SOLUTIA

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Solutia Inc.
702 Clydesdale Avenue
Anniston, Alabama 36201-5328
Tel 256-231-8400

December 6, 2005

SENT VIA FEDERAL EXPRESS

Alabama Department of Environmental Management
Industrial Hazardous Waste Branch
Land Division
1400 Coliseum Boulevard
Montgomery, Alabama 36130-1463

Attn: Mr. Phillip D. Davis
Chief, Industrial Hazardous Waste Branch

RE: **MAJOR MODIFICATION REQUEST FOR**
AHWMMA POST-CLOSURE PERMIT (ALD 004 019 048)
SOLUTIA INC.
ANNISTON, ALABAMA

Dear Mr. Davis:

Solutia Inc. (Solutia) requests a major permit modification in accordance with Alabama Department of Environmental Management (ADEM) Administrative Code R. 335-14-8-.04 for Solutia's Alabama Hazardous Waste Management and Minimization Act (AHWMMA) Post-Closure Permit Number ALD 004 019 048 (RCRA Permit). Solutia initially requested a permit modification in correspondence to ADEM dated April 14, 2004. Subsequent discussions between Solutia and ADEM resulted in including the modifications to the RCRA Part B Permit Application and Permit described below.

The RCRA Part B Permit Application and Permit have been revised to incorporate previously approved and recently proposed permit modifications. The previously approved permit modifications requiring revisions include:

- Changing SBP-05 to an effectiveness well and DW-01 to an interceptor well as approved in Minor Permit Modification #1, and
- Replacing OW-06, OW-08, and OW-16 with OW-06A, OW-08A, and OW-16A as approved in Minor Permit Modification #2.

The recently proposed revisions to the RCRA Part B Permit Application and Permit include:

- Addressing the decommissioning of the on-Site wastewater biological treatment system, adding carbon filtration of effluent from IW-10, and pumping of the effluent from all interceptor wells to the existing on-Site equalization basin;
- Clarifying that the investigation and cleanup of Area of Concern B (AOC B) (Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] Operable Units 1/2 and 4) will be conducted under the oversight of

the United States Environmental Protection Agency (USEPA) pursuant to the Partial Consent Decree (CV-02-PT-0749-E), except for AOC B1 (Highway 21 Bridge)and AOC B2 (Soil Stockpile at the Choccolocco Creek WWTP);

- Clarifying that the Plant Site, CERCLA Operable Unit 3, investigation and cleanup will be conducted under USEPA oversight pursuant to the Partial Consent Decree, except for Resource Conservation and Recovery Act Regulated Post-Closure Units and associated Groundwater Detection and Corrective Action Monitoring Programs;
- Changing water level gauging to a semi-annual basis when groundwater samples are collected;
- Changing the following constituent monitoring requirements based on historic sampling and analysis results:
    - Removing methylene chloride, phenol, 2,4-dichlorophenol, and 2,4,5-trichlorophenol from the sampling and analysis plan;
    - Changing 2,4,6-trichlorophenol and pentachlorophenol to constituents monitored annually in MW-20A only;
- Changing the concentration limit for mercury to 0.002 mg/L to reflect established MCL value;
- Changing the monitoring well purging methods to allow for use of low flow techniques to ensure consistency with USEPA requirements (previously approved on interim basis pending formal Permit modification approval);
- Including the replacement of MW-9, OW-21, and IW-14 with MW-9A, OW-21A, and IW-14A, respectively; and
- Including the addition of IW-22 through IW-25 to the Waste Management Area (WMA) II corrective action system.

The revised text pages, tables, figures, and appendices to be inserted into the RCRA Part B Application and Permit are appended, along with summary pages listing those pages of the application and permit that are affected. These proposed revisions represent revision No. 3 for the Permit Application and revision No. 4 for the Permit. All fees required for the RCRA Permit modification have previously been paid to ADEM via correspondence from me to Mr. Russell Kelly dated November 30, 2004.

With this letter, Solutia also requests that the Plant Emergency Coordinator be changed to Mr. Scott Dorsett. Mr. Dorsett is located at the Anniston facility and can be reached at (256) 231-8400.

We appreciate your review of the above information and we look forward to working with the Department to implement the above modification to the RCRA Permit. If you have any questions or need additional information, please give me a call.

Sincerely,

Craig R. Branchfield
Manager, Remedial Projects

attachments

cc: Ms. Pamela Langston Scully, USEPA Region IV

Solutia, Inc.
EPA ID No. ALD 004 019 048

Post-Closure Permit Application Revision No. 3

BASIS FOR PAGE CHANGES

This AHWMMA post-closure permit application has been revised to incorporate previously approved and recently proposed permit modifications. The previously approved permit modifications requiring revisions include:

- Changing SBP-05 to an effectiveness well and DW-01 to an interceptor well as approved in Minor Permit Modification #1, and
- Replacing OW-06, OW-08, and OW-16 with OW-06A, OW-08A, and OW-16A as approved in Minor Permit Modification #2.

The recently proposed revisions to the RCRA Part B Permit Application and Permit include:

- Addressing the decommissioning of the on-Site wastewater biological treatment system, adding carbon filtration of effluent from IW-10, and pumping of the effluent from all interceptor wells to the existing on-Site equalization basin;
- Clarifying that the investigation and cleanup of Area of Concern B (AOC B) (Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] Operable Units 1/2 and 4) will be conducted under the oversight of the United States Environmental Protection Agency (USEPA) pursuant to the Partial Consent Decree (CV-02-PT-0749-E), except for AOC B1 (Highway 21 Bridge)and AOC B2 (Soil Stockpile at the Choccolocco Creek WWTP);
- Clarifying that the Plant Site, CERCLA Operable Unit 3, investigation and cleanup will be conducted under USEPA oversight pursuant to the Partial Consent Decree, except for Resource Conservation and Recovery Act Regulated Post-Closure Units and associated Groundwater Detection and Corrective Action Monitoring Programs;
- Changing water level gauging to a semi-annual basis when groundwater samples are collected;
- Changing the following constituent monitoring requirements based on historic sampling and analysis results:
    - Removing methylene chloride, phenol, 2,4-dichlorophenol, and 2,4,5-trichlorophenol from the sampling and analysis plan;
    - Changing 2,4,6-trichlorophenol and pentachlorophenol to constituents monitored annually in MW-20A only;
- Changing the concentration limit for mercury to 0.002 mg/L to reflect established MCL value;
- Changing the monitoring well purging methods to allow for use of low flow techniques to ensure consistency with USEPA requirements (previously approved on interim basis pending formal Permit modification approval);
- Including the replacement of MW-9, OW-21, and IW-14 with MW-9A, OW-21A, and IW-14A, respectively; and
- Including the addition of IW-22 through IW-25 to the Waste Management Area (WMA) II corrective action system.

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Post-Closure Permit Application Revision No. 3

BASIS FOR PAGE CHANGES

Each of these revisions requires updating specific portions of Section C of the permit application. Only the pertinent portions of Section C have been updated; therefore, other portions of Section C will present data for the Site that was collected before 1996 when the original permit application was submitted. The following table provides the page change instructions for the modifications that were made to Section C of the permit application.

Solutia, Inc.
EPA ID No. ALD 004 019 048

Post-Closure Permit Application Revision No. 3

PAGE CHANGE INSTRUCTIONS

Section/Appendix	Remove Page(s)	Insert Page(s)	Reason
Table of Contents	i through v of vi	i through v of vi	Updated revision dates as appropriate.
Table of Contents	vi of vi	vi of vi	Added "C-6 IW-10 Filtration System Design"
Section: C-2c	Page 22 of 64	Page 22 of 64	First paragraph, third sentence: Changed "six" to "eleven". First paragraph, fourth sentence: Replaced "from these interceptor wells in March 1989 during start up of the six interceptor wells" with "during start up of six of these interceptor wells in March 1989"
Section: C-5a	Page 27 of 64	Page 27 of 64	Replaced "OW-6", "OW-8", and "OW-16" with "OW-6A", "OW-8A", and "OW-16A", respectively.
Section: C-5a	Page 28 of 64	Page 28 of 64	Replaced "OW-6", "OW-8", "OW-16", "OW-21",and "MW-9" with "OW-6A", "OW-8A", "OW-16A", "OW-21A", and "MW-9A", respectively.
Section: C-5a	Page 30 of 64	Page 30 of 64	Replaced "OW-21"and "MW-9" with "OW-21A" and "MW-9A", respectively. First paragraph, third sentence: Added "SBP-05" after "wells". Second paragraph: Deleted the sentences "It is proposed that SBP-05 be used to monitor the bedrock/residuum interface at Old Limestone Bed (SWMU 8). SBP-05 is west of and immediately adjacent to DW-1."
Section: C-6a	Page 35 of 64	Page 35 of 64	Last sentence: Replaced "parathion, PNP, and phenol" with "parathion and PNP".
Section: C-6a	Page 36 of 64	Page 36 of 64	Hanging paragraph: Deleted last sentence "It is proposed that phenol be added to the detection monitoring list of constituents as an indicator of breakdown products from biodegradation of PNP."

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PAGE CHANGE INSTRUCTIONS

			First paragraph, fourth sentence: Deleted "and".
Section: C-6a	Page 37 of 64	Page 37 of 64	Hanging sentence: Deleted "phenol".
Section: C-7a	Page 44 of 64	Page 44 of 64	Second paragraph, first sentence: Deleted "phenol".
Section: C-8a(1)	Page 49 of 64	Page 49 of 64	First paragraph, first sentence: Replaced "IW-21" with "IW-25 and DW-01". First paragraph, third sentence: Deleted sentence "In addition, it is proposed that existing well DW-1 which taps the bedrock/residuum interface be converted to a recovery well by installing a submersible pump with an automatic start/stop switch." First paragraph, last sentence: Replaced sentence with "Groundwater recovered from these wells is collected in a common collection tank for subsequent discharge to an on-site equalization basin which discharges to the City of Anniston Publicly-Owned Treatment Works (POTW)."
Section: C-8a(4)	Page 56 of 64	Page 56 of 64	Second paragraph, first sentence: Replaced "either: pumped and/or bailed dry and sampled upon recovery; or a three to five-fold volume of water removed and then sampled" with "purged according to the Sampling and Analytical Quality Assurance/Quality Control Plan." Third paragraph, first sentence: Replaced "quarterly" with "semi-annually when the wells are sampled"
Section: C-8a(5)	Page 59 of 64	Page 59 of 64	Hanging sentence: Replaced "Monsanto's on-site biological wastewater treatment facility." with "an on-site equalization basin for subsequent discharge to the POTW, with the exception of water collected from IW-10. Groundwater from IW-10 is passed through a filtration system before it is pumped to the equalization basin. The design of this filtration system is included as Exhibit C-6."

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PAGE CHANGE INSTRUCTIONS

Section: C-8a(5)	-----	Page 59a of 64	Added page to maintain pagination for the rest of the document.
Section: C-8a(5)	Page 60 of 64	Page 60 of 64	Hanging paragraph: First sentence: Replaced "It is proposed that DW-1 be" with "DW-1 has been". First paragraph, fourth sentence: Replaced "OW-6", "OW-8", "OW-16", "OW-21",and "MW-9" with "OW-6A", "OW-8A", "OW-16A", "OW-21A", and "MW-9A", respectively.
Section: C-8a(5)	Page 61 of 64	Page 61 of 64	First paragraph, first sentence: Replaced "parathion , PNP, and phenol" with "parathion and PNP"
Section: C-8a(6)	Page 62 of 64	Page 62 of 64	First paragraph, third sentence: Replaced "parathion, PNP, and phenol" with "parathion and PNP". First paragraph, third sentence: Deleted: "(March 1996)". First paragraph, third sentence: Deleted "methylene chloride, 2,4-dichlorophenol, pentachlorophenol, 2,4,5-trichlorophenol, 2,4,6-trichlorophenol". First paragraph, third sentence: Replaced "Tetraethyldithiopyrophosphate" with "sulfotepp". First paragraph, fourth sentence: Replaced "These" with "Two constituents will be monitored in MW-20A on an annual basis; these are 2,4,6-trichlorophenol and pentachlorophenol. All of these".
Section: C Table C-16	Page 1 of 1	Page 1 of 1	Replaced table with an updated version containing well construction details for the new wells.
Section: C Figure C-12	Page 1 of 1	Page 1 of 1	Replaced figure with an updated version to reflect the abandonment of some wells that were in the original figure.
Section: C Figure C-16	Page 1 of 1	Page 1 of 1	Replaced figure with an updated version depicting the locations of replacement wells OW-6A, OW-8A, and OW-16A.
Section: C Figure C-17	Page 1 of 1	Page 1 of 1	Replaced figure with an updated version depicting the locations of replacement wells OW-21A and MW-09A and interceptor wells IW-22 through IW-25.

Solutia, Inc.
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Post-Closure Permit Application Revision No. 3

PAGE CHANGE INSTRUCTIONS

Section: C Exhibit 1	Var.	Pages 1-9 of 9	Replaced boring logs for OW-6, OW-8, OW-16, OW-21,and MW-9 with boring logs OW-6A, OW-8A, OW-16A, OW-21A, and MW-9A, respectively.
Section: C Exhibit 6	---	Pages 1-3 of 3	Added Exhibit 6 IW-10 Filtration System Design. Changed breakthrough monitoring schedule to quarterly sampling.

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groundwater flow rate at WMA-I is approximately 7 ft/yr.

The horizontal hydraulic gradient at WMA-II was also based on historical water-level measurements in the monitor wells in the vicinity of WMA-II and was calculated to be 0.027 ft/ft. The horizontal hydraulic conductivity of the soils at this location were determined using procedures similar to WMA-I. Eleven interceptor wells are located in the vicinity of WMA-II to control the migration of contaminated groundwater from the Old Limestone Bed (SWMU 8). The data collected during start up of six of these interceptor wells in March 1989 indicated that the average discharge was 6.7 gph and that the average drawdown was 26 feet. Analysis of these data indicates that the horizontal hydraulic conductivity of sediments near WMA-II is approximately 2 x 10^{-5} cm/sec. Based on this assumption, and on an effective porosity of 0.2, the calculated horizontal groundwater flow at WMA-II is 3 ft/yr.

II. WMA-II was placed in corrective action monitoring due to the intermittent detections of constituents in MW-20A and upon the recommendation of ADEM. The inability to distinguish conclusively the source of the releases i.e. whether it is from the regulated unit (WMA-II) or the underlying surface impoundment (SWMU 9) was integral in making this proposal.

The proposed monitor wells for the detection monitoring program for the regulated unit WMA-I are:

Upgradient Monitor Well for WMA- I	MW-1B
Downgradient Monitor Wells for WMA-I	MW-11A MW-12A MW-13A

The locations of these wells are shown in Figure C-16, and their construction details are summarized in Table C-16 (see Exhibit C-2 for well construction diagrams).

For SWMUs where a corrective action program is underway, the proposed corrective action monitoring program is:

Monitor wells for Landfill (SWMU 1)	OW-2, OW-4, OW-6A, OW-7, OW-8A OW-15, OW-16A

Monitor wells for Old Limestone Bed (SWMU 8)	OW-19, OW-21A, OW-22, OW-24, MW-9A, SBP-5, MW-8

The locations of these wells are shown in Figures C-16 and C-17. The proposed monitor well system for the Landfill SWMU (Western and Northern Landfill and Plant site interceptor well systems) has been modified to reflect the effectiveness of the long-term operation of these systems. The interceptor system at the Western Landfill and portions of the Northern Landfill system were installed in 1982. The Northern Landfill system was expanded in 1988. The Plant Site interceptor well system was installed in 1988. All of these systems were installed to prevent further migration of site constituents away from the western half of the Landfill SWMU and remediate that which had migrated beyond its boundary. The proposed monitoring system for the Landfill SWMU is designed to monitor the effectiveness of the interceptor well systems at the landfill boundary (OW-2, OW-4, OW-6A, OW-7, OW-15 and OW-16A) as well as the continued effectiveness of the interceptor well system located downgradient (OW-8A)

system, have generally been the only existing monitor/observation wells with consistent detections of parathion and PNP. Concentrations of these constituents have generally decreased with continual operation of the system (Table C-6). Monitor/observation wells SBP-5, MW-9A and MW-8 monitor the western portion of the interceptor well system and OW-21A and OW-22 monitor the eastern portions of the interceptor well system.

The current permit lists WMA-II in the detection monitoring program and MW-15, MW-16, and MW-20A as the downgradient monitor wells for WMA-II. As discussed previously in Section C-4, MW-20A is no longer capable of detecting releases solely from WMA-II. Therefore, Monsanto proposes, in agreement with the recommendation of ADEM, that WMA-II be moved directly to the corrective action program. The data collected to date shows that the existing corrective action program for

samples will be collected from these monitor wells and analyzed for the following designated detection monitoring constituents: parathion and PNP.

Parathion and PNP have been chosen because each was a major component of the hazardous wastes treated, stored, or disposed of in the closed waste management facilities. Parathion is a pesticide registered for use on a wide variety of crops. It is highly immobile when incorporated into a soil matrix. It is only slightly soluble in water and degrades quickly in the presence of air, water and sunlight, and more slowly in the absence of air and sunlight. PNP is the first degradation product of parathion and is more soluble in water: at 25°C, the solubility of PNP is 1.6 grams per 100 milliliters [gm/100 mL). Therefore, one or both of these constituents would be expected to be present if constituents were to migrate from these closed waste management areas.

PNP is also subject to aerobic and anaerobic biodegradation processes in-situ. Various studies have been conducted on the degradation of parathion and its

degradation product PNP (Spain et al, 1984; Lokke, 1985; Lichtenstein, 1964; Rubin et al, 1983). According to these studies, further degradation of PNP is accomplished in relatively short time-frames. The half-life of PNP in subsoils has been estimated at 40 days (Handbook of Environmental Fate and Exposure Data for Organic Chemicals, Philip H. Howard, 1991). Metabolic by-products from aerobic biodegradation of PNP range from carbon dioxide to water. Anaerobic biodegradation of PNP may result from nitro-reduction or sulfate-reduction into various phenolic compounds and acid intermediates.

Parathion in groundwater is analyzed utilizing gas chromatography (GC) techniques with a nitrogen- phosphorus detector. The method used by Monsanto- Anniston is EPA Method 8140. This method is a procedure for analyzing organophosphorus pesticide pollutants in groundwater and waste samples. PNP

in groundwater is analyzed according to EPA Method 8040.

Benzene has been removed from the proposed detection monitoring program due to (1) the absence of this constituent in the previous 13 years of monitoring including the initial Appendix IX analyses conducted in May 1984 and (2) the improbability that this constituent would have been present in the wastes disposed of in WMA-I. A second round of Appendix IX analyses was conducted on March 5, 1996 (Table C-17). The results indicated the presence of one organic constituent (o,o,o- Triethylphosphorothioate) and three inorganic constituents (vanadium, zinc and sulfide), none of which have an applicable groundwater standard. Three other inorganic constituents were detected (barium, lead, and mercury); however, they were either below applicable standards or the background concentration. The wells were resampled to confirm the presence of the three inorganic constituents without applicable standards on March 22, 1996. The resampling included

determined by developing a concentration limit for these constituent(s), by incorporating ADEM's primary drinking water standards, by data collected from upgradient monitor well, MW-1B, or by the preparation of another Alternate Concentration Limit (ACL) Demonstration.

C-7 COMPLIANCE MONITORING PROGRAM FOR FACILITIES WHICH HAVE DETECTED PRESENCE OF HAZARDOUS CONSTITUENTS

A compliance monitoring program will be initiated if hazardous constituents are detected above concentration limits (groundwater protection standard) in detection monitor wells associated with WMA-I.

C-7a LIST OF PARAMETERS TO BE MONITORED

For WMA-I, the compliance monitoring program will include PNP, parathion, and any Appendix IX constituents identified and confirmed above concentration limits as discussed in Section C-6e. In addition, annually all of the compliance monitor wells will be analyzed for Appendix IX constituents. Any additional constituents detected and confirmed above concentration limits as described in Section C-6e will

The existing recovery system at the Old Limestone Bed (SWMU 8) consists of interceptor wells IW-16 through IW-25, and DW-01. It is proposed that this system continue to operate using the existing system. Groundwater recovered from these wells is collected in a common collection tank for subsequent discharge to an on-site equalization basin which discharges to the City of Anniston Publicly-Owned Treatment Works (POTW).

Site constituents have not been detected in the groundwater collected during the interim status period and during the permitted active life in the vicinity of WMA-I that can be attributed to releases from this unit. Parathion has been detected twice in the last four years in monitor well MW-20A, but for the reasons stated in Sections C-4 and C-5a, it is not believed to be due to releases from WMA-II. If site constituents are detected in the groundwater attributed to releases from WMA-I which exceed the concentration limits established by the ADEM Director, then a corrective

and Analysis Quality Control/Quality Assurance Plan presented as Exhibit C-4.

Before sampling, the interceptor well pumps will be manually started and allowed to pump until a fresh sample is assured. The sample preservation and analytical determination will depend upon analysis required. All analytical determinations will be undertaken in accordance with the latest approved edition of SW-846.

All of the other wells will be purged according to the Sampling and Analytical Quality Assurance/Quality Control Plan. Sample preservation and analytical determinations will depend upon required analysis. However, all analytical determinations will be in accordance with the latest approved edition of SW-846.

Water-level readings in every monitor well, observation well, and piezometer will be taken semi-annually when the wells are sampled using an electronic well sounder. Water-level determinations will be made during each monitor well and observation

collected from these systems is conveyed to an on-site equalization basin for subsequent discharge to the POTW, with the exception of water collected from IW-10. Groundwater from IW-10 is passed through a filtration system before it is pumped to the equalization basin. The design of this filtration system is included as Exhibit C-6.

The Northern, Western Landfill, and Plant Site corrective action systems recover groundwater from the upper water-bearing zone which contain concentrations of parathion and PNP. The observation and interceptor wells associated with the Western Landfill corrective action system are designed and located to detect and recover shallow groundwater that may flow west from the Landfill (SWMU 1). The Northern Landfill corrective action system consists of observation and interceptor wells designed and located to detect and recover shallow groundwater which may flow north from the Landfill (SWMU 1). The Plant Site corrective action system consists of observation and interceptor wells designed to detect and recover groundwater from the upper water-bearing zone which may have passed the Northern Landfill interceptor wells before they were installed.

The existing interceptor system at the Old Limestone Bed (SWMU 8) consists of observation and interceptor

wells designed to detect and recover groundwater from the upper water-bearing zone which contains constituents released from the SWMU 8. DW-1 has been added to this system to recover groundwater from the bedrock/residuum interface. Existing well SBP-5 would be used to evaluate the effectiveness of the bedrock/residuum interface corrective action program.

A semi-annual groundwater monitoring program is proposed for the corrective action system. In most instances, the proposed observation wells monitor the groundwater downgradient of the interceptor well network; therefore, Monsanto proposes that the semiannual groundwater monitoring program consist of analysis of groundwater from the monitor/observation wells. Observation wells OW-2, OW-4, OW-6A, OW-7, OW-15, OW-16A and OW-8A will be sampled to evaluate groundwater quality downgradient of the Landfill (SWMU 1). Observation wells OW-19, OW-24, OW-21A and OW-22 and monitor wells MW-8 and MW-9A will be sampled to evaluate groundwater quality downgradient of the Old Limestone Bed (SWMU 8) in the residuum. Monitor well

SBP-5 will be used to evaluate groundwater quality at the bedrock/residuum interface at SWMU 8.

All proposed observation wells will be sampled and analyzed for parathion and PNP. The effectiveness of each corrective action system, however, will be determined primarily from water-level measurements taken from the wells and piezometers in the vicinity of the corrective action systems.

C-8a(6) Proposed Groundwater Monitoring Program for WMA-II to be used to assess the adequacy of the Corrective Action that is now in operation

The proposed corrective action program for WMA-II includes the use of the existing corrective action program for SWMU 8 which is located immediately hydraulically downgradient from the unit. The effectiveness of the system would be monitored through existing monitor wells MW-15, MW-16, and MW-20A, located at the compliance point to ensure that the existing corrective action system adequately captures potential future releases to the uppermost saturated sediments in the vicinity of WMA-II. Figure C-16 shows

the location of the proposed corrective action monitor wells for WMA-II.

A semi-annual groundwater monitoring program is proposed for the corrective action system. The proposed corrective action monitor wells (MW-15, MW-16, and MW-20A) monitor the groundwater downgradient of the unit; therefore, Monsanto proposes that the semi-annual groundwater monitoring program consist of analysis of groundwater from these corrective action monitor wells. These wells will be analyzed for the site-specific indicator parameters, parathion and PNP plus the following Appendix IX constituents that have been identified in recent groundwater sampling: chlorobenzene, o,o,o-triethylphosphorothioate, sulfotepp, and cobalt. Two constituents will be monitored in MW-20A on an annual basis; these are 2,4,6- trichlorophenol and pentachlorophenol. All of these constituents were either detected above the background level (concentrations detected in MW-1B) or were above the Federal Primary Drinking Water Standard.

TABLE C-16
CONSTRUCTION DETAILS FOR RCRA MONITORING WELLS AND PIEZOMETERS
Solutia Plant, Anniston, Alabama

Well #	Northing	Easting	Date Installed	Ground Surface Elevation (ft MSL)	Top of Casing Elevation (ft MSL)	Approximate Well Depth (ft BGS)	Approximate Top of Screen (ft BGS)	Approximate Bottom of Screen (ft BGS)	Screened Interval Length (ft)	Top of Screen (ft MSL)	Bottom of Screen (ft MSL)	TYPE
MW-01B	651277.30	1145116.72	October 1985	880.09	881.59	62.5	57.5	62.5	5	822.59	817.59	Residuum
MW-08	649026.00	1147444.00	Pre-1995 (estimated)	743.20	746.80	27	22	27	5	721.20	716.20	Residuum
MW-09A	648784.60	1147328.70	February 2003	748.00	751.02	33.2	23	33	10	725.00	715.00	Residuum
MW-11A	651328.20	1146090.98	October 1985	783.13	784.13	117	109	114	5	674.13	669.13	Bedrock
MW-12A	651193.11	1146032.60	October 1985	783.69	785.69	124.5	105	110	5	678.69	673.69	Bedrock
MW-13A	651010.06	1145950.40	October 1985	779.34	782.01	123.5	105	110	5	674.34	669.34	Bedrock
MW-15	648755.00	1147084.00	October 1985	752.52	756.19	27	19	24	5	733.52	728.52	Residuum
MW-16	648804.30	1147135.97	October 1985	752.62	755.70	68.5	58	68	10	694.62	684.62	Residuum
MW-20A	648900.78	1147151.04	May 1988	751.65	752.90	24	19	24	5	732.65	727.65	Residuum
OW-02 [1]	650023.00	1145348.00	May 1985	806.10	807.69	35	19	24	5	787.10	782.10	Residuum
OW-04 [1]	650041.00	1145494.00	May 1985	796.70	798.57	30	22	27	5	774.70	769.70	Residuum
OW-06A	650663.00	1146210.00	March 1998	788.87	791.62	49	39	49	10	749.87	739.87	Residuum
OW-07 [1]	650587.56	1146355.13	May 1985	781.20	785.82	43	38	43	5	743.20	738.20	Residuum
OW-08A	650298.00	1146601.00	March 1998	746.30	749.16	23	12.5	22.5	10	733.80	723.80	Residuum
OW-15 [1]	650268.00	1146146.00	December 1987	764.00	766.90	40	35	40	5	729.00	724.00	Residuum
OW-16A	650202.00	1145907.00	March 1998	777.60	779.74	33	23	33	10	754.60	744.60	Residuum
OW-19	648966.21	1147262.06	October 1985	745.80	748.72	25	19	24	5	726.80	721.80	Residuum
OW-21A	649174.02	1147546.72	January 2003	741.90	744.46	35	25	35	10	716.90	706.90	Residuum
OW-22	649136.92	1147474.08	June 1986	741.90	745.57	34	24	34	10	717.90	707.90	Residuum
OW-24	649122.38	1147353.36	June 1986	743.50	746.15	29	24	29	5	719.50	714.50	Residuum
SBP-05	648744.38	1147087.09	November 1992	753.55	755.88	140	128	138	10	625.55	615.55	Bedrock

Notes:	
ft MSL	Feet Mean Sea Level
ft BGS	Feet Below Ground Surface

1) Ground surface around well may have been modified after well installed. Ground surface elevation reflects new ground level.

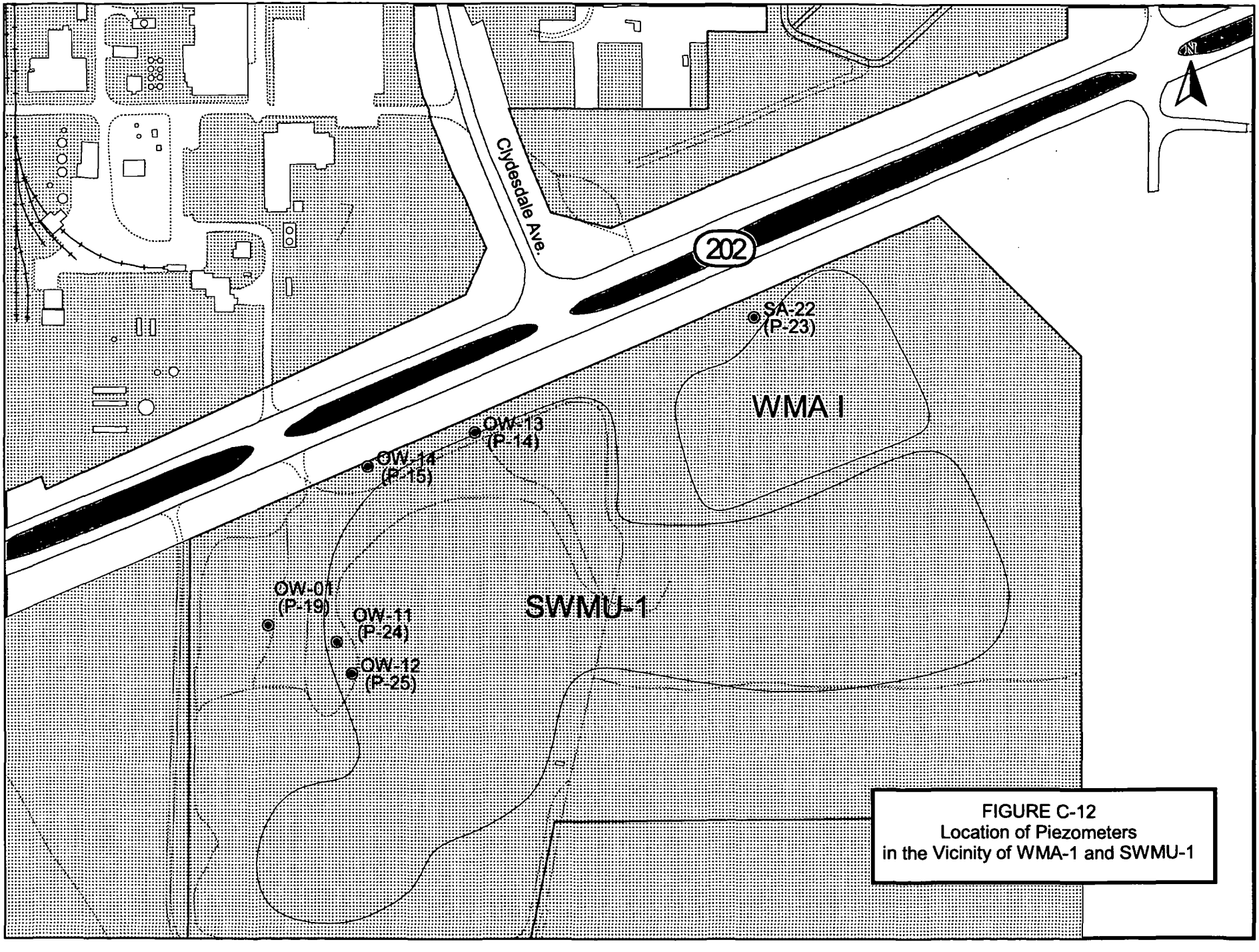


FIGURE C-12
Location of Piezometers
in the Vicinity of WMA-1 and SWMU-1

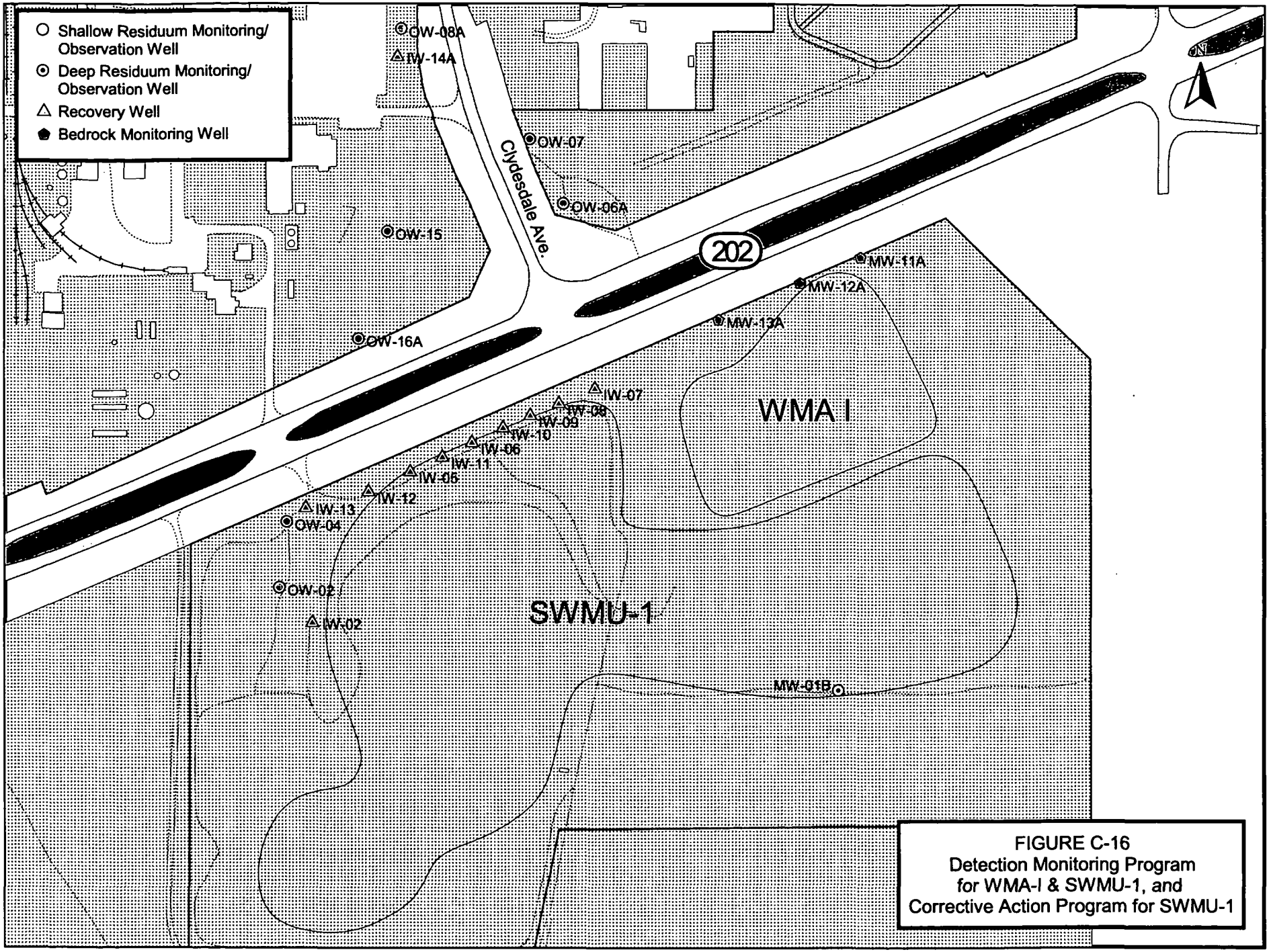


FIGURE C-16
Detection Monitoring Program
for WMA-I & SWMU-1, and
Corrective Action Program for SWMU-1

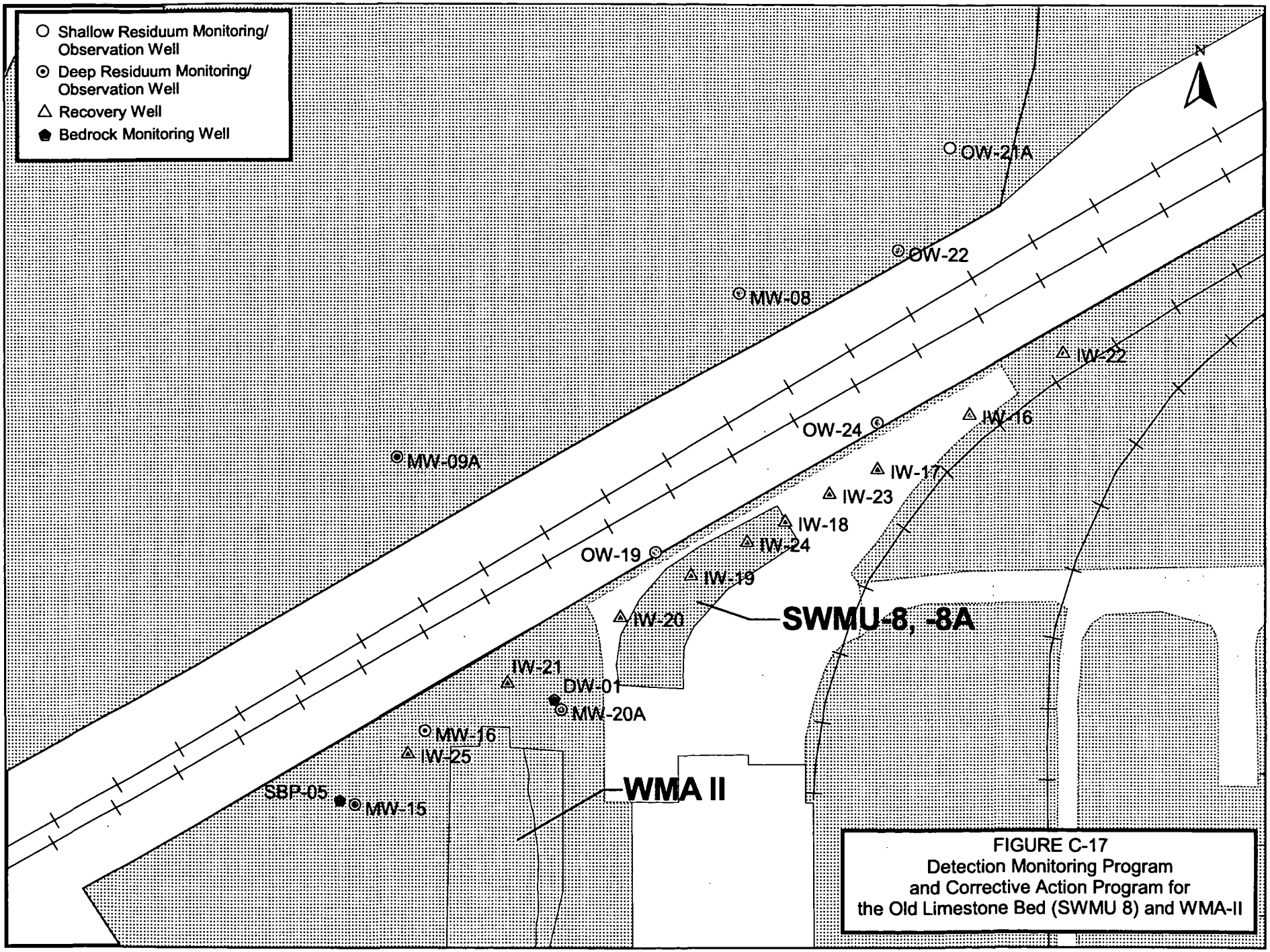


FIGURE C-17
Detection Monitoring Program
and Corrective Action Program for
the Old Limestone Bed (SWMU 8) and WMA-II

Golder Associates Inc.
3730 Chamblee Tucker Road
Atlanta, Georgia 30341
Telephone: 770-496-1893
Fax: 770-934-9476

Client: Solutia		Job No.: 943-3680	Boring/Well: MW-9 A
Project: Solutia/Supplemental RFI/CS/AL		Well Construction Data	(ft bgs)
Date Started: 1/16/03	Date Completed: 1/27/03	Screen: .006 inch slotted	From: 23 - To: 33
Logged By: K. Tyrrell	Checked By: KGH	Pack: 20/40 Silica Sand	From: 21 - To: 35.2
Drilling Co.: TDS	Driller: D. Campbell	Seal: Bentonite Pellets	From: 17.9 - To: 21
Method: 3.25 - 6.25" ID HSA	Equipment: CME 55 ATV	Grout: Cement-Bentonite	From: 2 - To: 17.9
Boring Depth: 35.2	Ground Surface Elevation:	Inner Casing: 2 inch diameter SCH 40 PVC	
GW Level: ▼ 22.0	Time/Date: 1/27/03	Outer Casing/Stick Up: 8 inch dia. steel casing set to 14' BGS	

Depth (ft bgs)	Sample Number	Type	Blows Per 6-inches	N-Value	Rec/Att	PID (ppm)	Description	Elevation (ft msl)
0	1	DO	3-3-3-17	6	1.3/2.0	0	Very stiff, damp, orange brown, SILTY CLAY. [FILL]	
	2	DO	6-2-2-2	4	0.1/2.0	0	Loose, black, fine to coarse SAND, trace fine to coarse gravel. [FILL]	
5	3	DO	2-2-2-2	4	1.0/2.0	0	Stiff to very stiff, wet to moist, mottled yellow, orange and brown, yellowish brown and gray, SILTY CLAY, trace to little fine to coarse Sand.	
	4	DO	WH-WH-2-5	2	1.8/2.0	0		
	5	DO	4-6-5-7	11	2.0/2.0			
10	6	DO	1-4-9-11	13	1.8/2.0			
	7	DO	1-3-4-6	7	2.0/2.0		Compact to firm, damp to moist, yellow brown, orange brown, red brown, fine to medium, SAND and CLAY, trace fine Gravel (white weathered chert).	
15	8	DO	2-4-5-9	9	2.0/2.0			
	9	DO	4-12-7-7	19	2.0/2.0		Stiff, moist to very moist, red brown and black CLAY and fine to coarse SAND.	
	10	DO	2-4-4-6	8	2.0/2.0		Stiff to very stiff, moist, light reddish brown, yellow brown and white mottling CLAY.	
20	11	DO	2-2-4-4	6	2.0/2.0		Firm to very stiff, very moist to wet, yellow brown, purple, and light reddish brown CLAY, little to and SILT, trace highly weathered shale fragments, trace to little, fine to coarse Sand.	▼
	12	DO	WH-1-2-1	3	2.0/2.0			
25	13	DO	1-1-2-4	3	2.0/2.0			
	14	DO	2-2-3-3	5	2.0/2.0			
	15	DO	WH-2-1-2	3	2.0/2.0			
30							Continued Next Page	

Well Construction

PID/SPT BMW 943-3680 SOLUTIA SUPP RFI.GPJ NICHOLSBMW.GDT 11/10/05

Golder Associates Inc.
3730 Chamblee Tucker Road
Atlanta, Georgia 30341
Telephone: 770-496-1893
Fax: 770-934-9476

Client: Solutia	Job No.: 943-3680	Boring/Well: MW-9A
Project: Solutia/Supplemental RFI/CS/AL		

Depth (ft bgs)	Sample Number	Type	Blows Per 6-inches	N-Value	Rec/Att	PID (ppm)	Lithology	Description	Elevation (ft msl)	Well Construction
	16	DO	WH-WH-1-2	1	2.0/2.0					
	17	DO	1-2-1-3	3	2.0/2.0					
35										

Golder Associates Inc.
3730 Chamblee Tucker Road
Atlanta, Georgia 30341
Telephone: 770-496-1893
Fax: 770-934-9476

Client: Solutia Inc		Job No.: 943-3680.RFI	Boring/Well: OW-21A
Project: Solutia/Supplemental RFI/CS/AL		Well Construction Data	(ft bgs)
Date Started: 1/16/03	Date Completed: 1/29/03	Screen: 0.006 inch slotted	From: 25 - To: 35
Logged By: KMT	Checked By: KH	Pack: 20/40 silica sand	From: 23 - To: 36
Drilling Co.: TDS	Driller: D. Campbell	Seal: bentonite pellets	From: 19.9 - To: 23
Method: 6.25" ID /3.25" ID HSA	Equipment: CME-55-ATV	Grout: Portland Type II	From: 0 - To: 19.9
Boring Depth: 35.0	Ground Surface Elevation: 741.9	Inner Casing: 2 inch diameter S40 PVC	
GW Level: ▼ 9.6	Time/Date: 1/31/03	Outer Casing/Stick Up: 8 inch diameter Stainless Steel set to 17' bgs	

Depth (ft bgs)	Sample Number	Type	Blows Per 6-inches	N-Value	Rec/Att	PID (ppm)	Lithology	Description	Elevation (ft msl)	Well Construction
0									741.90	
	1	DO	3-3-3-3	6	0.6/2.0	0		Very stiff, damp to dry, orange brown SILTY CLAY, trace roots, trace black stains (FILL)		
	2	DO	2-2-1-1	3	0.7/2.0	0				
5	3	DO	1-2-2-1	4	0.7/2.0	0		Loose/soft, damp, black and brown fine to coarse SAND and CLAYEY SILT, trace fine to coarse Gravel (FILL, possible foundry material)	737	
	4	DO	1-1-2-1	3	1.9/2.0	0				
	5	DO	1-0-1-1	1	1.3/2.0	0		Soft to stiff, wet to moist, yellow orange brown SILTY CLAY, trace to little fine Sand, trace mottling with red brown (RESIDUUM)	▼	
10								Continued Next Page	732	

PID/SPT BMW LOGS 2-20.GPJ NICHOLSBMW.GDT 5/2/03

Golder Associates Inc.
3730 Chamblee Tucker Road
Atlanta, Georgia 30341
Telephone: 770-496-1893
Fax: 770-934-9476

Client: Solutia Inc | Job No.: 943-3680.RFI | Boring/Well: OW-21A

Project: Solutia/Supplemental RFI/CS/AL

Depth (ft bgs)	Sample Number	Type	Blows Per 6-inches	N-Value	Rec/Att	PID (ppm)	Lithology	Description	Elevation (ft msl)	Well Construction
	6	DO	WH-1-2-1	3	1.3/2.0	0				
	7	DO	1-3-4-3	7	2.0/2.0	0				
15	8	DO	2-4-4-5	8	2.0/2.0	0		Stiff to very stiff, moist to very moist, yellow brown to dark yellow brown CLAY, trace fine to coarse Sand (lenses), trace to little fine to coarse chert Gravel, relict laminations from parent rock (RESIDUUM)	727	
	9	DO	2-6-8-11	14	2.0/2.0	0				
20	10	DO	2-6-8-12	14	2.0/2.0	0			722	
	11	DO	3-5-8-14	13	2.0/2.0	0				

Continued Next Page

PID/SPT BMW LOGS 2-20.GPJ NICHOLSBMW.GDT 5/2/03

Golder Associates Inc.
3730 Chamblee Tucker Road
Atlanta, Georgia 30341
Telephone: 770-496-1893
Fax: 770-934-9476

Client:	Job No.:	Boring/Well:
Solutia Inc	943-3680.RFI	OW-21A

Project: Solutia/Supplemental RFI/CS/AL

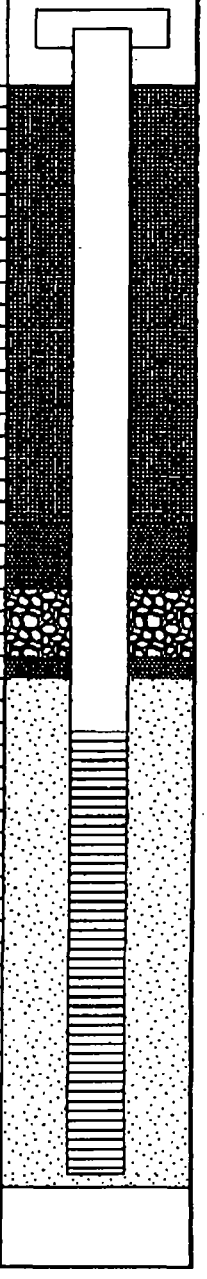
Depth (ft bgs)	Sample Number	Type	Blows Per 6-inches	N-Value	Rec/Att	PID (ppm)	Lithology	Description	Elevation (ft msl)	Well Construction
	11	DO	3-5-8-14	13	2.0/2.0	0				
25	12	DO	3-6-9-12	15	2.0/2.0	0			717	
	13	DO	3-5-7-11	12	2.0/2.0	0				
	14	DO	3-6-8-11	14	2.0/2.0	0				
30	15	DO	2-4-7-8	11	2.0/2.0	0			712	
	16	DO	5-6-8-8	14	1.8/2.0	0				
35									707	

PID/SPT BMW LOGS 2-20.GPJ NICHOLSBMW.GDT 5/2/03

Golder Associates Inc.
3730 Chamblee Tucker Road
Atlanta, Georgia 30341
Telephone: 770-496-1893
Fax: 770-934-9476

Client: Solutia Inc		Job No.: 943-3680.RFI	Boring/Well: IW-14A
Project: Solutia/Supplemental RFI/CS/AL		Well Construction Data	(ft bgs)
Date Started: 2/5/03	Date Completed: 2/5/03	Screen: 0.006 inch slotted	From: 29.4 - To: 49.4
Logged By: KMT	Checked By: KH	Pack: 20/40 silica sand	From: 27 - To: 50
Drilling Co.: TDS	Driller: D. Campbell	Seal: pellets/pure gold bent. gr	From: 20 - To: 27
Method: 6.25" ID HSA	Equipment: CME-55-ATV	Grout: Portland Type II	From: 2 - To: 20
Boring Depth: 50.0	Ground Surface Elevation: 748.0	Inner Casing: 4 inch diameter S40 PVC	
GW Level: ▼ 27.0	Time/Date: 2/6/03	Outer Casing/Stick Up: N/A	

Depth (ft bgs)	Sample Number	Type	Blows Per 6-inches	N-Value	Rec/Att	PID (ppm)	Lithology	Description	Elevation (ft msl)	Well Construction
0									748.00	
	1	DO	10-11-17	28	1.3/1.5	0		Very stiff to stiff, moist to damp, red brown to red orange brown SILTY CLAY, some to little fine to coarse sand, trace to some fine to coarse Gravel (chert and quartz) (FILL)		
5									743	
	2	DO	9-6-6	12	1.5/1.5	0				
10									738	
	3	DO	4-10-12	22	0.0/1.5	0		Loose to compact, dry to damp, red brown fine to coarse SAND, and CLAYEY SILT (FILL)		
15									733	
	4	DO	6-10-13	23	0.4/1.5	0				
20									728	
	5	DO	4-6-9	15	1.5/1.5	0		Very stiff to firm, moist, brown to yellowish orange brown SILTY CLAY, trace to little fine to coarse Sand, trace fine Gravel (black opaques and quartz) (RESIDUUM)		
25									723	
	6	DO	4-6-6	12	1.0/1.5	0				
30									718	
	7	DO	4-5-7	12	1.5/1.5	0		Very stiff to firm, moist to wet, finely mottled pink red brown, yellow brown, purple, white and black SILTY CLAY, little to some fine to coarse Sand (lenses), little fine Gravel (sandstone/lithified medium sand), trace black stains (RESIDUUM)		
35									713	
	8	DO	4-6-8	14	1.5/1.5	0				
40									708	
	9	DO	3-5-6	11	1.5/1.5	0				
45									703	
	10	DO	3-2-3	5	1.5/1.5	0				
50									698	



PID/SPT BMW LOGS 2-20.GPJ NICHOLSBMW.GDT 5/2/03

MONITORING WELL INSTALLATION LOG

JOB NO. 943-3680 PROJECT SOLUTIA/WELL REPLACEMENT/AL WELL NO. OW-6A SHEET 1 1

GA INSP. CDH DRILLING METHOD HSA 4 1/4" ID; 8 1/4" ID GROUND ELEV. - WATER DEPTH -

WEATHER SUNNY DRILLING COMPANY MILLER DRILLING COLLAR ELEV. - DATE/TIME -

TEMP. 60 DRILL RIG INGERSOL-RAND DRILLER DARREN STARTED 15:30/3-3-98 (TIME / DATE) COMPLETED 17:15/3-17-98 (TIME / DATE)

LOCATION / COORDINATES -

MATERIALS INVENTORY

WELL CASING 2/10 in. dia. 49/20 l.f. WELL SCREEN 3 in. dia. 10 l.f. BENTONITE SEAL PELLETS

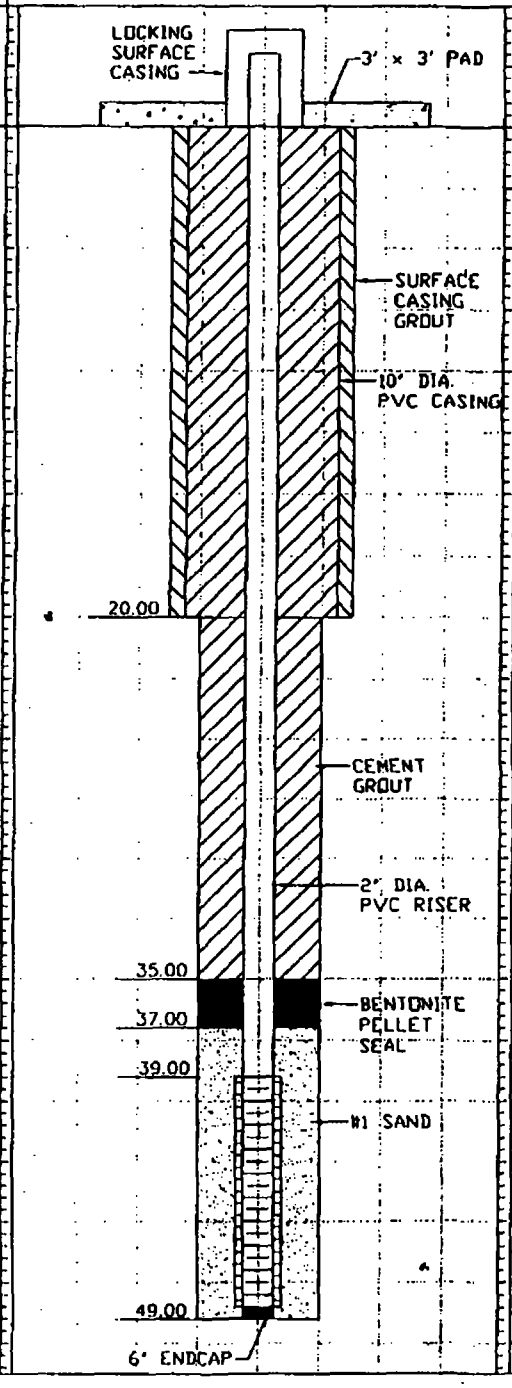
CASING TYPE PVC SREEN TYPE SEE NOTES INSTALLATION METHOD POURED

JOINT TYPE FLUSH SLOT SIZE 0.008 FILTER PACK QTY. 9 50 LB. BAGS

GROUT QUANTITY - CENTRALIZERS - FILTER PACK TYPE #1 SAND

GROUT TYPE PORTALAND CEMENT DRILLING MUD TYPE - INSTALLATION METHOD POURED

ELEV./DEPTH	SOIL/ROCK DESCRIPTION
	GROUND SURFACE
0.0	Stiff-very stiff, brown-red, CLAYEY SILT, trace sand
5.0	
10.0	
15.0	
20.0	
25.0	Stiff, brown-red-purple-orange, SILTY CLAY, moist, little fine to med. sand
30.0	
35.0	
40.0	Firm, brown-red-purple-orange, SILTY CLAY, increasing interlayered sand stringers
45.0	
	Soft, purple-red-brown, wet, SILTY CLAY, yellow brown, fine to medium sand
50.0	T.D. @ 49'



INSTALLATION NOTES

Augered with large diameter augers to depth of 20' BGS. Installed 10" dia. PVC casing and grouted in place. Allowed to set overnight. Augered through surface casing to approx. 49' BGS. Installed 10' of Pre-Pack filter pack consisting of: 10' section 2" dia. 0.008 slot screen; 10' section 3" dia. 0.001 slot screen and a 10' filter sock. Sand was placed between the 2" dia. and 3" dia. screen sections prior to installation. Installed 2" dia. PVC Riser to surface. Poured 9 50 lb. bags #1 sand to 37' BGS. Poured 1 bag bentonite chips to approx. 35' BGS. Injected bentonite/cement grout to within 2' of surface. Completed well with steel locking casing and 3' x 3' cement pad.

WELL DEVELOPMENT NOTES

Periodically developed over a three week period. Greater than 100 gallons removed.

Golder Associates

MONITORING WELL INSTALLATION LOG

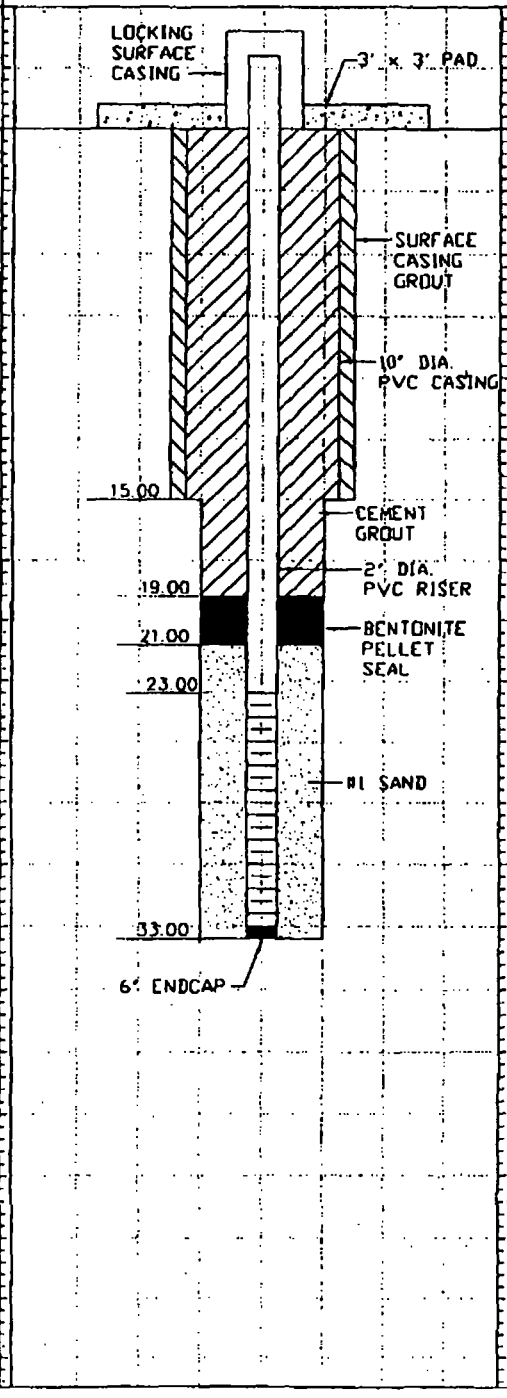
JOB NO. 943-3680 PROJECT SOLUTIA/WELL REPLACEMENT/AL WELL NO. OW-16A SHEET 1 OF 1
GA INSP. CDH DRILLING METHOD HSA 4 1/4" ID; 8 1/4" OD GROUND ELEV. - WATER DEPTH -
WEATHER SUNNY DRILLING COMPANY MILLER DRILLING COLLAR ELEV. - DATE/TIME -
TEMP. 60 DRILL RIG INGERSOL-RAND DRILLER DARREN STARTED 16:00/3-16-98 (TIME / DATE) COMPLETED 14:00/3-17-98 (TIME / DATE)
LOCATION / COORDINATES -

MATERIALS INVENTORY

WELL CASING 2/10 in. dia. 33/15 l.f. WELL SCREEN 2 in. dia. 10 l.f. BENTONITE SEAL PELLETS
CASING TYPE PVC SCREEN TYPE PVC INSTALLATION METHOD POURED
JOINT TYPE - SLOT SIZE 0.008 FILTER PACK QTY. 9 50 LB BAGS
GROUT QUANTITY - CENTRALIZERS - FILTER PACK TYPE #1 SAND
GROUT TYPE PORTLAND CEMENT DRILLING MUD TYPE - INSTALLATION METHOD POURED

ELEV./DEPTH	SOIL/ROCK DESCRIPTION
	GROUND SURFACE
0.0	Firm, orange-brown, CLAYEY SILT, trace fine sand
5.0	
	Stiff, red-brown, CLAYEY SILT, trace fine sand
10.0	
	Firm, mottled purple-brown-orange-white, slightly moist, CLAYEY SILT, trace med. gravel
15.0	
20.0	
25.0	Soft, yellow brown, moist, very fine to fine, SAND, some silt, little clay
30.0	Soft, white-brown, SILTY CLAY, and fine-med sand
	T.D. @ 33'
35.0	

WELL SKETCH



INSTALLATION NOTES

Augered to approx. 15' BGS with large diameter augers. Grouted in place and allowed to set overnight. Augered through surface casing to approx. 33' BGS. Installed 2" dia. PVC, 0.008 slot screen, 10' screen to approx. 23' BGS. Installed 2" dia. PVC riser to surface. Poured 9 bags #1 sand to 21' BGS. Poured 1 bag bentonite pellets to approx. 19' BGS. Injected bentonite/cement grout to within 2' of surface. Completed well with steel locking casing and 3' x 3' concrete pad.

WELL DEVELOPMENT NOTES

Periodically developed over a three week period. Greater than 100 gallons removed.

MONITORING WELL INSTALLATION LOG

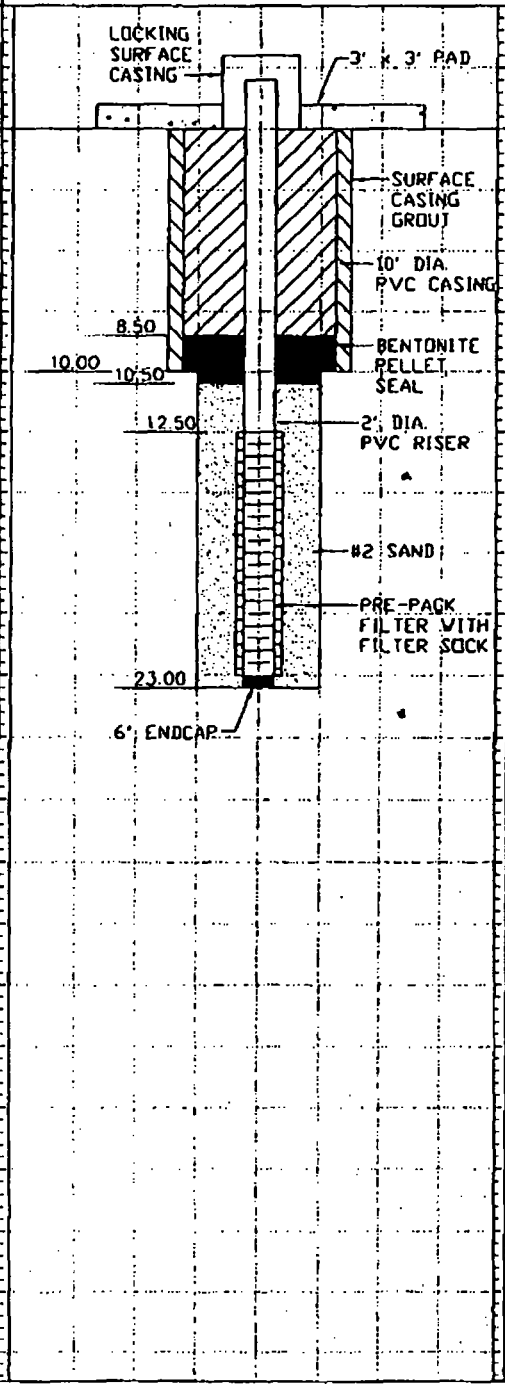
JOB NO 943-3680 PROJECT SOLUTIA/WELL REPLACEMENT/AL WELL NO. OW-8 A SHEET 1 1
GA INSP. CDH DRILLING METHOD HSA 4 1/4" ID; 8 1/4" ID GROUND ELEV. - WATER DEPTH -
WEATHER SUNNY DRILLING COMPANY MILLER DRILLING COLLAR ELEV. - DATE/TIME -
TEMP. 60 DRILL RIG INGERSOL-RAND DRILLER DARREN STARTED 14:00/3-17-98 (TIME / DATE) COMPLETED 16:00/3-18-98 (TIME / DATE)
LOCATION / COORDINATES -

MATERIALS INVENTORY

WELL CASING 2/10 in. dia. 23/10 l.f. WELL SCREEN 3 in. dia. 10 l.f. BENTONITE SEAL PELLETS
CASING TYPE PVC SREEN TYPE SEE NOTES INSTALLATION METHOD POURED
JOINT TYPE FLUSH SLOT SIZE 0.008 FILTER PACK QTY. 7 50 LB BAGS
GROUT QUANTITY - CENTRALIZERS - FILTER PACK TYPE #2 SAND
GROUT TYPE PORTLAND CEMENT DRILLING MUD TYPE - INSTALLATION METHOD POURED

ELEV /DEPTH	SOIL/ROCK DESCRIPTION
	GROUND SURFACE
0.0	Firm, brown-white, SILTY CLAY
5.0	
	Stiff, mottled orange-brown, CLAYEY SILT
10.0	
	Very stiff, orange, CLAYEY SILT
15.0	
	Firm, brown-orange, moist, SILTY CLAY, little to some medium-coarse sand and fine gravels
20.0	
	T.D. @ 23'
25.0	

WELL SKETCH



INSTALLATION NOTES

Augered with large augers to 10' BGS. Installed 10" dia. PVC casing and grouted in place. Allowed to set overnight. Augered through surface casing to approx. 22.5' BGS. Installed 10' of Pre-Pack filter pack consisting of: 10' section of 2" dia. 0.008 slot screen; 10' section of 3" dia. 0.001 slot screen and a 10' filter sock. Sand was placed between the 2" dia. and 3" dia. screen sections prior to installation. Installed 2" dia. PVC riser to surface. Poured approx. 7 50 lb. bags #2 sand to approx. 10.5' BGS. Poured 1 bag bentonite pellets to approx. 8.5' BGS. Injected bentonite/cement grout to within 2' of surface. Completed well with steel locking casing and 3' x 3' cement pad.

WELL DEVELOPMENT NOTES

Periodically developed over a three week period. Greater than 100 gallons removed.

Golder Associates

EXHIBIT C-6

IW-10 FILTRATION SYSTEM DESIGN

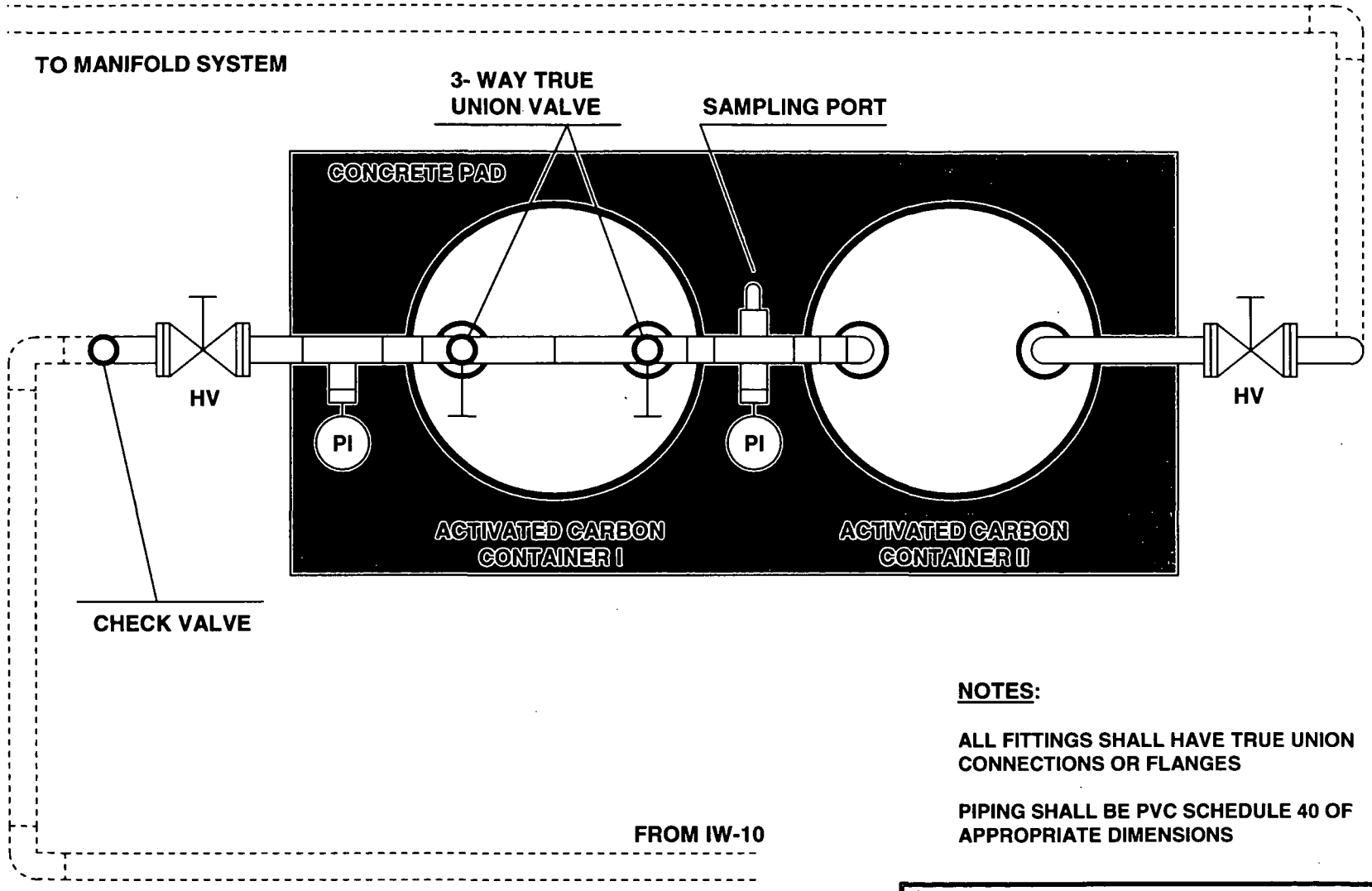
IW-10 FILTRATION SYSTEM DESIGN

Solutia presently operates and maintains two groundwater corrective action systems in accordance with the provisions of its RCRA Permit: Waste Management Area II (WMA II) and Solid Waste Management Unit 1 (SWMU 1). The WMA II Corrective Action System addresses potential impacts from the Old Limestone Bed Surface Impoundment, SWMU 8 and SWMU 9. The SWMU 1 Corrective Action System combines the Western and Northern Corrective Action Systems for the South Landfill, along with the Plant Site Corrective Action System. Groundwater recovered from both of these systems is pumped to the plant's on-site equalization basin, which discharges to the City of Anniston's publicly-owned treatment works (POTW).

Prior to discharging to the equalization basin, Solutia has installed a small carbon treatment system to treat the discharge from recovery well IW-10. The filtration system is housed in a pre-fabricated shed that was constructed on a concrete pad. The shed is equipped with a heat lamp and all external piping has heat trace tape and insulation. The design of the carbon filtration system is presented on the attached Figures.

As shown on the figures, the system consists of two activated carbon drums installed in series. The discharge line from IW-10 is spliced into prior to the point where it connects to the existing manifold system. The effluent line is directed to the carbon filtration system. After passing through the system, the effluent from the drums is directed back to the original manifold. A back-flow preventer is installed after the second drum so effluent from other wells can not be pumped through the system. There are in-line pressure gauges before each drum to monitor for potential plugging and a sample port to monitor potential breakthrough in the first drum. Shut-off valves are installed before the first drum and after the second drum and a series of three-way valves are installed before and after each drum. This combination of valves allows for either drum to be bypassed, both drums to be bypassed, or the whole system to be shut off during drum exchange and system maintenance.

The effluent has been monitored monthly since January 2004, and there have been no detections for PCBs. Therefore, once breakthrough has occurred on the first drum it will take at least one year for breakthrough to occur on the second drum. Because of this, breakthrough monitoring of PCBs on the first drum will be done on a quarterly basis. When breakthrough on the first drum or fouling on either drum has occurred, a new drum will be installed. Additionally, the following measures have been integrated into the Interim Measures Operation and Maintenance Plan for the Site: 1) weekly inspection of the piping and connections of the filtration system, 2) maintaining a weekly log of the pressure gauge values to monitor for fouling, and 3) quarterly sampling of the effluent from the first drum to monitor for breakthrough of PCBs.



NOTES:

ALL FITTINGS SHALL HAVE TRUE UNION CONNECTIONS OR FLANGES

PIPING SHALL BE PVC SCHEDULE 40 OF APPROPRIATE DIMENSIONS

LEGEND:

PI PRESSURE GAUGE

HV HAND-OPERATED VALVE

CLIENT/PROJECT **SOLUTIA**

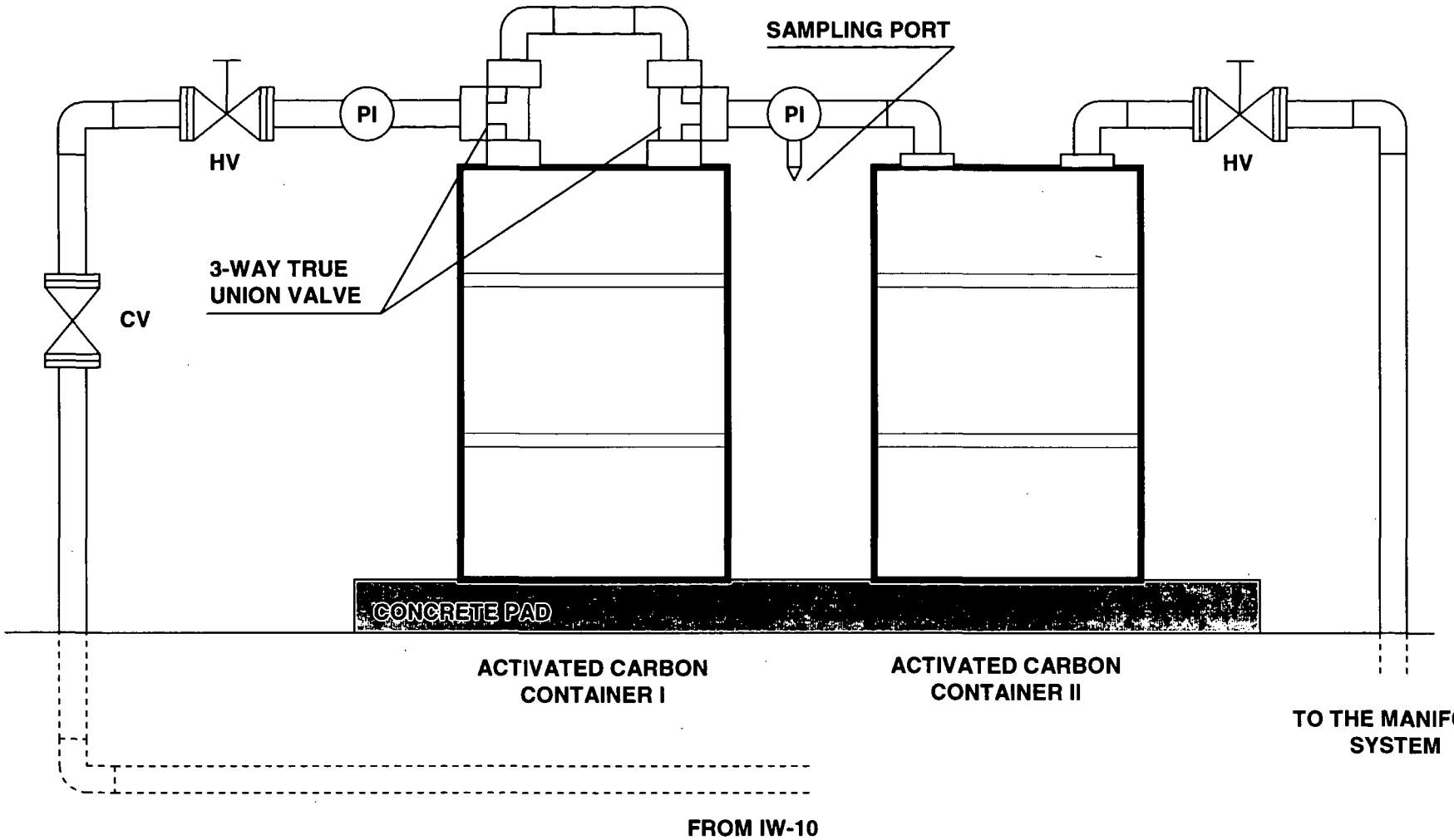
TITLE **PLAN VIEW**

Atlanta, Georgia

Golder Associates

DRAWN	EA	DATE	12/03/03
VERSION	1	SCALE	N/A
REVIEWED		DWG. NO.	
APPROVED		JOB NO.	
FILE NO.		SUBTITLE	

FIGURE 2



LEGEND:

PI	PRESSURE GAUGE
HV	HAND-OPERATED VALVE
CV	CHECK VALVE

NOTES:

ALL FITTINGS SHALL HAVE TRUE UNION CONNECTIONS OR FLANGES

PIPING SHALL BE PVC SCHEDULE 40 OF APPROPRIATE DIMENSIONS

CLIENT/PROJECT
SOLUTIA

TITLE
SIDE VIEW

Atlanta, Georgia
Golder Associates

DRAWN	EA	DATE	12/03/03
VERSION	1	SCALE	N/A
REVIEWED		DWG. NO	
APPROVED		JOB NO.	FIGURE 3
FILE NO.		SUBTITLE	

Solutia, Inc.
EPA ID No. ALD 004 019 048

Post-Closure Permit Modification No. 4

PAGE CHANGE INSTRUCTIONS

Section/Appendix	Remove Page(s)	Insert Page(s)	Reason
Table of Contents	Page 2 of 59 (M3)	Page 2 of 59 (M4)	Added to the list of documents incorporated by reference: "4. Letter from the Alabama Department of Environmental Management to Solutia Inc. dated September 5, 2003, deferring enforcement and oversight of all ongoing activities at the plant site and surrounding areas to the United States Environmental Protection Agency pursuant to the Partial Consent Decree (CV-02-PT-0749-E), except for RCRA-regulated Post Closure Units and associated Groundwater Detection and Corrective Action Monitoring Programs, AOC B1- Highway 21 Bridge, and AOC B2 – Soil Stockpile at the Choccolocco Creek WWTP."
Appendix A	A - Page 1 of 6 (M3)	A - Page 1 of 6 (M4)	Added the following footnote to the table: "The investigation and cleanup of AOC B (Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] Operable Units 1/2 and 4) will be conducted under the oversight of the United States Environmental Protection Agency pursuant to the Partial Consent Decree (CV-02-PT-0749-E), except for AOC B1 and AOC B2."
Part II.B.2.a	Page 18 of 59 (M3)	Page 18 of 59 (M4)	Deleted "at least quarterly and".
Part II.C.1.c	Page 21 of 59 (M3)	Page 21 of 59 (M4)	Changed "all" to "designated".
Part II.E.1.a	Page 25 of 59 (M3)	Page 25 of 59 (M4)	Replaced "MW-9" and "OW-21" with "MW-9A" and "OW-21A", respectively.
Part II.E.1.c	Page 25 of 59 (M3)	Page 25 of 59 (M4)	Added "IW-22, IW-23, IW-24, IW-25" to the list of recovery wells, and added the following to the end of the paragraph: "Groundwater recovered from any on-site extraction well will be treated and/or disposed of in compliance with applicable regulations."

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Part II.H	Page 29 of 59 (M3)	Page 29 of 59 (M4)	Replaced "quarterly and" and "as" with "semi-annually" and "a", respectively.
Table II.1	Page 31 of 59 (M3)	Page 31 of 59 (M4)	Replaced MW-9 and OW-21 well construction details with MW-9A and OW-21A well construction details, respectively. Added the construction details for IW-22, IW-23, IW-24, and IW-25.
Table II.2	Page 33 of 59 (M3)	Page 33 of 59 (M4)	Removed 2,4-dichlorophenol; methylene chloride; pentachlorophenol; phenol; 2,4,5-trichlorophenol; and 2,4,6-trichlorophenol from the table.
Table II.4	Page 35 of 59 (M3)	Page 35 of 59 (M4)	Replaced "UNIT" with "LOCATION" in the column header. Removed 2,4-dichlorophenol; methylene chloride; phenol; and 2,4,5-trichlorophenol from the table. Changed the concentration limit for Mercury from "MDL" to "0.002". Changed the monitoring unit for pentachlorophenol and 2,4,6-tricholorphenol from "WMA-II" to "MW-20A". Added "or well(s)" to the first footnote.
Appendix C-4 Table of Contents	Page i of iii (R3)	Page i of iii (R4)	Updated revision dates for affected sections.
Appendix C-4 Table of Contents	Page iii of iii (R3)	Page iii of iii (R4)	Updated revision dates for Appendices C and D. Added Appendix E "Alternative Groundwater Sampling Procedures" to the list of appendices.
Appendix C-4 Section 1.0	Page 1-2 of 2 (R3)	Page 1-2 of 2 (R4)	Hanging paragraph, first sentence: Replaced "eight downgradient" with "ten downgradient". Hanging paragraph, second sentence: Replaced "landfill area, the closed northern landfill" with "northern areas of the South Landfill,". Hanging paragraph, third sentence: Replaced "six" with "eleven" and "eight" with "seven".
Appendix C-4 Section 4.2.3	Page 4-7 of 22 (R3)	Page 4-7 of 22 (R4)	First paragraph, first sentence: Added "dissolved oxygen, oxidation reduction potential," after "pH,".

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Appendix C-4 Section 4.4	Page 4-10 of 22 (R3)	Page 4-10 of 22 (R4)	First paragraph, first sentence: Added "introduced" before "contamination". First paragraph: Added "The following sections describe procedures for sample collection. Alternatively, the sampling procedures described in Appendix E, which follow USEPA's Standard Operating Procedures for Low-Stress (Low-Flow) / Minimal Drawdown Groundwater Sample Collection, may be used for collecting groundwater samples at the site." to the end of the paragraph.
Appendix C-4 Section 4.4	-----	Page 4-10a of 22 (R4)	Added page to maintain pagination to the end of the Appendix.
Appendix C-4 Section 4.4.1.2	Page 4-15 of 22 (R3)	Page 4-15 of 22 (R4)	First paragraph, first sentence: Deleted "of three (3) to five (5) well volumes,".
Appendix C-4, Appendix C	Pages A-1, A-2, and A-3 of 3.	Page C-1 of 1	Replaced former constituent monitoring frequency tables with updated constituent monitoring frequency table (note: combined all information into one table).
Appendix C-4, Appendix D	Page B-1.	Pages D-1 to D-4 of 4	Replaced table with updated monitoring well construction details table.
Appendix C-4, Appendix E	-----	Cover page and Appendix.	Added Appendix E: Alternative Groundwater Sampling Procedures.

TABLE OF CONTENTS

DOCUMENTS INCORPORATED BY REFERENCE

1. Part B Post-Closure Permit Application

   Post-Closure Permit Application dated December 24, 1994, as amended. Volume I.

2. Corrective Measures Implementation Plan for Highway 21 Bridge, Revision 1 dated June 29, 2000, as amended.

3. Corrective Measures Implementation Work Plan to address the stockpiled soil at the Choccolocco Creek Wastewater Treatment Plant; dated January 2003, as amended.

4. Letter from the Alabama Department of Environmental Management to Solutia Inc. dated September 5, 2003, deferring enforcement and oversight of all ongoing activities at the plant site and surrounding areas to the United States Environmental Protection Agency pursuant to the Partial Consent Decree (CV-02-PT-0749-E), except for RCRA-regulated Post Closure Units and associated Groundwater Detection and Corrective Action Monitoring Programs, AOC B1- Highway 21 Bridge, and AOC B2 – Soil Stockpile at the Choccolocco Creek WWTP.

APPENDIX A

SOLID WASTE MANAGEMENT UNIT SUMMARY

A. 1. List of Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) requiring a RCRA Facility Investigation (RFI):

SWMU/AOC	DESCRIPTION
SWMU 1	Landfill
SWMU 2	Landfill Catchment Basins
SWMU 8	Old Limestone Bed
SWMU 9	Lagoon
SWMU 47	West End Landfill
AOC B*	Snow Creek Contamination Area / Off-Site Creek Contamination Area

* The investigation and cleanup of AOC B (Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] Operable Units 1/2 and 4) will be conducted under the oversight of the United States Environmental Protection Agency pursuant to the Partial Consent Decree (CV-02-PT-0749-E), except for AOC B1 and AOC B2.

d. The Permittee shall install and maintain additional groundwater monitoring wells as necessary to assess changes in the rate and extent of any plume of contamination or as otherwise deemed necessary to maintain compliance with ADEM Admin. Code R. 335-14-5-.06(6), 335-14-5-.06(8), 335-14-5-.06(9), 335-14-5-.06(10), and 335-14-5-.06(II), as applicable. These wells must be included immediately in the permittee's current groundwater monitoring program. A plan in the form of a permit modification request specifying the design, location and installation of any additional monitoring wells shall be submitted within 90 days prior to installation which, at a minimum, shall include:

i. Well construction techniques including casing depths and proposed total depth of well(s);

ii. Well development method(s);

iii. A complete description of well construction materials;

iv. A schedule of implementation for construction; and

v. Provisions for determining the lithologic characteristics, grain distribution, hydraulic conductivity and porosity
for the applicable water-bearing zone at the location of the new well(s).

2. General Groundwater Monitoring Requirements

a. The Permittee shall determine the groundwater surface elevation from all monitoring wells each time a sampling event is conducted. The results of these determinations shall be recorded as MSL/NGVD and submitted in accordance with Condition II.B.6. of this permit (ADEM Admin. Code R. *335*-14-5-.06(8)(f))

b. The Permittee shall determine the groundwater flow rate and direction in the underlying aquifer(s) at least annually and submit the results in accordance with Condition II.B.6. of this permit (ADEM Admin. Code R. 335-14-5-.06(9)(e), 335-14-5-.06(10)(e), and 335-14-5-.06(II)(d))

c. The Permittee shall determine background concentrations of hazardous constituents and other chemical parameters required to be monitored by this permit in accordance with Section C-6, Exhibit C-S (ACL demonstration) and Exhibit C-6 of the permit application and ADEM Admin. Code R. 335-14-5-.06(8)(g).

II.C. DETECTION MONITORING PROGRAM

The requirements of this Condition are applicable to WMA-I. Except as specified otherwise in this permit, the Detection Monitoring Program shall be implemented in accordance with Section C-6 of the permit application and ADEM Admin. Code R. 335-I4-5-.06(9).

1. Monitoring Requirements

In addition to the general groundwater monitoring requirements specified in Condition II.B.2. of this permit, the Permittee shall:

a. Sample all point of compliance wells and analyze for the constituents listed in Table II.2. of this permit each time the well is sampled in accordance with Condition II.B.5. of this permit. This schedule shall begin within 120 days after the effective date of this permit.

b. Sample all background and point of compliance monitoring wells (MW- II A, 1 2A and I 3A) and analyze for the field parameters listed in Table II.3. of this permit, at least semi-annually in accordance with Condition II.B.5. of this permit. This schedule shall begin within 120 days after the effective date of this permit. The field data .obtained should be submitted as raw data in the reports required by Condition II.B.6. of this permit.

c. Sample all designated background monitoring wells and analyze, in accordance with Condition II.B.5. of this permit, for the constituents listed in Table II.2. of this permit in designated monitoring events.

2. Reporting and Response Requirements

In addition to the recordkeeping and reporting requirements specified in Condition II.B.6. of this permit:

a. The Permittee shall determine whether there is statistically significant evidence of contamination above background levels at each monitoring well within 45 days after receipt of validated laboratory data from each sampling event. The statistical evaluation of monitoring well analytical data shall be performed pursuant to Condition II.B.5. of this permit and ADEM Admin. Code R. 335-14-5-.06(9)(f).

a. Maintain groundwater monitoring wells MW-8, MW-9A, OW-19, OW-21A, OW-22 and OW-24 as boundary wells for WMA-II as specified on Table II.1. of this permit and as shown on Figure C-17 of the permit application. The boundary well monitoring system shall be operated to monitor the boundary of the plume of contamination to ensure that the plume is not migrating beyond the limits of the well system.

b. Maintain groundwater monitoring wells MW-15, MW-16, MW20A and SBP-5 as effectiveness wells as specified on Table II.1. of this permit and as shown on Figure C-17 of the permit application. The effectiveness well monitoring system shall be operated and maintained to determine and monitor the effectiveness of the corrective action program taken to achieve the groundwater protection standard.

c. Maintain wells IW-16, IW-17, IW-18, IW-19, IW-20, IW-21, IW-22, IW-23, IW-24, IW-25, and DW-1 as recovery wells as specified on Table II.1. of this permit and as shown on Figure C-17 of the permit application. Groundwater recovered from any on-site extraction well will be treated and/or disposed of in compliance with applicable regulations.

2. Corrective Action Program

a. The Permittee shall implement a Corrective Action Program to ensure that all regulated units are in compliance with the groundwater protection standard under Condition II.B.3. of this permit.

b. The Permittee shall conduct a Corrective Action Program, as described in Section C-8 of the permit application, to remove or treat in place all hazardous constituents that exceed their respective concentration limits in the groundwater:

i. At the point of compliance in accordance with ADEM Admin. Code R. 335-14-5-.06(1 i)(b);

ii. Between the point of compliance and the downgradient facility property boundary in accordance with ADEM Admin. Code R. 335-14-5-.06(11)(e)i.; and

iii. Beyond the facility boundary in accordance with ADEM Admin. Code R. 335-14-5-.06(11)(e)2.

c. Pursuant to ADEM Admin. Code R. 335-14-5-.06(11)(c) and 335-14-5-.06(ii)(e)3., the Permittee shall implement the corrective action program as described in Section C-8 of the permit application within 120 days of permit issuance.

II.H. SUMMARY OF DEADLINES

The summary information provided herein is intended only as a guide to the requirements of Part II of this permit. It is not intended to be all inclusive; nor is it intended to be used as a substitute for the full text of this permit.

Schedule of Compliance	Due Date
Inspect closed units(s) Condition II.A.3 .b.	Weekly and after storms.
Install additional groundwater monitoring wells Condition II.B.1.d.	As necessary to assess changes in the rate and extent of any plume of contamination, or as otherwise deemed necessary. Note: a permit modification request must be submitted within 90 days prior to installation of additional groundwater monitoring well(s).
Install wells Condition II.B.1 .d.	Within 90 days after the effective date of this permit. Submit plan within 30 days after effective date of this permit. Submit report within 120 days after the effective date of this permit.
Repair/Abandon wells Condition II.B.1	Within 90 days after the effective date of this permit. Submit report within 120 days after the effective date of this permit.
Determine Groundwater surface Elevation, Condition II.B.2.a.	At least semi-annually, each time a well is sampled.
Determine groundwater flow and direction, Condition II.B.2.b.	Annually
Annual groundwater monitoring report Condition II.B.6.b.	Within 60 days of the first sampling event and annually thereafter.
Quarterly progress reports Condition II.B.6.c.	No later than 180 days after the effective days of this permit and quarterly thereafter.
Commence Detection Monitoring Condition II.C.I.	No later than 120 days after the effective date of this permit.
Semi-annual sampling for items on Table II.2., Condition II.C.1.a. and c.	Within 120 days after the effective date of this permit and semi-annually thereafter.
Semi-Annual sampling for field parameters (Table II.3.), Condition II.C.1.b.	Within 120 days of effective date of this permit and semi-annually after that.

TABLE II.1
MONITORING WELL DESIGNATION

WELL NUMBER	WELL TYPE*	UNIT(S) MONITORED	WELL DEPTH (ft BGS)	SCREENED INTERVAL (ft. BGS)	MONITORED ZONE	TOP-OF-CASING ELEVATION (ft. MSL)	GROUND ELEVATION (ft. MSL)
MW-1B	BKG	WMA-I & WMA-II	63	58-63	Upper	881.59	879.6
OW-2	EFF	SWMU 1	25	20—25	Upper	807.69	806.1
OW-4	EFF	SWMU 1	27	22—27	Upper	798.57	796.7
OW-6A	EFF	SWMU-1	49	39—49~	Upper	791.62	787.5
OW-7	EFF	SWMU-1	43	38—43	Upper	785.82	781.2
OW-8A	EFF	SWMU 1	23	13— 23	Upper	749.16	746.3
OW-15	EFF	SWMU-1	42	37—42	Upper	766.90	764.0
OW-16A	EFF	SWMU-1	33	23—33	Upper	779.74	777.6
MW-11A	POC	WMA-I	114	109—114	Bedrock	784.13	783.07
MW-12A	POC	WMA-I	110	105 - 110	Bedrock	785.69	782.12
MW-13A	POC	WMA-I	110	105— 110	Bedrock	782.01	779.35
DW-1	REC	WMA-II/SWMU 8 and SWMU 9	93	83—93	Bedrock	753.88	751.4
SBP-5	EFF	WMA-II/SWMU 8 & SWMU9	138	128—138	Bedrock	755.88	752.9
MW-8	BDY	•WMA-II	27	22—27	Upper	746.80	743.2
MW-9A	BDY	WMA-II	33.2	23.2-33.2	Upper	751.02	748.0
MW-15	POC/EFF	WMA-II/SWMU 8 &SWMU9	24	19—24	Upper	756.19	752.1
MW-16	POC/EFF	WMA-II/SWMU 8 & SWMU 9	68	*56—68*	Lower	755.70	752.7
IW-16	REC	WMA-II/SWMU 8 & SWMU 9	45	***	Upper	746.82	745.5
IW-17	REC	WMA- II/SWMU 8 and SWUM_9	48	***	Upper	746.65	745.9
IW-18	REC	WMA-II/SWMU 8 & SWMU 9	49	***	Upper	748.63	746.8
IW-19	REC	WMA-II/SWMU 8 &SWMU9	49	***	Upper	749.31	748.2
OW-19	BDY	WMA-II	24	19—24	Upper	748.72	745.8
IW-20	REC	WMA-II/SWMU 8 & SWMU 9	50	***	Upper	750.70	749.2
MW-20A	POC/EFF	WMA-II/SWMU 8	24	19—24	Upper	752.90	751.9
IW-21	REC	WMA-II/SWMU 8 & SWMU 9	50	***	Upper	752.45	751.8
IW-22	REC	WMA-II/SWMU 8 & SWMU 9	39.9	14.9-39.9	Upper	743.23	744.38
IW-23	REC	WMA-II/SWMU 8 & SWMU 9	50	25-50	Upper	745.2	746.15
IW-24	REC	WMA-II/SWMU 8 & SWMU 9	40	15-40	Upper	745.86	747.33
IW-25	REC	WMA-II/SWMU 8 & SWMU 9	40	15-40	Upper	751.96	753.5
OW-21A	BDY	WMA-II	35	25—35	Upper	744.46	741.9
OW-22	BDY	WMA-II	34	24—34	Upper	745.57	741.9
OW-24	BDY	WMA-II	29	24 -29	Upper	746.15	743.5

Well Type*

POC - Point of Compliance Wells
EFF - Effectiveness Monitoring Wells
BKG - Background Wells
BDY - Boundary Monitoring Wells
REC - Recovery
MONITORED ZONE - *e.g.*, upper, lower, bedrock, deep, intermediate, *etc.*

TABLE II.2.

GROUNDWATER QUALITY MONITORING CONSTITUENTS*

HAZARDOUS CONSTITUENT	UNIT**
Chlorobenzene	WMA-II
Cobalt	WMA-II
Parathion	WMA-I/WMA-II
P-Nitrophenol	WMA-I/WMA-II
Polychlorinated biphenyl	WMA-I/WMA-II
Tetraethyl dithiopyrophosphate	WMA-II
0,0,0-triethylphosphorothioate	WMA-I/WMA-II

* Note that this list, when used in the Corrective Action program, is the subset of the Groundwater Protection Standard. This list will be monitored semi-annually.

** Identifies the unit(s) at which the given constituent must be monitored.

TABLE II.4.

GROUNDWATER PROTECTION STANDARD

HAZARDOUS CONSTITUENT	LOCATION*	CONCENTRATION LIMIT (mg/L)**
Chlorobenzene	WMA-II	MDL
Cobalt	WMA-II	MDL
Mercury	WMA-I/WMA-II	0.002
o-dichlorobenzene	WMA-II	MDL
p-dichlorobenzene	WMA-II	MDL
Parathion	WMA-I/WMA-II	0.2
Pentachlorophenol	MW-20A	MDL
P-Nitrophenol	WMA-I/WMA-II	1.0
Polychlorinated biphenyl	WMA-II/WMA-II	MDL
Tetraethyl dithiopyrophosphate	WMA-II	MDL
0,0,0-triethylphosphorothioate	WMA-II/WMA-II	1.0
2,4,6-trichlorophenol	MW-20A	MDL

- Identifies the unit(s) or well(s) at which the given constituent must be monitored.

- The method detection limit (MDL) for a specific constituent must be equal to or less than the Drinking Water MCL if in existence for that constituent. Background levels will be used as the GWPS in those cases where background levels are above MDL or the listed GWPS.

CONTENTS

APPENDICES

wells, ten downgradient monitoring wells and a background monitoring well. SWMU 1 is comprised of the closed western and northern areas of the South Landfill, and the plant site area. The SWMU 1 corrective action system consists of eleven recovery wells, seven downgradient monitoring wells and a background monitoring well. Appendix C contains a list of the proposed groundwater monitoring and sampling programs analytical constituents.

This Sampling and Analytical Quality Assurance/Quality Control Plan (SAQCP) has been prepared to standardize procedures and practices for the plant groundwater monitoring program. This document describes essential components of the groundwater monitoring/sampling and analytical plan that conforms with the RCRA Part B Permit (USEPA ID No. ALD 004 019 048) issued on January 7, 1997 to Solutia Inc. Anniston, Alabama facility (the Permit), and the QA/QC protocol recommended by ADEM and the United States Environmental Protection Agency (EPA). The field and analytical procedures referred to in this plan are the most recent procedures described by EPA from: Test Methods for Evaluation of Solid Waste" EPA SW-846 third edition, November 1986 (SW-846); and the Resource and Conservation Recovery Act (RCRA) Groundwater Monitoring Technical Enforcement Guidance Document (TEGD) September 1986, SW-846 Specifications.

12. Pump is placed in a clean plastic bag or wrapped in aluminum foil for storage and transport.

4.2.3 Equipment Calibration

Field measurements of temperature, pH, dissolved oxygen, oxidation reduction potential, and conductivity will be documented for each water sample collected. The pH meter and conductivity meter will be calibrated at the beginning of each day and every eight hours of use during the sampling event. The calibration information will be documented in a field log.

4.2.3.1 pH Meter Calibration and Storage

The pH meter will be calibrated according to the manufacturer's instructions. A general outline of a typical procedure for calibration is listed below:

1. Wash hands with phosphate free detergent or deionized water.
2. Put on powder-free latex rubber or vinyl gloves.
3. Fit sensor to meter module. Remove wetting cap.
4. Switch on meter.
5. For first calibration point, place sensor in pH 7 buffer solution.
6. Press CAL. CAL 1 is displayed, and after endpointing, the display automatically updates to pH 7.

4.3 VEHICLE PREPARATION

Load all equipment into the field vehicle in a manner that ensures contamination and/or damage of equipment will not occur. Ideally, a dedicated "sampling only" vehicle should be used. Otherwise, all sampling equipment, sample containers, and decontamination solutions/equipment should be kept "clean" in the most praticable manner inside the vehicle.

4.4 SAMPLE COLLECTION

The procedures utilized for sample collection are designed to ensure that the sample submitted for analysis will be representative of the matrix collected and void of introduced contamination. The following sections describe procedures for sample collection. Alternatively, the sampling procedures described in Appendix E, which follow USEPA's Standard Operating Procedures for Low-Stress (Low-Flow) / Minimal Drawdown Groundwater Sample Collection, may be used for collecting groundwater samples at the site.

4.4.1 Groundwater Sampling

Proper sampling of groundwater wells requires that the water standing in the well at the time of collection be representative of the water

contained in the formation at that time. To accomplish this objective it is necessary to purge water that is standing in the well prior to sampling.

After the well has been purged or pumped or bailed to dryness, samples can be collected by filling the sample containers according to procedures described in Section 4.5. In order to ensure that changes in water chemistry do not occur after purging, groundwater samples must be collected within 24 hours after evacuation is completed, or, in the case of wells which are pumped or bailed dry, as soon as recharge occurs and there is sufficient water to fill all the required containers and make all the necessary field measurements.

If several parameters are being sampled, the order in which containers for specific parameters should be filled, as listed in the TEGD (September 1986), should be in the following order:

1. Volatile organics (VOA)
2. Purgeable organic carbon (POC)
3. Purgeable organic halogens (POX)
4. Total organic halogens (TOX)
5. Total organic carbon (TOC)
6. Extractable organics
7. Total metals
8. Dissolved metals
9. Phenols
10. Cyanide

Constituent Monitoring Frequency

Constituent	Detection Monitoring Program (Well Group 1)	Corrective Action Program (Well Group 2)	Corrective Action Program (Well Group 3)
Chlorobenzene	—	Semi-annual	Annual
Cobalt	—	Semi-annual	Annual
1,2-Dichlorobenzene	—	Annual	Annual
1,4-Dichlorobenzene	—	Annual	Annual
Parathion	Semi-annual	Semi-annual	Annual
Mercury	Annual	Annual	Annual
4-Nitrophenol	Semi-annual	Semi-annual	Annual
Pentachlorophenol	—	Annual *	—
PCBs (Polychlorinated biphenyls)	Semi-annual	Semi-annual	Annual
Tetraethyldithiopyrophosphate (Sulfotepp)	—	Semi-annual	Annual
o,o,o-Triethylphosphorothioate	Semi-annual	Semi-annual	Annual
2,4,6-Trichlorophenol	—	Annual *	—

Notes:

1) Well Group 1: MW-01B, -11A, -12A, -13A

2) Well Group 2: MW-01B, -15, -16, -20A, SBP-05, OW-02, -04, -06A, -07, -08A, -15, -16A

3) Well Group 3: MW-08, -09A, OW-19, -21A, -22, -24

* Sampled in MW-20A only.

CONSTRUCTION DETAILS FOR GROUNDWATER MONITORING WELLS AND PIEZOMETERS

Well #	Northing	Easting	Date Installed	Ground Surface Elevation (ft MSL)	Top of Casing Elevation (ft MSL)	Approximate Well Depth (ft BGS)	Approximate Top of Screen (ft BGS)	Approximate Bottom of Screen (ft BGS)	Screened Interval Length (ft)	Top of Screen (ft MSL)	Bottom of Screen (ft MSL)	TYPE
BR-01 [2]	650300.00	1144532.00	September 1987	892.60	897.46	311	291	311	20	601.60	581.60	Bedrock
BR-02 [2]	649841.00	1144543.00	September 1987	861.60	865.22	181	161	181	20	700.60	680.60	Bedrock
BR-03 [2]	649834.00	1145042.00	September 1987	825.70	827.58	258	238	258	20	587.70	567.70	Bedrock
BR-04	649592.91	1145636.18	December 1987	788.74	790.74	220	200	220	20	588.74	568.74	Bedrock
BR-05 [1]	648852.23	1146159.42	February 1988	763.30	764.10	149	129	149	20	634.30	614.30	Bedrock
CB-08 [2]	650082.00	1145411.00	October 1980	803.80	804.77	26	17	22	5	786.80	781.80	Abandoned
CB-08-C1 [2]	650077.00	1145406.00	October 1980	803.90	805.77	41	36	41	5	767.90	762.90	Abandoned
CB-09 [2]	650152.00	1144961.00	October 1980	837.10	839.05	42	37	42	5	800.10	795.10	Abandoned
CB-10 [2]	650084.00	1145336.00	October 1980	808.00	809.85	34	16	21	5	792.00	787.00	Abandoned
CB-26 [2]	650128.00	1145250.00	October 1980	816.40	818.37	16	11	16	5	805.40	800.40	Abandoned
CB-33 [2]	650082.00	1145385.00	October 1980	805.00	807.08	45	40	45	5	765.00	760.00	Abandoned
CB-53 [2]	650254.24	1145545.60	May 1985	798.22	800.62	50	44	49	5	754.22	749.22	Abandoned
CB-54 [2]	650189.00	1145558.00	May 1985	794.70	796.89	30	24	29	5	770.70	765.70	Abandoned
CB-55 [1,2]	650115.21	1145528.40	May 1985	795.15	795.48	50	40	45	5	755.15	750.15	Abandoned
CB-55-SH [2]	650114.00	1145521.00	May 1985	794.80	796.75	24	19	24	5	775.80	770.80	Abandoned
CB-85 [2]	649972.00	1147479.00	Pre-1995 (estimated)	733.80	736.37	40	35	40	5	698.80	693.80	Residuum
CMW-01	650928.78	1148202.46	August 2004	717.14	720.40	28.5	18	28.5	10.5	699.14	688.64	Residuum
CMW-02	651048.47	1148473.21	August 2004	713.85	716.69	22.5	12	22.5	10.5	701.85	691.35	Residuum
CMW-03	651705.61	1148770.79	August 2004	707.09	710.22	27	16.5	27	10.5	690.59	680.09	Residuum
DMW-PROD	649524.63	11486979.07	Pre-1995 (estimated)	NS	NS	958	100	958	858	NS	NS	Abandoned
DOP-01	648964.03	1147424.61	October 1992	743.80	747.49	300	265	290	25	478.80	453.80	Residuum
DW-01	648895.87	1147158.05	September 1991	751.08	753.88	96	83.25	93.25	10	667.83	657.83	Interceptor
IW-01 [2]	650109.00	1145164.00	Pre-1995 (estimated)	820.5	821.18	26	11	21	10	809.5	799.50	Interceptor
IW-02 [2]	650099.00	1145271.00	Pre-1995 (estimated)	813.5	815.27	25	10	20	10	803.5	793.50	Interceptor
IW-03 [2]	650104.00	1145371.00	Pre-1995 (estimated)	806.6	810.59	25	10	20	10	796.6	786.60	Interceptor
IW-04 [2]	650104.00	1145473.00	Pre-1995 (estimated)	798.9	799.88	25	10	20	10	788.9	778.90	Interceptor
IW-05	650319.73	1145611.76	Pre-1995 (estimated)	803.07	805.46	68	53	63	10	750.07	740.07	Interceptor
IW-06	650459.11	1145677.55	Pre-1995 (estimated)	800.07	803.84	68	25	68	43	775.07	732.07	Interceptor
IW-07	650734.10	1145799.00	Pre-1995 (estimated)	793.35	794.63	40	1	40	39	792.35	753.35	Interceptor
IW-08	650653.13	1145764.36	Pre-1995 (estimated)	796.77	798.02	39.5	1	39.5	38.5	795.77	757.27	Interceptor
IW-09	650589.28	1145737.25	Pre-1995 (estimated)	799.67	801.03	50	1	50	49	798.67	749.67	Interceptor
IW-10	650528.28	1145709.99	Pre-1995 (estimated)	800.67	801.93	68	1	68	67	799.67	732.67	Interceptor
IW-11	650392.38	1145644.22	Pre-1995 (estimated)	803.42	804.62	68	1	68	67	802.42	735.42	Interceptor
IW-12	650225.61	1145566.11	Pre-1995 (estimated)	796.49	797.86	50	1	50	49	795.49	746.49	Interceptor
IW-13	650083.91	1145529.73	Pre-1995 (estimated)	794.56	795.74	50	1	50	49	793.56	744.56	Interceptor
IW-14	650322.26	1146387.68	Pre-1995 (estimated)	753.65	754.95	46	1	46	45	752.65	707.65	Abandoned
IW-14A	650289.77	1146543.05	February 2003	748.00	746.70	49.4	29.4	49.4	20	718.60	698.60	Interceptor
IW-15	650245.49	1146349.39	Pre-1995 (estimated)	755.45	756.73	45	1	45	44	754.45	710.45	Interceptor
IW-16	649187.53	1147359.73	Pre-1995 (estimated)	746.14	746.82	50	1	50	49	745.14	696.14	Interceptor
IW-17	649123.03	1147321.33	Pre-1995 (estimated)	745.86	746.65	50	1	50	49	744.86	695.86	Interceptor
IW-18	649058.39	1147284.01	Pre-1995 (estimated)	747.9	748.63	50	1	50	49	746.9	697.90	Interceptor
IW-19	648991.94	1147246.11	Pre-1995 (estimated)	748.63	749.31	50	1	50	49	747.63	698.63	Interceptor
IW-20	648942.43	1147216.86	Pre-1995 (estimated)	750.02	750.70	50	1	50	49	749.02	700.02	Interceptor
IW-21	648862.80	1147170.58	Pre-1995 (estimated)	751.8	752.45	50	1	50	49	750.8	701.80	Interceptor

Well #	Northing	Easting	Date Installed	Ground Surface Elevation (ft MSL)	Top of Casing Elevation (ft MSL)	Approximate Well Depth (ft BGS)	Approximate Top of Screen (ft BGS)	Approximate Bottom of Screen (ft BGS)	Screened Interval Length (ft)	Top of Screen (ft MSL)	Bottom of Screen (ft MSL)	TYPE
IW-22	649253.88	1147403.35	February 2003	744.38	743.23	39.9	14.9	39.9	25	729.48	704.48	Interceptor
IW-23	649089.55	1147303.90	January 2003	746.15	745.20	50	25	50	25	721.15	696.15	Interceptor
IW-24	649031.47	1147269.88	January 2003	747.33	745.86	40	15	40	25	732.33	707.33	Interceptor
IW-25	648792.11	1147121.03	February 2003	753.50	751.96	40	15	40	25	738.50	713.50	Interceptor
MW-01	650901.37	1145104.14	Pre-1995 (estimated)	NS	868.72	62	47 and 57	52 and 62	5 and 5	NS	NS	Residuum
MW-01A	651231.00	1145095.00	May 1985	NS	884.49	56	51	56	5	NS	NS	Residuum
MW-01B	651277.30	1145116.72	October 1985	880.09	881.59	62.5	57.5	62.5	5	822.59	817.59	Residuum
MW-02 (1)	651509.56	1146152.48	Pre-1995 (estimated)	774.63	777.05	43	38	43	5	736.63	731.63	Abandoned
MW-03 (1)	651106.36	1145959.19	Pre-1995 (estimated)	789.50	791.00	73	58 and 68	63 and 73	5 and 5	NS	NS	Abandoned
MW-07	649173.00	1147637.00	Pre-1995 (estimated)	741.00	744.18	24	19	24	5	722.00	717.00	Residuum
MW-08	649026.00	1147444.00	Pre-1995 (estimated)	743.20	746.80	27	22	27	5	721.20	716.20	Residuum
MW-09 (1)	648809.00	1147320.00	Pre-1995 (estimated)	748.10	750.02	28	23	28	5	725.10	720.10	Abandoned
MW-09A	648784.60	1147328.70	February 2003	748.00	751.02	33.2	23	33	10	725.00	715.00	Residuum
MW-11	651309.00	1146061.00	May 1985	NS	783.74	29	24	29	5	NS	NS	Residuum
MW-11A	651328.20	1146090.98	October 1985	783.13	784.13	117	109	114	5	674.13	669.13	Bedrock
MW-12	651179.00	1146004.00	May 1985	NS	785.77	28	23	28	5	NS	NS	Residuum
MW-12A	651193.11	1146032.60	October 1985	783.69	785.69	124.5	105	110	5	678.69	673.69	Bedrock
MW-13	650962.00	1145913.00	May 1985	NS	782.24	29	24	29	5	NS	NS	Residuum
MW-13A	651010.06	1145950.40	October 1985	779.34	782.01	123.5	105	110	5	674.34	669.34	Bedrock
MW-14 (1)	648653.00	1147227.00	May 1985	749.14	751.3	24	19	24	5	730.14	725.14	Residuum
MW-15	648755.00	1147084.00	October 1985	752.52	756.19	27	19	24	5	733.52	728.52	Residuum
MW-16	648804.30	1147135.97	October 1985	752.62	755.70	68.5	58	68	10	694.62	684.62	Residuum
MW-20	648862.00	1147142.00	June 1986	NS	752.43	24	19	24	5	NS	NS	Abandoned
MW-20A	648900.78	1147151.04	May 1988	751.65	752.90	24	19	24	5	732.65	727.65	Residuum
MW-22	NA	NA	Pre-1995 (estimated)	NS	NS	24	19	24	5	NS	NS	Abandoned
OW-01 (2)	650002.00	1145248.00	Pre-1995 (estimated)	811.20	812.71	26	20	25	5	791.20	786.20	Residuum
OW-02 (2)	650023.00	1145348.00	May 1985	806.10	807.69	35	19	24	5	787.10	782.10	Residuum
OW-03 (2)	650031.00	1145419.00	May 1985	802.10	805.25	25	19	24	5	783.10	778.10	Residuum
OW-04 (2)	650041.00	1145494.00	May 1985	796.70	798.57	30	22	27	5	774.70	769.70	Residuum
OW-05 (2)	650148.00	1146017.00	Pre-1995 (estimated)	770.70	773.02	65	60	65	5	710.70	705.70	Residuum
OW-06 (2)	650659.00	1146226.77	May 1985	787.00	788.71	43	38	43	5	749.00	744.00	Abandoned
OW-06A	650663.00	1146210.00	March 1998	788.87	791.62	49	39	49	10	749.87	739.87	Residuum
OW-07 (2)	650587.56	1146355.13	May 1985	781.20	785.82	43	38	43	5	743.20	738.20	Residuum
OW-08	650304.69	1146604.44	May 1985	NA	NA	24	19	24	5	NA	NS	Abandoned
OW-08A	650298.00	1146601.00	March 1998	746.30	749.16	23	12.5	22.5	10	733.80	723.80	Residuum
OW-09	650471.00	1146931.00	Pre-1995 (estimated)	736.30	738.36	40	33	38	5	703.30	698.30	Residuum
OW-10	650297.70	1147198.92	October 1980	734.71	736.87	40	33	38	5	701.71	696.71	Residuum
OW-11 (2)	650158.00	1145210.00	October 1980	824.70	825.36	14	9	14	5	815.70	810.70	Residuum
OW-12 (2)	650192.00	1145139.00	October 1980	831.60	835.34	34.5	29.5	34.5	5	802.10	797.10	Residuum
OW-13 (2)	650472.00	1145686.00	October 1980	802.10	805.16	43	38	43	5	764.10	759.10	Residuum
OW-14 (2)	650229.00	1145608.00	October 1980	803.30	806.98	46	41	46	5	762.30	757.30	Residuum
OW-15 (2)	650268.00	1146146.00	December 1987	764.00	766.90	40	35	40	5	729.00	724.00	Residuum
OW-16 (2)	650209.00	1145916.00	December 1987	777.50	781.51	30	25	30	5	752.50	747.50	Residuum
OW-16A	650202.00	1145907.00	March 1998	777.60	779.74	33	23	33	10	754.60	744.60	Residuum
OW-17 (2)	650417.00	1145606.00	December 1987	810.30	812.29	40	35	40	5	775.30	770.30	Residuum
OW-18	648906.40	1147233.23	October 1985	747.52	750.47	27.5	22	27	5	725.52	720.52	Residuum

Well #	Northing	Easting	Date Installed	Ground Surface Elevation (ft MSL)	Top of Casing Elevation (ft MSL)	Approximate Well Depth (ft BGS)	Approximate Top of Screen (ft BGS)	Approximate Bottom of Screen (ft BGS)	Screened Interval Length (ft)	Top of Screen (ft MSL)	Bottom of Screen (ft MSL)	TYPE
OW-19	648966.21	1147262.06	October 1985	745.80	748.72	25	19	24	5	726.80	721.80	Residuum
OW-20	649018.61	1147295.14	October 1985	744.80	747.62	23	15	20	5	729.80	724.80	Residuum
OW-21	649204.87	1147523.72	June 1986	739.10	742.83	36	26	36	10	713.10	703.10	Abandoned
OW-21A	649174.02	1147546.72	January 2003	741.90	744.46	35	25	35	10	716.90	706.90	Residuum
OW-22	649136.92	1147474.08	June 1986	741.90	745.57	34	24	34	10	717.90	707.90	Residuum
OW-23	649067.29	1147323.02	June 1986	744.40	747.53	23	18	23	5	726.40	721.40	Residuum
OW-24	649122.38	1147353.36	June 1986	743.50	746.15	29	24	29	5	719.50	714.50	Residuum
OW-25	649908.69	1145442.89	Pre-1995 (estimated)	797.71	800.21	35	30	35	5	767.71	762.71	Residuum
OWR-01D	649884.00	1147697.00	June 1998	737.50	739.59	65	55	65	10	682.50	672.50	Residuum
OWR-01S	649892.00	1147706.00	June 1998	736.60	738.89	35	25	35	10	711.60	701.60	Residuum
OWR-02D	648703.00	1146850.00	June 1998	754.70	756.99	110	98	108	10	656.70	646.70	Residuum
OWR-02S	648706.00	1146844.00	June 1998	754.90	757.46	35	25	35	10	729.90	719.90	Residuum
OWR-03D	649093.00	1146478.00	June 1998	757.50	759.76	65	55	65	10	702.50	692.50	Residuum
OWR-03S	649095.00	1146468.00	June 1998	758.30	760.48	35	25	35	10	733.30	723.30	Residuum
OWR-04D	649130.00	1147481.00	May 1998	741.90	746.03	80	70	80	10	671.90	661.90	Residuum
OWR-05D	650482.00	1145694.00	June 1998	802.40	804.93	68	58	68	10	744.40	734.40	Residuum
OWR-06D	650283.00	1147190.00	June 1998	734.50	736.79	65	55	65	10	679.50	669.50	Residuum
OWR-07D	648474.00	1145807.00	May 1998	772.10	774.49	65	55	65	10	717.10	707.10	Residuum
OWR-08S	648846.00	1147145.00	June 1998	752.90	755.17	35	25	35	10	727.90	717.90	Residuum
OWR-09S	651456.00	1147319.00	June 1998	750.70	753.09	50	40	50	10	710.70	700.70	Residuum
OWR-10	648296.77	1146199.67	January 2003	767.0	769.95	49.2	39.2	49.2	10	727.80	717.80	Residuum
OWR-11	650249.85	1146857.44	January 2003	742.3	745.16	35	25	35	10	717.30	707.30	Residuum
OWR-12	649328.39	1146677.47	January 2003	760.6	763.20	37	27	37	10	733.60	723.60	Residuum
OWR-13	649678.04	1146480.77	January 2003	766.8	769.45	36	26	36	10	740.80	730.80	Residuum
P-11-C	NA	NA	October 1980	NS	854.59	75	70	75	5	NS	NS	Abandoned
P-12-C	NA	NA	October 1980	NS	792.93	40	35	40	5	NS	NS	Abandoned
P-7-C	NA	NA	October 1980	NS	874.64	70	65	70	5	NS	NS	Abandoned
PZ-01 [1]	648840.91	1147144.16	April 1991	753.08	754.92	52	45	50	5	708.08	703.08	Abandoned
PZ-02 [1]	648893.30	1147175.00	April 1991	751.28	753.46	51	45	50	5	706.28	701.28	Abandoned
PZ-02A [1]	648888.48	1147170.46	September 1991	751.85	753.05	35	28	33	5	723.85	718.85	Abandoned
PZ-03 [1]	648965.57	1147235.16	April 1991	748.97	750.97	50.5	43.6	48.6	5	705.37	700.37	Abandoned
PZ-03A [1]	648968.94	1147235.06	September 1991	748.69	750.69	34	28	33	5	720.69	715.69	Abandoned
PZ-04 [1]	649019.69	1147266.52	April 1991	747.80	750.47	53.5	45	50	5	702.80	697.80	Abandoned
PZ-04A [1]	649024.11	1147267.65	September 1991	747.73	749.73	31	25	30	5	722.73	717.73	Abandoned
PZ-04B [1]	649007.00	1147257.90	September 1991	748.00	750.00	34	28	33	5	720.00	715.00	Abandoned
PZ-04C [1]	648995.02	1147249.04	September 1991	748.53	750.35	34	28	33	5	720.53	715.53	Abandoned
PZ-05 [1]	649087.47	1147305.47	April 1991	746.58	749.00	50.2	45	50	5	701.58	696.58	Abandoned
PZ-05A [1]	649091.23	1147306.28	September 1991	746.22	748.22	27	21	26	5	725.22	720.22	Abandoned
PZ-06 [1]	649162.93	1147350.80	April 1991	745.85	747.52	55	45	50	5	700.85	695.85	Abandoned
PZ-06A [1]	649165.40	1147348.68	September 1991	745.53	747.20	30	24	29	5	721.53	716.53	Abandoned
PZ-07 [1]	649233.41	1147387.90	April 1991	744.85	746.85	55	45	50	5	699.85	694.85	Abandoned
PZ-08 [1]	649465.87	1147442.42	April 1991	747.84	750.51	49.9	44.9	49.9	5	702.94	697.94	Residuum
PZ-09 [1]	649094.63	1147132.36	April 1991	747.38	749.71	55	35	40	5	712.38	707.38	Residuum
PZ-10 [1]	648800.95	1147012.08	April 1991	753.98	756.06	55	45	50	5	708.98	703.98	Residuum
PZ-11 [1]	648581.81	1147283.97	April 1991	749.09	750.71	50	40	45	5	709.09	704.09	Residuum
PZ-17C	650121.87	1145032.26	October 1980	823.30	825.64	31	26	31	5	797.30	792.30	Abandoned

Well #	Northing	Easting	Date Installed	Ground Surface Elevation (ft MSL)	Top of Casing Elevation (ft MSL)	Approximate Well Depth (ft BGS)	Approximate Top of Screen (ft BGS)	Approximate Bottom of Screen (ft BGS)	Screened Interval Length (ft)	Top of Screen (ft MSL)	Bottom of Screen (ft MSL)	TYPE
PZ-20B [1]	648896.65	1147144.21	Pre-1995 (estimated)	751.87	754.08	25	NA	NA	NA	NS	NS	Abandoned
PZR-01	650398.00	1145640.00	June 1998	804.40	806.91	60	40	60	20	764.40	744.40	Residuum
PZR-02	650464.00	1145685.00	June 1998	803.50	805.86	60	40	60	20	763.50	743.50	Residuum
PZR-03	650508.00	1145699.00	June 1998	802.40	805.05	61	41	61	20	761.40	741.40	Residuum
PZR-04	650531.00	1145717.00	June 1998	801.50	803.94	60	40	60	20	761.50	741.50	Residuum
PZR-05	650315.00	1146377.00	June 1998	753.30	755.73	46	26	46	20	727.30	707.30	Residuum
PZR-06	650252.00	1146344.00	June 1998	754.90	757.09	46	26	46	20	728.90	708.90	Residuum
SA-06 [1]	651609.36	1145716.25	October 1980	813.56	815.56	50	45	50	5	768.56	763.56	Residuum
SA-22 [1]	651103.33	1145948.64	October 1980	790.00	792.84	24	18	23	5	772.00	767.00	Residuum
SA-64 [1]	648641.11	1147406.02	Pre-1995 (estimated)	746.23	748.65	24	19	24	5	727.23	722.23	Residuum
SBP-01	648695.95	1146863.48	August 1992	755.55	758.17	157	137	152	15	618.55	603.55	Bedrock
SBP-02	649190.70	1147132.39	July 1992	747.07	749.40	140	123	138	15	624.07	609.07	Bedrock
SBP-03	649183.78	1147578.15	August 1992	740.60	744.41	102	90	100	10	650.60	640.60	Bedrock
SBP-04	649111.31	1146471.57	September 1992	758.97	761.30	147.5	130	145	15	628.97	613.97	Bedrock
SBP-05	648744.38	1147087.09	November 1992	753.55	755.88	140	128	138	10	625.55	615.55	Bedrock
WEL-01	648369.53	1145603.34	April 1994	777.22	778.80	31.5	19	29	10	758.22	748.22	Residuum
WEL-02	648436.57	1145721.67	April 1994	773.68	775.35	31	18.5	28.5	10	755.18	745.18	Residuum
WEL-03	648498.69	1145905.50	April 1994	769.40	771.73	32	19.5	29.5	10	749.90	739.90	Residuum
WEL-04	648864.25	1146164.41	Pre-1995 (estimated)	763.14	765.94	47	34.5	44.5	10	728.64	718.64	Residuum

Notes:	
-	= Information does not exist.
NA	= Not Available.
NS	= Not Specified.
SBP-05	= Detection Monitoring/Corrective Action Monitoring Well

1) Ground surface elevation estimated based on well stick-up.
2) Ground surface around well may have been modified after well installed. Ground surface elevation reflects new ground level.

APPENDIX E

Standard Operating Procedures for Low-Stress (Low Flow) / Minimal Drawdown Ground-Water Sample Collection

STANDARD OPERATING PROCEDURE FOR LOW-STRESS (Low Flow) / MINIMAL DRAWDOWN GROUND-WATER SAMPLE COLLECTION

INTRODUCTION

The collection of "representative" water samples from wells is neither straightforward nor easily accomplished. Ground-water sample collection can be a source of variability through differences in sample personnel and their individual sampling procedures, the equipment used, and ambient temporal variability in subsurface and environmental conditions. Many site inspections and remedial investigations require the sampling at ground-water monitoring wells within a defined criterion of data confidence or data quality, which necessitates that the personnel collecting the samples are trained and aware of proper sample-collection procedures.

The purpose of this standard operating procedure (SOP) is to provide a method which minimize the amount of impact the purging process has on the ground water chemistry during sample collection and to minimize the volume of water that is being purged and disposed. This will take place by placing the pump intake within the screen interval and by keeping the drawdown at a minimal level (0.33 feet) (Puls and Barcelona, 1996) until the water quality parameters have stabilized and sample collection is complete. The flow rate at which the pump will be operating will be depended upon both hydraulic conductivity of the aquifer and the drawdown with the goal of minimizing the drawdown. The flow rate from the pump during purging and sampling will be at a rate that will not compromise the integrity of the analyte that is being sampled. This sampling procedure may or may not provide a discrete ground water sample at the location of the pump intake. The flow of ground-water to the pump intake will be dependent on the distribution of the hydraulic conductivity (K) of the aquifer within the screen interval. In order to minimize the drawdown in the monitoring well a low-flow rate must be utilized. Low-flow refers to the velocity with which water enters the pump intake from the surrounding formation in the

immediate vicinity of the well screen. It does not necessarily refer to the flow rate of water discharged at the surface, which can be affected by flow regulators or restrictions (Puls and Barcelona, 1996). This SOP was developed by the Superfund/RCRA Ground Water Forum and draws from an USEPA's Ground Water Issue Paper, Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedure, by Robert W. Puls and Michael J. Barcelona. Also, available USEPA Regional SOPs regarding Low-Stress(Low Flow)Purging and Sampling were used for this SOP.

SCOPE AND APPLICATION

This SOP should be used primarily at monitoring wells which have a screen or an open interval with a length of ten feet or less and can accept a sampling device which minimizes the disturbance to the aquifer or the water column in the well casing. The screen or open interval should have been optimally located to intercept an existing contaminant plume(s) or along flowpaths of potential contaminant releases. Knowledge of the contaminant distribution within the screen interval is highly recommended and is essential for the success of this sampling procedure. The ground-water samples which are collected using this procedure are acceptable for the analyses of ground-water contaminants which may be found at Superfund and RCRA contamination sites. The analytes may be volatile, semi-volatile organic compounds, pesticides, PCBs, metals and other inorganic compounds. The screened interval should be located within the contaminant plume(s) and the pump intake should be placed at or near the known source of the contamination within the screened interval. It is critical to place the pump intake in the exact location or depth for each sampling event. This argues for the use of dedicated, permanently installed sampling devices whenever possible. If this is not possible then the placement of the pump intake should be positioned with a calibrated sampling pump hose sounded with a weighted-tape or using a pre-measured hose. The pump intake should not be placed near the bottom of the screened interval to avoid disturbing any sediment that may have settled at the bottom of the well.

Water-quality indicator parameters and water levels must be measured during purging, prior to sample collection. Stabilization of the water quality parameters as well as

monitoring water levels are a prerequisite to sample collection. The water-quality indicator parameters which are recommended include the following: specific electrical conductance, dissolved oxygen, turbidity, oxidation-reduction potential, pH, and temperature. The latter two parameters are useful data, but are generally insensitive as purging parameters. Oxidation-reduction potential may not always be appropriate stabilization parameter, and will depend on site-specific conditions. However, readings should be recorded because of its value as a double check for oxidation conditions, and for fate and transport issues. Also, when samples are collected for metals, semi-volatile organic compounds, and pesticides every effort must be made to reduce turbidity to 10 NTUs or less (not just the stabilization of turbidity) prior to the collection of the water sample. In addition to the measurement of the above parameters, depth to water must be measured during purging (U.S. Environmental Protection Agency, 1995).

Proper well construction, development and maintenance are essential for any ground-water sampling procedure. Prior to conducting the field work, information on the construction of the well and well development should be obtained and that information factored into the site specific sampling procedure. The attached Sampling Checklist is an example of the type of information that is useful.

Stabilization of the water-quality indicator parameters is the criterion for sample collection. But if stabilization is not occurring and the procedure has been strictly followed, then sample collection can take place once three (minimum) to six (maximum) casing volumes have been removed (Schuller et al., 1981 and U.S. Environmental Protection Agency., 1986; Wilde et al., 1998; Gibs and Imbrigiotta., 1990). The specific information on what took place during purging must be recorded in the field notebook or in the ground-water sampling log.

This SOP is not to be used where non-aqueous phase liquids (immiscible fluids) are present in the monitoring well.

EQUIPMENT

- Depth-to-water measuring device - An electronic water-level indicator or steel tape and chalk, with marked intervals of

0.01 foot. Interface probe for determination of liquid products (NAPL) presence, if needed.

- Steel tape and weight - Used for measuring total depth of well. Lead weight should not be used.
- Sampling pump - Submersible or bladder pumps with adjustable rate controls are preferred. Pumps are to be constructed of inert materials, such as stainless steel and teflon®. Pump types that are acceptable include gear and helical driven, centrifugal (low-flow type) and air-activated piston. Adjustable rate, peristaltic pump can be used when the depth to water is 20 feet or less.
- Tubing - Teflon® or Teflon® lined polyethylene tubing is preferred when sampling for organic compounds. Polyethylene tubing can be used when sampling inorganics.
- Power Source - If a combustion type (gasoline or diesel-driven) generator is used, it must be placed downwind of the sampling area.
- Flow measurement supplies - flow meter, graduated cylinder and a stop watch.
- Multi-Parameter meter with flow-through-cell - This can be one instrument or more contained in a flow-through cell. The water-quality indicator parameters which must be monitored are pH, ORP/EH, dissolved oxygen (DO), turbidity, specific conductance, and temperature. Turbidity readings must be collected before the flow cell because of the potential for sediment buildup which can bias the turbidity measurements. Calibration fluids for all instruments should be NIST-traceable and there should be enough for daily calibration through-out the sampling event. The inlet of the flow cell must be located near the bottom of the flow cell and the outlet near the top. The size of the flow cell should be kept to a minimum and a closed cell is preferred. The flow cell must not contain any air or gas bubbles when monitoring for the water-quality indicator parameters.
- Decontamination Supplies - Including a reliable and documented source of distilled water and any solvents (if used). Pressure sprayers, buckets or decontamination tubes for pumps, brushes and non-phosphate soap will also be needed.
- Sample bottles, sample preservation supplies, sample tags or labels and chain of custody forms.
- Approved Field Sampling and Quality Assurance Project Plan.
- Well construction data, field and water quality data from the previous sampling event.
- Well keys and map of well locations.

- Field notebook, ground-water sampling logs and calculator. A suggested field data sheet (ground-water sampling record or ground-water sampling log) are provided in the attachment.
- Filtration equipment, if needed. An in-line disposable filter is recommended.
- Polyethylene sheeting which will be placed on ground around the well head.
- Personal protective equipment specified in the site Health and Safety Plan.
- Air monitoring equipment as specified in the Site Health and Safety Plan.
- Tool box -All needed tools for all site equipment used.
- A 55-gallon drum or container to contain the purged water.

Materials of construction of the sampling equipment (bladders, pumps, tubing, and other equipment that comes in contact with the sample) should be limited to stainless steel, Teflon®, glass and other inert material. This will reduce the chance of the sampling materials to alter the ground-water where concentrations of the site contaminants are expected to be near the detection limits. The sample tubing diameter thickness should be maximized and the tubing length should be minimized so that the loss of contaminants into and through the tubing walls may be reduced and the rate of stabilization of ground-water parameters is maximized. The tendency of organics to sorb into and out of material makes the appropriate selection of sample tubing material critical for trace analyses (Pohlmann and Alduino, 1992; Parker and Ranney, 1998).

PURGING AND SAMPLING PROCEDURES

The following describes the purging and sampling procedures for the Low-Stress (Low Flow)/ Minimal Drawdown method for the collection of ground-water samples. These procedures also describe steps for dedicated and non-dedicated systems.

Pre-Sampling Activities (Non-dedicated and dedicated system)

1. Sampling locations must begin at the monitoring well with the least contamination, generally up-gradient or furthest from the site or suspected source. Then proceed systematically to the monitoring wells with the most contaminated ground water.

2. Check and record the condition of the monitoring well for damage or evidence of tampering. Lay out polyethylene sheeting around the well to minimize the likelihood of contamination of sampling/purging equipment from the soil. Place monitoring, purging and sampling equipment on the sheeting.

3. Unlock well head. Record location, time, date and appropriate information in a field logbook or on the ground-water sampling log (See attached ground-water sampling record and ground-water sampling log as examples).

4. Remove inner casing cap.

5. Monitor the headspace of the monitoring well at the rim of the casing for volatile organic compounds (VOC) with a Photo-ionization detector (PID) or Flame ionization detector (FID), and record in the logbook. If the existing monitoring well has a history of positive readings of the headspace, then the sampling must be conducted in accordance with the Health and Safety Plan.

6. Measure the depth to water (water level must be measured to nearest 0.01 feet) relative to a reference measuring point on the well casing with an electronic water level indicator or steel tape and record in logbook or ground-water sampling log. If no reference point is found, measure relative to the top of the inner casing, then mark that reference point and note that location in the field logbook. Record information on depth to ground water in the field logbook or ground water sampling log. Measure the depth to water a second time to confirm initial measurement; measurement should agree within 0.01 feet or re-measure.

7. Check the available well information or field information for the total depth of the monitoring well. Use the information from the depth of water in step six and the total depth of the monitoring well to calculate the volume of the water in the monitoring well or the volume of one casing. Record information in field logbook or ground-water sampling log.

<u>Purging and Sampling Activities</u>

8A. Non-dedicated system - Place the pump and support equipment at the wellhead and slowly lower the pump and tubing down into the monitoring well until the location of the pump intake is set

at a pre-determined location within the screen interval. The placement of the pump intake should be positioned with a calibrated sampling pump hose, sounded with a weighted-tape, or using a pre-measured hose. Refer to the available monitoring well information to determine the depth and length of the screen interval. Measure the depth of the pump intake while lowering the pump into location. Record pump location in field logbook or groundwater sampling log.

8B. Dedicated system - Pump has already been installed, refer to the available monitoring well information and record the depth of the pump intake in the field logbook or ground-water sampling log.

9. Non-dedicated system and dedicated system - Measure the water level (water level must be measured to nearest 0.01 feet) and record information on the ground-water sampling log, leave water level indicator probe in the monitoring well.

10. Non-dedicated and dedicated system - Connect the discharge line from the pump to a flow-through cell. A "T" connection is needed prior to the flow cell to allow for the collection of water for the turbidity measurements. The discharge line from the flow-through cell must be directed to a container to contain the purge water during the purging and sampling of the monitoring well.

11. Non-dedicated and dedicated system - Start pumping the well at a low flow rate (0.2 to 0.5 liter per minute) and slowly increase the speed. Check water level. Maintain a steady flow rate while maintaining a drawdown of less than 0.33 feet (Puls and Barcelona, 1996). If drawdown is greater than 0.33 feet lower the flow rate. 0.33 feet is a goal to help guide with the flow rate adjustment. It should be noted that this goal may be difficult to achieve under some circumstances due to geologic heterogeneities within the screened interval, and may require adjustment based on site-specific conditions and personal experience (Puls and Barcelona, 1996).

12. Non-dedicated and dedicated system - Measure the discharge rate of the pump with a graduated cylinder and a stop watch. Also, measure the water level and record both flow rate and water level on the groundwater sampling log. Continue purging, monitor and record water level and pump rate every three to five minutes during purging. Pumping rates should be kept at minimal flow to

ensure minimal drawdown in the monitoring well.

13. Non-dedicated and dedicated system - During the purging, a minimum of one tubing volume (including the volume of water in the pump and flow cell) must be purged prior to recording the water-quality indicator parameters. Then monitor and record the water-quality indicator parameters every three to five minutes. The water-quality indicator field parameters are turbidity, dissolved oxygen, specific electrical conductance, pH, redox-potential and temperature. Oxidation-reduction potential may not always be an appropriate stabilization parameter, and will depend on site-specific conditions. However, readings should be recorded because of its value as a double check for oxidizing conditions. Also, for the final dissolved oxygen measurement, if the readings are less than 1 milligram per liter, it should be collected and analyze with the spectrophotometric method (Wilde et al., 1998 Wilkin et al., 2001), colorimetric or Winkler titration (Wilkin et al., 2001). The stabilization criterion is based on three successive readings of the water quality field parameters; the following are the criteria which must be used:

Parameter	**Stabilization Criteria**	**Reference**
pH	± 0.1 pH units	Puls and Barcelona, 1996; Wilde et al.,
Specific electrical conductance (SEC)	± 3% µS/cm	Puls and Barcelona, 1996
oxidation-reduction potential (ORP)	± 10 millivolts	Puls and Barcelona 1996
turbidity	± 10 % NTUs (when turbidity is greater than 10 NTUs)	Puls and Barcelona, 1996 Wilde et al., 1998
dissolved oxygen	± 0.3 milligrams per liter	Wilde et al., 1998

Once the criteria have been successfully met indicating that the water quality indicator parameters have stabilized, then sample collection can take place.

14. If a stabilized drawdown in the well can't be maintained at 0.33 feet and the water level is approaching the top of the screened interval, reduce the flow rate or turn the pump off (for 15 minutes) and allow for recovery. It should be noted whether or not the pump has a check valve. A check valve is required if the pump is shut off. Under no circumstances should the well be

pumped dry. Begin pumping at a lower flow rate, if the water draws-down to the top of the screened interval again turn pump off and allow for recovery. If two tubing volumes (including the volume of water in the pump and flow cell) have been removed during purging then sampling can proceed next time the pump is turned on. This information should be noted in the field notebook or ground-water sampling log with a recommendation for a different purging and sampling procedure.

15. Non-dedicated and dedicated system - Maintain the same pumping rate or reduce slightly for sampling (0.2 to 0.5 liter per minute) in order to minimize disturbance of the water column. Samples should be collected directly from the discharge port of the pump tubing prior to passing through the flow-through cell. Disconnect the pump's tubing from the flow-through-cell so that the samples are collected from the pump's discharge tubing. For samples collected for dissolved gases or Volatile Organic Compounds (VOCs) analyses, the pump's tubing needs to be completely full of ground water to prevent the ground water from being aerated as the ground water flows through the tubing. The sequence of the samples is immaterial unless filtered (dissolved) samples are collected and they must be collected last (Puls and Barcelona, 1996). All sample containers should be filled with minimal turbulence by allowing the ground water to flow from the tubing gently down the inside of the container. When filling the VOC samples a meniscus must be formed over the mouth of the vial to eliminate the formation of air bubbles and head space prior to capping. In the event that the ground water is turbid, (greater then 10 NTUs), a filtered metal (dissolved) sample also should be collected.

If filtered metal sample is to be collected, then an in-line filter is fitted at the end of the discharge tubing and the sample is collected after the filter. The in-line filter must be pre-rinsed following manufacturer's recommendations and if there are no recommendations for rinsing, a minimum of 0.5 to 1 liter of ground water from the monitoring well must pass through the filter prior to sampling.

16A. Non-dedicated system - Remove the pump from the monitoring well. Decontaminate the pump and dispose of the tubing if it is non-dedicated.

16B Dedicated system - Disconnect the tubing that extends from the plate at the wellhead (or cap) and discard after use.

17. Non-dedicated system - Before locking the monitoring well, measure and record the well depth (to 0.1 feet).
Measure the total depth a second time to confirm initial measurement; measurement should agree within 0.01 feet or re-measure.

18. Non-dedicated and dedicated system - Close and lock the well.

DECONTAMINATION PROCEDURES

Decontamination procedures for the water level meter and the water quality field parameter sensors.
The electronic water level indicator probe/steel tape and the water-quality field parameter sensors will be decontaminated by the following procedures:
1. The water level meter will be hand washed with phosphate free detergent and a scrubber, then thoroughly rinsed with distilled water.

2. Water quality field parameter sensors and flow-through cell will be rinsed with distilled water between sampling locations. No other decontamination procedures are necessary or recommended for these probes since they are sensitive. After the sampling event, the flow cell and sensors must be cleaned and maintained per the manufacturer's requirements.

Decontamination Procedure for the Sampling Pump

Upon completion of the ground water sample collection the sampling pump must be properly decontaminated between monitoring wells. The pump and discharge line including support cable and electrical wires which were in contact with the ground water in the well casing must be decontaminated by the following procedure:

1. The outside of the pump, tubing, support cable and electrical wires must be pressured sprayed with soapy water, tap water and distilled water. Spray outside of tubing and pump until water is flowing off of tubing after each rinse. Use bristle brush to help remove visible dirt and contaminants.
2.Place the sampling pump in a bucket or in a short PVC casing (4-in. diameter) with one end capped. The pump placed in this device must be completely submerged in the water. A small amount of phosphate free detergent must be added to the potable water

(tap water).
3. Remove the pump from the bucket or 4-in. casing and scrub the outside of the pump housing and cable.
4. Place pump and discharge line back in the 4-in. casing or bucket, start pump and re-circulate this soapy water for 2 minutes (wash).
5. Re-direct discharge line to a 55-gallon drum, continue to add 5 gallons of potable water (tap water)or until soapy water is no longer visible.
6. Turn pump off and place pump into a second bucket or 4-in. Casing which contains tap water, continue to add 5-gallons of tap water (rinse).
7. Turn pump off and place pump into a third bucket or 4-in. casing which contains distilled/deionized water, continue to add three to five gallons of distilled/deionized water (final rinse).
8. If a hydrophobic contaminant is present (such as separate phase, high levels of PCB's, etc.) An additional decon step, or steps, may be added. For example, an organic solvent, such as reagent-grade isopropanol alcool may be added as a first spraying/bucket prior to the soapy water rinse/bucket.

FIELD QUALITY CONTROL

Quality control (QC) samples must be collected to verify that sample collection and handling procedures were performed adequately and that they have not compromised the quality of the ground water samples. The appropriate EPA program guidance must be consulted in preparing the field QC sample requirements for the site-specific Quality Assurance Project Plan (QAPP).

There are five primary areas of concern for quality assurance (QA) in the collection of representative ground-water samples:

1. Obtaining a ground-water sample that is representative of the aquifer or zone of interest in the aquifer. Verification is based on the field log documenting that the field water-quality parameters stabilized during the purging of the well, prior to sample collection.
2. Ensuring that the purging and sampling devices are made of materials, and utilized in a manner, which will not interact with or alter the analyses.
3. Ensuring that results generated by these procedures are reproducible; therefore, the sampling scheme should incorporate co-located samples (duplicates).

4. Preventing cross-contamination. Sampling should proceed from least to most contaminated wells, if known. Field equipment blanks should be incorporated for all sampling and purging equipment, and decontamination of the equipment is therefore required.
5. Properly preserving, packaging, and shipping samples.

All field quality control samples must be prepared the same as regular investigation samples with regard to sample volume, containers, and preservation. The chain of custody procedures for the QC samples will be identical to the field ground water samples. The following are quality control samples which must be collected during the sampling event:

Sample Type	Frequency
• Field duplicates	1 per 20 samples
• Matrix spike	1 per 20 samples
• Matrix spike duplicate	1 per 20 samples
• Equipment blank	Per Regional requirements or policy
• Trip blank (VOCs)	1 per sample cooler
• Temperature blank	1 per sample cooler

HEALTH AND SAFETY CONSIDERATIONS

Depending on the site-specific contaminants, various protective programs must be implemented prior to sampling the first well. The site Health and Safety Plan should be reviewed with specific emphasis placed on the protection program planned for the sampling tasks. Standard safe operating practices should be followed, such as minimizing contact with potential contaminants in both the liquid and vapor phase through the use of appropriate personal protective equipment.

Depending on the type of contaminants expected or determined in previous sampling efforts, the following safe work practices will be employed:

Particulate or metals contaminants

1. Avoid skin contact with, and incidental ingestion of, purge water.
2. Use protective gloves and splash protection.

Volatile organic contaminants

1. Avoid breathing constituents venting from well.
2. Pre-survey the well head space with an appropriate device as specified in the Site Health and Safety Plan.
3. If monitoring results indicate elevated organic constituents, sampling activities may be conducted in level C protection. At a minimum, skin protection will be afforded by disposable protective clothing, such as Tyvek®.

General, common practices should include avoiding skin contact with water from preserved sample bottles, as this water will have pH less than 2 or greater than 10. Also, when filling pre-acidified VOA bottles, hydrochloric acid fumes may be released and should not be inhaled.

POST-SAMPLING ACTIVITIES

Several activities need to be completed and documented once ground-water sampling has been completed. These activities include, but are not limited to:

1. Ensure that all field equipment has been decontaminated and returned to proper storage location. Once the individual field equipment has been decontaminated, tag it with date of cleaning, site name, and name of individual responsible.
2. All sample paperwork should be processed, including copies provided to the Regional Laboratory, Sample Management Office, or other appropriate sample handling and tracking facility.
3. All field data should be complied for site records.
4. All analytical data when processed by the analytical laboratory, should be verified against field sheets to ensure all data has been returned to sampler.

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SAMPLING CHECKLIST

Well Identification:_____

Map of Site Included: Y or N
Wells Clearly Identified w/ Roads: Y or N
Well Construction Diagram Attached: Y or N

Well Construction:

Diameter of Borehole:_____ Diameter of Casing:_____
Casing Material:_____ Screen Material:_____

Screen Length:_____ Total Depth:_____

Approximate Depth to Water:_____
Maximum Well Development Pumping Rate:_____
Date of Last Well Development:_____

Previous Sampling Information:

Was the Well Sampled Previously: Y or N
(If Sampled, Fill Out Table Below)

Table of Previous Sampling Information

Parameter	Previously Sampled	Number of Times Sampled	Maximum Concentration	Notes (include previous purge rates)

Ground-Water Sampling Log

Site Name: **Well #:** **Date:**

Well Depth(Ft-BTOC[1]): **Screen Interval**(Ft):

Well Dia.: **Casing Material:** **Sampling Device:**

Pump placement(Ft from TOC[2]):

Measuring Point: **Water level (static)**(Ft):

Water level (pumping)(Ft): **Pump rate**(Liter/min):

Sampling Personnel:

Other info: (such as sample numbers, weather conditions and field notes)

Water Quality Indicator Parameters

Time	Pumping rates (L/min)	Water level (ft)	DO (mg/l)	ORP (mv)	Turb. (NTU)	SEC[3] (μS/cm)	pH	Temp. (C°)	Volume pumped (L)

Type of Sample collected:

1-casing volume was:

Total volume purged prior to sample collection:

Stabilization Criteria		
DO	±	0.3 mg/l
Turb.	±	10%
SEC	±	3%
ORP	±	10 mv
pH	±	0.1 unit

[1]**BTOC-Below Top of Casing**
[2]**TOC-Top of Casing**
[3]**Specific electrical conductance**