URS

May 18, 2010

Mr. James K. Moore, P.E.
Illinois Environmental Protection Agency
Bureau of Land
1021 North Grand Avenue East
Springfield, Illinois 62794

Subject: **Dissolved Phase Groundwater Investigation and P-60 Free Phase Product Delineation Report**
Roxana, Illinois
119115002 – Madison County
Log No. B-43-CA-12

Dear Mr. Moore:

On behalf of Shell Oil Products US, URS Corporation is submitting the enclosed Illinois EPA RCRA Corrective Action Certification form for the subject report. This was requested in an email from you on May 4, 2010.

If you have any questions, please contact Kevin Dyer, SOPUS project manager, at kevin.dyer@shell.com (618/288-7237), or me at bob_billman@urscorp.com (314/743-4108).

Sincerely,

Robert B. Billman
Senior Project Manager

Enclosures (original plus 2 copies)

Cc: Kevin Dyer, SOPUS
File

1001 Highland Plaza Drive West, Suite 300
St. Louis, MO 63110
Phone: 314.429.0100
Fax: 314.429.0462

ILLINOIS EPA RCRA CORRECTIVE ACTION CERTIFICATION

This certification must accompany any document submitted to Illinois EPA in accordance with the corrective action requirements set forth in a facility's RCRA permit. The original and two copies of all documents submitted must be provided.

1.0 FACILITY IDENTIFICATION

Name: WRB Refining LLC Wood River Refinery

County: Madison

Street Address: 900 South Central Ave.

Site No. (IEPA): 1191150002

City: Roxana, IL 62084

Site No. (USEPA): ILD 080 012 305

2.0 OWNER INFORMATION

Name: Not Applicable

Mailing Address:

3.0 OPERATOR INFORMATION

Equilon Enterprises LLC d/b/a Shell Oil Product US

17 Junction Drive, PMB #399

Glen Carbon, IL 62034

Contact Name:

Kevin Dyer

Contact Title:

Staff Project Manager

Phone No.:

618-288-7237

4.0 TYPE OF SUBMISSION (check applicable item and provide requested information, as applicable)

☐ RFI Phase I Workplan/Report
☐ RFI Phase II Workplan/Report
☐ CMP Report; Phase _____
☒ Other (describe):
Investigation report
Date of Submittal 2/18/10

IEPA Permit Log No. B-43-CA-12
Date of Last IEPA Letter on Project 5/12/09
Log No. of Last IEPA Letter on Project B-43-CA-12
Does this submittal include groundwater information: ☒ Yes ☐ No

5.0 DESCRIPTION OF SUBMITTAL: (briefly describe what is being submitted and its purpose)

Subsurface investigation report to meet requirements of IEPA work plan approval letter dated May 12, 2009.

6.0 DOCUMENTS SUBMITTED (identify all documents in submittal, including cover letter; give dates of all documents)

Cover letter and report, "Dissolved Phase Groundwater Investigation and P-60 Free Phase Product Delineation" dated 2/18/10.

7.0 CERTIFICATION STATEMENT - ***(This statement is part of the overall certification being provided by the owner/operator, professional and laboratory in Items 7.1, 7.2 and 7.3 below).*** The activities described in the subject submittals have been carried out in accordance with procedures approved by Illinois EPA. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

7.1 **OWNER/OPERATOR CERTIFICATION** (Must be completed for all submittals. Certification and signature requirements are set forth in 35 IAC 702.126.) All submittals pertaining to the corrective action requirements set forth in a RCRA Permit must be signed by the person designated below (or by a duly authorized representative of that person):

1. For a Corporation, by a principal executive officer of at least the level of vice-president.
2. For a Partnership or Sole Proprietorship, by a general partner or the proprietor, respectively.
3. For a Governmental Entity, by either a principal executive officer or a ranking elected official.

A person is a duly authorized representative only if:

1. the authorization is made in writing by a person described above; and
2. the written authorization is provided with this submittal (a copy of a previously submitted authorization can be used).

Owner Signature: _____ _____ (Date)

Title: _____

Operator Signature: Kevin E Adgate 05/14/10 (Date)

Title: STAFF Project Manager

7.2 **PROFESSIONAL CERTIFICATION** *(if necessary)* - Work carried out in this submittal or the regulations may also be subject to other laws governing professional services, such as the Illinois Professional Land Surveyor Act of 1989, the Professional Engineering Practice Act of 1989, the Professional Geologist Licensing Act, and the Structural Engineering Licensing Act of 1989. No one is relieved from compliance with these laws and the regulations adopted pursuant to these laws. All work that falls within the scope and definitions of these laws must be performed in compliance with them. The Illinois EPA may refer any discovered violation of these laws to the appropriate regulating authority.

Professional's Signature: Robert B Billman 5/18/10 Date

Professional's Seal:

LICENSED PROFESSIONAL GEOLOGIST
ROBERT B. BILLMAN
196-000646
ILLINOIS

Professional's Name: Robert B. Billman

Professional's Address: URS Corporation

1001 Highlands Plaza Drive West, Suite 300

St. Louis, MO 63110

Professional's Phone No.: 314-429-0100

7.3 **LABORATORY CERTIFICATION** *(if necessary)* - The sample collection, handling, preservation, preparation, and analysis efforts for which this laboratory was responsible were carried out in accordance with procedures approved by Illinois EPA.

Name of Laboratory Xenco Laboratories

Carlos A Castro 5/11/2010
Signature of Laboratory Responsible Officer — Date

Carlos A. Castro, Lab. Manager
Name and Title of Laboratory Responsible Officer

Mailing Address of Laboratory

4143 Greenbriar Dr.

Stafford, TX 77477

7.4 **LABORATORY CERTIFICATION** *(if necessary)* - The sample collection, handling, preservation, preparation and analysis efforts for which this laboratory was responsible were carried out in accordance with procedures approved by Illinois EPA.

Name of Laboratory Air Toxics Ltd.

Mailing Address of Laboratory

180 Blue Ravine Rd

Folsom, CA 95630

Signature of Laboratory Responsible Officer — Date: 5/10/2010

Robert S. Mitzel / President
Name and Title of Laboratory Responsible Officer

URS

September 5, 2008

Mr. Steven F. Nightingale, P.E.
Manager, Permit Section
Illinois Environmental Protection Agency
Bureau of Land
1021 North Grand Avenue East
Springfield, Illinois 62794

Subject: **Work Plan**
Dissolved Phase Groundwater Investigation
Roxana, Illinois

Dear Mr. Nightingale:

On behalf of Shell Oil Products U.S. (SOPUS), URS Corporation is submitting the enclosed work plan for your review. The work plan is submitted in partial fulfillment of SOPUS' Compliance Commitment Agreement as contained in its letter to the Agency dated July 22, 2008.

The scope of the work plan is based on the results of prior work conducted during the Spring and Summer 2008, and contained in a report dated August 19, 2008.

If you have any questions during your review, please contact Kevin Dyer, SOPUS project manager, at kevin.dyer@shell.com (618/288-7237), or me at bob_billman@urscorp.com (314/743-4108).

Sincerely,

Robert B. Billman
Senior Project Manager

Enclosures (3 copies)

Cc: Kevin Dyer, SOPUS
Mara McGinnis, IEPA
Chris Cahnovsky, IEPA
Lance Tolson, Shell Oil Company (electronic copy only)
Sanjay Garg, Shell Global Solutions (electronic copy only)

1001 Highland Plaza Drive West, Suite 300
St. Louis, MO 63110
Phone: 314.429.0100
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W O R K P L A N

DISSOLVED PHASE GROUNDWATER INVESTIGATION

ROXANA, ILLINOIS

Prepared for

Shell Oil Products US
Environmental Services
17 Junction Drive; PMB #399
Glen Carbon, Illinois 62034

September 5, 2008

URS Corporation
1001 Highland Plaza Drive West, Suite 300
St. Louis, MO 63110
(314) 429-0100
Project No. 21561979

TABLE OF CONTENTS

TABLE OF CONTENTS

List of Tables

List of Figures

List of Attachments

Shell Oil Products U.S. (SOPUS) is planning to conduct investigative activities in the Village of Roxana in the area generally bounded by Illinois Route 111 and the west property boundary (aka west fenceline) of the WRB Refining LLC Wood River Refinery (WRR) (**Figure 1**). The area is being investigated to further assess a 1986 benzene release and other hydrocarbon impacts in the area west of the WRR west fenceline.

URS Corporation (URS), on behalf of SOPUS, performed a subsurface investigation in 2006 to help gather information on the extent of benzene impact. The investigation provided initial information on the distribution of benzene in groundwater in the area, using primarily screening technologies (e.g., cone penetration testing (CPT), membrane interface probe (MIP) and groundwater profiling). The report of this work was submitted to the Illinois Environmental Protection Agency (IEPA) on September 28, 2007. Additional work was conducted in the Spring and Summer of 2008 to further delineate the extent of impact. This investigation revealed evidence of hydrocarbon impact, in the form of mixed hydrocarbons, in the area north of the benzene impacts. The report for this work was submitted to IEPA on August 19, 2008.

The IEPA issued SOPUS a Violation Notice dated May 2, 2008 (L-2008-01134) relative to groundwater conditions as identified in the 2007 report. In response, SOPUS submitted a proposed Compliance Commitment Agreement (CCA) to IEPA on July 22, 2008. While the CCA was rejected by the IEPA in correspondence dated August 4, 2008, SOPUS has been instructed verbally by that agency to conduct the subject work. The primary objectives of this investigation are to refine our understanding of the extent of benzene impact and to assess the nature and extent of hydrocarbons identified along the west fenceline of the WRR.

The investigative site and surrounding area, located approximately 0.7 miles east of the Mississippi River, are located on a broad floodplain known as the American Bottoms. The surface topography across the investigation area generally slopes downward to the west-southwest, with a total drop in elevation of approximately 15 feet across the area. The floodplain deposits consist of recent alluvial (i.e., river) deposits overlying Pleistocene (i.e., Ice Age) glacial outwash. The recent alluvial deposits consist of a complex, heterogeneous sequence of sands, silts, and clays. The underlying glacial outwash deposits consist of more uniform sands and gravels that extend to bedrock. The depth to bedrock in the area typically exceeds 100 feet.

The glacial outwash deposits (i.e., sands) underlying the area are the primary source for large volume water production in the area (e.g., industrial and municipal supply). Prior to development in the area, the natural movement of groundwater through the valley material was toward the west (toward the Mississippi River). Since development in the area, groundwater pumping has significantly altered this pattern. Regional groundwater flow in the area is directed toward nearby pumping centers, locally the WRR to the east and the BP former Wood River refinery to the west.

The sand unit is water-saturated below a depth of approximately 35 to 50 feet bgs (approximately elevation 397 to 395). Groundwater flow in the sand in the investigation area is generally toward the northeast, toward WRR pumping centers.

Groundwater data from the previous SOPUS investigations in the Village and data from along the west fenceline of the WRR have been reviewed in order to develop this work plan. Information from this review is summarized below.

3.1 DISSOLVED BENZENE RESULTS

Cumulative analytical information from the previous investigations indicates the highest benzene concentrations generally in a band on the order of 200 feet wide, extending between the 1986 benzene release location and the refinery. The core area of impact widens closer to the refinery, consistent with groundwater flow toward pumping centers on the WRR North and Main properties. Benzene concentrations in the core area have been identified in the hundreds to thousands of part per million (ppm). Wells on the north and south sides of this band exhibit less than 5 parts per billion (ppb) benzene concentrations[1].

3.2 SEPARATE PHASE HYDROCARBON RESULTS

Quarterly gauging data for the monitoring wells along the west fenceline of the North Property, from First Quarter 2007 (1Q07) through Second Quarter 2008 (2Q08), were reviewed. The quarterly groundwater gauging data for these wells can be found in **Table 1**. **Figure 2** illustrates the occurrence and thickness of separate phase hydrocarbon observed in these wells.

Well P-60 has exhibited light non-aqueous phase liquid (LNAPL) over the years and previous efforts have been conducted to recover product, as well as better understand this situation. It had been thought that the well integrity was compromised, allowing product at shallow depths in the subsurface to enter the well. In the Spring of 2006, free-phase product investigation activities were performed in the vicinity of monitoring well P-60 located in the WRR near the west fenceline. Cone Penetrometer Testing (CPT) and Rapid Optical Screening Tool (ROST) probes were performed to gather a soil stratigraphic profile and information on the extent of hydrocarbons in the soil. Soil borings were advanced for visual observation at locations where the CPT/ROST logs indicated potential hydrocarbon presence. Temporary piezometers were installed for subsequent gauging at locations where visual observation of soil cores noted potential separate phase hydrocarbon impact. Well P-60 was plugged and abandoned, and a new replacement monitoring well was installed near the former P-60 well.

[1] Refer to **Figure 11** of the *Route 111/Rand Avenue Vicinity Subsurface Investigation Report*, dated August 2008 (prepared by URS for SOPUS) for more information.

The periodic gauging data for the P-60 replacement well and the surrounding temporary piezometers can be found in **Table 2**. **Figure 2** shows the locations of the temporary piezometers installed relative to well P-60.

After installation of the replacement well, LNAPL continued to be observed. A Xitech Instruments Inc. ADJ 200 Smart Skimmer pump system was installed in well P-60 in May 2008. The system is presently operating on a schedule where it cycles on six times per day, and pumps for 10 minutes per cycle. This run time is yielding approximately 1 gallon of product per day. The system is monitored on a regular basis and is being optimized.

3.3 DISSOLVED PHASE MIXED HYDROCARBON RESULTS

During the previous URS investigations, wells in the vicinity of the southern portion of the North property west fenceline were sampled. On August 8, 2008, three additional wells along the northern portion of the North Property west fenceline were sampled. The analytical detections from this sampling are given in **Table 3** and the analytical detections of benzene, toluene, ethylbenzene and xylenes (BTEX) and MTBE are shown on **Figure 3** of this report.

3.4 SUMMARY

The cumulative data indicate groundwater impact by petroleum constituents along portions of the west fenceline. Separate phase hydrocarbons are present in wells in the southern portion of the fenceline (e.g., P-58, P-66) and near the middle of the west fenceline (e.g., P-59, T-12, P-60). Dissolved phase concentrations quickly decrease to ppb levels north of well P-60, and are non detect in wells north of P-55 (i.e., T-1, T-13). For this reason, First Street marks the northern boundary of the investigation area. Benzene concentrations are relatively higher along the southern roughly 1/3 of the fenceline (e.g., P-93A, P-57).

Data collection activities will consist of: groundwater profiling; monitoring well installation, development, gauging and sampling; vapor monitoring point installation and sampling; and surveying. **Figure 4** shows the planned sampling locations.

Health and Safety during these investigation activities will be governed by the *Route 111/Rand Avenue Vicinity Investigation Health and Safety Plan* (HASP) dated May 2008 and prepared by URS. This HASP is flexible in the types of activities identified in order to account for possible adjustments going forward.

The investigation locations are shown on **Figure 4** and are subject to accessibility and utility locations. The proposed locations represent a starting point or baseline. Locations may be added based on field observations or results obtained during the work. Investigation locations will be marked in the field (e.g. spray paint, stakes). The proposed locations will be reviewed with Village of Roxana representatives and Illinois' Joint Utility Locating Information for Excavators (JULIE) (SOP 5 – Utility Clearance). Most of the locations are on Village property (e.g., alley rights of way). Some of the soil borings are located on Illinois Department of Transportation (IDOT) property (i.e., Route 111 right of way) or Village of Hartford property (i.e., Rand Avenue right of way).

The following paragraphs describe the investigation activities. References are made to URS' Standard Operating Procedures (SOPs) for certain investigative procedures. The SOPs are incorporated by reference, but are not included in this work plan.

4.1 BOREHOLE CLEARANCE

An air-vac system or hand augering will be used to perform air-knife holes to depths of 5 to 10 feet below ground surface (bgs) in order to verify that no utility lines or other obstructions are present at each proposed subsurface location. The specific target depths of the air-knife holes will be determined based upon a review of the subsurface utilities in the area. The air-knife work will be conducted by a vacuum excavation firm contracted and supervised by URS (SOP 5 – Utility Clearance Procedures).

4.2 GROUNDWATER PROFILING

Groundwater profiling will initially be conducted at locations shown on the primary north-south transect and the location on the west side of Route 111, just north of the 1986 benzene release point. Profile locations are shown on **Figure 4**. Profiling activities will be performed using a 4-

foot long, mil-slotted sampler advanced by the hydraulic push system of a Geoprobe®. Samples will be collected from the top of the groundwater surface (approximate) and at a depth of approximately 8 foot below the first sample. The sampler will be positioned, the water level will be gauged, and samples will be collected (SOP 42 – Groundwater Profiling). Prior to sampling, the groundwater will be purged and monitored for pH, temperature, conductivity, turbidity, dissolved oxygen (DO), and oxygen-reduction potential (ORP). Parameter readings will be collected after each flow-through cell volume and purging will continue until water-quality parameters have stabilized over 3 flow-through cell volumes or for 1 hour, whichever occurs first (SOP 33-Water Quality Monitoring). Once stabilization is achieved, the groundwater flow will be diverted from the flow-through cell and the groundwater will be sampled.

The samples will be analyzed on an expedited basis (e.g., 24 hour) via local laboratory (refer to **Section 7** for the planned analyses). The intent of the profiling is to delineate the groundwater plume. The results of the samples along the initial transect will be used to determine whether to: step-in to locations on the secondary transect to the east (i.e., closer to WRR); or step-out to locations on the secondary transect to the west (i.e., closer to Route 111).

Groundwater samples from locations on the secondary transect will also be analyzed on an expedited basis in order to delineate the horizontal extent of dissolved phase groundwater impact in the investigation area. From this information, a brief plan with proposed monitoring well locations will be developed and submitted to IEPA for approval.

4.3 MONITORING WELL INSTALLATION AND DEVELOPMENT

Monitoring wells will be installed at locations sufficient to provide longer term monitoring of the plume defined via profiling. This will also include monitoring wells in the core of the previously identified benzene impact. Two wells are planned to be installed at the Roxana Public Works yard south of Eighth Street (**Figure 4).**

Monitoring wells will be drilled utilizing 4.25-inch inner diameter hollow stem augers (SOP 21 – Monitoring Well Installation). Soil will be continuously collected and logged (SOP 17 – Logging) by a qualified field scientist in accordance with the Unified Soil Classification System (USCS) standards using a 2-foot sampler. The field scientist will note soil attributes such as color, particle size, consistency, moisture content, structure, plasticity, odor (if obvious), and organic content (if visible). The soil samples will be screened in the field using a photoionization detector (PID) (SOP 14 – Head Space Soil Screening). Observations will be noted on the soil boring longs.

The monitoring wells will be constructed of a 2-inch diameter Schedule 40 PVC casing, with a 10-foot section of 0.010-inch slotted PVC well screen. The exact placement of the well screens will be determined based upon the lithology encountered and historical groundwater information. The sand pack will consist of the native sand in the water bearing stratum, and will extend to approximately 2 feet above the top of the well screen. The borehole annulus will then be grouted to the surface with high solids bentonite grout. Surface completions, including a locking expandable cap and flush-mount protector, will also be performed.

Once the monitoring well installations are complete, the wells will be developed in order to remove fines from the sand pack and screen (SOP 20 – Monitoring Well Development). The wells will be developed by pumping or bailing a minimum of five times the amount of any water introduced during probing plus five well volumes of water. During well development, water quality parameters including pH, temperature, conductivity, and turbidity will be measured and recorded on field sheets after each well volume is removed (SOP 33 – Water Quality Monitoring). Development will continue until pH, temperature, and conductivity have stabilized over two consecutive well volumes and those well volumes are visually sediment-free.

4.4 MONITORING WELL GAUGING AND SAMPLING

After well development, sufficient time will be allowed for the new wells to equilibrate with the groundwater (approximately two weeks). A comprehensive round of gauging and sampling will be performed, and will include the newly installed wells, the previously installed small diameter wells (MW-1 through MW-6), as well as selected WRR wells near the western fenceline.

The groundwater levels, product thickness (if present), and total depth of the wells will be measured and recorded on the field sheets (SOP 10 – Groundwater Level Measurements). During these gauging activities, the ambient and well-head VOC levels will be monitored. Groundwater samples will not be collected from wells which exhibit measurable separate phase hydrocarbon (if any).

The groundwater sampling will be performed using low-flow techniques as described below. Refer to **Section 7** for the planned analyses.

- Low-Flow Sampling – Groundwater sampling using low-flow procedures will follow SOP 18 – Low Flow Groundwater Purging and Sampling. For the monitoring wells (2-inch diameter or larger), a stainless steel submersible pump with the proper length of disposable polyethylene tubing will be slowly and carefully lowered into the well and set

with the pump intake near the mid-point of the screen or water column, whichever is deeper. For wells smaller than 2-inch diameter, a stainless steel submersible bladder pump with the proper length of bonded disposable polyethylene tubing will be slowly and carefully lowered into the well and set with the pump intake near the mid-point of the screen or water column, whichever is deeper. The tubing from the pump will be connected to a flow-through cell, which will discharge into a five-gallon plastic bucket. Pumping will be performed at a low flow rate (<500 ml/minute) so as to not create drawdown of the water level within the well. During purging, water quality parameters (pH, temperature, conductivity, turbidity, DO, and ORP) will be measured in the field and recorded on field sheets after every flow-through cell volume (SOP 33-Water Quality Monitoring). Purging will continue until a minimum of three flow-through cell volumes of water have been removed and the water quality parameters have stabilized. Once stabilization is achieved, the groundwater flow will be diverted from the flow-through and the groundwater will be sampled.

HydraSleeve® passive groundwater samplers will also be used on a subset of the samples for potential future use in replacing the sampling methodology.

- HydraSleeve Samplers – Groundwater sampling using no-purge procedures will follow SOP 45 – Passive Groundwater Sampling using HydraSleeve. These passive samplers will be lowered into the well and positioned to collect a groundwater sample from the mid-section of the well screen. When activated, the HydraSleeve® will yield a representative water sample from an approximately 2.5 to 3-foot interval without mixing fluid from other intervals. This sampling interval will be centered at the mid-point of the well screen. Once the sampler is full, the one-way reed valve will collapse, preventing mixing of extraneous, non-representative fluid during recovery. A short plastic discharge tube will then be used to fill sample containers.

  Once the HydraSleeve® is removed from the well, the probe from a water quality meter will be placed down-hole to measure water quality parameters (e.g., pH, temperature, conductivity, DO, and ORP). Refer to the HydraSleeve field manual in **Attachment A** for further information.

4.5 VAPOR MONITORING POINT INSTALLATION

A vapor monitoring point (VMP) with four discrete vapor monitoring ports will be installed at each of the investigation locations along the eastern secondary transect (i.e., nearest the WRR

west fenceline) as shown on **Figure 4**. VMPs will also be installed adjacent to existing well MW-4 and at the east end of the same alley near Chaffer Street (**Figure 4**). Additionally, VMPs may also be installed at locations adjacent to proposed monitoring wells. The ports at each of the VMP locations are planned to be installed at four depths throughout the unsaturated zone: 5 feet; 10 feet; and the remaining two evenly distributed between 10 feet and groundwater.

The vapor monitoring ports at each VMP location will be installed in a hollow-stem auger or Geoprobe® boring. Each vapor monitoring port will consist of a 0.5-inch out diameter by 6-inch long Geoprobe® Systems stainless steel screen connected to a 0.125-inch diameter stainless steel riser tubing extending to the ground surface. A sand pack will be placed in the annular space from approximately six inches below to six inches above each stainless steel screen. Granular bentonite seals will be placed between individual vapor monitoring port screen/sand pack intervals. The remaining annular space will be filled with grout to the ground surface and completed at the surface with a flush-mounted protective cover.

4.6 VAPOR MONITORING POINT SAMPLING

VMP sampling activities will be performed at the newly installed vapor ports at each of the VMP locations according to SOP 44 – Soil Vapor Purging and Sampling.

Prior to sampling from a vapor port, the vacuum/pressure reading will be collected utilizing a digital manometer. Three well volumes of air will then be purged from the vapor port using a 60 milliliter (mL) syringe. During the purging process, if water is encountered or drawback of the syringe plunger occurs, this will be noted and the sampling process will cease.

Once purging is completed, the summa canister sampling assembly, with flow controller, will be setup in such a way as to allow extraction from the monitoring port only and shut off from the atmosphere. Once the sample summa canister is filled, a Tedlar bag will be filled using a peristaltic pump. A rotometer will be used to adjust the flow of vapor to a rate less than or equal to 200 mL/min. When the proper flow rate is achieved, the Tedlar bag will be attached and filled with the vapor. This vapor sample will then be screened in the field for total VOCs via a PID, and for oxygen, carbon monoxide, hydrogen sulfide and the lower explosive limit via a 4-gas meter. All of the information collected in the field will be recorded on the field sheets. Refer to **Section 7** for the planned laboratory analyses.

4.7 DIRECT PUSH SOIL SAMPLING

Soil sampling will be performed in the area of the 1986 benzene release (**Figure 3**). Soil sampling with utilize a dual-tube sampling system for logging and sampling purposes (SOP 29 – Soil Probe Operation). The dual-tube system consists of a 4-foot long by 1.125-inch diameter clear acetate liner attached to 1-inch diameter inner rods. The acetate liner and inner rods are advanced simultaneously with the 2.125-inch diameter outer rods. Once a sample is collected within the acetate liner, the inner rods and acetate liner are retrieved while the outer rods remain in place. The acetate liner is replaced and returned to the sampling depth, at which point the process is repeated.

The subsurface stratigraphy will be continuously logged (SOP 17 – Logging) by a qualified field scientist in accordance with the Unified Soil Classification System (USCS). The field scientist will note soil attributes such as color, particle size, consistency, moisture content, structure, plasticity, odor (if obvious), and organic content (if visible). The soil samples will also be screened in the field using a PID (SOP 14 – Head Space Soil Screening). Observations will be noted on the soil boring logs.

These soil borings will extend to the groundwater table (approximately 40 feet bgs). Prior to backfilling, a groundwater sample may be collected from these locations.

Upon completion, the borings will be backfilled with bentonite grout and the ground surface will be returned to its original location (SOP 12 – Grouting Procedures).

During sampling proposed investigation locations, two or three soil samples may be retained for analysis based upon field headspace PID readings and/or from more permeable zones (SOP 14 – Headspace Soil Screening and SOP 28 – Soil Sampling). Refer to **Section 7** for the planned analyses.

4.8 SURVEYING

The investigation locations, monitoring wells, and VMP locations will be surveyed upon completion. The horizontal coordinates will be determined for each location relative to the Illinois State Plane Coordinates (NAD 83), and the elevations will be determined using the 1988 USGS datum.

Personnel conducting the sampling will wear clean disposable protective gloves. Sample containers will be labeled with a sample ID number, site name, sampler initials, sample date and time, sample preservative, and the parameters to be analyzed. After sample collection, the samples will be logged on a chain-of-custody (COC) form, packaged to prevent damage during shipment, and cooled to 4°C (except vapor samples, which are not shipped on ice). The samples will then be delivered, under the proper COC documentation, to the appropriate laboratory via delivery or courier service. Refer to SOP 24 – Sample Classification, Packaging, and Shipping (DOT), SOP 25 – Sample Containers, Preservation, and Holding Times and SOP 26 – Sample Control and Custody Procedures. Due to the potential flammable nature of the vapor within the summa canisters, the soil vapor samples will be shipped via air according to all applicable regulations as required by the International Civil Aviation Organization (ICAO).

Laboratories proposed for this scope of work include:

- Teklab, Inc., Collinsville, IL – expedited turnaround for groundwater profile samples.
- Xenco Laboratories, Inc., Stafford, TX – routine analysis of soil and groundwater samples.
- Air Toxics, Folsom, CA – routine analysis of soil vapor samples.

The data from the field activities will be collected in accordance with the procedures described in this work plan. Quality assurance samples in the form of duplicates, trip blanks, and matrix spike and matrix spike duplicates (MS/MSD) will be collected (SOP 23-Quality Assurance Samples). Duplicates of selected samples will be collected and analyzed from 10 percent of the sample locations to check for sampling and analytical reproducibility. MS and MSD samples will be collected and analyzed from 5 percent of the sample locations to evaluate the effect of the sample matrix on the accuracy of the analysis. Trip blanks will be collected and analyzed on a daily basis to assess VOC cross contamination of samples during shipment to the laboratory. The trip blank will consist of one or more VOA vials prepared by the laboratory, transported to the field, and shipped with the other samples to the laboratory. The trip blanks will not be opened in the field. Equipment blanks will also be collected and analyzed from 10 percent of the sample locations if non-dedicated or non-expendable equipment are used.

Field personnel will wear Level D personal protective equipment (PPE) with the potential to upgrade to USEPA Modified Level D or Level C if site conditions warrant. A PID with a 10.2 electron volt (eV) probe and combustible gas indicator (CGI) will be used during the field activities to monitor air quality for health and safety purposes. Field instruments will be calibrated prior to each use in accordance with the manufacturer's specifications. Health and safety related information will be primarily recorded in field logbooks. For work conducted on the WRR, COP personnel may inspect the work areas and monitor the ambient air, as necessary prior to the issuance of daily work permits in areas where they are required.

Field personnel and equipment will undergo decontamination procedures to ensure the health and safety of those present, to maintain sample integrity, and to minimize cross contamination between sampling locations (SOP 4 – Decontamination). Reusable sampling equipment (e.g., groundwater pumps) will be decontaminated between each sampling location by washing with Alconox®, LiquiNox®, or equivalent detergent wash, a desorbing agent (i.e. isopropyl alcohol), and a distilled water rinse. Personnel and small equipment decontamination will be performed at the sample locations. Drill rods will be decontaminated prior to the drilling of each new borehole with a high-pressure hot water wash. The washing will be conducted on a temporary decontamination station at the Roxana Public Works yard. Decontamination fluids will be collected and staged on-site in 55-gallon drums for proper disposal.

Investigative derived waste (IDW) including soil cuttings, PPE, and expendable materials will be collected and disposed of properly (SOP 16 – IDW Handling). Expendable materials (e.g., disposable sampling equipment, such as gloves and tubing) having a low probability of contamination will be collected in trash bags and disposed of as municipal waste. Impacted expendable materials and soil cuttings will be collected and placed in labeled and sealed 55-gallon drums or directly into roll-offs for future disposal. Prior to disposal, the soil cuttings and purge water will be sampled for waste characterization as part of the disposal profile process.

IDW possibly generated while sampling ConocoPhillips wells or conducting intrusive activities within the WRR will be disposed of in accordance with WRR procedures.

Field data and documentation will become a part of the project file. URS will be the custodian of the file and maintain the contents of files for the site, including all relevant records, logs, field logbooks, pictures, subcontractor reports, data reviews, and the database management system.

The following documentation will supplement the chain-of-custody records:

- Field logbooks and data
- Field sample collection sheets
- Photographs and drawings
- Soil boring and well construction logs
- Contractor and subcontractor reports
- Correspondence.

Analytical data will be provided in hard copy and electronic formats. Electronic data will be loaded into a database to facilitate data evaluation and reporting. The data presented in the report will include the data flags provided by Xenco as well as the qualifiers assigned by the data reviewer.

The reporting list for this project will be the volatile organic compounds (VOCs) included on the USEPA Region 5 "Skinner List". The Skinner List includes petroleum refinery-related hazardous constituents. Refined petroleum products are stored in the WRR's North Tank Farm, and as such, VOCs are an appropriate analytical suite.

Soil and groundwater samples will be analyzed via SW-846 Method 8260B, and the following constituents will be reported.

- Benzene
- Carbon disulfide
- Chlorobenzene
- Chloroform
- Methyl ethyl ketone
- Methyl tert-butyl Ether
- Styrene
- Toluene
- 1,1-Dichloroethane
- 1,2-Dichloroethane
- 1,4-Dioxane
- Ethylbenzene
- Ethylene dibromide (EDB)
- Tetrachloroethylene
- 1,1,1-Trichloroethane
- Trichloroethene
- Xylenes (total)

Soil vapor samples will be analyzed via Method TO-15 using the same reporting list as for soil and groundwater samples. Vapor samples will also be analyzed for relevant gases such as carbon dioxide, methane, nitrogen, oxygen, etc. via ASTM D-1946.

URS will work with the laboratory to attain reporting limits to meet the project objectives, however, due to technical constraints, achieving reporting limits that are lower than the screening levels might not be feasible for all compounds. Analytical data from the sampling will be independently reviewed and qualified by URS. A Level III validation will be performed on all data.

Analytical results for soil and groundwater will be compared to the latest version of the TACO screening levels in **Table 4**. Data from soil vapor samples will be evaluated using IEPA's draft *Guidance for Evaluating the Indoor Inhalation Exposure Route using TACO Principles*, dated May 2007.

A report will be prepared summarizing and providing documentation of the field work and collected data. The report will include tables, figures, boring logs and supporting information (e.g., laboratory data). The report will present an evaluation of the nature and extent of impact and will discuss possible future actions.

The proposed project schedule on the following page provides an approximate sequence for the activities described in this plan, taking into account potential delays associated with, but not limited to, weather, contractor availability, access issues, etc.. This scheduled will be reviewed and revised if necessary following IEPA's approval of this plan.

Project Schedule

Dissolved Phase Groundwater Investigation
Roxana, Illinois

	Nov-08				Dec-08				Jan-09					Feb-09				Mar-09			
ACTIVITY	**3**	**10**	**17**	**24**	**1**	**8**	**15**	**22**	**29**	**5**	**12**	**19**	**26**	**2**	**9**	**16**	**23**	**2**	**9**	**16**	**23**
Initiate Investigation (Assume work plan approved October 31st)																					
Pre-Field Activities																					
Borehole Utility Clearing (Hand Auger/Air-Knifing)																					
Groundwater Profiling																					
Submit Planned Well Locations to IEPA/Discuss																					
Monitoring Well Installations and Development																					
Groundwater Sampling																					
Direct Push Soil Sampling																					
Vapor Monitoring Point Installation																					
Vapor Monitoring Point Sampling																					
Surveying																					
Laboratory Testing																					
Data Analysis & Report Prepara ion																					
Submit Report to IEPA (March 6)																		■			

Notes:
1. The scope of monitoring well installations is not defined at this time. The schedule will be reviewed/revised once the scope has been determined.
2. The schedule is subject to revisions, pending potential delays associated wi h, but not limited to, weather, contractor availability, access issues, etc.
3. The schedule will be revised as appropriate once IEPA approves the work plan.

TABLE 1
CONOCOPHILLIPS QUARTERLY GAUGING DATA - WEST FENCELINE WELLS

Well ID	TOC Elevation	Gauging Event	DTP (btoc)	DTW (btoc)	Product Thickness (ft)	Corrected Water Elevation
P-54	442.97	1Q07	NE	48 50	NA	394.47
		2Q07	NE	48.45	NA	394 52
		3Q07	NE	47 88	NA	395 09
		4Q07	NE	48 34	NA	394 63
		1Q08	NE	48 99	NA	393 98
		2Q08	NE	56 50	NA	396.47
P-55	446.67	1Q07	NG	NG	NA	NA
		2Q07	NE	52 95	NA	393.72
		3Q07	NE	52.74	NA	393 93
		4Q07	NG	NG	NA	NA
		1Q08	NG	NG	NA	NA
		2Q08	NE	53 26	NA	393.41
P-56	446.73	1Q07	NE	53 28	NA	393.45
		2Q07	52.36	53 39	1 03	394.16
		3Q07	NE	52 95	NA	393.78
		4Q07	NE	53 24	NA	393.49
		1Q08	NE	53 91	NA	392 82
		2Q08	NE	53 24	NA	393.49
P-57	447.22	1Q07	NG	NG	NA	NA
		2Q07	NG	NG	NA	NA
		3Q07	NE	52 89	NA	394 33
		4Q07	NE	53.12	NA	394.10
		1Q08	NG	NG	NA	NA
		2Q08	NE	52 97	NA	394 25
P-58	445.60	1Q07	50.89	52.79	1 90	394 33
		2Q07	50.71	52 01	1 30	394 63
		3Q07	50.60	51 89	1 29	394.74
		4Q07	50.81	52.74	1 93	394.40
		1Q08	51.04	53.40	2 36	394 09
		2Q08	50.67	51.46	0.79	394.77
P-59	447.53	1Q07	53.99	55.14	1.15	393 31
		2Q07	54.11	55 33	1 22	393.18
		3Q07	53.83	54 24	0.41	393 62
		4Q07	54.03	54 82	0.79	393 34
		1Q08	54.79	56 07	1 28	392.48
		2Q08	54.29	54.40	0.11	393 22
P-60	446.78	1Q07	51.89	60 09	8 20	393 25
		2Q07	52.65	60 02	7 37	392 66
		3Q07	51.45	60 01	8 56	393 62
		4Q07	52.09	59 09	7 00	393 29
		1Q08	NG	NG	NA	NA
		2Q08	52.84	58 81	5 97	392.75
P-66	437.46	1Q07	42.36	44.18	1 82	394.74
		2Q07	42.21	43 26	1 05	395 04
		3Q07	42.13	43.10	0 97	395.14
		4Q07	52.34	43 89	-8.45	394 81
		1Q08	42.51	44 34	1 83	394 58
		2Q08	42.06	42.70	0 64	395.27
P-93A	447.30	1Q07	NE	53 09	NA	394.21
		2Q07	NE	52 83	NA	394.47
		3Q07	NE	52 81	NA	394.49
		4Q07	NE	53.14	NA	394.16
		1Q08	NE	53 66	NA	393.77
		2Q08	NE	52.76	NA	394 67
T-1	444.25	1Q07	NE	49.72	NA	394 53
		2Q07	NE	50 28	NA	393 97
		3Q07	NE	50.15	NA	394.10
		4Q07	NE	40.19	NA	394 06
		1Q08	NE	50 58	NA	393 67
		2Q08	NE	50 82	NA	393.43
T-6	451.61	1Q07	NE	53 36	NA	393 88
		2Q07	NE	53 24	NA	394 00
		3Q07	52.11	52.15	0 04	395.12
		4Q07	NE	54 35	NA	392 89
		1Q08	NE	53.76	NA	393.48
		2Q08	NE	53.18	NA	394 06
T-12	445.41	1Q07	52.36	53 01	0 65	392 92
		2Q07	52.95	53 55	0 60	392 34
		3Q07	52.11	52.15	0 04	393 29
		4Q07	52.49	52 54	0 05	392 91
		1Q08	53.48	54 93	1.45	391 64
		2Q08	52.85	52 87	0 02	392 56
T-13	444.19	1Q07	NE	49 62	NA	394 57
		2Q07	NE	49 90	NA	394 29
		3Q07	NE	49 67	NA	394 52
		4Q07	NE	49 96	NA	394 23
		1Q08	NE	50 32	NA	393 87
		2Q08	NE	50 22	NA	393 97

NE = Not Encountered
NG = Not Gauged
NA = Not Applicable

TABLE 2
2006 WELL & PIEZOMETER GAUGING DATA

Well/PZ ID	Screen Length (ft)	Set Bottom Depth (bgs)	Riser Height (ft above ground)	Date Gauged	DTP (btoc)	DTW (btoc)	Product Thickness (ft)	Notes
P-60	20	65 00	3.13	04/17/06	NG	NG	NA	
				04/18/06	NG	NG	NA	
				04/19/06	NG	NG	NA	
				04/27/06	NE	49.04	NA	Staining and odor observed.
				05/05/06	49.14	60.26	11.12	Staining and odor observed.
				06/05/07	52.37	59.91	7.54	Staining and odor observed.
				08/08/08	48.37	58.40	10.03	
P-60-8	10	19 83	5.30	04/17/06	18.10	19.00	0.90	No product tone given by interface probe, but 0 9 ft of probe stained with product.
			0.10	04/18/06	18.80	18.82	0.02	Strong odor observed.
				04/19/06	NG	NG	NA	
				04/27/06	NE	18.81	NA	
				05/05/06	18.59	18.61	0.02	Staining and odor observed.
				06/05/07	11.78	12.28	0.50	No product tone given by interface probe, but 0.5 ft of probe stained with product.
				08/08/08	11.40	12.90	1.50	No product tone given by interface probe, but 1 5 ft of probe stained with product.
P-60-9	15	56 00	0.09	04/17/06	NG	NG	NA	
				04/18/06	NG	NG	NA	
				04/19/06	NG	NG	NA	
				04/27/06	NE	NE	NA	
				05/05/06	NE	44.75	NA	Highly sedimented
				06/05/07	49.20	50.35	1.15	Soft bottom
				08/08/08	43.78	49.13	5.35	
P-60-10	10	45.68	0.13	04/17/06	NG	NG	NA	
				04/18/06	NE	45.12	NA	
				04/19/06	NE	NE	NA	
				04/27/06	NE	45.12	NA	
				05/05/06	NE	38.61	NA	Highly sedimented
				06/05/07	NG	NG	NA	Piezometer covered by gravel.
				08/08/08	NG	NG	NA	
P-60-11	15	65 31	0.03	04/17/06	NG	NG	NA	
				04/18/06	65.23	48.83	0.08	Strong odor observed.
				04/19/06	NG	NG	NA	
				04/27/06	NE	49.00	NA	
				05/05/06	NE	48.94	NA	Piezometer under pressure.
				06/05/07	51.05	52.56	1.51	
				08/08/08	47.90	49.10	1.20	
P-60-12	10	70 00	4.62	04/17/06	NE	53.68	NA	
			0.05	04/18/06	48.98	49.00	0.02	
				04/19/06	NG	NG	NA	
				04/27/06	NE	49.12	NA	
				05/05/06	49.11	49.13	0.02	
				06/05/07	NE	51.52	NA	
				08/08/08	NE	48.12	NA	
P-60-12S	10	23 84	0.02	04/17/06	NG	NG	NA	
				04/18/06	NG	NG	NA	
				04/19/06	NG	NG	NA	
				04/27/06	NE	NE	NA	
				05/05/06	NE	NE	NA	
				06/05/07	NE	23.09	NA	
				08/08/08	21.70	22.41	0.71	

NE = Not Encountered
NG = Not Gauged
NA = Not Applicable

TABLE 3
SUMMARY OF GROUNDWATER ANALYTICAL DETECTIONS AND SCREENING

SCREENING VALUE EXCEEDANCES ARE HIGHLIGHTED YELLOW

Analyte			Benzene	Ethylbenzene	Toluene	o-Xylene	m,p-Xylene	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	Isopropylbenzene
Ingestion Screening Values (mg/L)			0.005	0.7	1.0	10		0.35*	0.35*	0.66**
Location	Sample ID	Date	ANALYTICAL RESULTS (mg/L)							
P-55	P-55080808	8/8/2008	**0.686 D**	**0.921 D**	**0.350 D**	**0.118**	**1.78 D**	**0.403 D**	**0.0936**	**0.0537**
T-1	T-1080808	8/8/2008	<0.005	<0.005	<0.005	<0.005	<0.010	<0.005	<0.005	<0.005
T-13	T-13080808	8/8/2008	<0.005	<0.005	<0.005	<0.005	<0.010	<0.005	<0.005	<0.005

Analyte			Methyl tert-Butyl Ether	Methylene Chloride	Naphthalene	n-Propylbenzene	n-Butylbenzene	p-Isopropyltoluene	sec-Butylbenzene
Ingestion Screening Values (mg/L)			0.07	0.005	0.14	0.24***	0.24***		0.24***
Location	Sample ID	Date	ANALYTICAL RESULTS (mg/L)						
P-55	P-55080808	8/8/2008	<0.005	**0.00218 J**	**0.149 D**	**0.0873**	**0.0111**	**0.0043 J**	**0.00738**
T-1	T-1080808	8/8/2008	<0.005	**0.00314 J**	<0.010	<0.005	<0.005	<0.005	<0.005
T-13	T-13080808	8/8/2008	<0.005	**0.00283 J**	<0.005	<0.005	<0.005	<0.005	<0.005

NOTES:
1) Sample ID explanation --> X-XXDDDDDD --> X-XX is the well location at which the sample was collected; DDDDDD is the date on which the sample was collected.
2) <#.## Denotes the analyte was not detected below the indicated reporting limit.
3) The screening value provided is for Xylenes (total), which is the summation of o-Xylenes and m,p-Xylenes.

LAB QUALIFIERS:
D = The samples were diluted due to targets detected over the highest point of he calibra ion curve, or due to matrix interference. Dilution factors are included in the final results. The result is from a diluted sample.
J = The target analyte was positively identified below the reporting limit (RL) and above the method detection limit (MDL).

REFERENCES:
Illinois Environmental Protection Agency (IEPA); Tiered Approach to Corrective Action Objectives (TACO); Ti le 35 of the Illinois Administrative Code, Part 742, Appendix B, Table E.
* IEPA; TACO; Groundwater Remediation Objectives for Chemicals not listed in TACO; dated May 1, 2007.
** U.S. Environmental Protection Agency (USEPA); Region 6 Human Health Medium-Specific Screening Levels; dated December 2007.
*** USEPA; Region 9 Preliminary Remediation Goals (PRGs) Table; dated October 2004.

Table 4
TARGET REPORTING LIST AND SCREENING LEVELS FOR SOIL AND GROUNDWATER

Constituents[1]	Tier 1 Soil Remediation Objectives (mg/kg)			Proposed Soil Screening Criteria (mg/kg)	Tier 1 Groundwater Remediation Objectives (mg/L)
	Residential				
	Ingestion	Inhalation	Soil Component of GW Ingestion		
Volatile Organics					
Benzene	12	0.8	0.03	0.03	0.005
Carbon disulfide	7,800	720	32	32	0.7
Chlorobenzene	1,600	130	1	1	0.1
Chloroform	100	0.3	0.6	0.3	0.0002
1,2-Dichloroethane	7	0.4	0.2	0.2	0.005
1,1-Dichloroethane	7,800	1,300	23	23	0.7
1,4-Dioxane	58	8.1	0.031	0.031	*ADL (0.001)
Ethylbenzene	7,800	400	13	13	0.7
Ethylene dibromide (EDB)	2.9	0.12	62	0.12	0.00005
Methyl ethyl ketone	47,000	25,000	17	17	4.2
Methyl tert-butyl ether	780	8,800	0.32	0.32	0.07
Styrene	16,000	1,500	4	4	0.1
Toluene	16,000	650	12	12	1.0
1,1,1-Trichloroethane	[c]	1,200	2	2	0.2
Tetrachloroethylene	12	11	0.06	0.06	0.005
Trichloroethene	58	5	0.06	0.06	0.005
Xylenes (total)	16,000	320	150	150	10.0

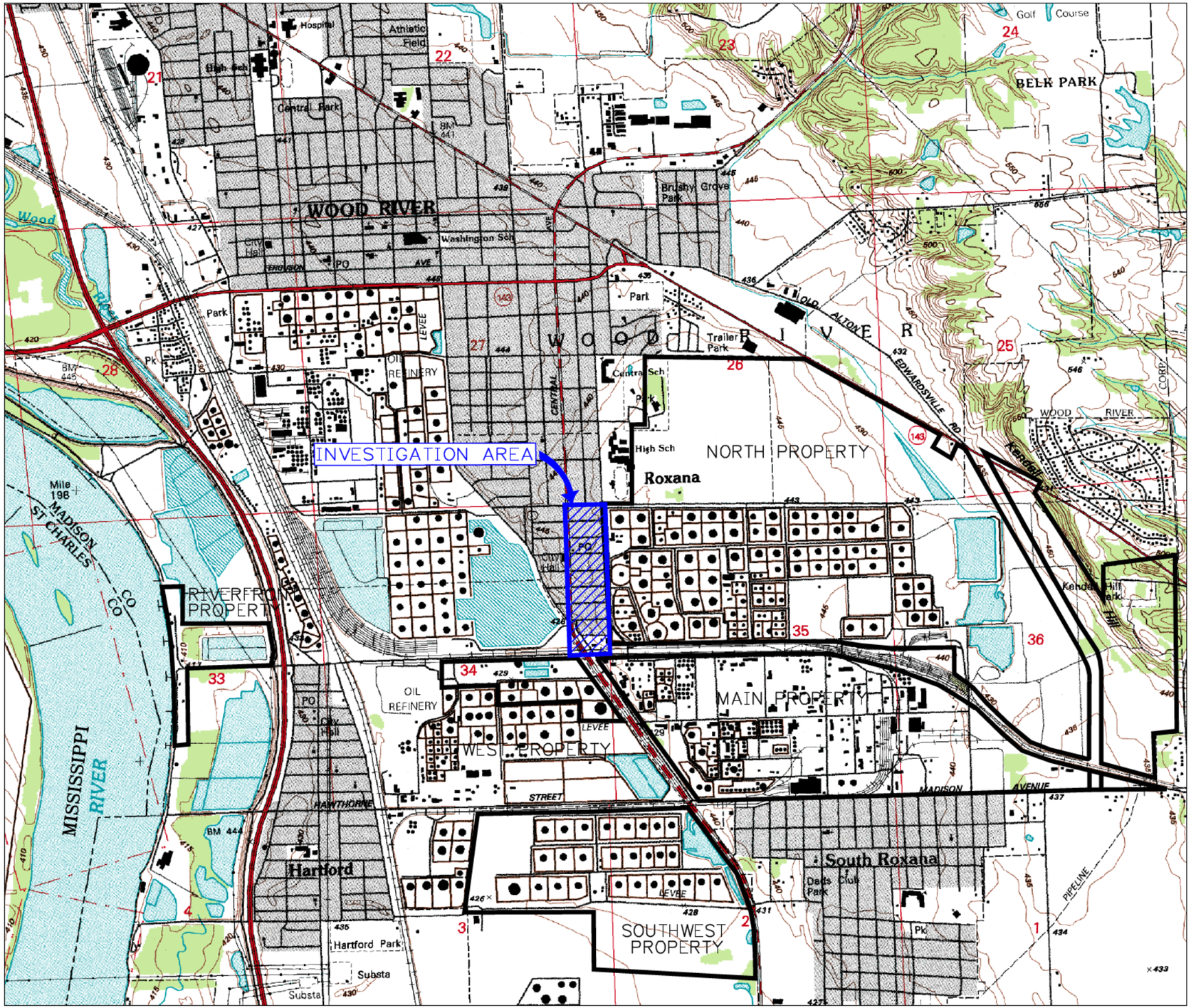
[1] USEPA Region 5 Skinner List volatile organic compounds downloaded from www.epa.gov/reg5epa/ca/skinner.htm.

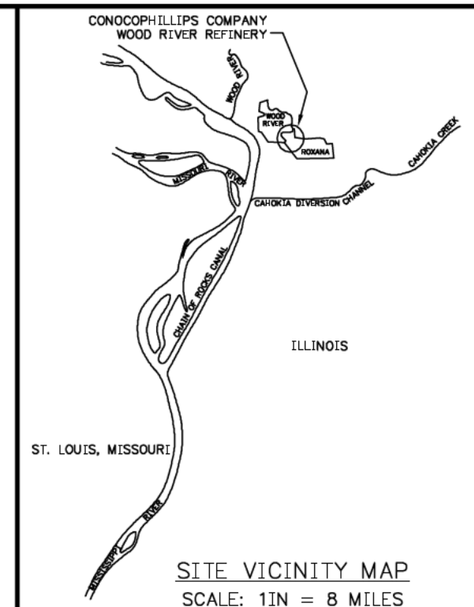
[c] No toxicity criteria available for the route of exposure.

* ADL The groundwater objective is equal to the Acceptable Detection Limit for carcinogens.

GENERAL NOTE:

Screening criteria from IEPA TACO rules, 35 IAC 742 Appendix B, Tables A and E (based on Class I groundwater).





SITE VICINITY MAP
SCALE: 1IN = 8 MILES

LEGEND

- WOOD RIVER REFINERY PROPERTY BOUNDARY
- INVESTIGATION AREA

SOURCE: MAP TAKEN FROM ELECTRONIC USGS DIGITAL RASTER GRAPHIC 7.5 MINUTE TOPOGRAPHIC MAP OF WOOD RIVER, ILL–MO REVISED 1994.

CONTOUR INTERVAL = 10FT

Ø 2000

SCALE FEET

N

SHELL OIL PRODUCTS US DISSOLVED PHASE GROUNDWATER INVESTIGATION ROXANA, ILLINOIS	PROJECT NO. 21561979
URS	
DRN. BY: djd 7/19/06 DSGN. BY: gh CHKD. BY: wmp	Site Location Map — FIG. NO. 1

File: P:\ENVIRONMENTAL\21561979 SOPUS ROUTE 111 RAND AVE VICINITY INVESTIGATION\PLUME DELINEATION WORKPLAN\FIG 1 SITE LOCATION MAP.DWG Last edited: 09/03/08 ● 12:41 p.m. ● WCC-ST.LOUIS

File: P:\ENVIRONMENTAL\21561979 SOPUS ROUTE 111 RAND AVE VICINITY INVESTIGATION\PLUME DELINEATION WORKPLAN\FIG 2 PRODUCT OCCURRENCE & THICKNESS.DWG Last edited: SEP. 03, 08 @ 12:42 p.m. by: wendy_pennington

LEGEND

- GROUNDWATER MONITORING WELL LOCATION
- GROUNDWATER PIEZOMETER LOCATION

NOTES:
1) ALL GRAYSCALE LOCATIONS REPRESENT WELLS IN THE AREA DEPICTED BUT GAUGING DATA NOT PRESENTED FOR THIS FIGURE.
2) PRODUCT THICKNESS IN MONITORING WELLS OBTAINED FROM QUARTERLY GAUGING RESULTS.
3) PRODUCT THICKNESS IN P-60 PIEZOMETERS OBTAINED DURING GAUGING ON AUGUST 8, 2008.
4) NE = PRODUCT NOT ENCOUNTERED.
5) NG = WELL/PIEZOMETER NOT GAUGED.
6) P-60 PIEZOMETERS ARE SCREENED SIMILAR TO WELL P-60 EXCEPT P-60-12S, WHICH IS SCREENED APPROXIMATELY 14 TO 24 FEET BELOW GROUND.

TYDEMAN AVE
FIRST ST
SECOND ST
THIRD ST
FOURTH ST
FIFTH ST
SIXTH ST
SEVENTH ST
EIGHTH ST
RAND AVENUE
(S. CENTRAL AVE) HIGHWAY 111
CHAFFER ST
VILLAGE OF ROXANA
NORTH PROPERTY
WOOD RIVER REFINERY
BP
APPROXIMATE 1986 BENZENE RELEASE SITE

T-13

Gauging Event	1Q07	2Q07	3Q07	4Q07	1Q08	2Q08
Well ID	Product Thickness (feet)					
T-13	NE	NE	NE	NE	NE	NE

T-1

Gauging Event	1Q07	2Q07	3Q07	4Q07	1Q08	2Q08
Well ID	Product Thickness (feet)					
T-1	NE	NE	NE	NE	NE	NE

P-55

Gauging Event	1Q07	2Q07	3Q07	4Q07	1Q08	2Q08
Well ID	Product Thickness (feet)					
P-55	NG	NE	NE	NG	NG	NE

P-60-11 1.20 FT
P-60-10 NONE
P-60-09 5.35 FT
P-60-12 NONE
P-60-12S 0.71 FT
P-60
P-68
P-60-08 1.50 FT
T-24

Gauging Event	1Q07	2Q07	3Q07	4Q07	1Q08	2Q08
Well ID	Product Thickness (feet)					
P-60	8.20	7.37	8.56	7.00	NG	5.97

T-12

Gauging Event	1Q07	2Q07	3Q07	4Q07	1Q08	2Q08
Well ID	Product Thickness (feet)					
T-12	0.65	0.60	0.04	0.05	1.45	0.02

P-70

P-59

Gauging Event	1Q07	2Q07	3Q07	4Q07	1Q08	2Q08
Well ID	Product Thickness (feet)					
P-59	1.15	1.22	0.41	0.79	1.28	0.11

P-61

P-56

Gauging Event	1Q07	2Q07	3Q07	4Q07	1Q08	2Q08
Well ID	Product Thickness (feet)					
P-56	NE	1.03	NE	NE	NE	NE

MW-2 (B-2)
MW-1 (B-1)

T-6

Gauging Event	1Q07	2Q07	3Q07	4Q07	1Q08	2Q08
Well ID	Product Thickness (feet)					
T-6	NE	NE	0.04	NE	NE	NE

P-93-09
P-57

Gauging Event	1Q07	2Q07	3Q07	4Q07	1Q08	2Q08
Well ID	Product Thickness (feet)					
P-57	NG	NG	NE	NE	NG	NE

MW-3 (B-3)
MW-4 (B-4)
P-93C
P-93D
P-93B
P-93A
P-73

Gauging Event	1Q07	2Q07	3Q07	4Q07	1Q08	2Q08
Well ID	Product Thickness (feet)					
P-93A	NE	NE	NE	NE	NE	NE

GP-12
GP-12(II)
GP-11
MW-5 (B-5)
GP-9
P-93-05
GP-13
P-93-06
P-93-03
P-93-02
GP-7(II)
P-93-11
COP B-1
COP B-3
COP B-5
MW-6 (B-6)

P-58

Gauging Event	1Q07	2Q07	3Q07	4Q07	1Q08	2Q08
Well ID	Product Thickness (feet)					
P-58	1.90	1.30	1.29	1.93	2.36	0.79

Gauging Event	1Q07	2Q07	3Q07	4Q07	1Q08	2Q08
Well ID	Product Thickness (feet)					
P-66	1.82	1.05	0.97	1.55	1.83	0.64

P-66

P-54

N

Ø 200
SCALE FEET

REFERENCE:
SOPUS, WRB REFINING LLC 2008; RCRA PART B POST CLOSURE PERMIT APPLICATION; DATED JUNE 2008; PREPARED BY URS.

SHELL OIL PRODUCTS U.S
DISSOLVED PHASE GROUNDWATER INVESTIGATION
ROXANA, ILLINOIS

PROJECT NO. 21561979

URS

DRN. BY:djd 8/19/08
DSGN. BY:wmp
CHKD. BY:b3

West Fenceline Product Occurrence and Thickness

FIG. NO. 2

File: P:\ENVIRONMENTAL\21561979 SOPUS ROUTE 111 RAND AVE VICINITY INVESTIGATION\PLUME DELINEATION WORKPLAN\FIG 3 BTEX-MTBE DETECTIONS-N MAP.DWG Last edited: SEP. 03, 08 @ 12:43 p.m. by: wendy_pennington

LEGEND

GROUNDWATER MONITORING WELL LOCATION

NOTES:
1) ALL GRAYSCALE LOCATIONS REPRESENT WELLS IN THE AREA DEPICTED BUT ANALYTICAL DATA NOT PRESENTED FOR THIS FIGURE.
2) EXCEEDANCES OF THE SCREENING CRITERIA ARE HIGHLIGHTED IN YELLOW.
3) D = (LAB QUALIFIER) THE RESULT IS FROM A DILUTED SAMPLE.

TYDEMAN AVE
FIRST ST
SECOND ST
THIRD ST
FOURTH ST
FIFTH ST
SIXTH ST
SEVENTH ST
EIGHTH ST
VILLAGE OF ROXANA
NORTH PROPERTY
WOOD RIVER REFINERY
WELLS GENERALLY EXHIBIT MEASURABLE SEPARATE-PHASE HYDROCARBON
WELLS GENERALLY EXHIBIT MEASURABLE SEPARATE-PHASE HYDROCARBON
1986 APPROXIMATE BENZENE RELEASE SITE
RAND AVENUE
(S. CENTRAL AVE) HIGHWAY 111
CHAFFER ST
BP

T-13

Sample Location	Sample Date	Analyte	Result (mg/L)
T-13	8/8/2008	Benzene	<0.005
		Ethylbenzene	<0.005
		Toluene	<0.005
		o-Xylene	<0.005
		m,p-Xylene	<0.010
		Methyl tert-Butyl Ether	<0.005

T-1

Sample Location	Sample Date	Analyte	Result (mg/L)
T-1	8/8/2008	Benzene	<0.005
		Ethylbenzene	<0.005
		Toluene	<0.005
		o-Xylene	<0.005
		m,p-Xylene	<0.010
		Methyl tert-Butyl Ether	<0.005

P-55

Sample Location	Sample Date	Analyte	Result (mg/L)
P-55	8/8/2008	Benzene	0.686 D
		Ethylbenzene	0.921 D
		Toluene	0.350 D
		o-Xylene	0.118
		m,p-Xylene	1.78 D
		Methyl tert-Butyl Ether	<0.005

P-60
P-68
T-24
P-54
T-12
P-69
P-62
P-70
P-74
P-61
P-59

Sample	Sample	Analyte	Result
P-56	6/9/2008	Benzene	0.383 D
		Ethylbenzene	1.67 D
		Toluene	0.49 D
		m,p-Xylene	2.22 D
		o-Xylene	0.233 D
		Methyl tert-Butyl Ether	<0.005

P-56

Sample Location	Sample Date	Analyte	Result (mg/L)
P-57	6/11/2008	Benzene	257 D
		Ethylbenzene	0.624
		Toluene	0.133
		m,p-Xylene	0.76
		o-Xylene	0.117
		Methyl tert-Butyl Ether	<0.050
	3/3/2006	Benzene	177
		Ethylbenzene	1.12
		Toluene	<1.0
		Xylenes (total)	<3.0
		Methyl tert-Butyl Ether	<1.0

P-93-09
T-6
P-57
MW-3 (B-3)
MW-4 (B-4)
P-93C
P-93B
P-93D
P-93A

Sample Location	Sample Date	Analyte	Result (mg/L)
P-93A	4/30/2008	Benzene	366 D
		Ethylbenzene	0.238
		Toluene	0.0187
		m,p-Xylene	0.347
		o-Xylene	0.0255
		Methyl tert-Butyl Ether	6.26 D
	3/3/2006	Benzene	506
		Ethylbenzene	<5.0
		Toluene	<5.0
		Xylenes (total)	<15.0
		Methyl tert-Butyl Ether	<5.0
P-93B	4/30/2008	Benzene	232 D
		Ethylbenzene	0.0907
		Toluene	0.11
		m,p-Xylene	0.174
		o-Xylene	0.0394
		Methyl tert-Butyl Ether	0.465
	3/3/2006	Benzene	370
		Ethylbenzene	<5.0
		Toluene	<5.0
		Xylenes (total)	<15.0
		Methyl tert-Butyl Ether	<5.0

P-58
P-66
MW-6 (B-6)
MW-2 (B-2)
MW-1 (B-1)
MW-5 (B-5)
GP-9
GP-12
GP-12(II)
GP-11
GP-13
P-93-05
P-93-06
P-93-03
P-93-02
P-93-11
GP-7(II)
COP B-1
COP B-3
COP B-5
P-54

N

Ø 200
SCALE FEET

REFERENCE:
SOPUS, WRB REFINING LLC 2008; RCRA PART B POST CLOSURE PERMIT APPLICATION; DATED JUNE 2008; PREPARED BY URS.

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DSGN. BY:wmp
CHKD. BY:b3

Groundwater Analytical BTEX & MTBE Results Map

FIG. NO. 3

File: P:\ENVIRONMENTAL\21561979 SOPUS ROUTE 111 RAND AVE VICINITY INVESTIGATION\PLUME DELINEATION WORKPLAN\FIG 4 PROPOSED LOCATIONS.DWG Last edited: SEP. 03, 08 @ 12:51 p.m. by: wendy_pennington

LEGEND

- PROPOSED GROUNDWATER PROFILING LOCATION
- PROPOSED GROUNDWATER MONITORING WELL LOCATION
- PROPOSED VAPOR MONITORING POINT LOCATION
- PROPOSED SOIL BORING LOCATION (POSSIBLE GROUNDWATER SAMPLE)

NOTES:
1. GRAYSCALE LOCATIONS REPRESENT PREVIOUS SAMPLE LOCATIONS OR EXISTING WELLS OR VAPOR POINTS.
2. GROUNDWATER PROFILING WILL INITIALLY BE CONDUCTED AT LOCATIONS ON THE PRIMARY TRANSECT.
3. PROFILING WILL CONTINUE AT LOCATIONS ON THE SECONDARY TRANSECTS DEPENDING ON PRIMARY RESULTS. REFER TO TEXT FOR DECISION CRITERIA.

TYDEMAN AVE
FIRST ST
SECONDARY PROFILING TRANSECT
PRIMARY PROFILING TRANSECT
SECONDARY PROFILING TRANSECT
SECOND ST
THIRD ST
FOURTH ST
VILLAGE OF ROXANA
FIFTH ST
SIXTH ST
SEVENTH ST
EIGHTH ST
(S. CENTRAL AVE) HIGHWAY 111
CHAFFER ST
RAND AVENUE
BP
NORTH PROPERTY
WOOD RIVER REFINERY
1986 APPROXIMATE BENZENE RELEASE SITE
T-13
T-1
P-55
P-60
P-68
T-24
P-54
T-12
P-69
P-62
P-70
P-74
P-61
P-59
P-56
T-6
P-93-09
P-57
P-73
P-93B
P-93C
P-93D
P-93A
MW-2 (B-2)
MW-1 (B-1)
MW-3 (B-3)
MW-4 (B-4)
GP-12
GP-12(II)
GP-11
MW-5 (B-5)
GP-9
GP-13
P-93-05
P-93-06
P-58
P-93-03
P-93-02
P-93-11
GP-7(II)
COP B-1
COP B-3
COP B-5
P-66
MW-6 (B-6)

N

Ø 200Ø
SCALE FEET

REFERENCE:
SOPUS, WRB REFINING LLC 2008; RCRA PART B POST CLOSURE PERMIT APPLICATION; DATED JUNE 2008; PREPARED BY URS.

SHELL OIL PRODUCTS U.S
DISSOLVED PHASE GROUNDWATER INVESTIGATION
ROXANA, ILLINOIS

PROJECT NO. 21561979

URS

DRN. BY:djd 8/19/08
DSGN. BY:wmp
CHKD. BY:b3

Proposed Investigation Locations

FIG. NO. 4

HYDRASleeve

Simple by Design

US Patents No. 6,481,300; No. 6,837,120; others pending

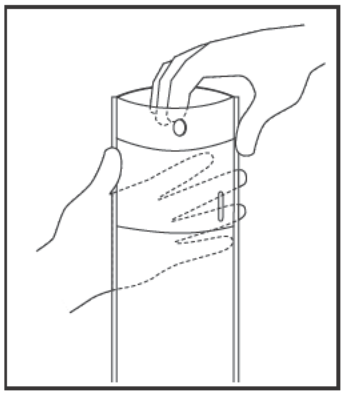
Field Manual

Introduction

The HydraSleeve groundwater sampler can be used to collect a representative sample for most physical and chemical parameters without purging the well. It collects a whole water sample from a user-defined interval (typically within the well screen), without mixing fluid from other intervals. One or more HydraSleeves are placed within the screened interval of the monitoring well, and a period of time is allocated for the well to re-equilibrate. Hours to months later, the sealed HydraSleeve can be activated for sample collection. When activated, HydraSleeve collects a sample with no drawdown and minimal agitation or displacement of the water column. Once the sampler is full, the one-way reed valve collapses, preventing mixing of extraneous, non-representative fluid during recovery.

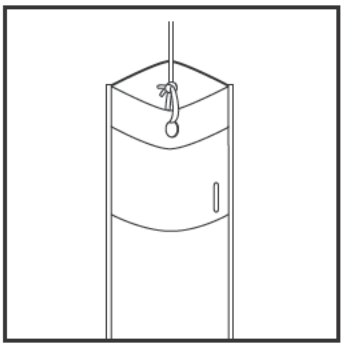
Assembly

Assembling the HydraSleeve is simple, and can be done by one person in the field, taking only a minute or two.

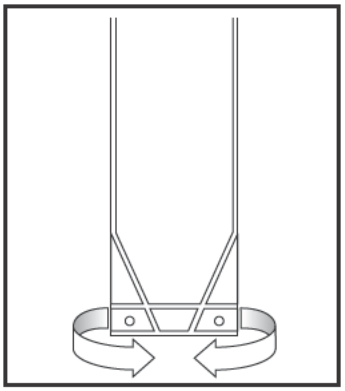


1 Remove HydraSleeve from package and grasp top to "pop" open.

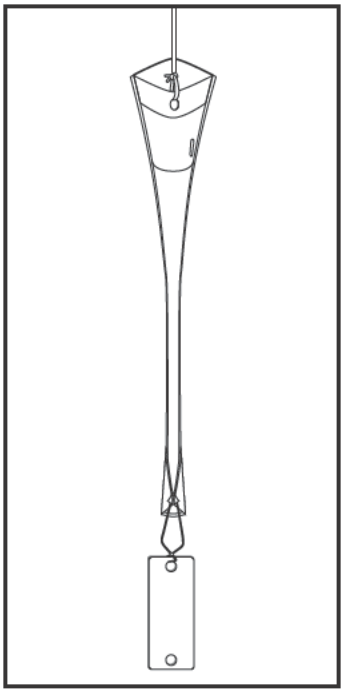
2 Squeeze side fins together at top to bend reinforcing strips outward.



3 Attach line to hole at top of HydraSleeve.



4 Fold the two holes at bottom of HydraSleeve together and attach weight



5 Sampler is ready to insert into the well.

Placing the HydraSleeve(s)

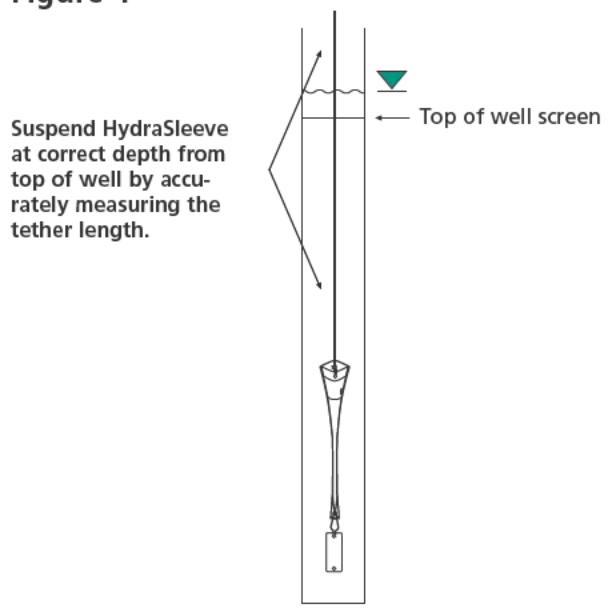
To collect a representative groundwater sample without purging, the well must be allowed time to re-equilibrate after placement of the sampler. When any device is lowered into a well, some mixing of the water column occurs. The diameter of the device and its shape greatly affect the degree of mixing. The flat cross-section of the empty HydraSleeve minimizes the disturbance to the water column as the sampler is lowered into position, reducing the time needed for the well to return to equilibrium.

There are three basic methods for holding a HydraSleeve in position as the well equilibrates.

TOP DOWN DEPLOYMENT (Figure 1)
Measure the correct amount of suspension line needed to "hang" the top of the HydraSleeve(s) at the desired sampling depth (in most cases, this will be at the bottom of the sampling zone). The upper end of the tether can be connected to the well cap to suspend the HydraSleeve at the correct depth until activated for sampling.

Note: For deep settings, it may be difficult to accurately measure long segments of suspension line in the field. Factory prepared, custom suspension line and attachment points can be provided.

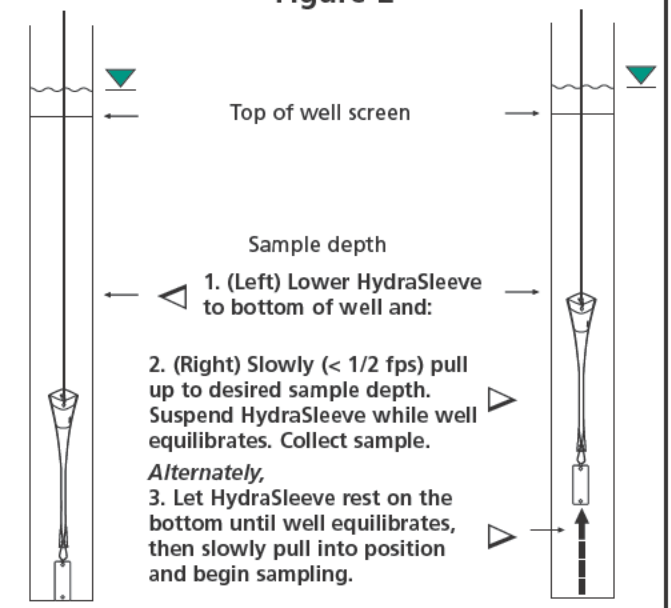
Figure 1



BOTTOM DEPLOYMENT (Figure 2)
Sound the well to determine the exact depth. Lower the weighted HydraSleeve into the well and let it touch the bottom. Very slowly (less than 1/2 foot per second) raise the sampler to the point where the check valve is at the depth the sample is to be collected. Attach the suspension line to the top of the well to suspend it at this depth. (It is often easier to measure a few feet from the bottom of the well up to the sample point, than it is to measure many feet from the top of the well down.)

Alternately, the sampler can be left on the bottom until the well re-equilibrates. For sampling, it can be very slowly pulled (< 1/2 fps) to sampling depth, then activated (see "Sample Collection," p. 6) to collect the sample, and retrieved to the surface.

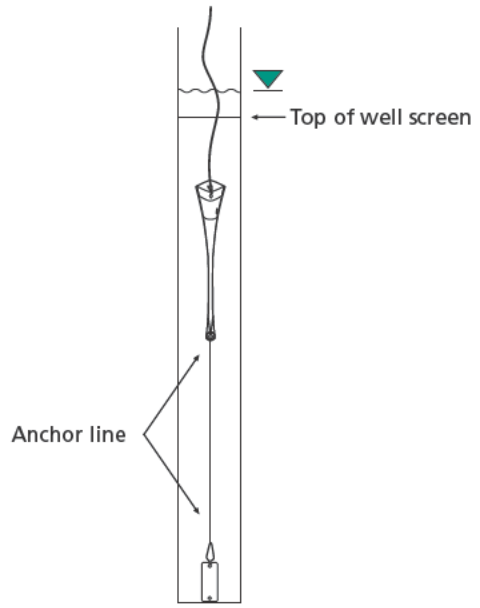
Figure 2



BOTTOM ANCHOR (Figure 3)

Determine the exact depth of the well. Calculate the distance from the bottom of the well to the desired sampling depth. Attach an appropriate length anchor line between the weight and the bottom of the sampler and lower the assembly until the weight rests on the bottom of the well, allowing the top of the sampler to float at the correct sampling depth.

Figure 3



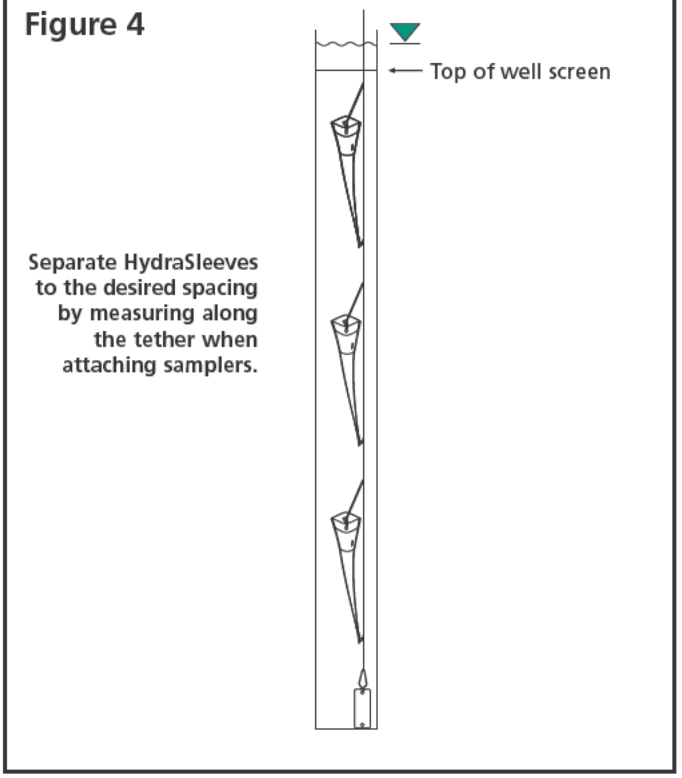
Multiple Interval Deployment

There are two basic methods for placing multiple HydraSleeves in a well to collect samples from different levels simultaneously.

ATTACHED TO A SINGLE TETHER (Figure 4)

To use 3 or more samplers simultaneously, we recommend attaching them all to a tether for support to prevent the sampling string from pulling apart. The weight is attached to a single length of suspension line and allowed to rest on the bottom of the well. The top and bottom of each HydraSleeve are attached to the tether at the desired sample intervals. Cable tie or stainless steel clips (supplied) work well for attaching the HydraSleeves to the line. Simply push one end of the clip between strands of the rope at the desired point before attaching the clip to the HydraSleeve.

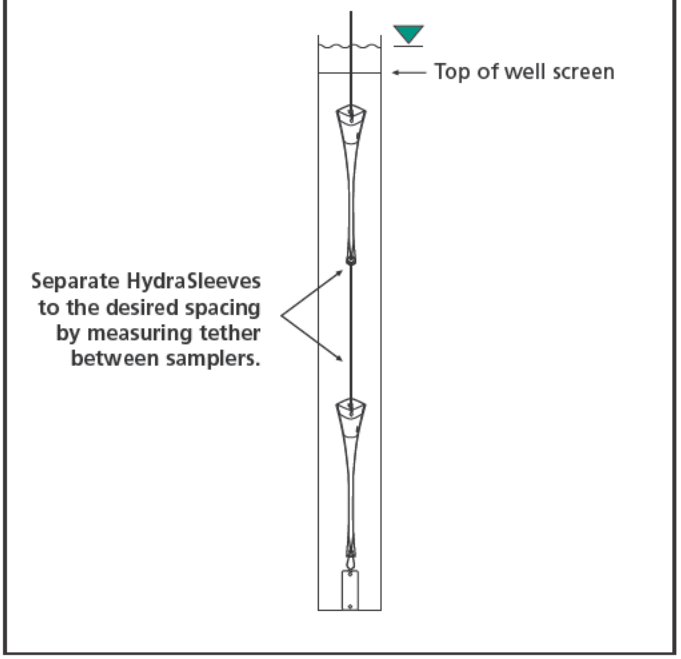
Figure 4



ATTACHED END TO END (Figure 5)

To place 2 or 3 stacked HydraSleeves for vertical profiling, use one of the methods described above to locate the bottom sampler. Attach the bottom of the top sampler to the top of the following HydraSleeve(s) with a carefully measured length of suspension cable. Connect the weight to the bottom sampler. Note: if many HydraSleeves are attached to a tether, more weight may be required than with a single sampler.

Figure 5



Sample Collection

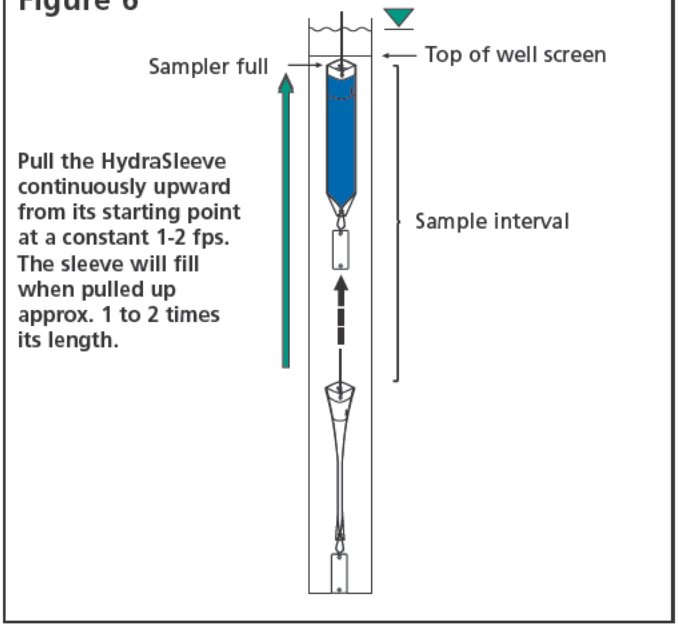
The HydraSleeve must move upward at a rate of one foot per second or faster (about the speed a bailer is usually pulled upward) for water to pass through the check valve into the sample sleeve. The total upward distance the check valve must travel to fill the sample sleeve is about 1 to 2 times the length of the sampler. For example, a 24-inch HydraSleeve needs a total upward movement of 24 to no more than 48 inches to fill. The upward motion can be accomplished using one long continuous pull, several short strokes, or any combination that moves the check valve the required distance in the open position. A special technique is used for sampling low-yield wells.

CONTINUOUS PULL (Figure 6)

Pull the HydraSleeve continuously upward from its starting point at a constant 1 to 2 feet per second until full. This method usually provides the least turbid samples and is analogous to coring the water column from the bottom up.

Note: When using this method, the screen interval should be long enough so the sampler fills before exiting the top of the screen.

Figure 6

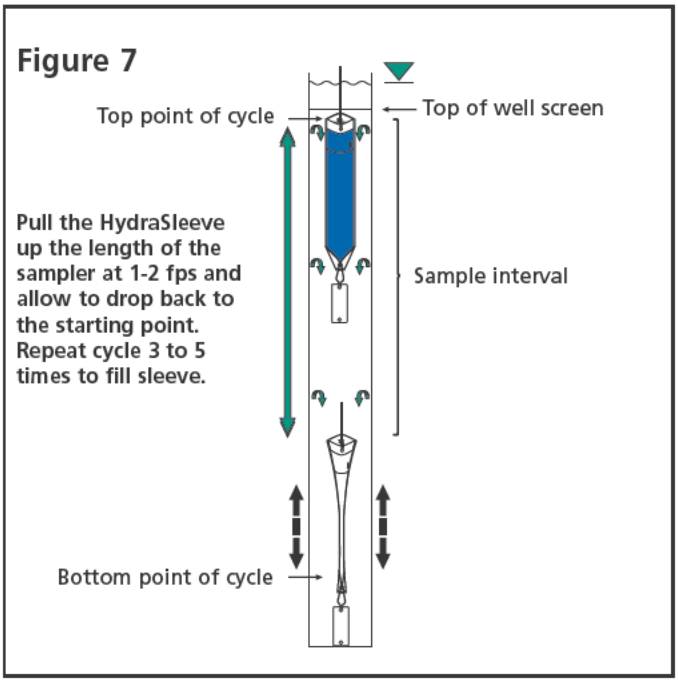


SHORT STROKES (Figure 7)

Pull the sampler upward at about 1 to 2 feet per second for the length of the sampler and let it drop back to the starting point. Repeat the cycle 3 to 5 times.

This method provides a shorter sampling interval than the continuous pull method (above), and usually reduces the turbidity levels of the sample below that of numerous rapid, short cycles (below). The sample comes from between the top of the cycle and the bottom of the sampler at its lowest point.

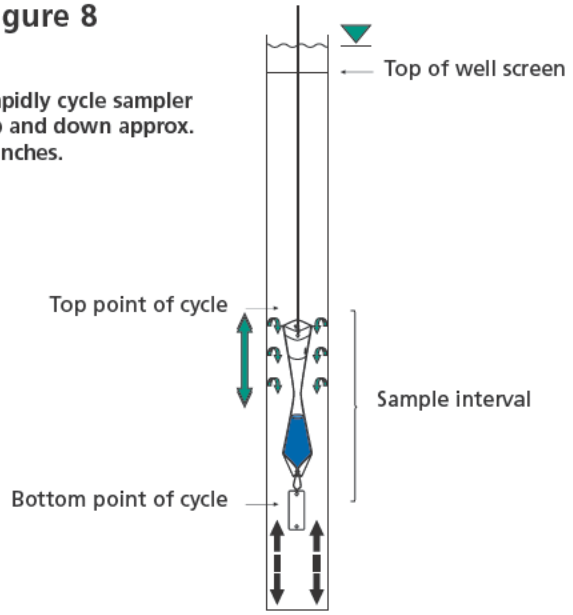
Figure 7



RAPID, SHORT CYCLES (Figure 8)

Cycle the HydraSleeve up and down using rapid, short strokes (6-inch cycle at a minimum of 1 cycle per second) 5 to 8 times. This method provides the shortest sampling interval. Dye studies have shown that when using this method the sample flows into the check valve from along the length of the sampler and immediately above the check valve. The sample interval is from the bottom the sampler at its lowest point in the cycle to the top of the check valve at the peak of the cycle.

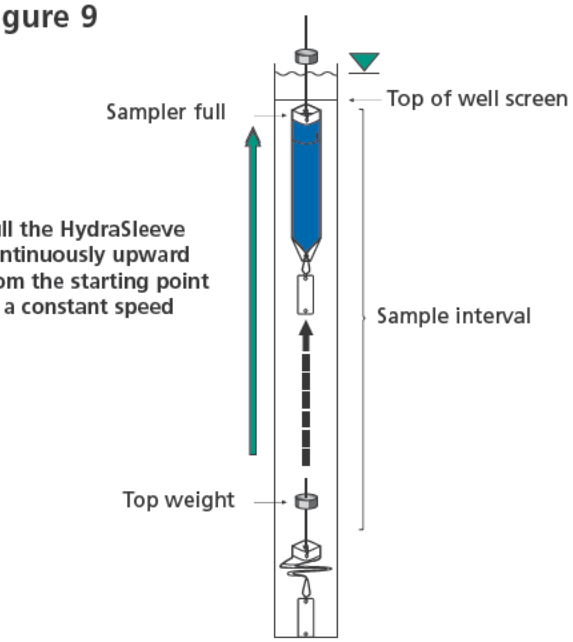
Figure 8



SAMPLING LOW-YIELD WELLS (Figure 9)

HydraSleeve provides the best available technology for sampling low yield wells. When pulled upward after the well re-equilibrates, the HydraSleeve will collect a water core from the top of the sampler to about its own length above that point. The sample is collected with no drawdown in the well and minimal sample agitation. An optional top weight can be attached to compress the sampler in the bottom of the well if needed for an extremely short water column. With a top weight, the check valve is pushed down to within a foot of the bottom of the well.

Figure 9



Sample Discharge

The best way to remove a sample from the HydraSleeve with the least amount of aeration and agitation is with the short plastic discharge tube (included).

First, squeeze the full sampler just below the top to expel water resting above the flexible check valve. (Photo 1, top left)

Then, push the pointed discharge tube through the outer polyethylene sleeve about 3-4 inches below the white reinforcing strips. (Photo 2, middle left)

Discharge the sample into the desired container. (Photo 3, bottom left)

Raising and lowering the bottom of the sampler or pinching the sample sleeve just below the discharge tube will control the flow of the sample. The sample sleeve can also be squeezed, forcing fluid up through the discharge tube, similar to squeezing a tube of toothpaste. With a little practice, and using a flat surface to set the sample containers on, HydraSleeve sampling becomes a one-person operation.

GeoInsight

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