16 22.12	4430	6.7		56.7	7.28	47.97	18		
1344 1347	22.16 22.12	4430	6.7		56.7	7.28	47.97	18		
1344 1347	22.16 22.12	4430	6.7		56.7	7.28	47.97	18		
1344 1347	22.16 22.12	4430	6.7		56.7	7.28	47.97	18		
1344	22.16 22.12	4430	6.7		56.7	7.28	47.97	18		
1344 1347 1350	22.16 22.12 22.09	4430 4430	6.7	6	56.7 59.9	7.28 7.06	47.97	18		
1347 1350	22.16 22.12 22.09	44 30 4430	6.7	6	56.7 59.9	7.28	47.97	18		

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1.10.19.00

								MONI	TOR WELL NO:	EW-1-90'
				Moni	tor We	ll Samp	ling Data			· · · · · · · · · · · · · · · · · · ·
Project:	Cooper Drum						-			یند. وسید در در این در
•		1-90ft				Job No:	18500147.070	30		· · · ·
					-		SL/DG			
		4/5/06			_				Date:	
		t from dedicat			_					
Sampling T	ïme:									
NATER EL	EVATION DA	TA				Product Obs:	Y	N		
	easurement:	Depth Sounder	Y N				duct:		X	انيا : مسرحين
Other:	nterval: 4	85-885	_			1	easurement:	nterface Probe	Y	· N
		(WCE)		ft						
(from cas	sing top as ma	rked)		~						
		e (DTW	•	<u>+</u> ft	t	<u>Well Di</u>	ameter (in)	<u>(</u>	Casing Volume (CV)/ft (gals)
	sing top as ma oth (WD):		0.26				2 4		0.163 0.652	
	sing top as ma		<u> </u>		-		6		1.468	· · · · ·
) Height o	f Water Colum	in (H)		ft			D		CV = (23.49) x [([
(from cas	sing top as ma	rked)					CV = 3	.14 [(D/2)/12 in.1	t] ² h (7.48 gal/cu. Ft)
	RGE AND SAM	IPLING DATA				Purge Meth	od: 2" G	irundfos subr	nersible pump	· · · · · ·
	.									
ingle Casi	ing Volume of CV x H = V	Water in Well	(VW)		_gals	Purge Date	:		-	· · · · · · ·
lumber of		es to Purge (N	C)		_gals		Pumped Dry?	Y	Ν	
Total Volun	ne of Water to	Purge (TV)			nals	Fe ² (mg/L):	0.0			
	(VW x NC =				_ 90.0	(iiig/=).	·····			
		Quad		Thursday in the s		DO	Meter Level	Removed	Flow Dete	Observations
Time	Temp (C)	Cond (umhos)	рH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	(L)	Flow Rate (L/min)	Observations Phys. App.
1302		8260	6.5	1	23.8	1	47.97	3		· · · ·
				4	-			6		····
1305	20.74	8238	6.6	4	19.9	0.29	47-97			····
1308	21-05	8223	6.6	4	17.7	0.30	47.97	9		······
1311	21.35	8216	6.6	4	15.3	0.48	47.97	12		
1314	21.41	8200	6.6	3	12.8	0.4.8	47.97	15		
										· · · · · · · · · · · · · · · · · · ·
453	20.97	44.								
	0107			<u> </u>						······································
						-				
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			+	<u> </u>	+				<u> </u>	· · · · · · · · · · · · · · · · · · ·
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	TIONS AND CO	OMMENTS		<u> </u>		."				er Alexandre de la composición Alexandre de la composición de la composición de la composición de la composición de

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									IITOR WELL N	O: <u>MW-33A</u>
				Mon	itor We	ell Samp	ling Data	1		
Project:	Cooper Drun	<u>n</u>								
Location N	o: MW-33	A				Job No:	18500147.07	030		
Sample No	(s):376	09				Sampler(s):	SL <u>/DG</u>		· · · · · · · · · · · · · · · · · · ·	
Sampling D	Date:May	8, 2006			_	Reviewer(s)):		Date:	
Sampling N	lethod: Direc	ct from dedicate	ed tubing	1						
Sampling T	īme:	<u> </u>								
Method of M Other:		Depth Sounder	Э́ N				Y duct: easurement:	N Interface Probe	Y	N
	nterval: sing Elevation	55 - 65 (WCE)		f	_ t	Other:				
(from cas	sing top as ma	arked)	02	19 - C		L	<u> </u>			
	Water Surfac	·· (- · · · <u> </u>	,83	f	t	Well Dia	ameter (in)		Casing Volume (0	CV)/ft (gals)
	sing top as ma		5			Contract (1)	2		0.163	
	oth (WD): sing top as ma	- 1 - 1			-		4 6		0.652	
	f Water Colun		.02	ft			D		1.468 CV = (23.49) x	
	sing top as ma							3.14 [(D/2)/12 in.	CV = (23.49) x $[t]^2h (7.48 gal/cu.)$	
WELL PUR	IGE AND SAM	MPLING DATA				Purge Meth	od: <u>2"</u>	Grundfos sub	nersible pump)
Single Casi		Water in Well (VW)		gals	Purge Date:				
Number of	CV x H = V) Casing Volum	nes to Purge (NC	c)		gals	Was Well P	umped Dry?	Y	N	
_		·					0.0	ng],	p.	
⊺otal Volum	e of Water to (VW x NC =	Purge (TV) TC)			_gals	Fe ² (mg/L):	0.0	<u></u>		
		Cond,		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
Time	Temp (C)	(umhos)	pH	<u>(NTU)</u>	(mV)	(mg/L)	(ft. bgs)	(L)	(É/min)	Phys. App.
0952				r.					0.5	
1028	20.91	4980	7.6	>1000	103.1	17.82			e Ít	
1031	20.89	4992	7.6	71000	104.3	18.50	_	6	I.	
1034	20.94	4998	7.5	71000	1053	19.20	-	9		
1037	20.92	5053	٦.٢	>1000	105,2	18.31		12	1 .	· · · ·
1040	20,90	5052	٦.5	>1000	105.3	18.28		15		
							e			
<u> </u>										
										•
		· ·				•	1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -			
				L						N ²
L						L				
	ONS AND CO	<u>OMMENTS</u> ksPump	o @ 60 ft.	8)zone	e = Ø	Н	ydrogen Pr	woxide 4.6	m7/L
				· · · · · · · · · · · · · · · · · · ·						
Note: A com and an estima	plete list of cor ate of the total v	ntainers and analy valume of water re	ses used (moved. W	can be found /ater measure	in the assoc	ciated sample i	og. The final ro	w of readings st	ould list the time	sampling was complete
			•						•	•
										• .
									Page	of
		No. 27.24 No. The statement water of the statement of the								2

Sample No(s): _376 Sampling Date: Sampling Method: _ Sampling Time: VATER ELEVATIO Method of Measureme Other: Other:) Well Casing Elev (from casing top a (from casing top a (from casing top a) Well Depth (WD) (from casing top a	MW-33B 10 May 8, 2006 Direct from dedicar Direct from dedicar N DATA nt: Depth Sounder 80 - 90 ation (WCE) s marked) urface (DTW s marked) olumn (H) s marked) SAMPLING DATA	<u>Y</u> N 	2 f	- [t	Job No: Sampler(s) Reviewer(s Weather: Ambient Te Product Obs Depth to Pro Method of M Other:	emp. (F): : Y duct:	N Interface Probe	Casing Volume (C 0.163 0.652	N
Location No: Sample No(s):376 Sampling Date: Sampling Method: Sampling Time: Sampling Time: VATER ELEVATIO Method of Measurement Other: VATER ELEVATIO Method of Measurement Other:) Well Casing Elev (from casing top a comparison of the second secon	MW-33B 10 May 8, 2006 Direct from dedicar Direct from dedicar N DATA nt: Depth Sounder 80 - 90 ation (WCE) s marked) urface (DTW s marked) olumn (H) s marked) SAMPLING DATA	<u>Y</u> N 	<u>و</u> ۲	ft ft	Sampler(s) Reviewer(s Weather: Ambient Te Product Obs Depth to Pro Method of M Other:	:SL/DG	N Interface Probe	Date: Y Casing Volume (C 0.163 0.652	N SV)/ft (gals)
Sample No(s): _376 Sampling Date: Sampling Method: Sampling Time: VATER ELEVATIO Method of Measurement Other: Screened interval:) Well Casing Elev (from casing top a (from casing top a) Well Depth (WD) (from casing top a) Height of Water C (from casing top a	10 _May 8, 2006 Direct from dedication N DATA nt: Depth Sounder 80 - 90 ation (WCE) s marked) urface (DTW s marked) s marked) olumn (H) s marked) SAMPLING DATA	<u>Y</u> N 	<u>و</u> ۲	ft ft	Sampler(s) Reviewer(s Weather: Ambient Te Product Obs Depth to Pro Method of M Other:	:SL/DG	N Interface Probe	Date: Y Casing Volume (C 0.163 0.652	N SV)/ft (gals)
Sampling Date: Sampling Method: _ Sampling Time: VATER ELEVATIO Method of Measureme Dither: Other: Well Casing Elev (from casing top a common casing top a Well Depth (WD) (from casing top a) Height of Water C (from casing top a	_May 8, 2006 Direct from dedicar Direct from dedicar N DATA nt: Depth Sounder 80 - 90 ation (WCE) s marked) urface (DTW s marked) olumn (H) s marked) SAMPLING DATA	<u>ү</u> N 	!	ft ft	Reviewer(s Weather: Ambient Te Product Obs Depth to Pro Method of M Other:	<pre>b): emp. (F): emp. (F): duct: easurement: ameter (in) 2 4 6</pre>	N Interface Probe	Date: Y Casing Volume (C 0.163 0.652	N SV)/ft (gals)
Sampling Method: Sampling Time: Method of Measureme Other: Creened interval: Well Casing Elev (from casing top a comparing top a (from casing top a Well Depth (WD) (from casing top a) Well Depth (WD) (from casing top a) Height of Water C (from casing top a	Direct from dedica	<u>ч</u> - 1.30	<u>و</u>	ft ft	Weather: Ambient Te Product Obs Depth to Pro Method of M Other:	emp. (F): : Y duct: easurement: ameter (in) 2 4 6	N Interface Probe	Y Casing Volume (C 0.163 0.652	N :V)/ft (gals)
Sampling Time: Method of Measureme Other: Screened interval:) Well Casing Elev (from casing top a comparing top a (from casing top a Well Depth (WD) (from casing top a) Well of Water C (from casing top a) Height of Water C (from casing top a	N DATA nt: Depth Sounder 80 - 90 ation (WCE) s marked) urface (DTW s marked) s marked) olumn (H) s marked) SAMPLING DATA	Y N - 1.30	f	ft 	Ambient Te Product Obs Depth to Pro Method of M Other:	emp. (F): : Y duct: easurement: ameter (in) 2 4 6	N Interface Probe	Y Casing Volume (C 0.163 0.652	N EV)/ft (gals)
VATER ELEVATIO Method of Measureme Other:	N DATA nt: Depth Sounder 80 - 90 ation (WCE) s marked) urface (DTW s marked) olumn (H) s marked) SAMPLING DATA	y N 	f	ft 	Product Obs Depth to Pro Method of M Other:	: Y duct: easurement: ameter (in) 2 4 6	N Interface Probe	Y Casing Volume (C 0.163 0.652	N
Method of Measureme Other:	nt: Depth Sounder 80 - 90 ation (WCE)	1.30	f	ft 	Depth to Pro Method of M Other:	duct: easurement: ameter (in) 2 4 6	Interface Probe	Casing Volume (C 0.163 0.652	VV)/ft (gals)
Other: Screened interval: (from casing top a Depth to Water S (from casing top a Well Depth (WD) (from casing top a) Height of Water C (from casing top a	80 - 90 ation (WCE)	1.30	f	ft 	Method of M Other:	easurement: ameter (in) 2 4 6	Interface Probe	Casing Volume (C 0.163 0.652	VV)/ft (gals)
Screened interval:) Well Casing Elev (from casing top a 2) Depth to Water S (from casing top a 2) Well Depth (WD) (from casing top a 2) Height of Water C (from casing top a	80 - 90 ation (WCE)	1.30	f	ft 	Other:	ameter (in) 2 4 6		Casing Volume (C 0.163 0.652	VV)/ft (gals)
) Well Casing Elev (from casing top a 2) Depth to Water S (from casing top a 2) Well Depth (WD) (from casing top a) Height of Water C (from casing top a	ation (WCE) s marked) urface (DTW s marked) olumn (H) s marked) SAMPLING DATA	1.30	f	ft 	L	<u>ameter (in)</u> 2 4 6		0.163 0.652	
 Depth to Water S (from casing top a Well Depth (WD) (from casing top a Height of Water C (from casing top a 	urface (DTW s marked) s marked) olumn (H) s marked) SAMPLING DATA			— .	<u>Well</u> Di	2 4 6	<u>(</u>	0.163 0.652	
(from casing top a) Well Depth (WD) (from casing top a) Height of Water C (from casing top a	s marked) s marked) olumn (H) s marked) SAMPLING DATA			— .	<u>Well Di</u>	2 4 6	<u>(</u>	0.163 0.652	
(from casing top a) Well Depth (WD) (from casing top a) Height of Water C (from casing top a	s marked) s marked) olumn (H) s marked) SAMPLING DATA		fi	— . t		4 6		0.652	Ś
(from casing top a) Height of Water C (from casing top a	s marked) olumn (H) s marked) SAMPLING DATA		fi	t .		6			\$
) Height of Water C (from casing top a	olumn (H) s marked) SAMPLING DATA		fi	t					E .
(from casing top a	s marked) SAMPLING DATA				1	-		1.468 CV = (23.49) x	[(D/24) ²]
VELL PURGE AND							.14 [(D/2)/12 in.f	t] ² h (7.48 gal/cu. l	
					Purge Moth			nersible pump	
							an unutos subr	nersiole pump	
ingle Casing Volun	e of Water in Well	(VW)		_gals	Purge Date	5 8 01	2		
(CV x ⊢		•							
lumber of Casing V	olumes to Purge (N	C)		_gals		umped Dry?	Y	N .	
otal Volume of Wat	er to Purge (TV)			_gals	Ee^2 (ma/L):	3.8 "3			
	IC = TC)			_ 9410	10 (mg/L).		/		
	Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
Time Temp	C) (umhos)	pН		(mV)	(mg/L)	(ft. bgs)	(L)	(L/min)	Observations Phys. App.
1110 20.6	5 8100	7,2	142	-74.4	2.55	-	2.4	9.8	<u></u>
1113 21.0	1 8309	7.3	151	-85.7	0.89	~	¥.8	44	
116 21.6	3 8390	7.3	101	-92.6		-	7.2	- 11	
119 21.8	7 8467	7.2	93	-918			19.6	11	
122 21.9	0 8454	7.2	75	-100.6	0.49	-	13.0	.(
125 22.0		7.2	64	-101.4	0.41	_	19.4	_ E C	
128 22.0	9 8541	7.2	63	-100.7	0.38	-	176.8		
					, - e*				
				<u> </u>					
								├───┤	
		I					-		· · · · · · · · · · · · · · · · · · ·
STRUCTIONS AN	COMMENTS					ide = #	ring!		

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Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

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							%		MONITOR WELL	_ NO: <u>EW-1</u> _
				Mon	itor We	ell Sam	oling Data	ł		
	Cooper Drur	-					<u> </u>			
Monitor We		1-53'				Job No:	18500147.07	030		
		3				Sampler(s):SL <u>/DG</u>			· · ·
		8, 2006				Reviewer(s):		Date:	
		ct from dedicat		<u> </u>		Weather:				
Sampling T	ime:					Ambient T	emp. (F):			
	EVATION D	ATA Depth Sounder				Product Ob	-	N		
Other:	easurement.	Depth Sounder	YN				oduct:			
	nterval:			88.5			leasurement:		e Y	N
I) Well Cas	sing Elevation	1 (WCE)			ť					
	sing top as m	,	47.	7 🔿						•
	Water Surfac		_ [' ·	<u>`7</u>	ť	<u>Well</u> D	liameter (in)		Casing Volume (C	CV)/ft (gals)
	sing top as ma oth (WD):		90.5				2		0.163	
	sing top as ma						4 6		0.652 1.468	
4) Height of	f Water Colur	nn (H)	12.73	/f	t		D		CV = (23.49) x	[(D/24) ²]
(from cas	sing top as ma	arked)					CV = 3	3.14 [(D/2)/12 in	.ft] ² h (7.48 gal/cu.	Ft.)
VELL PUR	GE AND SAM	MPLING DATA				Purge Met	nod: 2 " (Grundfos sub	mersible pump	
ingle Casi	••• \/• ···· · · /									
angle Casil	ng Volume of (CV x H = V	Water in Well	(VW)		_gals	Purge Date):		-	•
lumber of (vv) nes to Purge (N	C)		aale		Pumped Dry?	V		
· • • · .	9				_ 9415			Y	N	
otal Volum	e of Water to	Purge (TV)			_gals	Fe ² (mg/L):	0.0 mg	1/2		
	(VW x NC =	TC)							•	
		Cond		Turbidity	ORP	DO	Martin I.	-		
Time	Temp (C)	(umhos)	pН	-	(mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed	Flow Rate	Observation
349	22,12	4462	1.5	8	55.9	9.76	47.80	<u>(L)</u>	(L/min)	Phys. App.
1352	22.78	4423	7.5	10	61.0	11.19	47.80	4,8	11	
395	23.19	4427	7.5	10	64.3	11.16	47.80	7.2	+	
358	23.27	4431	7.5	8	69.7	10.95	47.80	9.6		······
401	23.36	4442	7.5	8	70.9	10.79	47.80	12.0	st	
404	23 HZ	4142	7.9	7	79.7	10.92	47.80	14.4		
									+	
						÷			-	

								M	ONITOR WELL	NO: <u>EW-1</u>
				Mon	itor We	ll Samp	ling Data	l		
Project:	Cooper Drum	<u>ı </u>								
Monitor We	ell EW-1	ľ				Job No:	18500147.07	030		<u></u>
Sample No	(s):37612	2				Sampler(s)	:			
Sampling D	ate:May	8, 2006				Reviewer(s	i):		Date:	
Sampling N	lethod: Direc	t from dedicat	ed tubing							
Sampling T	ïme:									
	EVATION DA					Product Obs		N	·	
	easurement:	Depth Sounder	Y N	•			duct: easurement:	Interface Probe	V	
		27-1-1-1-	- 48.5 -	88.5			easulement.		, ř	N
		(WCE)			t					
	sing top as ma	arked)		1						
	Water Surfac		41.7-	(f	t	<u>Well Di</u>	iameter (in)	<u>(</u>	Casing Volume (C	V)/ft (gals)
-	sing top as ma	arked)	90.5			- - -	2		0.163	
	sing top as ma	arliad)			_		4 6		0.652 1.468	
•	f Water Colun		2.73	fi	<u>.</u>	1	D		CV = (23.49) x [(D/24) ²]
(from cas	sing top as ma	arked)					CV = 3	3.14 [(D/2)/12 in.f	t] ² h (7.48 gal/cu. f	
WELL PUR	GE AND SAM	MPLING DATA				Purge Meth	nod: 2"	Grundfos subr	nersible pump	
Single Casi	na Volume of	Water in Well (VW)		nals		:\$ 8			
	(CV x H = V				-•				- B	
Number of	Casing Volun	les lo Fuige (in			_yais		Pumped Dry?	Y		
Total Volum	ne of Water to (VW x NC =	Purge (TV)			_gals	Fe ² (mg/L):	0.0 "	<u> 1 L</u>		
	(*** × 140 =								×.	
Time	Tomp (C)	Cond	m LJ	Turbidity		D.O.	Water Level	Removed	Flow Rate	Observations
1313	Temp (C)	(umhos)	<u>₽</u> ⊓ 7.4	(NTU)	(mV) 31.6	(mg/L)	(ft. bgs)	(L) 2.1	(L/min)	Phys. App.
			-	-			47.80		0.8	
1316	21.60		7.4	6	37.8	9.09	47.80	4.8	• (
1219	22.11	4472	7.4	4	44.6		47.80	1.2	11	
1322	22.40	4473	7.4	5	48.7	8.71	47.80	9,6	11	
1325	22,58		1.1	4	55,1	8.62	47.80	12.0	f (
1328	22.69	4475	7.4	1	58.4	8.68	47.80	14.4	11	
1221	22.76	4476	1.1	4	57.9	8.59	47.80	16.8	(L	
		· · · · · · · · · · · · · · · · · · ·					_			
	<u> </u>									
						<u> </u>				·
· · · · · · ·		·			[
	IONS AND CO	OMMENTS	a 63 4	Ozoni	× 0,0	, mg/L	Hu	wogen Pe	voxila =	<1.0 mg/L
			5 VV II			••		- +		

Monitor Well Sampling Data oper:			. ·					•	MON	ITOR WELL NO	D:EW-1-90'
cadion No:EW-160ft					Mon	itor We	ll Samp	ling Data	l		
smple No(s): 37611	Project:	Cooper Drum	<u> </u>								
							Job No:	18500147.07	030		
mpling Weihod: Direct from dedicated tubing mpling Time: 12-45 Weather:										Date:	
Impling Time: 1245 ATER ELEVATION DATA thed of Measurement: Depth Sounder Y N her	Sampling N	Aethod: Direc	t from dedicate	ed tubing							
thot of Measurement: Depth Sounder Y N ber:	Sampling T	ime: 12	15								
thot of Measurement: Depth Sounder Y N ber:	WATER EL	-EVATION DA	TA				Product Obs	· v	N	,	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $				Y N							
Well Casing Elevation (WCE)			 	-						Y	Ν
$ \begin{array}{c} \mbox{(from casing top as marked)} & \mb$. .	Other:				
Depth to Water Surface (DTW111111 ft (ftom casing top as marked) $9 \cdot 2 \cdot 0$ (well Depth (WO):14 $9 \cdot 2 \cdot 0$ (ftom casing top as marked) $12 \cdot 13$ (ftom casing top as marked) $0 \cdot 22 \cdot 314$ (ftom casing top as marked) $0 \cdot 22 \cdot 314$ (ftom casing top as marked) $0 \cdot 22 \cdot 314$ (ftom casing top as marked) $0 \cdot 22 \cdot 314$ (ftom casing top as marked) $0 \cdot 22 \cdot 314$ (ftom casing top as marked) $0 \cdot 22 \cdot 314$ (VX H = VW) gals (CV X H = VW) gals (VW x NC = TC) gals Time Cond Time Temp (C) (umhos) pH (NTU)		-	• • •		f	t		·····			
(from casing top as marked) $90, 20$ 0.183 Well Depth (WD): 0.652 Height of Water Column (H) $1/2, 1/3$ ft (from casing top as marked) $1/2, 1/3$ ft Height of Water Column (H) $1/2, 1/3$ ft (from casing top as marked) $1/2, 1/3$ ft ft $0, 163$ 0.52 (from casing volumes of Water in Well (WW) gals Purge Datie: $5/2$ [0.00 (GV r H = Wi) (WX NC = TC) gals Fe ² (mgL): $1/2$ Time Temp (C) (umhos) pH (NTU) (mY) (mg/) (ft dgs) (L) (U/min) Phys.App. 23/8 20.65 8/6 /1 7.2 8 1/3 9.26 7.4	(nom ca: 2) Denth to	Water Surfac	W (DTW Y1	1.77	f	4	Mall Di	amatar (in)		On all and 1/1 / 1/1	A A A A
Well Depth (WD): 90 / 2 0 (from casing top as marked) $42, 43$ height of Water Column (H) $42, 43$ (from casing top as marked) $42, 43$ telepit of Water Column (H) $42, 43$ mgle Casing Volume of Water in Well (VW) gals (OV $X H = VW$) gals mber of Casing Volumes to Purge (NC) gals (VW $X NC = TC$) gals Time Temp (C) (WW $X NC = TC$) gals Time Temp (C) (WW $X NC = TC$) Gals Time Temp (C) (Umote) pH (NTU) (mV) (B $23, 64, 11$ (X $23, 64, 12$ (X $13, 12, 12, 12, 13, 14, 14, 14, 14, 14, 14, 14, 14, 14, 14$			velca el)		I	ı	<u>vveit Di</u>				
(from casing top as marked) $42, 43$ ft Height of Water Column (H) $42, 43$ ft CV = 3:14 [(D/2)/12 in:ft/ th (7.48 galcou. Ft)] CV = 3:14 [(D/2)/12 in:ft/ th (7.48 galcou. Ft)] CV = 3:14 [(D/2)/12 in:ft/ th (7.48 galcou. Ft)] Purge AND SAMPLING DATA Purge Method: 2* Grundtos submersible pump ngle Casing Volume of Water in Well (VW) gals (CV × H = VW) gals (W × NC = TC) Was Well Pumped Dny? Time Temp (C) (umhcs) pH (NTU) (mV) (mV) (mV) (W × NC = TC) S -1.3 Time Temp (C) (umhcs) pH (NTU) (mV) (mV) (mV) (W × NG = TC) S -1.3 Time Temp (C) (umhcs) pH (NTU) (mV) (mV) (mV) (H) 2.4 2.4 2.4 2.5 8.6 /1 2.4 2.4 2.4 2.4 2.5<				20	<u> </u>	_					
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $			· · · · · · · · · · · · · · · · · · ·	12				6			
ELL PURGE AND SAMPLING DATA Purge Method:? "Grundfos submersible pump					ft	t					
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	(from cas	sing top as ma	arked)					CV = :	3.14 [(D/2)/12 in.	ft] ² h (7.48 gal/cu.	Ft.)
$\begin{array}{c} (CV \times H = VW) \\ \text{imber of Casing Volumes to Purge (NC)} gals \\ \text{tal Volume of Water to Purge (TV)} \\ (WV \times NC = TC) \\ \hline \\ $	WELL PUP	GE AND SAM	IPLING DATA				Purge Meth	od:2"	Grundfos sub	mersible pump)
$\begin{array}{c} (CV \times H = VW) \\ \text{imber of Casing Volumes to Purge (NC)} gals \\ \text{tal Volume of Water to Purge (TV)} \\ (WV \times NC = TC) \\ \hline \\ $	Single Casi	ing Volume of	Water in Well (VW)		gals	Purge Date	5/8/)6		
tal Volume of Water to Purge (TV) gais $fe^2 (mg/L)$: $fe^2 (mg/L)$: Time Temp (C) Cond pH Turbidity ORP D.O. Water Level Removed Flow Rate Observations 235 I9.91 $gais$		(CV x H = V	W)	-		-	J		· · · · · · · · · · · · · · · · · · ·	\sim	
$(W \times NC = TC)$ $(W \times NC = TC)$ $\frac{Cond}{(umhos)} \xrightarrow{pH} (NTU) (mV) (mV) (mV) (mV) (mV) (mV) (mV) (mV$	Number of	Casing Volum	es to Purge (NC	>)		_gals				\mathbb{C}	
$(W \times NC = TC)$ $(W \times NC = TC)$ $\frac{Cond}{(umhos)} \xrightarrow{pH} (NTU) (mV) (mV) (mV) (mV) (mV) (mV) (mV) (mV$	Total Valum	no of Motor to					- 2 / 4	0.6 m			
Time Temp (C) Cond (umhos) Turbidity pH ORP (NTU) D.O. (mV) Water Level (mg/L) Removed (L) Flow Rate (L/min) Observations Phys. App. 235 19.97 & 631 7.2 & -1.3 9.26 — 2.4 0.8 238 20.65 & 641 7.2 & -1.3 9.26 — 2.4 0.8 238 20.65 & 641 7.2 & -1.3 9.26 — 2.4 0.8 238 20.65 & 641 7.2 & -1.3 9.26 — 2.4 0.8 241 21.19 & 651 7.2 & -23.6 1.65 47.83 2.9 '' 241 21.45 & 8611 7.2 & -27.6 0.966 41.82 19.0 '' 241 21.08 & 8561 7.2 \$ -27.6 0.76 ¥7.82 13.0 '' 240 21.78 & 8529 7.2 \$ -27.8 0.76 ¥7.82 16.4 '' 240 21.78 21.6 21.2 21.2						_gals	Fe⁻ (mg/L):		/ -		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		(*** × 110 -	10)								
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Timo	Tomp (C)							·		
$\frac{238}{20.65} \frac{20.65}{8641} \frac{8641}{1.2} \frac{17}{1.2} \frac{-15.5}{4.74} \frac{4.74}{7} \frac{-15.5}{1.65} \frac{4.74}{7.83} \frac{-11}{1.2} -1$			-			<u>^</u>	T	(ft. bgs)		T	Phys. App.
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	· · · · · ·			<u> </u>							
244 21.4 8611 7.2 6 -27.6 0.96 41.82 19.6 # 247 21.08 8561 7.2 5 -27.6 0.83 47.82 13.0 11 240 21.78 8529 7.2 5 -27.8 0.76 47.82 13.0 11 240 21.78 8529 7.2 5 -27.8 0.76 47.82 15.4 11 240 21.78 8529 7.2 5 -27.8 0.76 47.82 15.4 11 240 21.78 8529 7.2 5 -27.8 0.76 47.82 15.4 11 241 21.78 25.29 7.2 5 -27.8 0.76 47.82 15.4 11 241 24.24 <td></td> <td>· · · ·</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>1707</td> <td></td> <td></td> <td></td>		· · · ·						1707			
247 21.08 8561 7.2 5 -27.6 0.83 47.82 13.0 11 140 21.78 8529 7.2 5 -27.8 0.76 47.82 13.0 11 140 21.78 8529 7.2 5 -27.8 0.76 47.82 15.0 11 140 21.78 8529 7.2 5 -27.8 0.76 47.82 15.0 11 140 1 1 1 1 1 1 1 1 140 1 1 1 1 1 1 1 1 140 1											
										n	
									· · · · · · · · · · · · · · · · · · ·		
Image: Sampling RemarksPump @ 85 ft	1290	21.78	8729	7,2	ş	-27.8	0.76	47.82	19.4	, ¿ C	
STRUCTIONS AND COMMENTS rging/Sampling RemarksPump @ 85 ft											
STRUCTIONS AND COMMENTS rging/Sampling RemarksPump @ 85 ft http://www.fooxiax_Orlemyll											
STRUCTIONS AND COMMENTS rging/Sampling RemarksPump @ 85 ft http://www.fooxiar_OrD_myll											
STRUCTIONS AND COMMENTS rging/Sampling RemarksPump @ 85 ft http://www.fooxiax_Orlemyll											
STRUCTIONS AND COMMENTS rging/Sampling RemarksPump @ 85 ft http://www.fooxiar O.P.my/l									<u></u>		-
STRUCTIONS AND COMMENTS rging/Sampling RemarksPump @ 85 ft http:// fooxiar Or D mgll					<u> </u>					1	
rging/Sampling Remarks Pump @ 85 ft http:// fooxar 0.0 mg/l											
rging/Sampling RemarksPump @ 85 ft http:// fooxiar O.D. mg[l						J		· · · · · · · · · · · · · · · · · · ·	· · · · ·	.1	
				9 05 th		1	Im	0 -	in a	7.0 MC	11
V	urging/Saf	nping nemar	∿∋Pump @	s ος π		^ 7	wyer	~ 400;	cont c	the my	
			·	·····			V				

जनसम्बद्धाः सम्ब

TABLE 2 **Request for Analysis** Monitor Well Groundwater Samples - ISCO Field Pilot Test **Regional Analytical Program**

April 5, 2006 Case# R06S10 and CLP # 35218

									MATRIX #	WATER									
OR					ORGANICS		·				IS	SCO GROU	NDWATER	MONITORI	NG				
PARAMETER - According to the Requirements of the DQIs (if applicable)					VOCs (8260)	Priority Pollutant Metals ^(a) (E6010)	Hexavalent Chromium ^(a) (E7196A)	1,4-Dioxane	Chloride (E300.0)	Nitrate (E300.0)	Sulfate (E300.0)	Bromide (E300.0)	O- phosphate (E300.0)	Alkalinity (E310.1)	TSS (160.2)	TDS (E160.1)	TOC (E415.2)	Sulfide (E376.2)	Cations (barium, boron, calcium, iron, manganesium, manganese, potassium, and sodium [200.7])
PRESERVATIVES HCL to pH <2, Cool to 4*C HNO3 to pH <2, Cool to 4*C Cool to 4*C Cool to 4*C Cool to 4*C											NaOH/zinc acetate to pH >9, Cool to 4°C	HNO ₃ to pH <2, Cool to 4°C							
TECHNICAL HOLDING TIMES CONTRACT HOLDING TIMES					14 days	28 days	24 hours		28 days	48 hours	28 days		48 hours	14 days	7 days	7 days	28 davs	28 days	6 months
		URS	NG TIMES		7 days No. of 40	7 days	24 hours	7 days	7 days	7 days	7 days	7 days	7 days	7 days	7 days	7 days	7 days	7 days	NA
Sample Location	Sample Sample Sample QA/QC Sampling Schedule					No. of 500 mL poly bottles	No. of 500 mL poly bottles	No. of 1 L amber bottles	No. of 1-L polyethylene bottles						No. of 40 mL VOA vials		No. of 250 mL polyethylene bottles		
MW-33A MY2FY7 37595- 37606 4/\$/06						Seveth Round Groundwater Samples									Dottics				
	MY2FY8	37596-	37606	4/\$/06 4/5/06	3	1	1	2	1					2	1				
	EW-1-90' MY2FY9 37598 Lab QC ^(b) 4/5/06					1	1	2							2	1			
	EW-1 MY2FZ0 37500-37605 4/5/06					2	2	2	2						4	2			
MW-6 MY2FZ137600Duplicete*4/\$/06					3	1	1	2	1					2	1				
	MY2FZ2	- 37601-		4/5/06	3	1	1	2					1				2	1	
MW-7	MY2FZ3	37602	Equipmen t Blank	4/5/06	3	1	1	2 2					1				2	1	
MW-7A		37605	l	4/5/06	3														
MW-7B		37604	Field Blank	4/5/06	3														
											·								
	Total # of	Samples/C	Containers		9/27	6/7							·······						
				l	J/21	0//	6/7	7/14				6	17				6/14	6/7	

Notes:

^(a) Priority pollutant metals and hexavalent chromium will be analyzed during the initial sampling round and biannually thereafter. All other analyses will be conducted during each sampling event.

(b) Lab QC = MS/MSD

DQI = data quality indicator

HCI = hydrochloric acid

 $HNO_3 = nitric acid$

ISCO = In Situ Chemical Oxidation

L = liter

mL = milliter

MS/MSD = matrix spike/matrix spike duplicate

EW-1 37605 4/17/16 1210 EMW. 33A 37606 4/17/06 (300) TripT31 cmk 37608

NA = not available NaOH = sodium hydroxide No. = number QA/QC = quality assurance/quality control TDS = total dissolved solids TOC = total organic carbon TSS = total suspended solids VOA = volatile organic analysis VOC = volatile organic compound

Sampled only two wells No monitor well data sheets

Monitor Well Sampling Data Project: <u>Cooper Drum</u>		
Location No:MW-20 Job No:18500147.07030		
Sample No(s):37615 Sampler(s):SL/DG		
Sampling Date:June 5, 2006 Reviewer(s):		
Sampling Method: Direct from dedicated tubing Weather: Cloudy		· · · · · · · · · · · · · · · · · · ·
Sampling Time: Ambient Temp. (F): _73°F		
WATER ELEVATION DATA Product Obs: Y	N	
Method of Measurement: Depth Sounder (N Depth to Product:		
	ace Probe Y	N
Screened interval: 55 - 70 Other:		
1) Well Casing Elevation (WCE)ft		
(from casing top as marked) 2) Depth to Water Surface (DTW_ <u>46.98</u> _ft <u>Well Diameter (in)</u>		
2) Depth to Water Surface (DTW76ftftft		e (CV)/ft (gals)
3) Well Depth (WD): 70 4	0.1	63
(from casing top as marked) 6	1.4	
4) Height of Water Column (H) <u>23.02</u> ft D	CV = (23.49	
(from casing top as marked)	D/2)/12 in.ft] ² h (7.48 gal/	
WELL PURGE AND SAMPLING DATA Purge Method:2" Grund	dfos submersible pu	mp
Single Casing Volume of Water in Well (VW) gals Purge Date:		
(CV x H = VW) Number of Casing Volumes to Purge (NC) gals Was Well Pumped Dry?		
	r C	
Total Volume of Water to Purge (TV) gals Fe ² (mg/L):		
	emoved Flow Rate	Observations
Time Temp (C) (umhos) pH (NTU) (mV) (mg/L) (ft. bgs)	(L) (L/min)	Phys. App.
0950 21.19 4676 7.25 259 185.6 2.56 47.11 2.	4 0.8	
0953 21.64 4687 725 232 146.0 2.52 47.11 4.5		
0956 22.06 4690 7.24 279 121.6 2.24 47.11 7.2	2	
0959 22.20 4670 725 488 97.4 2.23 47.12 9.0	6	
1002 22.55 4661 724 389 89.4 2-19 47.12 12.	.0	
1005 22.61 4651 7.24 245 84.7 2.11 47.13 14.1	4	
1008 22.46 46.45 7.23 205 74.2 1.84 47.13 16.	.8	
1011 22.46 4646 7.23 195 65.7 1.62 47.13 19	1.2	
1014 22.45 4646 - 7.23 175 62.1 1.52 47.13 21	'.(q	
		-
NSTRUCTIONS AND COMMENTS		•

Purging/Sampling Remarks _____Pump @ 63 ft._

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Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

and the second second

Page _____ of _____

								MONI	TOR WELL NO	. <u>MW-20B</u>
				Moni	tor We	li Samp	ling Data	L		
Project: <u>Cc</u>	ooper Drum									
Location No:	MW-20B					Job No:	18500147.07	030		
Sample No(s)):37616_					Sampler(s)	SL/DG			
Sampling Dat	te: _June 5,	2006				Reviewer(s):		Date:	
		t from dedicat				Weather:	cloud	./		
Sampling Tirr	ne:					Ambient Te	mp. (F): 74	ŀF		
WATER ELE	VATION DA	TA				Product Obs	Y	N		
Method of Mea	surement:	Depth Sounde	Ψ N			Depth to Pro	duct:			
Other:			-			Method of M	easurement:	Interface Probe	Y	Ν
			80 - 9) 0	-	Other:	<u>.</u>			
1) Well Casin (from casin	ig Elevation				n					
2) Depth to W		e (DTW 4	7.00		f	Well Di	ameter (in)		Casing Volume (C	W)/ft (gale)
	ng top as ma					wen Di	2		0.163	zv jnt (gais)
3) Well Depth		· · · · ·	90		_		4		0.652	
-	ng top as ma	arked)	42 ~~	`			6		1.468	
4) Height of V			43,00	/f	t		D		CV = (23.49) x	
(trom casin	ng top as ma	irked)					CV =	3.14 [(D/2)/12 in.	ft] ² h (7.48 gal/cu.	Ft.)
VELL PURG	E AND SAM	IPLING DATA				Purge Meth	od: <u>2"</u>	Grundfos sub	mersible pum	<u>p</u>
		Water in Well	(VW)		gals	Purge Date	:(e/5/0	6	_	
	CV x H = V\ asing Volum	/v) ies to Purge (N	C)		gals	Was Well F	umped Dry?	Y		
Tat-1 \/_1	- /) • / - • / -	•				- 2				
	VW x NC =	Purge (TV) TC)			gais	Fe ⁻ (mg/L):			-	
		Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
Time	Temp (C)	(umhos)	рН	(NTU)	(mV)	(mg/L)	(ft. bgs)	(L)	(L/min)	Phys. App.
1048 0	20.97	8107	7.20	17 iooo	201.1	0.12	47.03	1.5	0.5	<u></u>
	20.95	8172	7.19	743 ·	176.6	0-14	47.03	3.0		
	21.13	8190	7.18	V	162.5	0.19	47.03	4.5		
1057 -	2153	8199	7.10	358.	149.7	0.18	47.04	6.9	0.8	
		\$196	7.16		150.7	1	47.04	8.3	│ 	
102.0	2.53	8182		266-		0.16	47.04	10.7		5
1106 =	22.57	8160	7.15	251	-136.3	0.16	47.04	13.1	V	
									┼───┼	
										<u> </u>
									+	
	·								+	
			<u> </u>						╀╼──┝╸	
1			1						1 1	

Purging/Sampling Remarks _____Pump @ 85 ft._

Time Tomp (C) (umboo) \mathbb{P} (NITU) (\mathbb{P})	
Location No:MW-33A	
Sample No(s):37617 Sampler(s):SLDC Sampling Date:June 5, 2006 Sampling Date: Date:	
Sample No(s):37617 Sampler(s):SL_DQ Sampling Date:June 5, 2006 Sampling Method:Direct from dedicated tubing Sampling Method:Direct from dedicated tubing Reviewer(s):Date: Sampling Time: Ambient Temp. (F):U*F WATER ELEVATION DATA Weather:Q*G Weather:Q*G N Other: Depth Sounder @ N Storeened interval:S5-65 Tf (from casing top as marked) ft 2) Depth to Water Surface (DTWG*_7.1_3 ft (from casing top as marked) G*	
Sampling Date:June 5, 2006	
Sampling Method: Direct from dedicated tubing Sampling Time:	-
iampling Time: Ambient Temp. (F): $\frac{74^\circ F}{24^\circ F}$ VATER ELEVATION DATA Product Obs: Y N lethod of Measurement: Depth Sounder (P) N wher: 55 - 65) Well Casing Elevation (WCE) ft (from casing top as marked) (Product Obs: Y N)) Depth to Water Surface (DTW 48.7(6) (from casing top as marked) (Platter Column (H)) Well Depth (WD): 51.13 (from casing top as marked) ft (from casing top as marked) (Platter Column (H) Well Diameter (In) Casing Volume (CV)/ft (gats 4 D CV = 3.14 [(D/2)/12 in:ft) ^e h (7.48 gat/cu. Ft) VELL PURGE AND SAMPLING DATA Purge Method: (FV = H = VW) gals (CV x H = VW) gals (CV x H = VW) gals (CV x H = VW) gals (VW x NC = TC) gals Time Temp (C) (umhos) pH PH (NTU) (MU) Method: (MU) Gals (Well Diameter (In) Casing Volume of Water in Well (VW) (CV x H = VW)	
tethod of Measurement: Depth Sounder \bigcirc N there:	
ther:	
creened interval:55-65	
Well Casing Elevation (WCE)ft (from casing top as marked) Depth to Water Surface (DTWS7ft (from casing top as marked) Well Depth (WD):S7S7ft (from casing top as marked) Height of Water Column (H)S7ft (from casing top as marked) (from casing volume of Water in Well (VW) gals (CV x H = VW) umber of Casing Volumes to Purge (NC) gals (VW x NC = TC) Cond	N
Depth to Water Surface (DTW 49.76 ft (from casing top as marked)Well Depth (WD):59.13Well Depth (WD):59.13(from casing top as marked)4Height of Water Column (H)10.377(from casing top as marked)6Height of Water Column (H)10.377(from casing top as marked)CV = (23.49) x [(D/24)^2](from casing top as marked)CV = (23.49) x [(D/24)^2](from casing top as marked)CV = (3.14 [(D/2)/12 in.ft] ² h (7.48 gal/cu. Ft.)ELL PURGE AND SAMPLING DATAPurge Method:2" Watera pumpngle Casing Volume of Water in Well (VW)galsPurge Date:(CV x H = VW)galsVas Well Pumped Dry?Ywater to Purge (NC)galsFe ² (mg/L):O.(VW x NC = TC)CondTurbidityORPD.O.TimeTemp (C)(umhos)pH(NTU)(mV)(mg/L)(ft. bgs)(L)(L/min)PageBeaaAurai raWell Mater a form for a for a form for a for	
$\begin{array}{ccccc} (from casing top as marked) \\ Well Depth (WD): _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _$	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$;)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1
Height of Water Column (H) 1405 Itelepting of Water Column (H) 16.57 (from casing top as marked) $CV = (23.49) \times [(D/24)^2]$ (from casing top as marked) $CV = (3.14 [(D/2)/12 in.ft]^2 h (7.48 gal/cu. Ft.))$ VELL PURGE AND SAMPLING DATA Purge Method: $2"$ Watera pump ingle Casing Volume of Water in Well (VW) gals Purge Date: $6f5 fb b$ (CV x H = VW) gals Was Well Pumped Dry? Y N umber of Casing Volumes to Purge (NC) gals Fe² (mg/L): O O (VW x NC = TC) Cond Turbidity ORP D.O. Water Level Removed Flow Rate Obse Time Temp (C) (umhos) pH (NTU) (mV) (mg/L) (ft. bgs) (L) (L/min) Phy QQ Begaa $\omega e ff$ $\omega e fff$ $\omega e ff$ $\omega e fff$	
(from casing top as marked) $CV = (23.49) \times [(D/24)^{-1}]$ (from casing top as marked) $CV = 3.14 [(D/2)/12 \text{ in ft}]^2 h (7.48 \text{ gal/cu. Ft.})$ /ELL PURGE AND SAMPLING DATA Purge Method: ingle Casing Volume of Water in Well (VW) gals (CV x H = VW) umber of Casing Volumes to Purge (NC) gals was Well Pumped Dry? Y N N otal Volume of Water to Purge (TV) gals (VW x NC = TC) Fe ² (mg/L): Cond Turbidity ORP D.O. Water Level Removed Time Temp (C) (umhos) pH Q2 Begaa Purgi rra Weff	
VELL PURGE AND SAMPLING DATA Purge Method: 2" Watera pump ingle Casing Volume of Water in Well (VW) gals Purge Date: 6 /5 /6 /6 (CV x H = VW) gals Was Well Pumped Dry? Y N umber of Casing Volumes to Purge (NC) gals Fe² (mg/L):O_O N otal Volume of Water to Purge (TV) gals Fe² (mg/L):O_O N otal Volume of Water to Purge (TV) gals Fe² (mg/L):O_O N Otal Volume of Water to Purge (TV) gals Fe² (mg/L):O_O N Otal Volume of Water to Purge (TV) gals Fe² (mg/L):O_O O (VW x NC = TC) Mater Level Removed Flow Rate Obse Obse Time Temp (C) (umhos) pH (NTU) (mV) (mg/L) (ft. bgs) (L) (L/min) QQO Begaa purgi ra Well W Water a purgi ra Well Water a purgi ra Men	
ingle Casing Volume of Water in Well (VW)gals Purge Date: $\frac{1}{6}\frac{f_{5}}{6}\frac{g_{4}}{6}g$	
(CV x H = VW) gals gals Was Well Pumped Dry? Y N paint of Casing Volumes to Purge (NC) gals Fe ² (mg/L): O.O O potal Volume of Water to Purge (TV) gals Fe ² (mg/L): O.O O (VW x NC = TC) gals Fe ² (mg/L): O.O O Time Temp (C) (umhos) pH (NTU) (mV) (mg/L) (ft. bgs) (L) (L/min) Phy QQ Beaa pumpi ra Well Water a fill of the phy O O	
umber of Casing Volumes to Purge (NC) gals gals Was Well Pumped Dry? Y N otal Volume of Water to Purge (TV) gals Fe ² (mg/L):OO O.O N (VW x NC = TC) Cond Turbidity ORP D.O. Water Level Removed Flow Rate Obse Time Temp (C) (umhos) pH (NTU) (mV) (mg/L) (ft. bgs) (L) (L/min) Phy QQ Beas pumpi rsa West with Water raa pimp N Water raa pimp N	
(VW x NC = TC) Cond Turbidity ORP D.O. Water Level Removed Flow Rate Obsection Time Temp (C) (umhos) pH (NTU) (mV) (mg/L) (ft. bgs) (L) (L/min) Phy 220 Bean pure in a well w/ Water of firm p	
Time Temp (C) (umhos) pH (NTU) (mV) (mg/L) (ft. bgs) (L) (L/min) Phy 220 Beaan purgi ra Werr W/ Watera Nom A	
220 Began purging werr w/ Waterra hump -	ervations /s. App.
	<u>ia. App.</u>
	••
STRUCTIONS AND COMMENTS	
Irging/Sampling Remarks Pump@60 ft. 0.0 0ZOAR, Fe ^{z+} = 0.0 mg/L Hydrogen Peroxide = 1-2 mg/L	
Hudrogen Peroxide = 1-2 ma /1	

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للمصدوفة بعوادية بالتداد ومعقص من

Carlos and a final fille

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

مأخذته مزرار وبكها

								MON	ITOR WELL I	NO: <u>MW-33B</u>
				Mon	itor We	ell Samp	ling Data	1		
Project:	Cooper Drun	<u>n</u>								
Location I	No:MW	-33B		·		Job No:	18500147.07	030		
Sample No	o(s):370	618					:SL <u>/DG</u>			
		ne 5, 2006				Reviewer(s	;):		Date: <u>6/4</u>	5/04
		ct from dedica				Weather: _	Cloudy	15°F		
Sampling ⁻	Гіте:					Ambient Te	emp. (F):	5°F		
	LEVATION D		\sim			Product Obs	: Y	N		
		Depth Sounder	(N				duct:			
Other: Screened i	nterval:	80 - 90	_				easurement:	Interface Probe	Y	N
		(WCE)		f	<u> </u>	Other:				
	sing top as m									
2) Depth to	Water Surfac	ce (DTW <u>4</u>	7.22	f	t	<u>Well D</u>	ameter (in)	<u>(</u>	Casing Volume	(CV)/ft (gals)
(from ca	sing top as ma	ce (DTW <u>4</u> arked) 90.1	C				2		0.16	3
(from ca	pth (WD): sing top as ma	/0./	<u> </u>		-		4 6		0.65	
	f Water Colur		2.913	fi			D		1.46 CV = (23.49)	
(from ca	sing top as ma	arked)				L		3.14 [(D/2)/12 in.f		
	RGE AND SAM	MPLING DATA				Purge Meth	iod: 2"	Grundfos subr	nersible pur	
Single Cas	ina Volume of	f Water in Well	(VW)		nals		: 6/5/00			
ł	(CV x H = V	'W)			•	i dige bale	· <u>-+/ ·/·</u>			
Number of	Casing Volum	nes to Purge (N	C)		_gals	Was Well F	Pumped Dry?	Y	Ń	4 · · · · · · · · · · · · · · · · · · ·
Total Volur	ne of Water to	Purge (TV)			gals	Fe ² (mg/L):	3.2			
	(VW x NC =					,				
		Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
Time		(umhos)	pH		(mV)	(mg/L)	(ft. bgs)	(L)	(L/min)	Phys. App.
1312	21.35	79,15	7.12		-88-3	<u>0_44</u>	47.36	2-4	0.8	
1315	21.49	8040	7.13	-74	118.8	0.22	47.36	4.8		
1318	21.86	8099	7.11	71	-129.1	0.14	47.36	7.2		· · · · · · · · · · · · · · · · · · ·
1321	21.99	8128	7.11	77	-138.0	0.11	47.36	9.6		
1324	22.03	8144	7.11	50	- 147.4	0.11	47.36	12.0	1	
						-				

ľ

								MC	ONITOR WEI	L NO: <u>EW-1</u>
				Moni	tor We	ll Sampl	ing Data			
roject: <u>Coope</u>	er Drum									
W-1						Job No:	18500147.070	30		
ample No(s): 37	7619					Sampler(s):	SL <u>/DG</u>			
ampling Date: _	June 5,	2006	<u></u>							
ampling Method	d: Direct	from dedicate	ed tubing			Weather:	Darty C	loudy		·
ampling Time: _						Ambient Ter	mp. (F): <u>7</u> 9	°F'		
ATER ELEVAT		TA	_			Product Obs:	Y	N		
lethod of Measure			Ω N			•	luct:			
ther:						Method of Me		Interface Probe	Y	N
creened interva			48.5 - 1		-	Other:				
) Well Casing E				ft						
from casing to) Depth to Wate (op as mai		7601	4			ameter (in)		Casing Volume	(CV)/ft (cale)
from casing to (from casing to	n as ma	≂(DIW rked)					2	<u>(</u>	asing volume 0.1	
) Well Depth (W	•	•	90.5		_		4		0.6	
(from casing to		rked)				ļ	6		1.40	
) Height of Wate			2.84	ft			D		CV = (23.49)	•• ••
(from casing to	op as ma	rked)					CV = 3	3.14 [(D/2)/12 in.f	t] ² h (7.48 gal/c	u. Ft.)
VELL PURGE A	ND SAM	IPLING DATA				Purge Metho	od:2" (Grundfos subr	nersible pun	np
ingle Casing Vo	olume of	Water in Well (VW		aals	Purge Date:	615/04			
(CV	′ x H = VV	V)								
lumber of Casin	ng Volum	es to Purge (NC) (_gals	Was Well P	umped Dry?	Y	\checkmark	
otal Volume of					gals	Fe ² (mg/L):	0.0			
(VW	V x NC =	TC)								
		Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
Time Te	emp (C)	(umhos)	pH ·	(NTU)	(mV)	(mg/L)	(ft. bgs)	(L)	(L/min)	Phys. App.
1359 2	1.06	4269	7.56	~	253.7	13.64	-		-	Downhole probe,
		· · · ·								prior to sampli
1454 2:	2)8	6641	7.15	3	28.4	3.05	47.71	2.4	0.8	
1457 22	2.14	6959	7.12	2	12.3	1.64	47.71	4.8		
-	1.49	69107	7.11	2	69	1.31	11.71	7.2	•	
	2.44	6979	7.11	2	8.6	0-99	47.71	9.4		
1506 25	2.41	6995	7.11	2	1.2	0.76	47.71	12.0	4	
1	2.39	7022	7.11	2	-5.8	0-68	47.71	14.4		
•										
					1	1	1			
NSTRUCTIONS	:									

Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

				Mon	tor We	ll Samp	ling Data	l ·		::EW-1-90'
Project: C	Cooper Drun	1								
	· · · · ·	-1-90ft				Job No:	18500147.07	030		
)			-					
		5, 2006							Date:	
-		t from dedicat								
						Ambient Te	mp. (F): <u>79</u>	F		
VATER EL	EVATION DA	<u>ATA</u>	~			Product Obs	Y	N		
		Depth Sounder	(y) _N			Depth to Pro	duct:			
other:								Interface Probe	Y	N
	ing Elevation	48.5 - 88.5			-	Other:				
	ing top as ma	•								
	Mate	- (DTH UT	.64	f	:	Well Di	ameter (in)	(Casing Volume (C	V)/ft (gals)
(from cas	ing top as ma	arked) 90.4					2	_	0.163	
•			7	·	-		4		0.652	
•	ing top as ma Water Colur	nn (H) 47	2.86	f4			6 D		1.468	
	ing top as ma		<u> </u>					3.14 [(D/2)/12 in.f	CV = (23.49) x t] ² h (7.48 gal/cu. 1	
VELL PUR	GE AND SAM	MPLING DATA		an An a st		Purge Meth			nersible pump	
ingle Casir		Water in Well	(VW)	-	gals	Purge Date	G/5/04	1		
umber of ((CV x H = V Casing Volum	vv) nes to Purge (N	C)		gals	Was Well F	umped Dry?	Y		
otal Volum	e of Water to (VW x NC =	Purge (TV) TC)			gals	Fe ² (mg/L):	i.B	\$		
Time	Temp (C)	Cond (umhos)	pH ⁻	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	ہ Removed (L)	Flow Rate (L/min)	Observations Phys. App.
1411	21.40	8790	7.10	4	-35.5	0-31	47.78	2.4	0.8	<u>7</u>
	R1.68	8899	7.09	,	62.4		47.7%	4.8		
1417	21.73	8902	7.09	1		0.17	47.76	7.2		· · · · · · · · · · · · · · · · · · ·
	21.74	8913	7.09		-73.1	0.14	47.76	9.6		
423	21.74	8912	7.09	ī	-78.1	0.14	47.76	12.0	Y I	
426	21.86	8900	7.08	1	-72.4	0-16		14.4		
	a						91.10	17.4		
		· · ·								
								·	├──	
					<u> </u>					
										· · · · · · · · · · · · · · · · · · ·
	ONS AND Co	OMMENTS	@ 85 #		Ha	$D_1 = 0$.D mg/L	0	3 dNS	
	indiana menual		ອ ບວ ແ			·L··	· my		<u>, ur/</u>	

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Note: A complete list of containers and analyses used can be found in the associated sample log. The final row of readings should list the time sampling was completed and an estimate of the total valume of water removed. Water measurements should be re

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HYDRODATA SHEET Project <u>looper Dram</u> Event 15c0 Water (2-215 Sampler______ Project No. _____ Datum TOC______ Sheet ______

WELL or LOCATION	DATE	TIME	MEASUREMENT	TOTAL DEPTH	СО	MMENTS
mw-zo	7-12-0	0848	-48.60			
MN-2013		1003	48.44	1	102.34	
MW-33A MW-333 EW-1		1112	48.84	1	102,15	54.22
Mu-333		1213	48.65		102.79	54.14
- DW-1	V	1331	49.00		103.57	<u> </u>
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					<u> </u>	
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HYDRODATA SHEET

Project Cooper prim

Event_8/15/05

シア Sampler_

Project No.

Datum TOC

Sheet <u>/</u> of <u>/</u>

	WELL or LOCATION	DATE	TIME	MEASUREMENT	TOTAL DEPTH	COMMENTS
	MW-17	8/15/05	1236	48.89	÷	····
	m - 21	u U	1242	49.15		
	Mw - 4	n	1252	48.44		
	MW-20	11	1256	48.20		
	1W-20B	h	1300	48.15		
L	MW-33B	11	1304	48.37		
-	EN-1		1307	48.81		
4	MW-33A	1(1308	47.50		
4	MW-23	Li .	1314	49.35		
	EW-2		1320	48.85		
	MW-15	и	1635	48.56		
				-		
						-
L						
<u> </u>				1	<u>`</u>	· · · · · · · · · · · · · · · · · · ·
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HYDRODATA SHEET

Project Cooper Drum Project No.

Event 8/16/05 Datum 19C

Sampler DG/SDL Sheet $_l$ of $_1$

WELL or LOCATION	DATE	TIME	MEASUREMENT	TOTAL DEPTH	COMMENTS	
MW-20	8-16-05	0700	47.85			
MV-33A	n	0702	47.38	+		
EU-1	11	0703	48.83			-
MW-33A	'n	0737	47.58	1		-1
MV-20	M	0738	48.02		ORP 203.5@63	DAIRA
				<u> </u>		my/g
MW-20	u	0743	48.10			
MW-203	٤ſ	0858	48.15		came up dwingsamp	ins
MW-33A	٤٢	1017	47+38			-
MW-33B	4	1128	48.50			-
Ew-1	ч	1314	48.83			
						-
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HYDRODATA SHEET

Project Cope rum

Event____

Sampler DG

Project No. _

Datum TOL

Sheet _____ of _____

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WELL or LOCATION	DATE	TIME	MEASUREMENT	TOTAL DEPTH	COMMENTS
MW-15	9/6/05	1409	48.56		
MW-17) (14 12	48.84		
MV-23	η	1414	49.28		
EW-2	11	1422	48.82		
MW-21	И	1428	49.08		1
mw~4	и 1	1431	48.19		
MW-20	- 4	1436	47.98		· · · · · · · · · · · · · · · · · · ·
MW-208 MW-200		1442	48.10		
MW-33B MW-33A		14.44	48.32		
Ew-1	//	448	47.68		
	<u> </u>	446	48.82		
······					-
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			/		

HYDRODATA SHEET Project Cooper Drum

Project No.

Event 03 Pilot Test Datum TPC

Sampler <u>S. Look</u>, bill Sheet <u>l</u> of <u>l</u>

·				TOC	
WELL or LOCATION	DATE	TIME	MEASUREMENT	TOTAL DEPTH	COMMENTS
MW-17	9/28/05	137	48.67	103.26	54.69
MW-15		1142	48.40	102.77	
MW-23		1150	49.14	104.15	
EW-2		1155	48.66	103.65	54.99
mw-21		1215	48.91	103.63	54.72
Mury		1210	48.11	102.91	54.80
11W-20		1219	47.00	102.94	55.04
MU-20B		1220	47.98	102.45	54.47
MW-334	, 	12 22	47,46	103.06	55.60
33B	+/-+	1227	18.19	102.79	54.60
_Ewq	V I	1235	48.45	103,37	54.92
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HYDRODATA SHEET

Event 1900 PT

Project No.

Datum<u>TOC</u>

Sampler D Gube

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$\begin{array}{c c c c c c c c c c c c c c c c c c c $	L	OCATION	DATE	TIME	MEASUREMEN		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	LE	N-2	10/25/05	1415	4871	DEPTH	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	M	W-73	1				
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	M	V-17	11		17.28		<i>i</i>
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	M	V-15	11	1			· · · ·
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Cal	11-4	(/		78.50		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	m	V-20]1		48.25		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	mi	1-200			47.74		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	AL.	1-370			78.00		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	mw						
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	MI	$\frac{35}{1-11}$					
	111m	21		<u>· / / / / / / / / / / / / / / / / / / /</u>			
	E	<u>y-1</u>		1452	48.80		
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					<u> </u>		

Sheet _/_ of _/__

HYDRODATA SHEET

Project Ceoper Dram Event 1500 - Sounding Pourd, Sampler Project No. 18500147.07030 Datum_TOC Sheet _____ of _____

	WELL or LOCATION	DATE	TIME	MEASUREMENT	TOTAI DEPTH	٦
	MW-15	11-29-0	0710	48.34		-
ŀ	MW-17 MW-73		0714	48.70		-
ſ	MW-4		0721	49.11]
	MW-20		0724	48.02		
	MW-2013		0820	47,90		 -
\vdash	MW-33A	<u>- </u>	0919	48.62		 -
╞	MW-33B		1016	48.15		1
F	MW.7		<u>1110</u> 1240	48.65 49.67]
	EW-2		1324	48.55		4
_	MU-21		1417	48.79	· · · ·	
	MW-5		1459	35.84	· · · · · · · · · · · · · · · · · · ·	
<u></u>						

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HYDRODATA SHEET

Project Coope Drm

Project No. _

Datum_TOC

Event_1/19/06

Sampler_Scott Looking bill Sheet 1 of 1

WELL or	DATE	· _	T	Tomas	
LOCATION	DATE	TIME	MEASUREMENT	TOTAL DEPTH	
MW-17	1/19/06	2745	48.19		
MW-15	1	0748	45.92		
MW-23 MW-21		0750	48.68		
BW-2			M/M.		
MW-4		0752	48.13		
EW-1		0755	47.62		
MU-33A		0730	48.13		
MW-20	-++	0735	46.44		
MW-20B		0740	47.08		
MW-33B	_ <u></u> !'	792	47.43 47.60	· · · ·	
11.50 370		2737	T1060		
					_
			1	`	

HYDRODATA SHEET

Project Cooper Drum

Event 1900 PT -

Sampler_S4/BG

Project No. _

Datum_TOC

Sheet 1 of 2

	WELL or LOCATION	DATE	TIME	MEASUREMENT	TOTAL DEPTH	COMMENTS
	MW-16	6/6/06		50.81	50-0+	
	MW-15	†i †i	0714	47.34	1	
ļ	MU-17	v	0717	47.61		
	MW-18	ν	0719			1. I too tight
ŀ	MV-26	- li	0737	51.35		I d too Tight
· -	MW-25	10	0742	46.74		
4-	1/w - 32	М	0747	50.87		·
.	MW-31	И	0749	46.48		
	MW-30	<i>61</i>	0759	46.90		
	Mw-29		0809	46.33		
H	MW-27		0814	46.77		
Ľ	MW-28		0817	46.90		
H	NW-24		0824	46.82		
Ц	<u>mw-22</u>		0829	47.85		
4	<u>nw-19</u>		9835	48.03		
Ľ	hv-23		0840	48.17		
4	$\overline{N}\overline{V}-3$		2846	45.93		
12	VE-1	·' (36.01		
44	hw-2	17 (2853	48.79		t.
	-W-2	10	0858 1	+7.54		
	5W-1	n (0907 4	77.42		
\square	1w-33B	h 0	909 4	+7.0,2		
$ \mathcal{D} $	W-33A	" (912 4	6.73		
1	w-20		A	6.95		

HYDRODATA SHEET

Project Cooper Drun

Event____

Sampler_SL/DG

Sheet 2 of 2

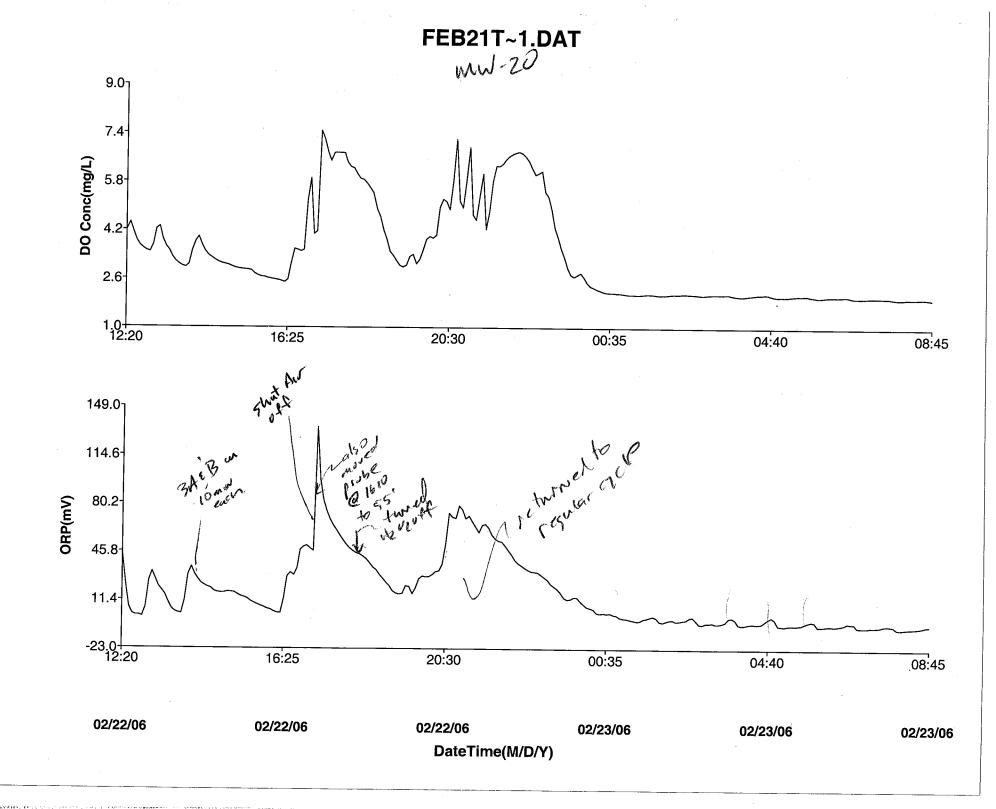
Project No. _____

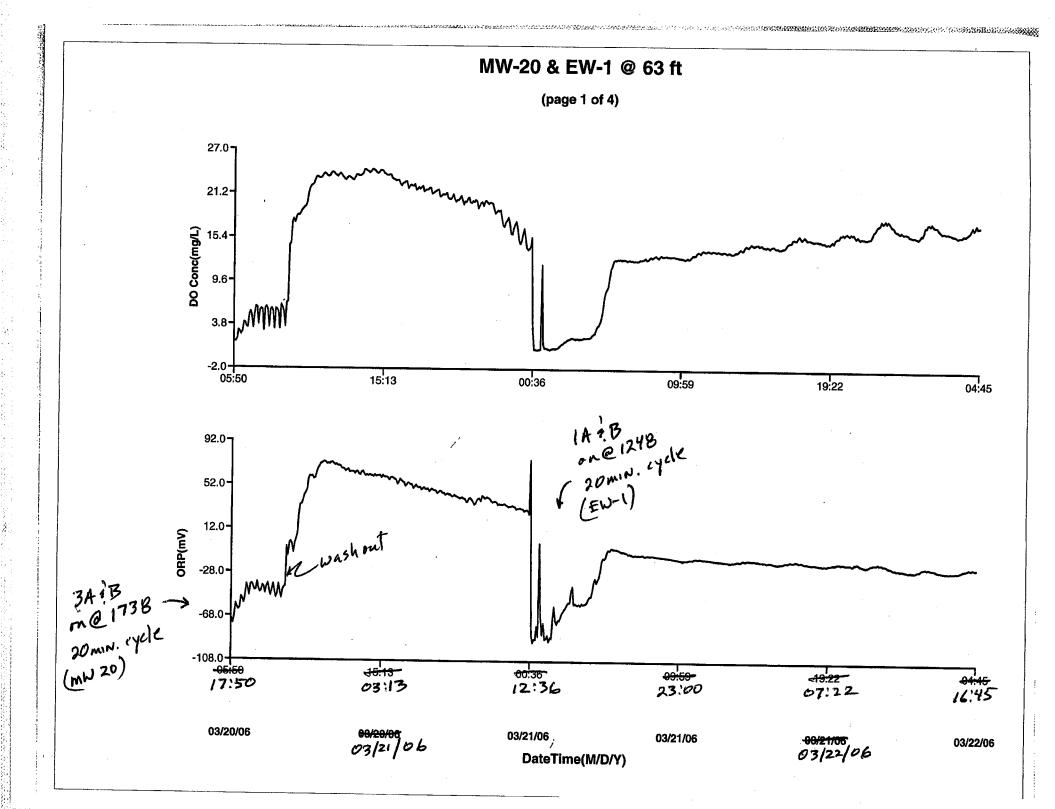
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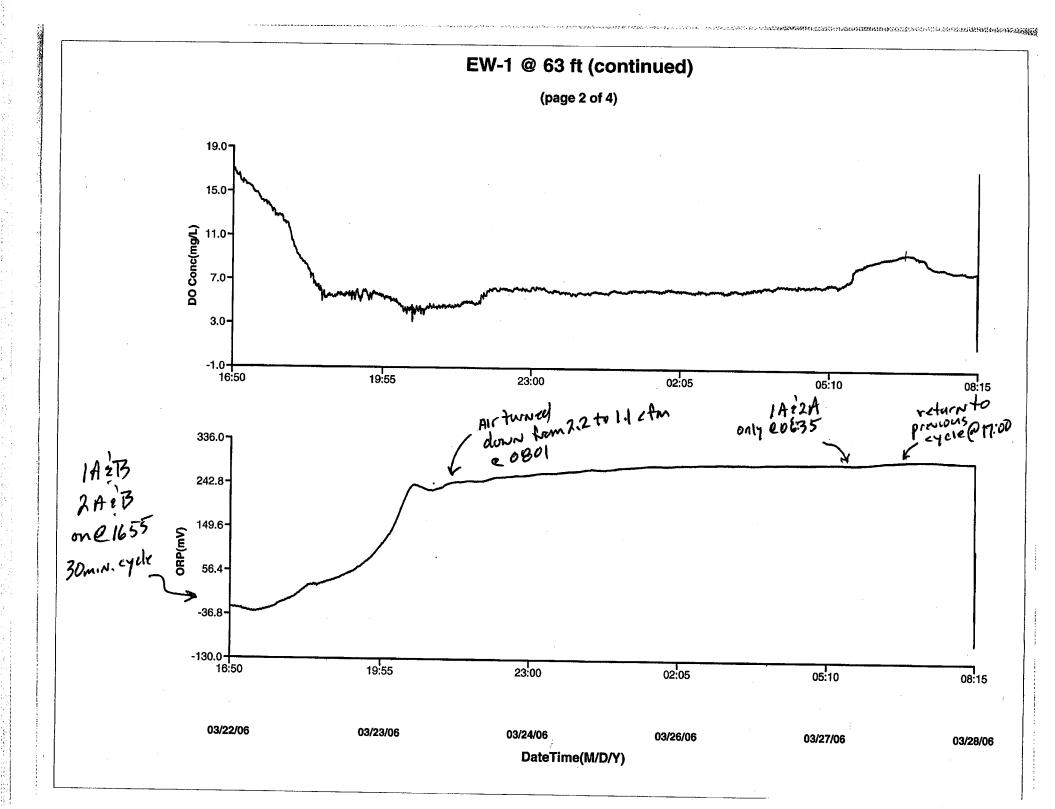
	WELL or LOCATION	DATE	TIME	MEASUREMENT	TOTAL DEPTH	COMMENTS
	MW-21	6/6/06	0920	47.64		· · · · · · · · · · · · · · · · · · ·
	MW-5	21	0923	35.44	1	
	MW-12	61	1000	48,35		
	MW-10	*/	1002	48.19		
	MW-8	V	1015	47.15		
	MW-14	61	1022	34.48		
	MW-20B	. V	1055	46.82		· · · · · · · · · · · · · · · · · · ·
	INW-1	M	1410	44.12		
	min-4	V	·	•		benerth pallets.
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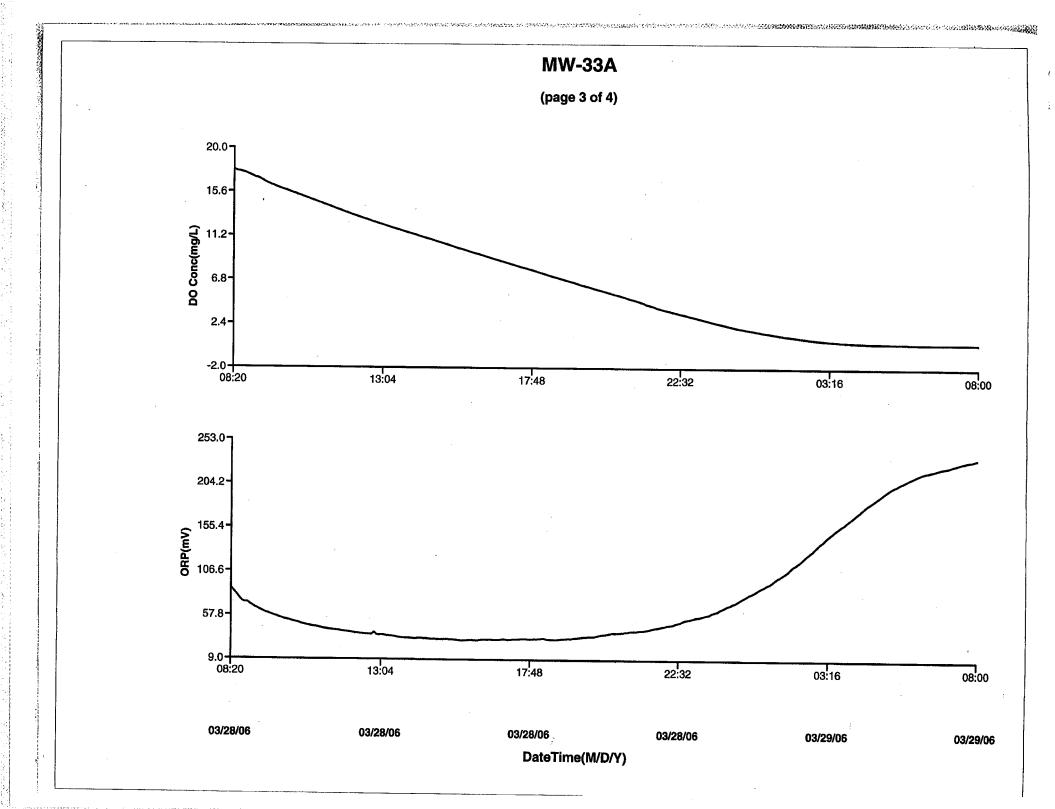
APPENDIX E

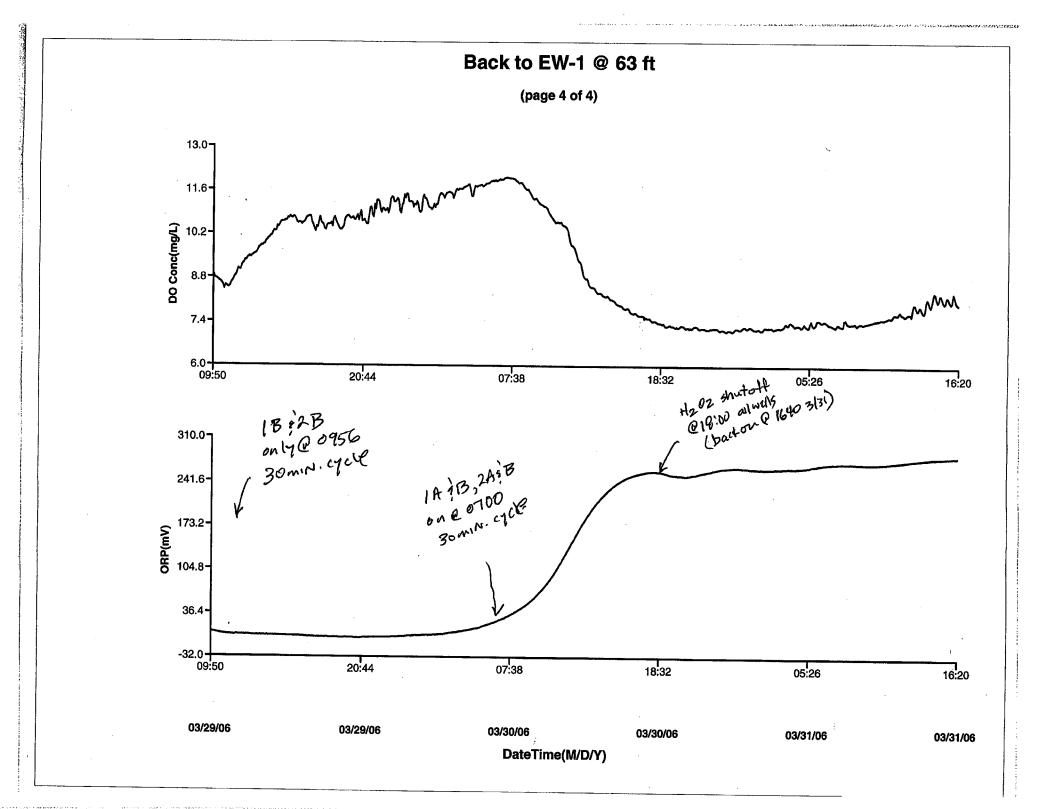
Downhole DO and ORP Data

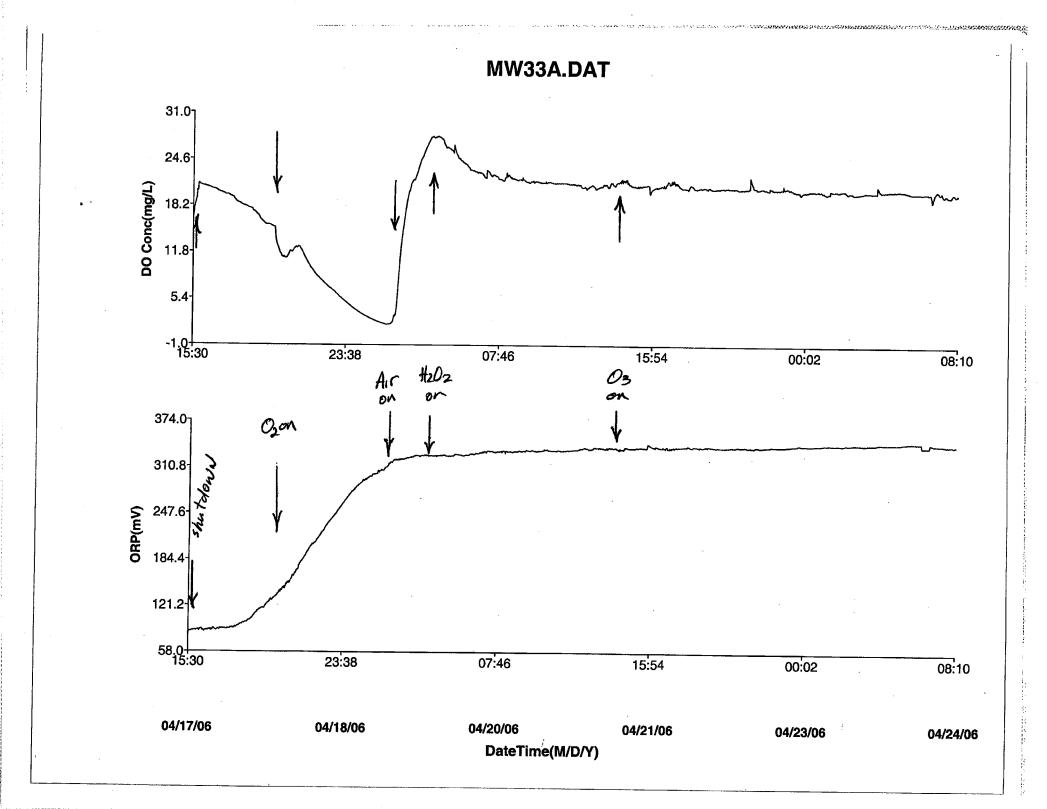


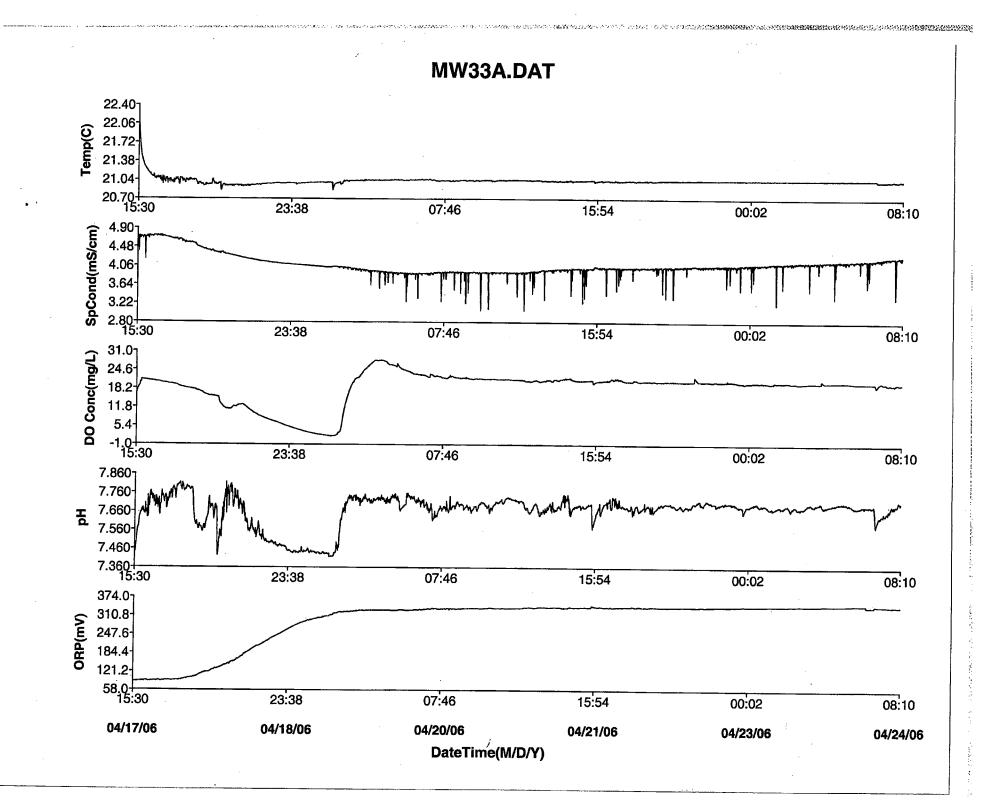


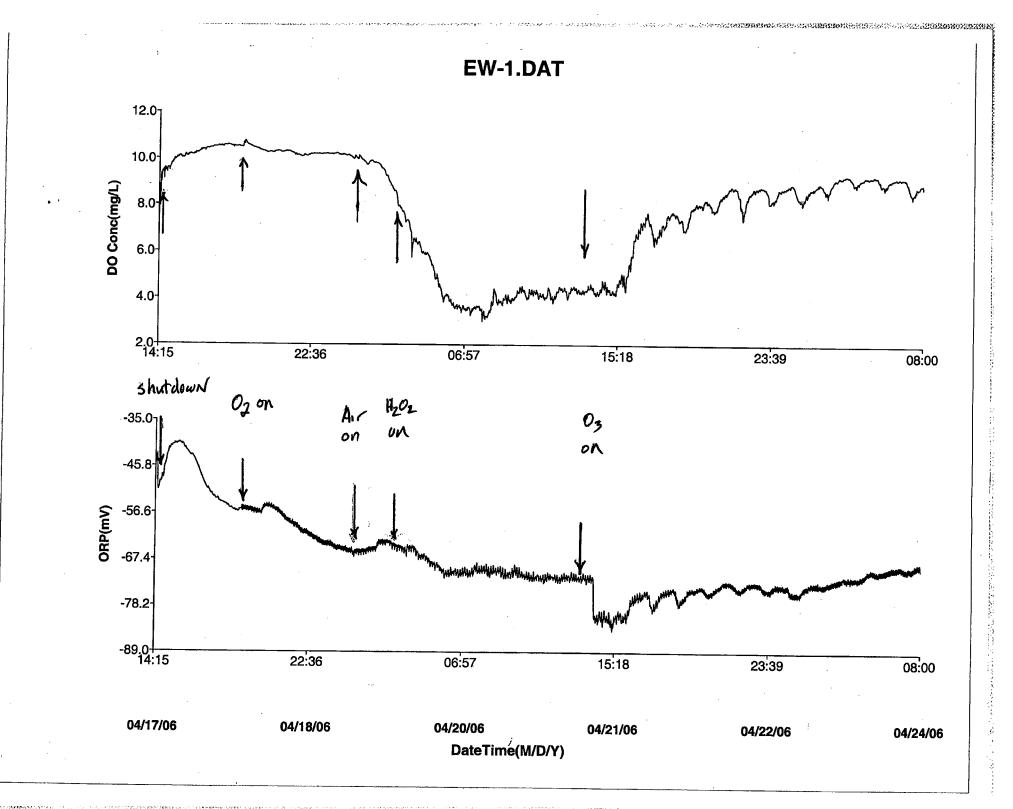


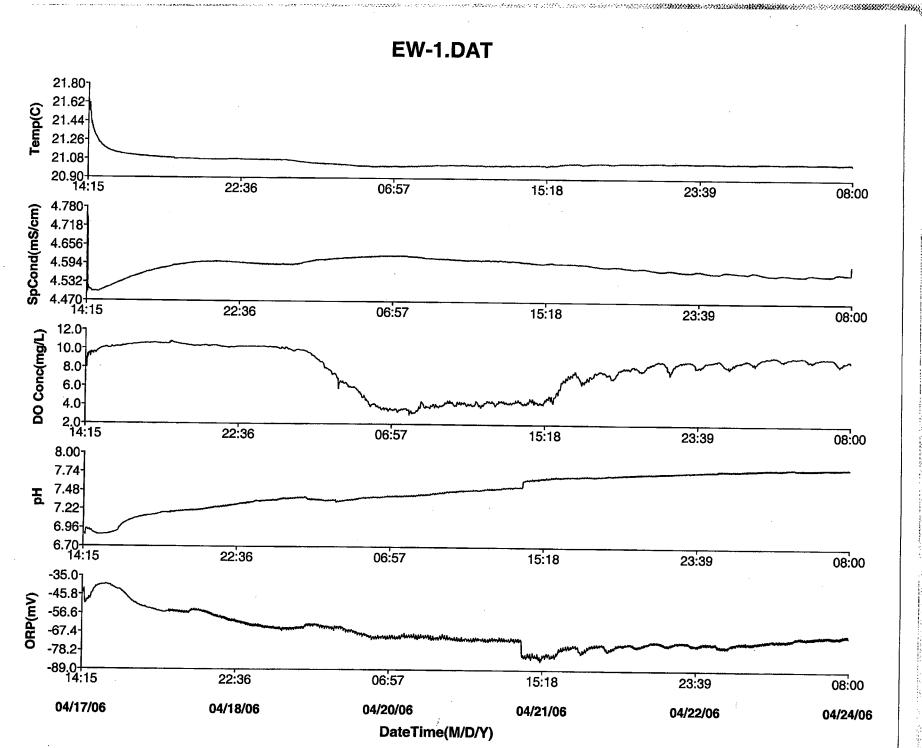


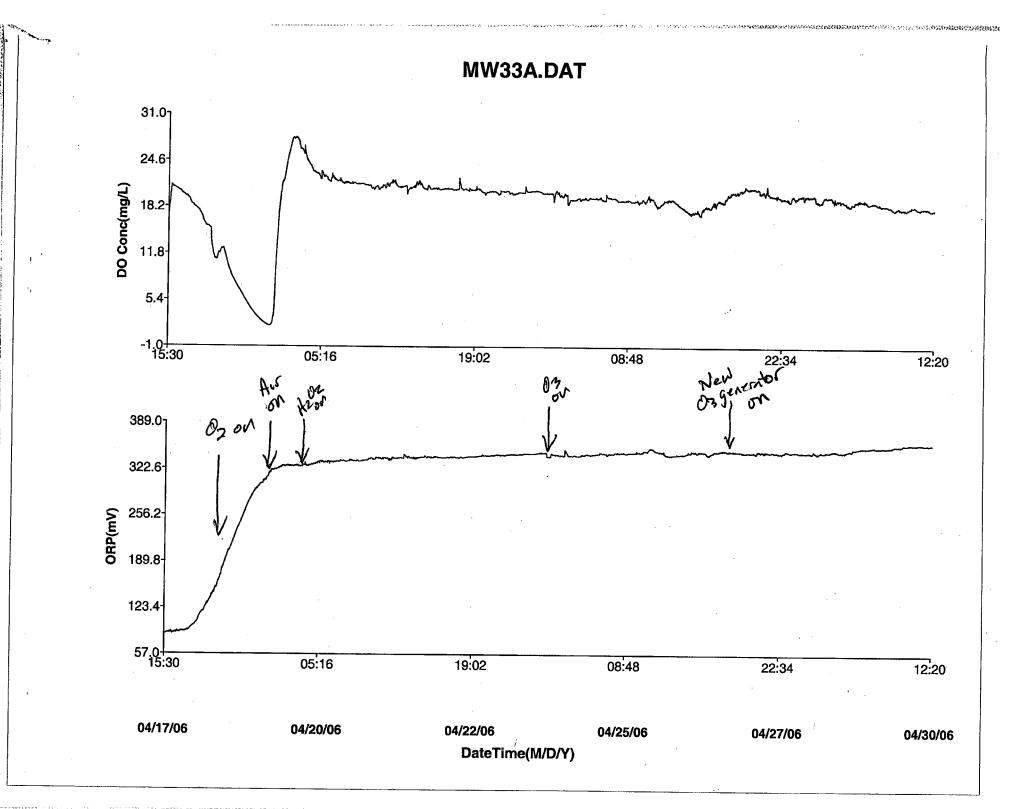


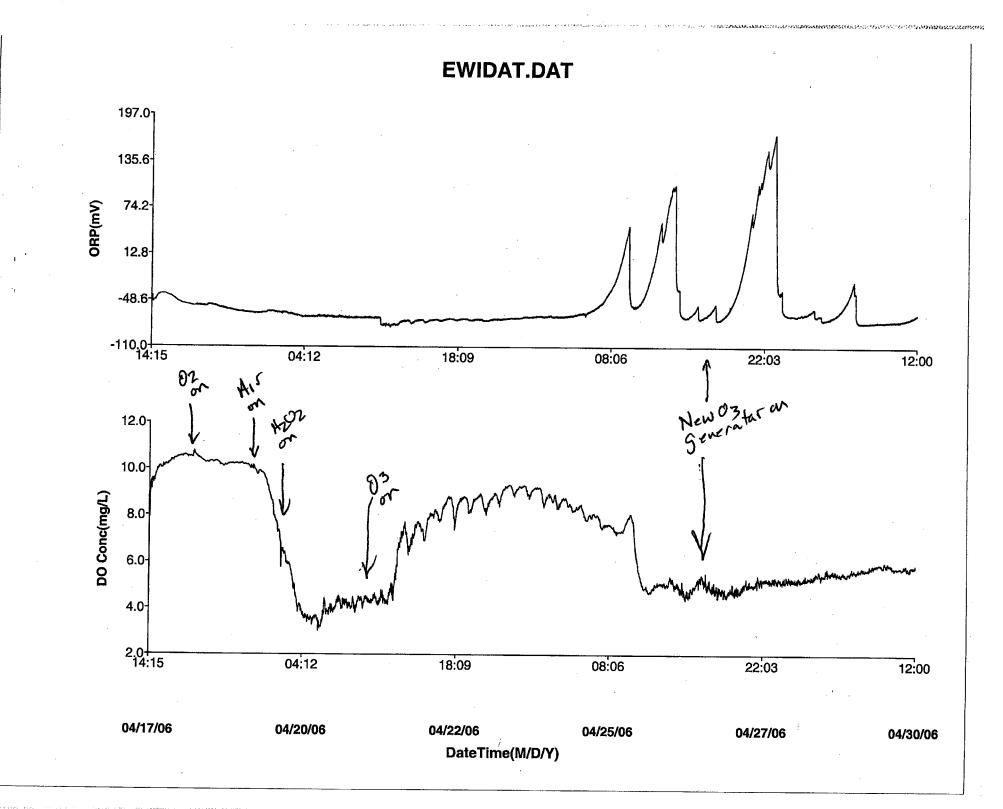


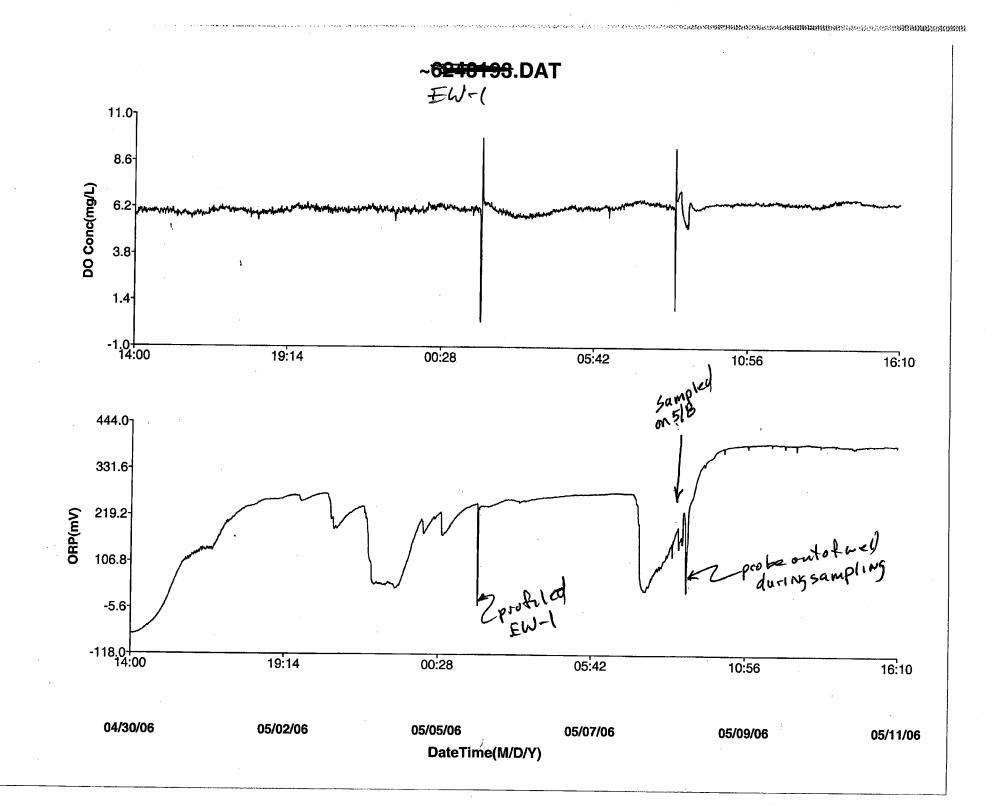




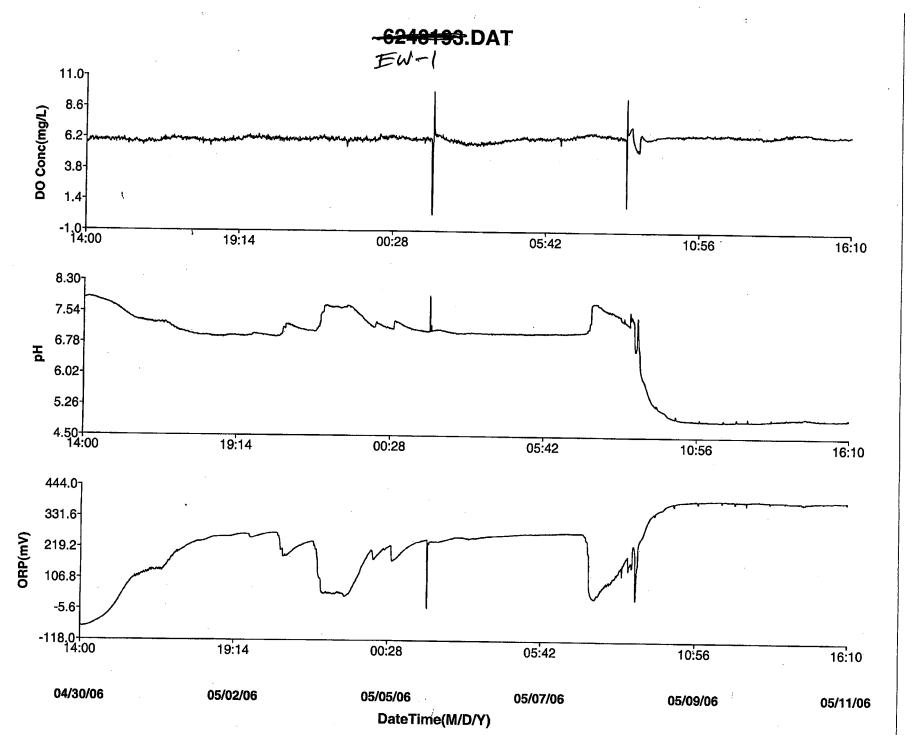


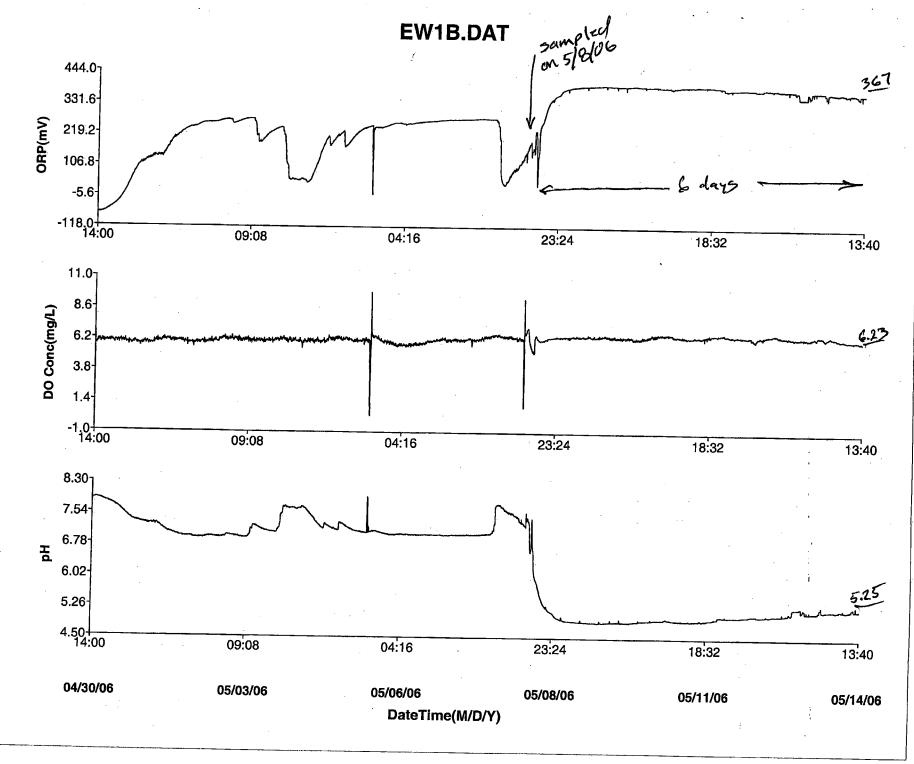


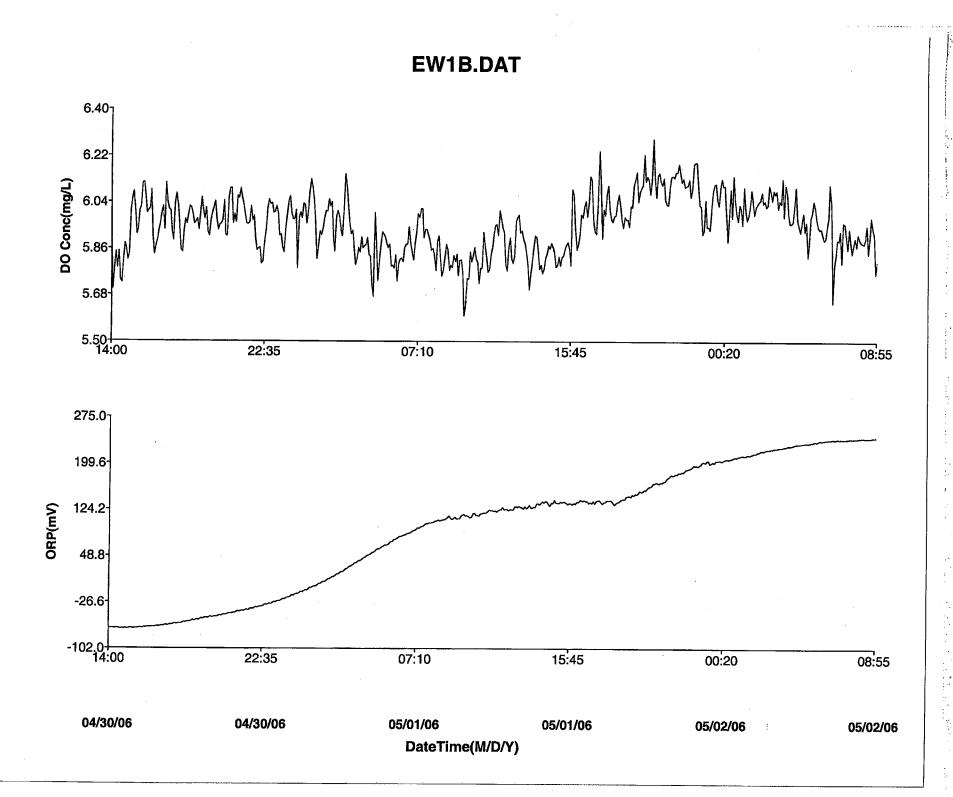




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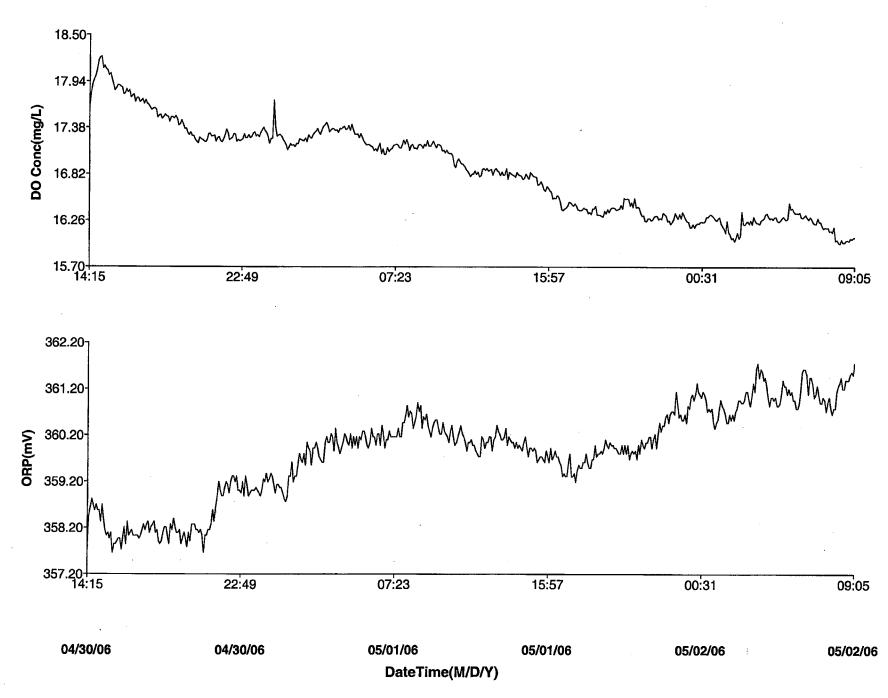


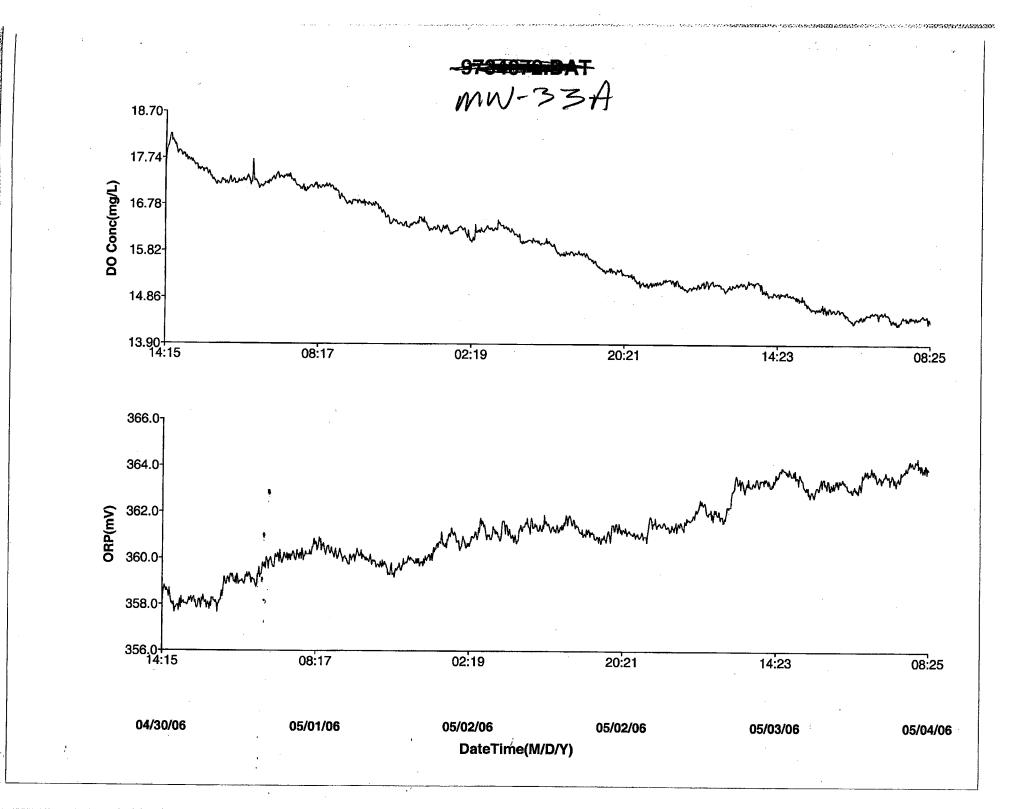


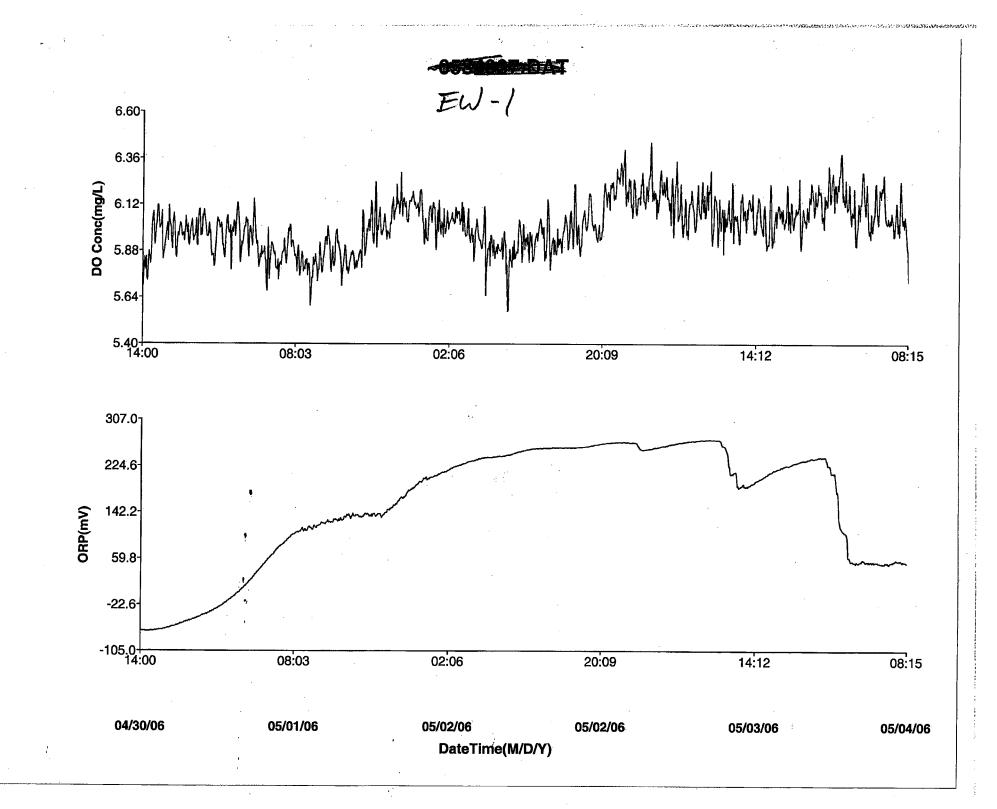
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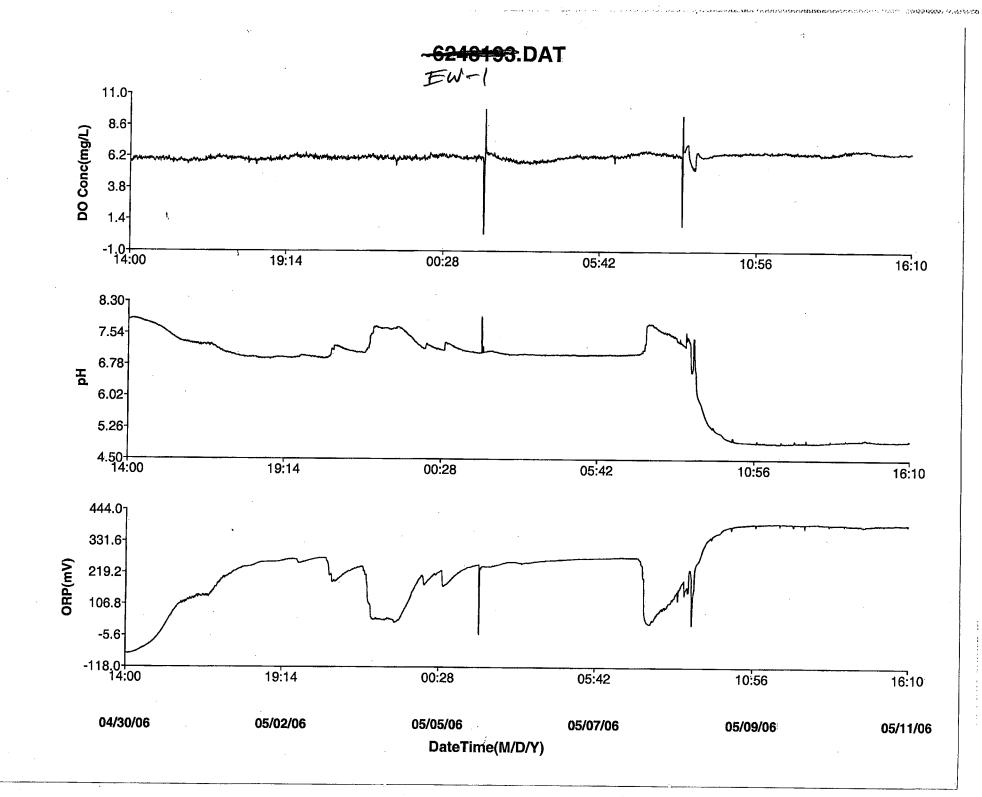
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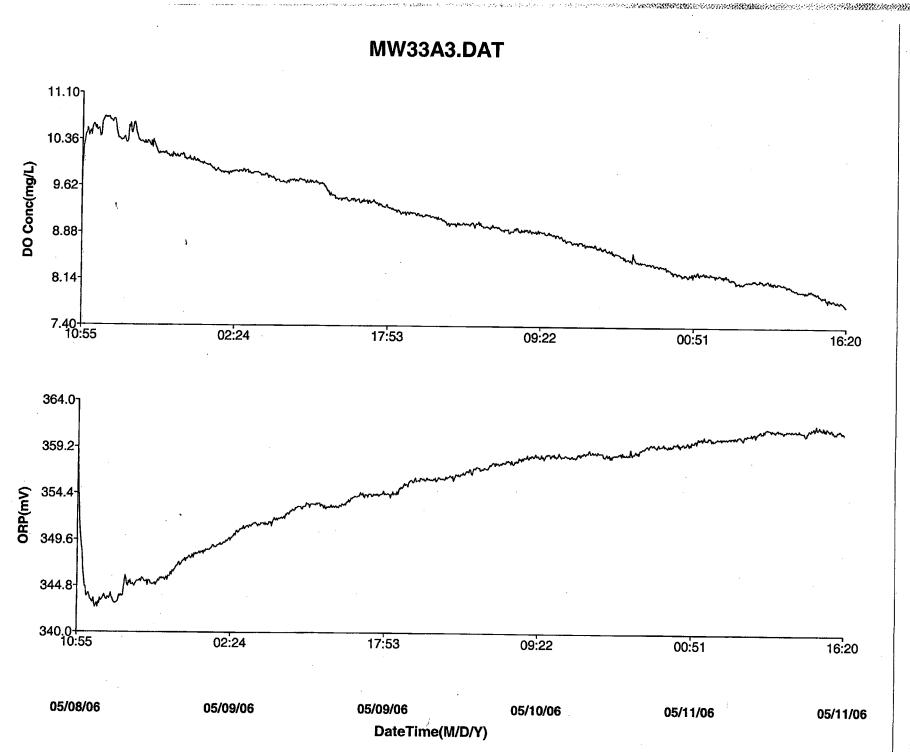
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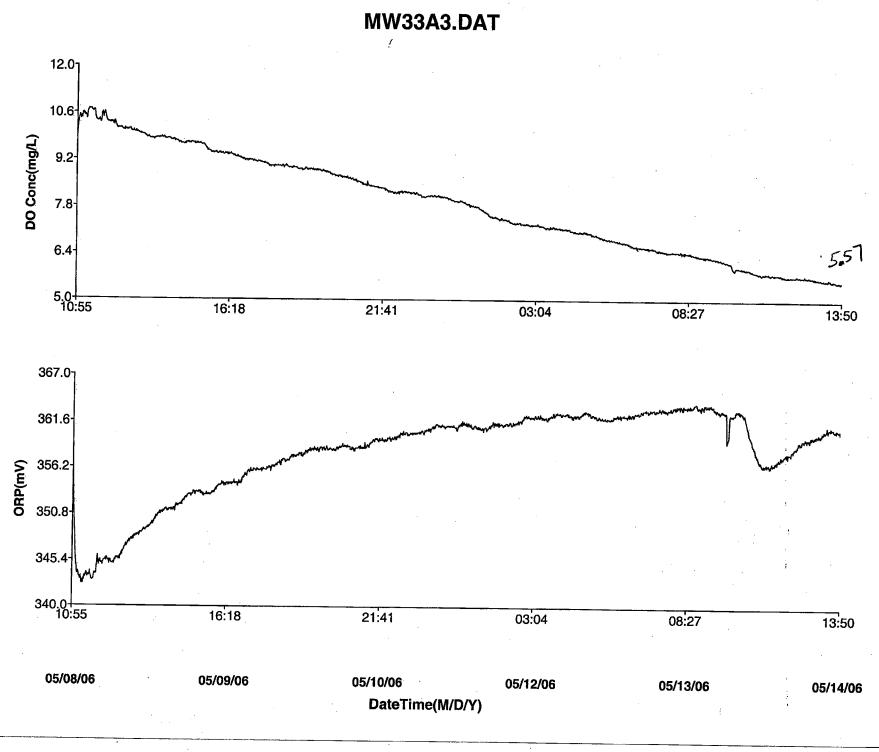




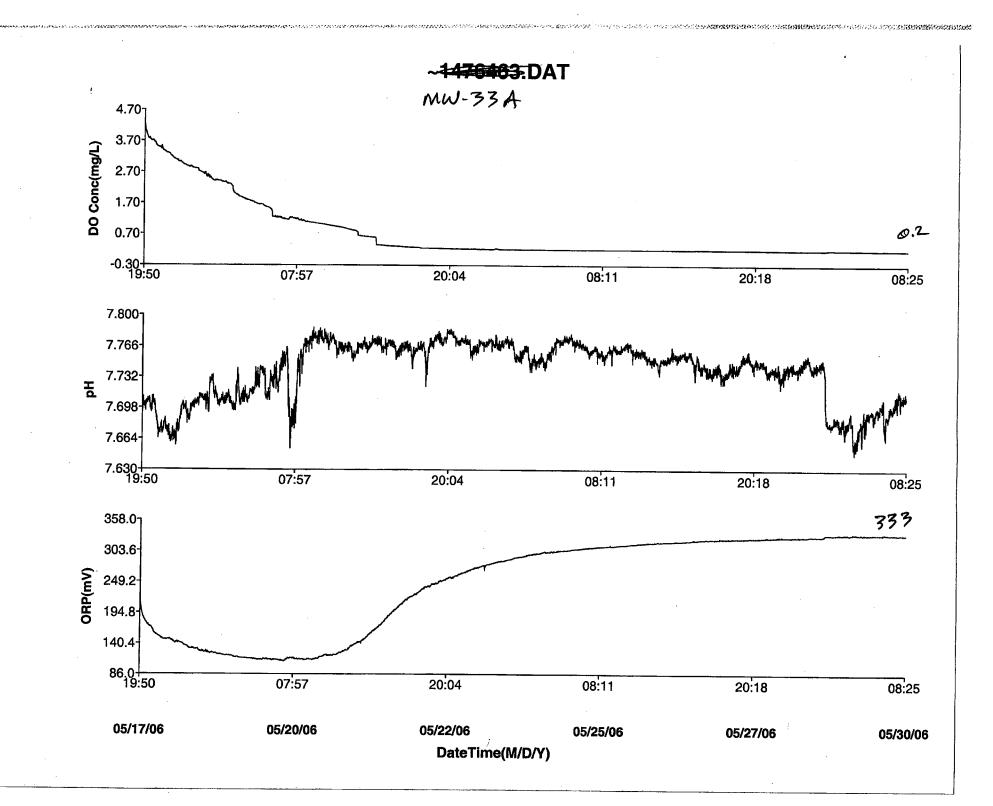


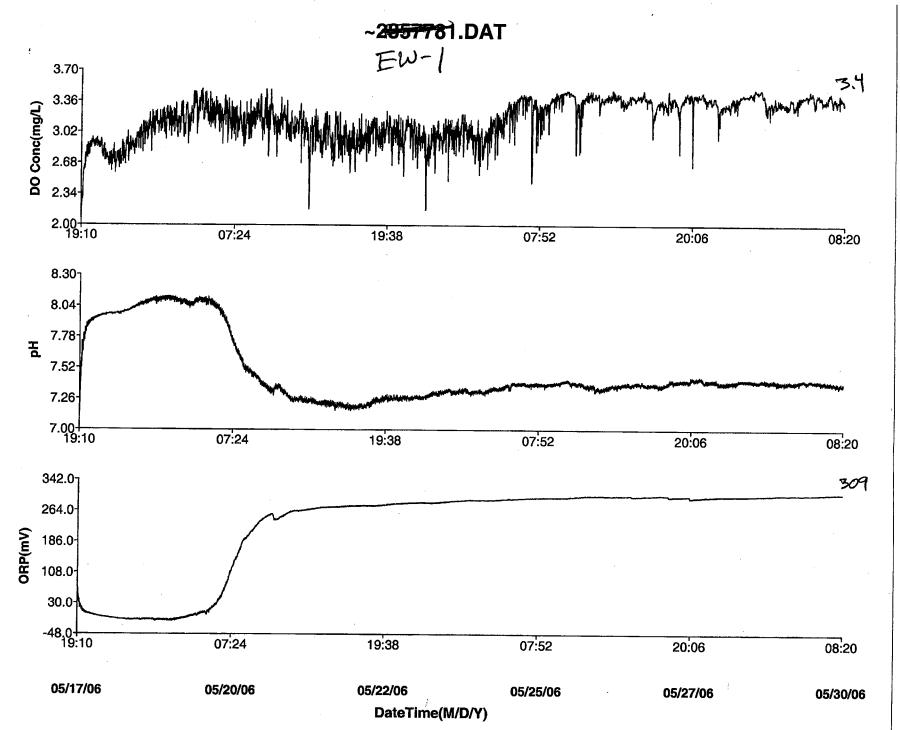


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н 1	12-1	4-03		~ M				n frot		MONITOF	R WELL NO:
	Time	Temp (C)	Cond (umhos)	0 IVI рн	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Data (co Water Level (ft. bgs)	Removed (L)	Flow Rate (L/min)	Observations Phys. App.
EW-190	[]400	70.08	3921	8.58		-29.6	2076				N 16-17
EW-163	ţ	20,94	4408	8.57		11.70	7.27		· · · · · · · · · · · · · · · · · · ·		
MN 24 33A	≯	20.67	3604	8,42		42.1	2.09				
MU 201 33	3	20.15	8393	8.74	-	61.4	2.09				
MW 20	B	20.17	8056	8.90		-77.2	1.52		:		
nuw	2D	20.79	4780	8.88		2,2	6.50				ORP 9 curstow
12	-15-	-05									
Ewaqu	,' OBII	19,75	7011	8.55	-	-24.0	1,77			2	
-w-1-6	\$	20.7]	4489	8.51		3,90	13.0				
MW 33A	·	20,78	3637	9,69		27.9	1.7.2				
NW33	B	20.13	8273	8.6	7 -	-57,9	1.09				
MW2	OB	20,14	8134	9.B0		-66.6	1.35	· · · · · · · · · · · · · · · · · · ·			· · · · · · · · · · · · · · · · · · ·
MUS2	<u>p</u>	20.79	48,44	8.65		6,5	1,28				
			· · · · · · · · · · · · · · · · · · ·		х 						
				<u> </u>						L	J

-

	Project:	Cooper Drum	l								
	Location No):					Job No:		<u>.</u>		
	Sample No	(s): <u>2 / 2</u>	2/06				Sampler(s)	:/DG		· · · ·	
	Sampling D	ate:	•			11	Reviewer(s	s):		Date: 21	2/06
			t from dedicate				Weather: _				-
	Sampling Ti	ime:			<u> </u>		Ambient Te	emp. (F):			
		EVATION DA					Product Obs		N		
	Other:		Depth Sounder	YN				duct:	Interface Probe	v	Ν
	Screened in						1				IN
	1		(WCE)		ft	t					
		ing top as ma			_						
		Water Surfac	e (DTW		fl	t	<u>Well Di</u>	iameter (in) 2	<u>(</u>	Casing Volume	
								2 4		0.16 0.65	
	(from cas	ing top as ma	arked)					6		1.46	
		Water Colum	ın (H) arked)		ft			D	3 1/ I/D/2\/42 - 4	CV = (23.49)	••• / •
		ing top as the	ancuj					Cv = .	3.14 [(D/2)/12 in.f	y n (7.48 gal/c	u. rī.)
	WELL PUR	GE AND SAM	IPLING DATA				Purge Meth	nod: <u>2"</u>	<u>Grundfos subr</u>	nersible pun	np
	Single Casi		Water in Well (/W)		gals	Purge Date	:		-	
	Number of (CV x H = V) Casing Volum	w) les to Purge (NC	3		nals	Was Well F	Pumped Dry?	Y	N	
		saonig roloni				_ 90.0	Theo Troat	umpou bry.	•	.,	
	Total Volum		Purge (TV)			gals	Fe ² (mg/L):				
		(VW x NC =	TC)								
			Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
	Time	Temp (C)	(umhos)	pH .	-	(mV)	(mg/L)	(ft. bgs)	(L)	(L/min)	Phys. App.
			e)	1.							
)	1410	20.66	8 25/cm	7.19		290	2.02	\square			
	1413	20,69		7.22	***	2261		11. Par	CHO 5	h h.t	Hown rech
						10 0 - 2 - 2 - 2		12 apore	cupv	n Dol	TOUN LEON
	1416	20.72		7,23		209.1	1.38	ļ/			
2	147)	0077	3985	Ch F		11/10	0.80	6 9.			
В	FTH-	20.37	2105	7.23		-142.9			song ci	<u>ap on</u>	botton re
	1921	20.38	7886	7.26		-155.3	0,94)	· · · · · · · · · · · · · · · · · · ·			0.85'
	1430	20.35	7898	7.23		-134.8		1			
	1433	20.33	7902	7,21		-124.9	0.73				
	1436	20.92	4445	7.20		147.7	2.21			-	aci
מו	1120	20.88	4489				1.04				063'
0	1420			7.21 7.20		81.6	0.97				
0	1439	7A 89 1	4071			101.10	V171	1		1	I
0	1439 1442	20.89	4981	1,20	-	<u> ~ 110</u>	<u> </u>				I

and an estimate of the total valume of water removed. Water measurements should be re

Page _____ of _____

Contraction of the

	21	2/06		M	onitor	Well Sa	ampling	Data (co	nt.)		
			Cond	2	Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
-> A	Time 1447	Temp (C)	(umhos) 3801	_{рн} 6.9Д	(NTU)	(mV) 1662 B	(mg/L)	(ft. bgs)	(L)	(L/min)	Phys. App.
3A	1171 1450	20.85	3797	6.89			2.23 1.18		<u> </u>		063'
	1453	20-87 20-88		6.89		136.9 135.8					
л. Т.	1257	0.0.00	3795	601		125.0	1.10		·	· · · ·	
	1455	20.30	7406	6.92		~51.7	110				· · · · · · · · · · · · · · · · · · ·
33B	1458	10.31	1408	6.91		-60.9					1685
	150 l	20.28		691		-64.4	0.94		ar sh deana -		1 275
	150 1	PU.EO	1905	1.			0,11		ž.		
							101.7				<u></u>
1	1510	20,84	4195	7.15		101.2	5.02				163'
	1513	20,87		7.10		91.6	4.35				<u> </u>
	1516	80.93	420B	7.09		97.3	3,99			· · · · ·	• • • • • • • • • • • • • • • • • • •
	1.1.10										
ı-	1518	20.16	7793	6.98		-2.9	-2.011	17			CP 85'
- '	1521	20.17	7800	6.87		-12.9	1.04				
	1524	20,17	7802	6.87		-14.2	1.03				
									1		1
21	1531	20.38	7088	6.9.3		-22.4	1.72			· .	CR34
	1534	20.35	7090	6.93			1.42				
	1537	20.34	7090	6.93		-41.8	1.25				
23	1543	20.36	9710	6.88		-60,0	1.51		e ^{nt} a de la companya de la company		P73
-	1546	20.37	9736	6.85		-67,0	1.20				
	1549	20.37	9745	6.85		-68.7	1.06		· .		
Z	1554	20.48	5355	7.03		-1956	1.61			-	R631
3'	1557	20.41	5352	7.03		-238.6	1.31				
	1400	20.41	5350	7.03		-244.3	1.23				
					1		- -				
2	1407	30.18	5444	7.02		-2525					Q77'
1	1405	20.18	5433	7.02			0.92				
	1408	Joils	5424	7.02		-27/.4	0.89		····		
-2	1412	7000	9612	600		-17/7	1.23		<u></u>		65'
6		20.08		6.87 6.85		-184,1					67
	<u>1415</u> 1418	20.11	<u>9608</u> 9606				6.94		<u></u>		1
	0171		1000	6-85		<u>[1 07.7</u>	0.38	· · · · ·			

Page 7 of 3

					Ceop	es Dr	um			MONITO	R WELL NO:
			1	N	lonitor	Well S	ampling	y Data (co	ont.)	79	
	7/27/0	и Тетр (С)	u 5/cm Cond (umhos)	рH	Turbidity (NTU)	ORP (mV)	D.O. (mg/L)	Water Level (ft. bgs)	Removed	Flow Rate	T <u>Q</u> Observations
	07577	T	T T	T					(L)	(L/min)	Phys. App.
5.1.1	2/22/30	,				27.2	7.17			-	
av-l	154			1		27.4	7.27	47.88		+	075163
ſ	0759					16.2	3.92	1 1100	· · · · · · · · · · · · · · · · · · ·		60
	0201	20.26	6986	1,90	170	15.9	3.81	0.7			13
	0308	-			1210	-54.8	4.50		· · · · · · · · · · · · · · · · · · ·		78'
	OBIZ	20.11	8700	7.02		=122	4.75	1			801
	0833	20.95		7.23		20	207	45			63
	0240	21.05	4270	726		10,7	8.31	<i>h</i> 2			65
	0844	20.98	4287	1.23		115	7.88				59' 63'
	0850	21.12	4113	1.74		<u>91.</u>]	11.34			<u> </u>	63
	0958	20.98	42 29	7.23		17.0	7.99			<u>.</u>	<u>53'</u> 63
	0400		ion cycli		star		1771			<u> </u>	62
I	0906	20.97	4282	7.23	4 7 40	18,6	7.89		·····		1.71
\mathbf{V}	0913		4289	7.23		19.6	7.89				63
	124,2	2.01	1001	1.00		11.6	1.01				63
W-33A	0927	20.92	3500	7.00	· · · · · ·	17.6	15.50	46.54			55
1	N933	20.86		7.14	·····	11.2	5.49	76.21	<u></u>		
V	Ogun	20.86		7.11		12.5					60'
V		00100	5001	1.10		140	5.09				62 70+62,5
W-338	0946	20.31	7352	7.01		-103	4.71	46.54			Oct 1
	0453	20,19	7977	698		-106	5.01	16:01			80' systema
N	0955	2013	7352 7927 8690	696		-107					85
V I		ACC	to IV	-		6	5.13				90'
WIN	1009	20.89	4263	7.45		692	15.93	47.15	(1 0	h 7 . h	5-1
	1016	20.91	9432	7.27			-		020	O. 3mg/L	
		20.71		7,24		275 156	<u> </u>				60'
\mathbb{V}		20.63		7.23		150					65' 68' D
	<u>i </u>	70,001	7512	112)			3,45				60 0
WOB	1043	20.41	7878	7.36		1711	4.43	47.39			<u></u> ;>₽
1	1047	20.29	7899	7.13				11.24			0/ <u>`38</u> m
V		20,22	7905	7.08		-1(4	4.98			<u>к</u>	<u>85'</u> 89'
V F	1221	Will	1105	1.08			5.10		··· ·· ·· ·· ··· ···		31
Sect	Q M	W-20	063	((7 11.	0 (1	2: 20 d	evice)			
	IN BUL D	Ingge	1 mile	-11 /12		5 0	77		101		
ŀ			1 0215	11204			12	Note	1Bh	as bus	20195
	Rest		15:00	1	te						
-	No	ly ma	u-33A- 33B	18'	from 1 from	MALOS MacOZ	2 3	c'from p	hx 03	Page _	1_of_2

		· · ·	· · · · · · · · · · · · · · · · · · ·		150	per d.	ram			MONITOR	WELL NO:
				М		1		Data (co	ont)		
	1.1.00	19	, s/cm	141	onnor	Well Ge	unping	Data (CC	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
	2/22/09		US/CM Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
	Time	Temp (C)	(umhos)	pH	(NTU)	(mV)	(mg/L)	(ft. bgs)	(L)	(L/min)	Phys. App.
jnw20	1538	20,92	4400	7.27	·····	47.6		Ø15	CHAHD N	1a+033A	10 min code
1	1545		4402	728		49.2	5.55			<u>7</u> B	[Omin]
	1557			7,29		48.7	4.35			H202	same as 03
	1558	2 0 .99	4405	721		46.2	4.20		Q	60D 31	ut ar off
			hap to	55	0129	350	Do II.	50 -1	etword te	631,	
	1605	20.96	4391	7.32		111.5	7.31	6		FOR/D	Acadily depart
	1610	20,95	4397	7,29		90.5	7.08			l	7
	1615	20.95	4402	7.27		78.3	6.95				
	1620			7.30		719	6.71				
		20,92		7.30	······	66.8	6.77				
		20.92		7.30		63.2	6.77				
	1635	2091	4417	7.30		59.8	6.74				
	1641	20.88		7.30		543	7.32	659			
	1645	20.86		7.30	· · · · · · · · · · · · · · · · · · ·	53.7					
		20,00		7.29			6.30		hutdan	#0-	
			44.22	1 1		47.6			1	no av	
				7.29			5.99		03000		
		20.04		729							
	1708	2.83	4422	7.29		442			·	1	
	FILES	22.23	· · · · · · · · · · · · · · · · · · ·	7,22		43.1	5.11	· · · · · · · · · · · · · · · · · · ·			
	VUS	20.01	4425	7.23		41.5	5.64				
X/.	1720	20.81	4427	7.28		40.7	5.53				
V	1725	20.80	4431	7,28		38.4	5,20				
2/23/0	Å										
2/3/0	6										
-											
muse	074D	20,83	4491	7.23		-5,2	2.03		2		
\checkmark	0745	20.81	4481	7.23		-5.5	2,14				
۱.								Latra 1		obl	
								note	raisid	to 55	ORP
		[
	· · · · ·									1	
								· · · · · · · · · · · · · · · · · · ·			
				• •		+					· · · · · · · · · · · · · · · · · · ·
	L	I		I		1	l	I	I	<u> </u>	
											22

Page 2 of 2 -

URS

URS	_					Page of
Job Description	Cooper D Water Quali	um Hu Morisin	Projec	t No uted by Di	Weson	Sheet of 3 Date $3-20-07$
				ed by		Date
		1 7 4				Reference
	WELL E	WL			<i>,</i>	
Depth	Time	Temp	C Cond us/	and DO mg/	L pH	ORP
96'	1331	20.54	6490	0.86	7.69	-177.3
	1336	00.04 00.04	5975 5980	0.79	7.70	-(79.7)
851	1341 1341	D0.10	6000	0.77 0.78	子.わ そ.わ	-1 <i>8</i> 0.9 -182.9
	1344	3D.10	6007	0,83	7.68	-183.6
	1347	90,10	totoztala	5 0.83	7.68	-(83.8
	1352	20.11	6634	1.04	7.69	-184.5
80'	1353	20117 20177	6541 6539	0.83	7,68	-(84.3 -(84.4
	1400	90.17	6550	0.81	7.68	-18457
75'	1401	2023	6486	0.81	7.68	-184.7
	1408	20.24	6474	0.81	7.68	-185.2
7~	1411	20.24	6466	0.81	7.68	-185.4
70'	1412 1413	90,43 70,46	5794 5800	2.79 5.25	7.74 7.49	-186.3 -75.9
	1415	20.46	5798	5.70	7.43	-62.1
	1417	20.45	5794	5.76	7.41	-54.0
t	1423	20.45	5779	5.13	7.41	-51.7
105	1424	20.79	5602	7.18	7.42	-43.3
	1427 1430	20.78 20.80	5627 5628	7.95 7.42	7.42	-40.0 -38.6
	1434	20.81	5621	7.72	7.42	-38.0
60'	1434	20.93	5504	8.16	7.44	-37.5
	1438	20.94	5517	8.64	7.44	-38.2
	1440	70.94 70.95	5516 5514	8,57 8,37	7.45 7,44	-37.3 -37.0
55'	1446	21.02	5381	9.37	7.49	-34.9
00	1448	21.01	5400	10.41	7.49	-33.0
	1451	21.02	5401	10.30	7.49	-33.4
Ch l	1456	21.02	5403	10.48	7.50	- 33.2
SD'	1457 1500	71.05 H.05	5376 5364	12.92 13.39	7.59 7.62	-32.6 -30.7
	1503	21.06	5249	13.42	7.62	-31.1
	1507	21.06	5309	13.42	7.64	-30.6

UND						Page _	of
Job(ooper Drum		Project No.			Sheet	2 of 3
Description	Water Quali				lason	Date	3-20-00
<u></u>			Checked b	• •		Date	
	WELL 33B						Reference
Dept	n Time	Temp "C	Cond " Yom	DO mg/L	pH		ORP
95.	1517	30.06	9121	1.11	7.70	2	-234.6
	1520	W.De	9121	1.06	7.6	-	-232.4
	1523	20.06	9122	1.05	7.61	0	-228.2
	1527	20.06	9125	1.03	7.6	4	-222.60
85'	1528	20.12	8237	1.05	7.6	Ч	-211.4
	1531	D.11	875D	1.03	7.5	3	-202.7
	1535	20.12	8257	1.03	7.57	•	-197.9
	1539	20.12	8222	1.00	7.50	7	-195.7
8D'	1910	20.21	7748	1.61	7,58		-195.5
-	1543	20.21	7747	1.61	7.57		-190.8
	1545	20.21	7747	1.00	7.56		-187.8
	1548	30.31	7743	1001	7,55		-184.0
	155D	20.21	7742	1.01	7.54		-182.4
		•			1751		
	WELL 33	4					
60'	1555	30,76	4116	11.63	7.31		-58,4
00	1559	20.77	4139	11018	7,29		-50.0
	1602	20.78	4132	11.61	7.32		-46.6
	1605	20,79	4124	12.07	7.34		-43.7
55'	lloble	20.87	varying	*	8.08		
	1613	00.90	Varying	18.54	8.07		-43.7
	lelle	30.91	3000-3200	18.63	8.07		-42.6
	i ur i ur	<u> </u>		1			. = • •

* Checked water level - 416.5' - Conductivity varying widely. Feels like bubbles in well-not injecting nearby!

Job COD	per Drun	า	Design the			Page of
	A 1.1	asurements	Project No.			Sheet 3 of 3
Description Water	many me	USUIT VIR VII 3	Computed			Date <u>3-20-06</u>
Ϋ́	1W-20B	······	Checked by	У		Date
· · · · · · · · · · · · · · · · · · ·	Time	Temp °C	Cond HS/cm ³	DD "JL	рH	Reference ORP
90'	1626	20.13	4967	0.48	7.87	
	631	M.05	4970	0.93	7.80	-238.1
851	1633	M.73	7929	0.97	7.75	
O(n)	1638	20.34	8170	0.97	7.67	
80'	1639	90.32	8205	0.88	7.96	
	1644	20.33	8216	0.85	7.97	-234.5
05' 1649	20.75	× 4420	V.	1.36	7.54	-103.4
	1653	20.75	4406	0.96	7.60	-119.7
	1656	26.73	4440	0.92	7.60	-120.6
(ac)	1657	30.90	3282	5.33	7.58	-73.1
	1702	20.91	3136	11.60	7.43	-49.7
551	1703	2091	2500-3000	17.96	7.32	106
	1706	20.91	2500-2900	18.53	7,19	187.5
	1708	30.92	26-2800	18.55	7.14	226
(2)		2001	1.50	21.	700	
63 '	17:13	20.81	4169	3.64	7.24	74.7

	3A&B		
3/20/06	5:38 PM		
Injection Cycle ti		20	
H2O2 inj on/off		60 - 120	1
H2O2 16 %			1
			1
O3 / A	hir / H2O2 valve	timing	1
on O3 off	on Air off	on H2O2 off	1
-	-	-	1
-	-	-	23
-	-	-	3
-	-	-	4
0 - 10	5 11	0 - 10	5
1020	0 5	1020	6
-	-	-	7
-	-	-	8

3 A & B

20-Mar	9:30 PM	
Injection Cycle ti		30
H2O2 inj on/off		60 - 120
H2O2 16 %		
	ir / H2O2 valve	timing
on O3 off	on Air off	on H2O2 off
-	-	-
-	-	
-	-	-
_	-	-
0 - 10	7 12	0 - 10
1030	0 7	1030
_	-	-
-	-	-

3 A & B

21-Mar 10:00 AM

Injection Cycle ti	me	30
H2O2 inj on/off		60 - 120
H2O2 %		
O3 / A	ir / H2O2 valve	timing
on O3 off	on Air off	on H2O2 off
-	-	-
-	-	-
-	_	
_	-	-
0 - 5	2 7	0 - 10
5 30	25 2	10 30
_	-	-
-	-	-

3 A & B

21-Mar 7:00 AM

Injection Cycle ti	30							
H2O2 inj on/off	60 - 120							
H2O2 %								
O3 / A	Air / H2O2 valve	timing						
on O3 off	on Air off	on H2O2 off						
		-						
-	-	-						
-	-	-						
-								
0-5	0-5 27							
5 30	5 30 25 2							
-	-	-						
-	-	-						

1 A & B

21-Mar				
Injection Cycle ti	20			
H2O2 inj on/off		60 - 120		
H2O2 %				
O3 / A	ir / H2O2 valve	timing		
on O3 off	on Air off	on H2O2 off		
0 - 10	5 11	0 - 10		
1020	1020 0 5			
-	-	-		
-	-	-		
_	-	-		
	_	-		
-	_	-		
-	-	-		

1 A & B

1

2 3 4

22-Mar 9:05

Injection Cycle ti	15					
H2O2 inj on/off						
H2O2 %						
O3 / A	ir / H2O2 valve	timing				
on O3 off	on Air off	on H2O2 off				
0 - 5	5 11	0 - 7				
515	0 5	715				
_	-	-				
_	-	-				
-						
-						
-	-	-				
	-	-				

1&2 A&B

1 & 2 A & B

15/15 03 15/15 Kan 17:00 (pm)

22-Mar

Injection Cycle time	30
H2O2 inj on/off	60 - 120
H2O2 %	

O3 / A	ir / H2O2 valve	timing	1
on O3 off	on Air off	on H2O2 off	1
0 - 5	4 7	0 - 7	1 1
515	15 20	7 15	2
15 20	24 27	15 22	3
20 30	0 4	22 - 30	4
-	-	-	5
-	-	-	6
-	-	-	7
-	_	-	8

Injection Cycle ti	me	30
H2O2 inj on/off		60 - 120
H2O2 %		
O3 / A	ir / H2O2 valve	timing
on O3 off	on Air off	on H2O2 off
Disable	5 8	0 - 7
0 15	15 20	7 15
Disable	20 23	15 22
15 0	0 5	22 30
-	-	-
-	-	-
-	-	-
-		_

15/15 03 8/13 11202

3/26/2006 Shal	1 & 2 A & B low wells only	
Injection Cycle til		20
H2O2 inj on/off		60 - 120
H2O2 %		
O3 / A	ir / H2O2 valve	timing
on O3 off	on Air off	on H2O2 off
010	6 11	0 - 5
Disable	11 15	5 10
10 0	16 1	1015
Disable	1 5	15 0
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-	-	-

11/10 03 1/202 10110

					Pag	e of
Job	Cooper Drum		Project N	lo	She	et of
Description _	Water Parame	er Measurer	nents Compute	d by A Dic	USON Date	3-21-06
			Checked	by	Date	
	WELL EWI	* Was	pressure on	well when	we opened if	_
DEPTH	TIME*	Temp °C	Cond. ^{US/cm®}	DO mg/L	we opened it	ORP
85	OD:39	20.10	SUSY	0.59	7.31	- 83.3 -
	DD: 42	20.09	8648	0.54	7.33	-88.0
	00:45	20.09	8649	0.65	7.35	-91.0
	00:46	20.09	8649	0.63	7.35	-91.1
75	00:47	ND. HO	7946	0.52	7.37	- 89.3
	00:49	20.20	7887	0.52	7.36	-88.1
	00:52	9D.H	7869	0.62	7.35	-84.8
65	00:53	2040	6844	0.53	7.40	-86.6
-	00:55	20,40	8618	0.56	7.41	-85.8
	00:59	20.41	12802	0.60	7.39	-75.2
63	01:00	90,47	6657	0.55	7.41	- 84.7
	61:04	00.48	6632	0.64	7.41	-85.8
55		20.97	4293	11.28	7.55	-2.8
_	01-11	20.97	4297	11.90	7.57	-104
63	01:12	20.57	6588	6.05	7.38	-24.8
		- •		-	,	· · · · •

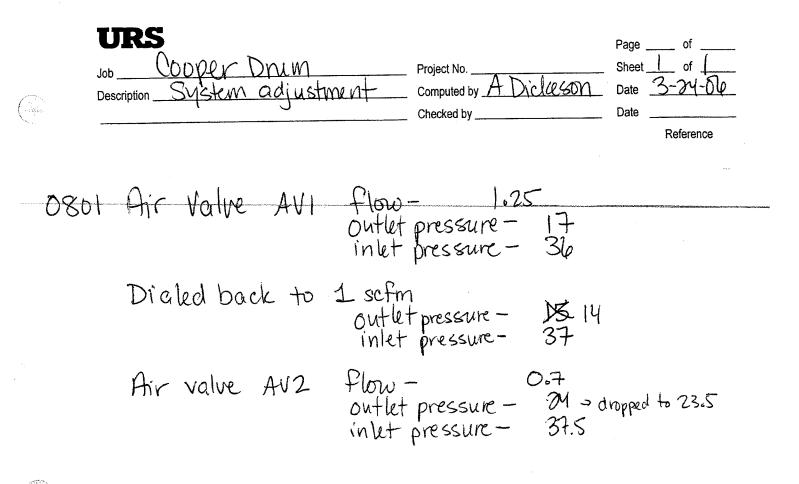
Left in well to auto-sample

* Time as measured by Sonde clock - 650 clock is correct Sorde cloch =0046 when 650 clock = 12:44

Job <u>CC</u> Description D	Page of Project No Sheet of Paily Log + Measurements Computed by A Didusson Date 3-22-04 Checked by Date
1630	- Return to site to check cable. It definitely dues not fit. Called Equipco + described end of 100° cable. They will ship cable to connect that to laptop > straight to Tony's.
	Chuck parameters w/ 650. $D D^{m8/L} DRP$ 3:00 16.20 -74.7 3:00 16.05 -74.9 3:10 15.97 -74.8 3:20 15.76 -74.7 3:30 15.85 -74.6 3:40 16.05 -23.9 3:50 16.03 -22.9 4:00 16.78 -71.5 4:10 16.78 -71.5 4:20 16.80 -71.4 4:30 17.41 -70.7
1650	Stop logging. Change time on sonde Restart logging in file COUPERZ. DAT
1655 1700	Shut off system. Reprogram timing per Doug's "3-22 pm" instructions. Start up system Off site

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(



0830 Download Cooper2, leave site

	$\hat{\mathbf{O}}$	puted by A Dicusor	Page of Sheet of Date 3-29-06
	Chi Chi	ecked by	Data
	* MWZD is bubbling the OTUS Arr site. Open well, d clear memory in sonde.	11 works 5, stop	Reference much pressure logging ozone smell).
	0805 Pull up probe to 581 0805 Temp Cond ^{105/cm} DO ms 30.96 1362 22.45		2
	0809 70.99 1312 22.52 0812 70.96 1290 77.5D	7.83 167	.9
- 14 -	Pull out probe, decon. batteries. Indicator st	Offsite for neu ill flashes after in) sonde stallation (?!?)
Depth 90' 80' 70' 60' 50'	EW1 Profile Time Temp Cond DO 0858 Dr.61 9378 0.94 0902 70.00 9367 0.70 0905 70.00 9362 6.74 0907 70.22 7944 4.71 0907 70.22 7944 4.71 0912 70.20 7934 6.38 0916 70.70 7930 5.98 0917 70.57 4453 7.66 0920 70.56 4430 8.10 0923 70.58 4427 8.12 0974 70.91 4355 8.78 0932 70.89 4357 8.97 0932 70.89 4357 8.97 0933 71.02 4280 13.79 0938 71.02 4280 13.79 0941 71.02 4283 14.53	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	8 4 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5
Ć	Hang probe @ 63' in EW1 s 09 Start system on deep		
	10 ich - Offsite	,	

				:	· · · · · · · · · · · · · · · · · · ·			4	· · · · · · · · · · · · · · · · · · ·		
	1	•		· ·			-			IONITOR W	
٨		1 -		N	Ionitor	Well S	Samplin	g Data (c	ont.)		
•	(4)	1710	6 15/LM	N			-		• •		· · ·
`.	Time	Temp (C	Cond) (umhos)	рН	Turbidity (NTU)	r ORP (mV)	D.O. (mg/L)	Water Leve (ft. bgs)	Removed	Flow Rat (L/min)	
41	1055	21.1	4045	567	1400		14:00				Phys. App.
	1056	21.1	4046	5.71		89.5					55'
	1057	21.04	4151	5.9		601					55
	1059	21.04	5 4151	5.83		58.0					60
	1100	20.94		6.56			914				60
	1107	20.9		6.76			9.47	2			65
	1103	20.8		6.86		-47.		,		+	65
	1105	20.87		ERI		-52.4			<u> </u>	+	70
	1106	20.60							<u> </u>	ļ	70'
	1108						19.54		<u> </u>	ļ	78
	1109	20.35				-56.9	9.36			ļ	75'
		20.75	7062			-55.0			ļ		801
	1112	20.33		6.86		- 56.0			· · ·	· · ·	861
	1114			691		62.8		47.88			851
		20.33		696	د	67.5	3.32	<u></u>	· · · ·		851
	1115	2097	4162	6.99			9.18	A1 . 6	m		63
/ 1	1129	20.96		G.95		5/10	9.45	filer	ENID	A	631
	1531	21.37	4185	697		49.7	9.69	- from	DNG S	dat.	63'
24	1157	0140	20.0	$\left - \right $							
77A	1152	21.03	3600	7.90		31.1	18.28	- hea	rwide bu	bling	55
•	1155	21.04.	3100	7.92		33.4	18.71	140			55
	1158	20.97	4161	7.6/		41,0	19.08				60'
1	n 00		4131	7.58		42.1	19.10				60'
	1201	20.92	4207	736		46.3	1892	47.14	TD 62.	5	63.5
/											
	1529	22,29	497L	7.42		88.0	16.42	-	startes	lac	NCG15
1											Scent
ļ		MW-37	A samp	ud+	for H	207	+20	mg/			
ļ			Negati	61 f	J C	2					······
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Ļ		EW-	5a	nold	'+	for	A20-	,			· · · · · · · · · · · · · · · · · · ·
				no	tobe	tim	per	fond			
			Ne	atur	fas	O2					
					n'			· · ·			
			alled	VOL	19/1	-4 0	10tan	2 GAM	ar A		11. //c
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N		oper Uni ofice notes	a)	Project No Computed Checked t	CULSON Date	Sheet of Date Date Reference		
		48-7	8' EI	N 1 1 hook e	Profile 123			
85 7 7 65 hook	Depth 16t Yellow Inucle Columents D' 2nd D' 2nd	Time 1409 1409 1411 1413 1416 1413 1423 1428 1428 1428 1428 1428 1430 1435 1430 1435 1435 1435 1439 1445 1445 1445	Temp °C 70.34 70.33 70.33 70.33 70.33 70.39 70.45 70.65 70.90 70.05 71.05 71.05 71.09 71.00 71.00	Cond 1910me 7200 7281 7298 7298 7304 5709 5709 5709 5709 5709 5700 5709 5700 5709 5700 5700	DO mg/L O.47 O.37 O.37 O.37 O.37 O.32 O.37 I.06 I.17 I.08 I.17 I.08 I.17 I.08 I.17 I.08 I.17 I.08 I.17 I.08 I.17 I.08 I.17 I.08 I.17 I.00 I.17 I.00 I.17 I.00 I.26 C.33 T.07 I.00 I.26 C.33 T.07 I.00 I.26 C.33 T.07 I.00 I.26 C.33 T.07 I.00 I.26 C.33 T.07 I.00 I.26 C.33 T.07 I.00 I.26 C.33 T.07 I.00 I.26 C.33 T.07 I.00 I.26 C.33 T.07 I.00 I.26 C.33 T.07 I.00 I.26 C.33 T.07 I.00 I.26 C.33 T.07 I.00 I.26 C.33 T.07 I.00 I.26 C.26 C.33 T.07 I.26 I.26 I.26 I.26 I.26 I.27 I.00 I.26 C.26 C.26 C.33 T.07 T.07 I.30 C.26 C.26 C.33 T.07 T.30 I.30 I.30 I.37 I.30 I.37 I.30 I.37 I.30 I.37 I.30 I.37 I.30 I.37 I.30 I.30 I.37 I.30 I.37 I.30 I.33 T.07 I.30 I.33 T.37 I.30 I.33 T.37 I.30 I.33 T.37 I.30 I.33 I.30 I.33 I.30 I.33 I.30 I.33 I.30 I.33 I.30 I.33 I.30 I.33 I.30 I.33 I.30 I.33 I.30 I.33 I.30 I.33 I.30 I.33 I.30 I.33 I.30 I.33 I.30 I.33 I.30 I.33 I.30 I.30 I.33 I.33 I.	рН 7,94 7,89 7,89 7,88 7,88 7,28 7,28 7,28 7,07 7,07 7,07 7,07 7,09 7,09 7,09 7,09	0RP 7.2 8.8 4.1 189.7 27.2 277.2 277.2 277.2 237.7 238.6 238.6 238.6 238.6 238.6 238.6 238.6 238.6 238.6 238.6 238.6 238.5 233.5 233.5	
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			N/	lonitor	Well C	amolina	Data (co	ant)	MONITOF	R WELL NO:
TI	NAG		IV	lonitor	wen 5a	ampling	Data (co	οπτ.)		
5/2	3/06	Cond		Turbidity	ORP	D.O.	Water Level	Removed	Flow Rate	Observations
Time	Temp (C)	(umhos)	рН	<u>(NTU)</u>	(mV)	(mg/L)	(ft. bgs)	(L)	(L/min)	Phys. App.
910					364	10.65				Pourto Samo
		Rodl	rohe	backi	0 336	ARTO	Samplu	19-211:00	P F.4 2	343
1930	21.03	4051	7.76		152,3					631
0938		7304	175			0.65				B5
0940		5764	1.39		130	1.20				Bo'
0942		4117	7.36		144.8	5.53				80' 75'
0944		4087	7.35	ſ	149.0					70'
0946		4583	7,24	. <u>-</u>		6.52				651
0948		4065	7:35		154.7	6.94				651
		3971	7.39	· ·	156.5	8.91				55'
CG 49		31	7.38	<u>.</u>		8.70				50
					100.1	0 10				
1147					194	7.2				C63 Palley
1412		twined		1			7 00			Parte
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URS Page of ¥ Job COOPER Drum Project No. Sheet Description Davily NOKES i alusan Computed by Date Date Checked by Profile (w/new DO membrane) Reference MW 20 Cond us/cm Tempoc DO my/L Depth ptf Time OPP O(ŦÒ lõ (65 1020 60 Aluctucting 20 20 55 4181 4602 20 1040 1042 104**2** 20.31 20.32 20.33 85' 0.10 0.09 13.8 92.1 91.2 7.06 7.06 7.06

& Conductivity values fluctuate wildly C 55 360'

		System of	6-11-04			
n - Manazako di Magazaki "''''' na Maka Yaya''' a m ''	Achi	EWI	Profile	allta häjtand opper sign och setter att som	anna na 44 yawa danakana kutaka ku	ORP
Depth	Time	Temp	Cond us/cm	DD mg/L	pH	nin georgeol Carlier al topological control or angle or and an and an
5D'	1341	21.26	4400	13.52	7.69	-0 .7 -
	1346	ગ.ઝ્ય	YUGY	12.62	7.76	9.0
55'	1348	n.12	4391	12.72	7.83	0.7
	1350	27.12	4392	12:68	7.87	- 7 .0-
¢D,	1351	90.99	4374	12,83	7.93	-11.9
-h +	1353	90.97	4373	12.89	7.95	-11.0
45°	1359	20.70	6665	6.24	7.72	-26.1
	1356	20.70	6485	3,83	7.76	-305
	1357	30.49	6702	1079	7.82	-430
	1359	20.50	6708	1.57	7.81	-41.5
	1400	20.45	6813	1,27	7,83	-48.0
ŵ.	1402	20,44	6817		7.82	-45.5 FE II
	1403	20.39	6942	1.05	7.86	-55.4
85'	1405	a da anti-arresta da Mandal Trada antina da antina	6981	1.05	7.86	-53.9 -60.9
	1406	70.32 20.32	7781	1.00	7,86 7,86	- 58.9
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600 7	ime	Temp	Cond MS/cm	DO Mall	pH	OPP
⁻ vituers waa mista waterraan waana waa	4:21 423 1425	71.01 71.01 71.01	3884 3889 3889 3889	4.90 4.83	8.12 8.09 8.10	-43.9 -42.1 -40.2
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