Final

Travis Air Force Base
Environmental Management
Building 570, Travis AFB, California
Environmental Restoration Program
Remedial Program Manager's
Meeting Minutes

27 January 2010, 0930 Hours

Mr. Mark Smith, Travis Air Force Base (AFB), conducted the Remedial Program Manager's (RPM) meeting on 27 January 2009 at 0930 in the Base Civil Engineer's Conference Room, Building 570, Travis AFB, California. Attendees included:

• Glenn Anderson	Travis AFB
• Lonnie Duke	Travis AFB
• Mark Smith	Travis AFB
• Gregory Parrott	Travis AFB
• James Chang	U.S. Environmental Protection Agency (USEPA)
• Alan Friedman	California Regional Water Quality Control Board (Water Board)
• Jose Salcedo	California Department of Toxic Substances Control (DTSC)
• Dezso Linbrunner	United States Army Corp of Engineers (USACE), Omaha District
• Rachel Hess	ITSI
• Mike Wray	CH2M HILL
• Doug Berwick	CH2M HILL
• Doug Downey	CH2M HILL
• Loren Krook	CH2M HILL

Handouts distributed at the meeting and presentations included:

• Attachment 1	Meeting Agenda
• Attachment 2	Master Meeting, Teleconference, and Document Schedules
• Attachment 3	SBBGWTP Monthly Data Sheet (December 2009)
• Attachment 4	CGWTP Monthly Data Sheet (December 2009)
• Attachment 5	Presentation: Update Site DP039 Bioreactor Demonstration
• Attachment 6	Presentation: 2009 Field Investigations, Summary, and Next Steps.
• Attachment 7	Presentation: Program Update

1. ADMINISTRATIVE

A. Previous Meeting Minutes

The 21 October 2009 RPM meeting minutes were approved and finalized as written.

B. Action Item Review

Actions Items from October were reviewed.

Action item 1 - Closed.

Action item 2 - Closed.

Action item 3 - Closed.

Action item 4 - Closed.

C. Master Meeting and Document Schedule Review (attachment 2)

The Travis AFB Master Meeting and Document Schedule was discussed during this meeting (see Attachment 2).

Travis AFB Annual Meeting and Teleconference Schedule

— The next RPM meeting will be moved from 31 March 2010 to 30 March 2010 and start at 0800, with a Focused Feasibility Study (FFS) scoping meeting to follow. The date change avoids a schedule conflict with a State Holiday on 31 March 2010. The next RAB meeting is scheduled for 22 April 2010. Possible Adhoc meeting to be held on 3 March 2010 for Response to Comments for NAAR and VI Report, if needed. Mr. Chang questioned response to comments dated today's date on the schedule. Mr. Anderson said it is not due today, that date was tentative and optimistic. Mr. Chang suggested that we hold future RPM and RAB meetings on the same day to optimize his work schedule and travel time. Mr. Smith agreed, and will try to schedule the RPM and RAB meetings on the same day.

Travis AFB Master Document Schedule

— Focused Feasibility Study (FFS): FFS, PP and ROD are now on the same page to view at a glance. Mr. Chang suggested holding a scoping meeting for the FFS to get an open discussion and streamline the document review. Mr. Anderson suggested having a scoping meeting in the afternoon after the next RPM meeting in March. Mr. Chang suggested a presentation of a "straw man" of the proposed RAOs remediation alternatives in the FFS.

- Proposed Plan (PP): Hold the PP Public meeting on the same date as a RAB meeting in the interest of time and getting the Public to attend. May possibly be moved to the April 2011 RAB meeting date.
- Record of Decision (ROD): Mr. Anderson recognizes 2011 is very optimistic as all the bases are looking at the 2012 due date for achieving remedy-in-place (RIP).
- Potrero Hills Annex: FFS, PP, and ROD: Mr. Anderson said Travis added on 500 extra days. The dates are tentative and subject to change.
- Union Creek Sites SD001 and SD033 Remedial Action Report: Is undergoing internal draft review. Travis allocated 60 days for draft review.
- Vapor Intrusion Assessment Report: This project is funded separately from the PBC, and it is near the end date of its period of performance (POP), which is the end of March 2010. Travis needs comments back within that period. Mr. Chang forwarded the report on to Mr. Stralka and will check with him to see if they can meet deadline.
- Natural Attenuation Assessment Report (NAAR): Mr. Anderson said they have received all the comments from the regulatory agencies. Travis will set up an FTP site that will have all the changes as well as a link to CH2M HILL table to view on-line. Mr. Anderson will send out an explanatory email next week.
- DP039 RPO Work Plan: Mr. Salcedo said DTSC had no comments. Travis to finalize.
- FT005 Data Gap Work Plan: Travis to start site characterization when the weather clears.
- SD036/SD037 RPO Work Plan: Ready to finalize.
- ST027B Site Characterization Report: Schedule for submittal of the pre-draft in early March.
- LF008 Rebound Test Technical Memorandum: Will be finalized next month.
- Quarterly Newsletter (Jan 2010): Mr. Salcedo and Mr. Friedman both said it looks very good. Mr. Anderson will start finalizing tomorrow.
- 2008/2009 GSAP: Regulators are still reviewing. Mr. Smith said the GSAP report suggests wells that can be decommissioned – which Travis will be looking into. This action will be reviewed very carefully so as not to decommission wells that we will need down the road. Mr. Chang added, when looking at decommissioning the wells, to think about future sampling needs to confirm cleanup validation.
- 2009 GWTP RPO Annual Report: Scheduled to go out draft in April.
- CAMU annual report not listed on schedule – will be coming out today after Mark Smith signs the cover letter.

— Model QAPP Update: Moved to historical.

— Comprehensive Site Evaluation Phase II Work Plan: Moved to historical.

— Field Sampling Plan: Moved to historical.

— SS016 RPO Work Plan: Moved to historical.

— ST018 POCO Remedial Action Work Plan: Moved to historical.

2. CURRENT PROJECTS

A. Treatment Plant Operation and Maintenance Update

Mr. Duke reported on the water treatment plant status.

South Base Boundary Groundwater Treatment Plant (see Attachment 2)

The South Base Boundary Groundwater Treatment Plant (SBBGWTP) performed at 88.9% uptime, and 4.3 million gallons of groundwater were extracted and treated during the month of December 2009. All of the treated water was discharged to Union Creek. The average flow rate for the SBBGWTP was 84.5 gallons per minute (gpm) and electrical power usage was 19,860 kWh; 27,208 pounds of CO_2 was created (based on DOE calculation). Approximately 1.6 pounds of volatile organic compounds (VOCs) were removed in December. The total mass of VOCs removed since the startup of the system is 375 pounds (see Attachment 3).

No shutdowns or restarts occurred in December 2009. Samples were collected on 3 December 2009. Total VOC concentration was again, very low. TCE and CIS-1,2-DEC were the only VOCs detected in the influent sample. 1,2-Dichloroethane, the indicator chemical for Site FT005, was not detected in the influent sample. VOCs were not detected in the effluent sample, indicating good treatment efficiency.

Mr. Chang questioned why Travis wasn't using in situ chemox for the concentrated areas of VOCs, adding it's very effective and uses a lot less energy. Mr. Wray answered that the cost is prohibitive and that the VOCs are slightly above MCL.

Central Groundwater Treatment Plant (see Attachment 4)

The CGWTP performed at 100% uptime with approximately 2.0 million gallons of groundwater extracted and treated during the month of December 2009. All treated water was diverted to the storm drain. The average flow rate for the CGWTP, while operating, was 34.0 gpm and electrical power usage was 26,802 kWh for all equipment connected to the Central plant; approximately 36,719 pounds of CO_2 was created. Natural gas usage for the ThOx was 3,172 therms. Approximately 5.59 pounds of VOCs were removed from groundwater, and 19.57 pounds from vapor, in December. The total mass of VOCs removed since the startup of the system is 11,135 pounds (see Attachment 4).

The December 2009 monitoring period included several days from January 2010 due to a power outage that affected several areas across the base, including the WTTP and ThOx. As a result of the power outage, several meters could not be read between December 30 and January 04.

North Groundwater Treatment Plant

Not yet operational. The plant is off-line to convert to carbon treatment only. Carbon is in place, initial sampling has been completed, still waiting for lab results. System cannot be turned on until Vernal Pools dry up. LF007 extraction wells are all solar power, fully sustainable.

3. PRESENTATIONS

A. Bioreactor (see Attachment 5)

Mr. Downey gave a presentation of the DP039 Bioreactor Demonstration Update. Mr. Downey began by thanking everyone for their help in reviewing the documents quickly for the in situ Bioreactor. Due to the quick reviews, Travis was able to get the bioreactor in the ground within 3 months. The bioreactor research project was funded by the AFCEE BAA program. The contract was awarded on 27 September 2008 and ends 03 March 2011 (includes a 6 month extension).

Travis AFB was using an energy intensive dual phase extraction technology at Site DP039 previously that ran its course. An alternative sustainable technology to the previous system is the solar-powered in-situ bioreactor, which is cost efficient and a sustainable remedy. This technology is now being installed at two other Air Force Bases. There is a lot of good technology data coming from this project that will be applicable to Travis AFB as well as to other facilities. The approach was to excavate several hundred cubic yards of soil material right from where the contaminant source was located. The excavation was then filled with a mixture of tree mulch, gravel, iron pyrite, and gypsum to make the bioreactor. The in situ bioreactor provides the ingredients needed to enhance reductive de-chlorination and promote anaerobic reactions favorable to TCE destruction. An advantage of this technology is that not only is TCE, DCE and vinyl chloride destroyed biologically, but in an iron rich environment, you can get non-biotic or A-biotic destruction of those compounds. Mr. Downey shared results from the last two sampling rounds. (sample results are attached), provided maps and cross sections (also in attached).

This bioreactor is a very simple system, simple to install, and simple to operate. The old extraction well EW563, right in the middle of the bioreactor, is now being used as a monitoring well. The goal is to drive oxidation-reduction potential (ORP) to negative. Data on the map presented shows the ORP reduction since the bioreactor installation.

Mr. Smith asked about the 430 mg/L TOC result, and whether that was the value after in the bioreactor was installed? Mr. Downey said those are the baseline numbers and the TOC analysis samples were taken when the bioreactor was first started up. Mr. Anderson added that it had rained before the bioreactor first started up, which could have contributed to the high TOC results.

Summary of Performance: The solar powered pump is very reliable, and has re-circulated over 220,000 gallons of water (2 gpm during sunlight hours). ORP continues to drop in all monitoring wells indicating organic substrate is slowly spreading and creating anaerobic conditions within 30 feet of the bioreactor. An estimated 75% reduction of TCE has occurred in the aquifer, based on data from the performance monitoring wells. The bioreactor is achieving 99% TCE destruction and 77% total molar reduction. The data shows only minimal vinyl chloride formation (<5 µg/L). Mr. Smith asked if it is possible that vinyl chloride does not exist in this environment long enough. Mr. Downey said a couple things could be happening here. By putting iron in the bottom of the reactor, the goal is to promote non-biologic or aerobic destruction. The other reason is the aerobic cloud in the aquifer that surrounds the anaerobic zone in the source area, once you get far enough away from the bioreactor. When there is enough oxygen in the water, vinyl chloride de-grades very quickly. It could be the two-step process. Mr. Smith asked about ethane/ethane and methane. Mr. Downy said there is methane and low hits of ethane/ethane; both are short-lived and do not build up.

Current issues: The goal of 20 mg/L TOC has not yet been achieved in all the wells. Recirculation of organic substrate is a slow process due to low vertical permeability through silt and clay layers and due to natural substrate demand by the soils. Annual substrate recharge may be needed (vegoil, whey, fructose), which is estimated to have a cost of approximately $5000.00 per recharge. Costs can be kept low due to the use of simple gravity feed into the top of the bioreactor.

One commenter from the group asked if the bioreactor could achieve cleanup in a reasonable time. Mr. Downey indicated it would be faster than pump-and-treat.

B. **Status of Current Investigations (see Attachment 6)** Mr. Wray gave the following presentation, titled 2009 Field Investigations, Summary and Next Steps. Several investigations were conducted in 2009 and data from the following sites was presented at the RPM meeting: Site DP039 Mid-Plume, Site SS016 Source Area, Site SS030 Eastern Edge of Plume, Site SD036 Hot Spot, Site SD037 Hot Spot, and Site ST027B Plume Characterization.

1) **Site DP039** is located in the WABOU. The contaminant plume of TCE originated near Building 755, which was demolished in September 2009. Remedial processes in the area have included a Bioreactor (in the source area), Permeable Reactive Barrier (not very effective, it was experimental), Phytoremediation, Soil Vapor Extraction (SVE), Groundwater Extraction and Treatment (GET), and Monitored Natural Attenuation (MNA).

Maps and cross-sections of the site were presented showing the TCE concentration contours, and soil lithology (maps and cross sections included in attachment 6). The 500 µg/L TCE plume was defined in all directions and vertically. Bedrock was encountered at about 50 to 60 feet below ground surface across the planned biobarrier area.

Next steps: For the biobarrier monitoring network, install three new monitoring wells to complement the existing well pairs, for a total of fifteen monitoring wells. Install ten emulsified vegetable oil (EVO) injection wells across the plume downgradient of the 500 µg/L TCE contour. Inject about 25,000 lbs of EVO to form the biobarrier. Initiate performance monitoring of the remedy optimization. Prepare a completion report after EVO injection is complete. Evaluate ongoing progress in the GSAP reports.

Performance Monitoring Plan for the Biobarrier: Use six upgradient wells, three performance wells (injection wells), and six downgradient compliance wells. Analytes: VOCs, Dissolved Hydrocarbon Gasses, Total Organic Carbon, Nitrate/Nitrite, Sulfate, Chloride, Sulfide, Ferrous Iron, Alkalinity, pH, ORP, Temperature, EC, DO. Frequency of monitoring: Pre-installation – sample all wells in a baseline event. Post-installation – sample the monitoring network semi-annually for the first two years, then annually thereafter.

2) **Site SS016** located in the NEWIOU. The OSA source area is located in the northwest corner of Site SS016. The OSA TCE contaminant plume travels southeast beneath the active runway. The existing remedial processes include groundwater and soil vapor extraction, and treatment. The groundwater extraction system is designed to capture VOC concentrations greater than 1,000 µg/L. The 5-year reviews in 2003 and 2008 concluded that the source control objective is being met.

   Work plan approach: Define the TCE plume to 1,000 µg/L. Confirm source areas. Utilize findings during characterization activities to optimize injection of Emulsified Vegetable Oil (EVO). The source of the plume was confirmed to be the wash rack near building 18. TCE was found mostly in the shallow part of the bedrock, just below the alluvium-bedrock contact.

   Maps and cross-sections of the site were presented showing the TCE concentrations and soil lithology (maps included in attachment 6). The investigation results indicate that the source of TCE appears to be the Wash Rack. The 1,000 µg/L TCE plume was defined in the source area, and the TCE contamination was found mostly in the shallow fractured bedrock. The alluvial layer was found above about 15 feet below ground surface in the source area, and was also quite dry.

   Next Steps: Excavate the highly contaminated soil in the wash rack area (20x20x20 ft) down to a few feet below the bedrock interface. This excavation is expected to remove a large mass of the TCE in the soil. Create a gravel/mulch

bioreactor in the excavation. Potentially install a collection trench across the source area plume and tie into the existing horizontal well (EW03x16), if appropriate. Re-circulate extracted groundwater through the bioreactor with sustainable solar powered pumps. Install two new monitoring wells to complement the existing monitoring of the effectiveness of the bioreactor. Prepare a completion report after the optimization is accomplished. Evaluate ongoing progress in the GSAP reports. Attachment 6 shows the bioreactor design. This bioreactor approach reflects a significant change from the planned EVO injections, due to the discovery of the solvent source area at the Wash Rack.

Performance Monitoring Plan: The monitoring well network will include three wells downgradient from the bioreactor, and one new well upgradient from the bioreactor. Analytes: VOCs, Dissolved Hydrocarbon Gasses, Total Organic Carbon, Nitrate/Nitrite, Sulfate, Chloride, Sulfide, Ferrous Iron, Alkalinity, pH, ORP, Temperature, EC, DO. Frequency of monitoring: Pre-installation - sample all wells in a baseline event. Post-installation - sample semi-annually for the first two years, then annually thereafter.

3) **Site SS030** is one of three off-base groundwater plumes, located in the southern part of the base. TCE is the only contaminant detected above the interim remedial goal (IRG). Travis has an existing easement that covers the previously known extent of the off-base plume. Groundwater IRA objectives specified in the IROD included off-base remediation using extraction wells to remove the TCE to below the IRG of 5 µg/L. The second 5-year review shows increasing TCE concentrations on the east side of the plume indicating contamination may be escaping hydraulic capture in that direction. There are insufficient monitoring wells to assess the extent of the contamination and the local groundwater flow direction. For the site investigation, samples were collected from five borings on the eastern side of the plume/easement. Three of the four hydropunch samples on the easement boundary were greater than the IRG for TCE. Mr. Duke and Mr. Linbrunner were able to get a right-of-entry agreement from the landowner, so that samples could be collected to the east. Samples collected east of the easement boundary were below the IRG for TCE. A pair of monitoring wells was installed on the easement boundary to provide ongoing monitoring on the eastern edge of the plume. Sample results from the well pair are 10 and 15 µg/L TCE, slightly above the IRG.

   Maps and cross-sections were presented of the site showing the TCE concentrations and soil lithology (maps included in attachment 6).

   Next Steps: Maximize groundwater extraction at the site, restart extraction well EW03x30. Monitor groundwater levels and TCE concentration across the site during annual GSAP event in May and June 2010. Determine if additional monitoring wells or extraction wells are needed to capture the TCE plume; based on 2010 GSAP data.

4) **Sites SD036 and SD037** are located in the WIOU in the western portion of the base. The hot spots of TCE contamination are in one small area near the sanitary sewer line at each site. Existing remedial processes in the area include both groundwater and soil vapor extraction and treatment.

   The investigation results for Site SD036 show that bedrock is deeper than originally thought – approximately 100 ft. The 1,000 µg/L TCE plume is defined to the east, south and west. TCE concentrations greater than 10,000 µg/L were found in the northern portion of the hot spot area. More investigation is needed to the southwest, north, and the northeast of the hot spot.

   Maps and cross-section of the site show the TCE concentrations and soil lithology (maps included in attachment 6).

   Next Steps: Step out to the southwest, north and northeast. Define the hot spot, and optimize the EVO injection design. Identify locations of EVO injection points and monitoring well network. Conduct remedy optimization, (presumably EVO injection) followed by implementation of performance monitoring. Prepare a completion report after EVO injection is accomplished. Evaluate ongoing progress in GSAP reports.

   Mr. Chang asked what the time frame was for getting back out in the field. Mr. Wray said with in the next 4 to 6 weeks.

   The investigation results for Site SD037 show that bedrock was encountered at about 45 to 70 ft below ground surface. Bedrock was relatively soft and difficult to determine. The 1,000 µg/L TCE plume was defined laterally and vertically except to the east beneath the new two-bay hangar. No TCE concentrations in the hot spot area appear to be significantly greater than 1,000 µg/L.

   Maps and cross-section of the site were presented showing the TCE concentrations and soil lithology (maps included in attachment).

   Next steps: Install downgradient well pairs at two locations. Install six EVO injection wells in the hot spot. Inject 36,000 lbs of EVO and monitor effectiveness. Initiate performance monitoring of the remedy optimization. Prepare completion report after EVO injection is accomplished. Evaluate ongoing progress in GSAP report.

   Monitoring plan: Two upgradient wells, three performance (injection) wells, and four compliance wells will be used to monitor progress. Analytes: VOCs, Dissolved Hydrocarbon Gasses, Total Organic Carbon, Nitrate/Nitrite, Sulfate, Chloride, Sulfide, Ferrous Iron, Alkalinity, pH, ORP, Temperature, EC, DO. Frequency of monitoring; Pre-installation - sample all wells in baseline event. Post-installation - sample semi-annually for the first two years, then annually thereafter.

Mr. Chang recommended including a remedy in the ROD to address the possible increase in toxicity (vinyl chloride), if it does increase, resulting from the EVO injection.

C. Program Update: Activities Completed, In Progress, and Upcoming (see Attachment 7)

Mr. Wray gave an update on program field work and documents.

The following documents were added to the "Completed Documents" slide:

Model QAPP.

LF008 Rebound Test Tech Memo.

Comprehensive Site Evaluation Phase II Work Plan.

Field Sampling Plan (FSP).

SS016 RPO Work Plan.

ST018 POCO RA Work Plan.

The following field investigations were added to the "Completed Field Work" Slide:

DP039 Site Characterization (mid plume).

ST018 Site Characterization.

SS030 Site Characterization (off-site VOC plume).

DP039 Site Characterization (for Biobarrier Placement).

The following items were added to the "In-Progress Documents & Field Work" Slide (note there is no field work currently in progress):

2008/2009 GSAP Annual Report (draft).

Vapor Intrusion Assessment Report (draft).

Quarterly Newsletter – January 2010 (draft).

The following items were added to the "Upcoming Documents & Field Work" Slide:

Documents:

FT005 Data Gap Work Plan scheduled for February.

Union Creek Site SD001 and SD033 Remedial Action scheduled for March.

2009 GWTP RPO Annual Report scheduled for April.

Field Work:

SD036 Site Characterization (north and east).

DP039 Biobarrier Installation.

SD037 EOS Injection TDB.

SS016 Bioreactor and Cutoff Wall Installation.

ST018 GETS Installation.

SS015 Site Characterization.

SS014 and ST032 Q1 2010 MNA Sampling scheduled for March.

2009 GSAP Annual Event scheduled for May.

4. NEW ACTION ITEM REVIEW

Mr. Smith to schedule a FFS scoping meeting for 30 March.

CH2M HILL to present a "straw man" presentation for the FFS scoping meeting.

Mr.Wray to talk to Ms. Eisert, about proposing to US Fish and Wildlife to turn pumps on all year round at LF007C.

5. PROGRAM/ISSUES/UPDATE

None.

General Discussion

The 30 March 2010 RPM meeting is scheduled to start at 0800 with FFS scoping meeting to follow. The RPM meeting scheduled in April was changed to the afternoon on the same day as the RAB meeting (22 April).

5. Action Items

1.	Air Force	Update document schedule to include revised names and dates in Remedial Action Work Plan for Sediment Sites	July 2009	**Closed**
2.	Air Force	Update document schedule to include revised names and dates for interim plans for FT005	October 2009	**Closed**
3.	Air Force	Coordinate site visit of sediment excavations with RAB members	September 2009	**Closed**
4.	Air Force	Prepare the Meeting schedule for RPM and RAB meetings in 2010	TDB	**Closed**

TRAVIS AIR FORCE BASE
ENVIRONMENTAL RESTORATION PROGRAM
REMEDIAL PROGRAM MANAGER'S MEETING
27 January 2010, 9:30 A.M.
AGENDA

1. ADMINISTRATIVE

   A. PREVIOUS MEETING MINUTES
   B. ACTION ITEM REVIEW
   C. MASTER MEETING AND DOCUMENT SCHEDULE REVIEW

2. CURRENT PROJECTS

   A. TREATMENT PLANT OPERATION AND MAINTENANCE UPDATE (LONNIE)
   B. MILITARY MUNITIONS RESPONSE PROGRAM UPDATE (GLENN)
   C. DP039 BIOREACTOR DEMONSTRATION UPDATE (CH2M HILL)

3. PRESENTATIONS

   A. STATUS OF CURRENT INVESTIGATIONS
      (1). DP039
      (2). SS016
      (3). SS030
      (4). SD036/SD037
   B. PROGRAM UPDATE: ACTIVITIES COMPLETED, IN PROGRESS AND UPCOMING

4. NEW ACTION ITEM REVIEW

5. PROGRAM/ISSUES/UPDATE

6. POTENTIAL RESPONSE TO COMMENTS MEETINGS
   NAAR
   2009 ANNUAL GSAP REPORT

Travis AFB Master Document Schedule

Annual Meeting and Teleconference Schedule

Monthly RPM Meeting (Begins at 9:30 a.m.)	RPM Teleconference (Begins at 9:30 a.m.)	Restoration Advisory Board Meeting (Begins at 7:00 p.m.) (Poster Session at 6:30 p.m.)
01-27-10	—	—
—	—	—
03-31-10	—	—
04-21-10	—	04-22-10
05-19-10	—	—
06-23-10	—	—
07-21-10	—	—
08-25-10	—	—
09-22-10	—	—
10-20-10	—	10-21-10
—	11-17-10	—
12-08-10	—	—

Travis AFB Master Document Schedule

PRIMARY DOCUMENTS			
Life Cycle	**Basewide Groundwater**		
	Focused Feasibility Study Travis, Glenn Anderson CH2M Hill, Loren Krook	**Proposed Plan Travis, Glenn Anderson CH2M HILL, Tony Jaegel**	**Record of Decision Travis, Glenn Anderson CH2M HILL, Tony Jaegel**
Scoping Meeting	**NA**	NA	**01-24-07**
Predraft to AF/Service Center	03-24-10	06-07-10	10-06-10
AF/Service Center Comments Due	04-07-10	06-17-10	10-20-10
Draft to Agencies	04-21-10	06-24-10	11-03-10
Draft to RAB	04-21-10	06-24-10	11-03-10
Agency Comments Due	06-23-10	08-23-10	12-29-10
Response to Comments Meeting	**07-21-10**	**08-31-10**	01-12-11
Agency Concurrence with Remedy	NA	NA	01-19-11
Public Comment Period	NA	10-12-10 to 11-12-10	NA
Public Meeting	**NA**	**10-21-10**	**NA**
Response to Comments Due	08-24-10	09-07-10	01-26-11
Draft Final Due	08-24-10	9-07-10	01-26-11
Final Due	09-23-10	10-07-10	02-23-11

PRIMARY DOCUMENTS				
	Potrero Hills Annex Travis, Glenn Anderson			Union Creek Sites SD001 &SD033 Remedial Action Travis, Lonnie Duke ITSI, Rachel Hess
Life Cycle	FFS	**Proposed Plan**	**ROD**	**Completion Report**
Scoping Meeting	**180 days after Water Board Order Rescinded**	**+470 days**	**+735 days**	**NA**
Predraft to AF/Service Center	+ 270 days	+530 days	+ 915 days	01/06/10
AF/Service Center Comments Due	+ 300 days	+560 days	+ 975 days	02/05/10
Draft to Agencies	+330 days	+590 days	+ 1035 days	03/01/10
Draft to RAB	+ 330 days	+590 days	+ 1035 days	03/01/10
Agency Comments Due	+390 days	+650 days	+ 1095 days	05/05/10
Response to Comments Meeting	**+ 405 days**	**+665 days**	**+ 1110 days**	**05/19/10**
Agency Concurrence with Remedy	NA	NA	+ 1130 days	NA
Public Comment Period	NA	+735 to 765 days	NA	NA
Public Meeting	**NA**	**+745 days**	**NA**	**NA**
Response to Comments Due	+430 days	+695days	+ 1190 days	06/02/10
Draft Final Due	+430 days	+695 days	+ 1190 days	06/02/10
Final Due	+460 days	+725 days	+ 1250 days	07/02/10

SECONDARY DOCUMENTS		
Life Cycle	**Phases 1 and 2 Vapor Intrusion Report Travis, Glenn Anderson CH2M HILL, Leslie Royer**	**Vapor Intrusion Assessment Report** Travis, Glenn Anderson CH2M HILL, Leslie Royer**
Scoping Meeting	**NA**	**NA**
Predraft to AF/Service Center	12-08-08	01-04-10
AF/Service Center Comments Due	12-15-08	01-14-10
Draft to Agencies	01-12-09	01-22-10
Draft to RAB	01-12-09	01-22-10
Agency Comments Due	02-17-09	02-26-10
Response to Comments Meeting	**02-25-09**	03-03-10
Response to Comments Due	TBD*	03-24-10
Draft Final Due	NA	NA
Final Due	TBD*	03-24-10
Public Comment Period	NA	NA
Public Meeting	**NA**	**NA**

*The Vapor Intrusion report will be rescheduled to incorporate the Phase 3 data and evaluation per discussion with EPA on 30 March 2009.

**The Vapor Intrusion Assessment Report contains the results of Phases 1, 2, and 3 of the Vapor Intrusion Assessment and a data evaluation. This report complies with the decisions made during the 30 March 2009 EPA-Travis AFB meeting.

SECONDARY DOCUMENTS			
Life Cycle	**Natural Attenuation Assessment Report Travis AFB, Glenn Anderson CH2M HILL, Leslie Royer**	**DP039 RPO Work Plan Travis AFB, Glenn Anderson CH2M HILL, Loren Krook**	**FT005 Data Gap Work Plan Travis, Lonnie Duke ITSI, Rachel Hess**
Scoping Meeting	**NA**	**NA**	**NA**
Predraft to AF/Service Center	07-07-09	09-17-09	10/22/09
AF/Service Center Comments Due	07-21-09	10-01-09	11/20/09
Draft to Agencies	08-26-09	10-11-09	02/05/10
Draft to RAB	08-26-09	10-11-09	02/05/10
Agency Comments Due	10-15-09	11-13-09 (TBD)	03/08/10
Response to Comments Meeting	**01-27-10**	**12-09-09**	**03/31/10**
Response to Comments Due	02-24-10	02-11-10	04/22/10
Draft Final Due	NA	NA	NA
Final Due	02-24-10	02-11-10	04/22/10
Public Comment Period	NA	NA	NA
Public Meeting	**NA**	**NA**	**NA**

SECONDARY DOCUMENTS			
Life Cycle	**SD036/SD037 RPO Work Plan Travis AFB, Lonnie Duke CH2M HILL, Tony Chakurian**	**ST027B Site Characterization Report Travis AFB, Lonnie Duke CH2M HILL, Gavan Heinrich**	**LF008 Rebound Test Technical Memorandum Travis AFB, Glenn Anderson CH2M HILL, Doug Berwick**
Scoping Meeting	**NA**	**NA**	**NA**
Predraft to AF/Service Center	08-13-09	02-22-10	08-14-09
AF/Service Center Comments Due	08-27-09	03-08-10	08-28-09
Draft to Agencies	10-01-09	03-23-10	09-17-09
Draft to RAB	10-01-09	03-23-10	09-17-09
Agency Comments Due	11-02-09 (TBD)	04-20-10	10-19-09 (11-04-09)
Response to Comments Meeting	**11-16-09 (TBD)**	**04-21-10**	**10-21-09 (12-09-09)**
Response to Comments Due	12-22-09 (TBD)	05-07-10	11-10-09 (12-11-09)
Draft Final Due	NA	NA	NA
Final Due	12-22-09 (TBD)	05-07-10	11-10-09 (01-20-10)
Public Comment Period	NA	NA	NA
Public Meeting	**NA**	**NA**	**NA**

INFORMATIONAL DOCUMENTS			
Life Cycle	**Quarterly Newsletters (Jan 2010) Travis, Glenn Anderson**	**2008/2009 GSAP Travis AFB, Lonnie Duke CH2M HILL, Leslie Royer**	**2009 GWTP RPO Annual Report Travis AFB, Lonnie Duke CH2M HILL, Doug Berwick**
Scoping Meeting	**NA**	**NA**	**NA**
Predraft to AF/Service Center	NA	10-26-09	02-19-10
AF/Service Center Comments Due	NA	11-09-09	03-19-10
Draft to Agencies	01-13-10	12-07-09	04-02-10
Draft to RAB	NA	12-07-09	04-02-10
Agency Comments Due	01-22-10	01-15-10	05-04-10
Response to Comments Meeting	**TBD**	**01-27-10**	**05-19-10**
Response to Comments Due	01-27-10	02-24-10	05-21-10
Draft Final Due	NA	NA	NA
Final Due	01-29-10	02-24-10	05-21-10
Public Comment Period	NA	**NA**	**NA**
Public Meeting	**NA**	**NA**	**NA**

HISTORICAL			
Life Cycle	**Model QAPP Update Travis, Glenn Anderson ITSI, Rachel Hess**	**Comprehensive Site Evaluation Phase II Work Plan Travis, Glenn Anderson Sky Research, Ian Roberts**	**Field Sampling Plan Travis AFB, Glenn Anderson CH2M HILL, Loren Krook**
Scoping Meeting	**06-26-09**	**NA**	**NA**
Predraft to AF/Service Center	07-03-09	01-15-09	04-28-09
AF/Service Center Comments Due	07-10-09	02-12-09	05-12-09
Draft to Agencies	07-20-09	04-29-09	06-26-09
Draft to RAB	07-20-09	04-29-09	06-26-09
Agency Comments Due	08-18-09	08-10-09	07-27-09 (08-20-09)
Response to Comments Meeting	**08-26-09**	**09-23-09**	**09-23-09**
Response to Comments Due	08-24-09	09-28-09	09-08-09
Draft Final Due	09-01-09	10-13-09	09-28-09
Final Due	10-02-09	11-13-09	11-04-09
Public Comment Period	NA	NA	NA
Public Meeting	**NA**	**NA**	**NA**

HISTORICAL		
Life Cycle	**SS016 RPO Work Plan Travis AFB, Lonnie Duke CH2M HILL, Doug Berwick**	**ST018 POCO Remedial Action Work Plan Travis AFB, Lonnie Duke CH2M HILL, Gavan Heinrich**
Scoping Meeting	**NA**	**NA**
Predraft to AF/Service Center	06-11-09	08-18-09
AF/Service Center Comments Due	06-25-09	09-01-09
Draft to Agencies	07-02-09	09-15-09
Draft to RAB	07-02-09	09-15-09
Agency Comments Due	08-26-09	10-13-09
Response to Comments Meeting	09-23-09	**10-21-09**
Response to Comments Due	11-02-09	11-24-09
Draft Final Due	NA	NA
Final Due	11-02-09	11-24-09
Public Comment Period	NA	NA
Public Meeting	**NA**	**NA**

South Base Boundary Groundwater Treatment Plant
Monthly Data Sheet

Report Number: 113 Reporting Period: 25 November – 4 January 2010 Date Submitted: 15 January 2010

This data sheet includes the following: results for the operation of the South Base Boundary Groundwater Treatment Plant (SBBGWTP), a summary of flow rates for the individual extraction wells, a brief description of any shutdowns or significant events related to the system, and a summary of analytical results for selected samples collected.

Operations Summary – December 2009

Operating Time: **853 hours** Percent Uptime: **88.9%**

Electrical Power Usage: **19,860 kWh**

Gallons Treated: **4.3 million gallons** Gallons Treated Since July 1998: **671 million gallons**

Volume Discharged to Union Creek: **4.3 million gallons**

VOC Mass Removed: **1.6 pounds**[a] VOC Mass Removed Since July 1998: **375 pounds**

Rolling 12-Month Cost per Pound of Mass Removed: $4,350[b]

Monthly Cost per Pound of Mass Removed: $2,646[b]

[a] Calculated using December 2009 EPA Method SW8260B analytical results.
[b] Costs include operations and maintenance, reporting, analytical laboratory, project management, and utility costs related to operation of the system.

Flow Rates

Average Groundwater Total Flow Rate: 84.5 gpm[a]

Average Flow Rate (gpm)[b]							
FT005[c]				SS029		SS030	
EW01x05	Off line	EW736x05	Off line	EW01x29	1.4	EW01x30	4.8
EW02x05	Off line	EW737x05	Off line	EW02x29	5.3	EW02x30	2.4
EW03x05	Off line	EW742x05	Off line	EW03x29	Off line[d]	EW03x30	Off line[d]
EW731x05	Off line	EW743x05	Off line	EW04x29	9.7	EW04x30	21.4
EW732x05	Off line	EW744x05	Off line	EW05x29	Off Line[e]	EW05x30	11.6
EW733x05	Off line	EW745x05	Off line	EW06x29	13.6	EW06x30	Dry
EW734x05	Off line	EW746x05	Off line	EW07x29	16.9	EW711x30	10.2
EW735x05	Off line						
FT005 Total:		**Off line**		**SS029 Total:**	**46.0**	**SS030 Total:**	**50.4**

[a] The average groundwater flow rate was calculated using the Union Creek Discharge Totalizer and dividing it by the operating time of the plant.
[b] Extraction well flow rates are based on the average of the weekly readings.
[c] Extraction wells at FT005 were taken off line in accordance with the *2008 Annual Remedial Process Optimization Report for the Central Groundwater Treatment Plant, North Groundwater Treatment Plant, and South Base Boundary Groundwater Treatment Plant.*
[d] Extraction well is off line due to low VOC concentrations.
[e] Extraction well offline due to faulty Variable Frequency Drive (VFD) at the well head.

gpm—gallons per minute

Shutdown/Restart Summary

Location	Shutdown		Restart		Cause
	Date	Time	Date	Time	
SBBGWTP (water)	30 December 2009	16:00	4 January 2010	14:30	Base power outage. Internal level switch fouled preventing lasting restart. Switch cleaned, system back online.

SBBGWTP = South Base Boundary Groundwater Treatment Plant

Summary of O&M Activities

Monthly groundwater samples at the SBBGWTP were collected on 3 December 2009. Sample results are presented in Table 1. The total VOC concentration (44.1 µg/L) in the influent sample has decreased since the November 2009 sample (60.4 µg/L) was collected. TCE and cis-1,2-DCE were the only VOCs detected in the influent sample. VOCs were not detected in the effluent sample, indicating good treatment efficiency.

The December 2009 monitoring period includes several days from January 2010 due to a power outage that affected several areas across the base, including the SBBGWTP. As a result of the power outage, several instrument meters could not be read between December 30 and January 04.

A system audit was performed on 2 November 2009 to determine the status of all wells from each of the three sites that feed into the SBBGWTP (SS029, SS030, FT005). Wells EW04x29, EW05x29, EW01x30, and EW711x30 were all malfunctioning, and all but EW711x30 was taken off line. In December 2009, well EW01x30 was placed back online after replacing its faulty pressure transducer. EW04x29 was likewise returned to service following repair to its flowmeter. The pump in well EW05x29 is damaged and needs to be replaced along with its associated VFD, so that well remains offline.

EW05x29 will be brought back online once replacement parts can be ordered and installed.

Optimization Activities

All of the FT005 extraction wells remained offline following completion of sediment removal work in September 2009. These extraction wells will remain off line for the remainder of the interim period (through December 2010) in accordance with the *2008 Annual Remedial Process Optimization Report for the Central Groundwater Treatment Plant, North Groundwater Treatment Plant, and South Base Boundary Groundwater Treatment Plant*, or until monitoring data indicate that one or more extraction wells should be brought back online.

As part of ongoing optimization efforts at Site SS030, well EW03x30 will be brought back online. This well was originally taken out of service in February 2004 due to low VOC concentrations in the vicinity of that well. Groundwater extraction from all wells within Site SS030, including EW03x30 will maximize capture of the Site SS030 VOC plume. It is anticipated that EW03x30 will be returned to service in January 2010.

No other optimization activities were performed.

Table 1
Summary of Groundwater Analytical Data for December 2009 – South Base Boundary Groundwater Treatment Plant

Constituent	Instantaneous Maximum[a] (µg/L)	Detection Limit (µg/L)	N/C	3 December 2009 (µg/L)	
				Influent	Effluent
Halogenated Volatile Organics					
Bromodichloromethane	5.0	0.15	0	ND	ND
Carbon Tetrachloride	0.5	0.14	0	ND	ND
Chloroform	5.0	0.16	0	ND	ND
Dibromochloromethane	5.0	0.13	0	ND	ND
1,1-Dichloroethane	5.0	0.19	0	ND	ND
1,2-Dichloroethane	0.5	0.15	0	ND	ND
1,1-Dichloroethene	5.0	0.19	0	ND	ND
cis-1,2-Dichloroethene	5.0	0.19	0	2.5	ND
trans-1,2-Dichloroethene	5.0	0.33	0	ND	ND
Methylene Chloride	5.0	0.66	0	ND	ND
Tetrachloroethene	5.0	0.21	0	ND	ND
1,1,1-Trichloroethane	5.0	0.14	0	ND	ND
1,1,2-Trichloroethane	5.0	0.20	0	ND	ND
Trichloroethene	5.0	0.19	0	41.6	ND
Vinyl Chloride	0.5	0.18	0	ND	ND
Non-Halogenated Volatile Organics					
Benzene	1.0	0.17	0	ND	ND
Ethylbenzene	5.0	0.22	0	ND	ND
Toluene	5.0	0.14	0	ND	ND
Xylenes	5.0	0.23 – 0.5	0	ND	ND
Other					
Total Petroleum Hydrocarbons – Gasoline	50	8.5	0	NM	ND
Total Petroleum Hydrocarbons – Diesel	50	50	0	NM	ND
Total Suspended Solids (mg/L)	NE	1.0	0	42	NM

[a] In accordance with Appendix B of the *Travis AFB South Base Boundary Groundwater Treatment Plant Operations and Maintenance Manual* (CH2M HILL, 2004).

J = analyte concentration is considered an estimated value
mg/L = milligrams per liter
N/C = number of samples out of compliance with discharge limits
ND = not detected
NE = not established
NM = not measured
µg/L = micrograms per liter

South Base Boundary Groundwater Treatment Plant
Monthly Data Sheet

Report Number: 113 Reporting Period: 25 November – 4 January 2010 Date Submitted: 15 January 2010

This data sheet includes the following: results for the operation of the South Base Boundary Groundwater Treatment Plant (SBBGWTP), a summary of flow rates for the individual extraction wells, a brief description of any shutdowns or significant events related to the system, and a summary of analytical results for selected samples collected.

Operations Summary – December 2009

Operating Time: **853 hours** Percent Uptime: **88.9%**

Electrical Power Usage: **19,860 kWh**

Gallons Treated: **4.3 million gallons** Gallons Treated Since July 1998: **671 million gallons**

Volume Discharged to Union Creek: **4.3 million gallons**

VOC Mass Removed: **1.6 pounds**[a] VOC Mass Removed Since July 1998: **375 pounds**

Rolling 12-Month Cost per Pound of Mass Removed: $4,350[b]

Monthly Cost per Pound of Mass Removed: $2,646[b]

[a] Calculated using December 2009 EPA Method SW8260B analytical results.
[b] Costs include operations and maintenance, reporting, analytical laboratory, project management, and utility costs related to operation of the system.

Flow Rates

Average Groundwater Total Flow Rate: 84.5 gpm[a]

Average Flow Rate (gpm)[b]							
FT005[c]				SS029		SS030	
EW01x05	Off line	EW736x05	Off line	EW01x29	1.4	EW01x30	4.8
EW02x05	Off line	EW737x05	Off line	EW02x29	5.3	EW02x30	2.4
EW03x05	Off line	EW742x05	Off line	EW03x29	Off line[d]	EW03x30	Off line[d]
EW731x05	Off line	EW743x05	Off line	EW04x29	9.7	EW04x30	21.4
EW732x05	Off line	EW744x05	Off line	EW05x29	Off Line[e]	EW05x30	11.6
EW733x05	Off line	EW745x05	Off line	EW06x29	13.6	EW06x30	Dry
EW734x05	Off line	EW746x05	Off line	EW07x29	16.9	EW711x30	10.2
EW735x05	Off line						
FT005 Total:		**Off line**		**SS029 Total:**	**46.0**	**SS030 Total:**	**50.4**

[a] The average groundwater flow rate was calculated using the Union Creek Discharge Totalizer and dividing it by the operating time of the plant.
[b] Extraction well flow rates are based on the average of the weekly readings.
[c] Extraction wells at FT005 were taken off line in accordance with the *2008 Annual Remedial Process Optimization Report for the Central Groundwater Treatment Plant, North Groundwater Treatment Plant, and South Base Boundary Groundwater Treatment Plant.*
[d] Extraction well is off line due to low VOC concentrations.
[e] Extraction well offline due to faulty Variable Frequency Drive (VFD) at the well head.

gpm—gallons per minute

Shutdown/Restart Summary

Location	Shutdown		Restart		Cause
	Date	Time	Date	Time	
SBBGWTP (water)	30 December 2009	16:00	4 January 2010	14:30	Base power outage. Internal level switch fouled preventing lasting restart. Switch cleaned, system back online.

SBBGWTP = South Base Boundary Groundwater Treatment Plant

Summary of O&M Activities

Monthly groundwater samples at the SBBGWTP were collected on 3 December 2009. Sample results are presented in Table 1. The total VOC concentration (44.1 µg/L) in the influent sample has decreased since the November 2009 sample (60.4 µg/L) was collected. TCE and cis-1,2-DCE were the only VOCs detected in the influent sample. VOCs were not detected in the effluent sample, indicating good treatment efficiency.

The December 2009 monitoring period includes several days from January 2010 due to a power outage that affected several areas across the base, including the SBBGWTP. As a result of the power outage, several instrument meters could not be read between December 30 and January 04.

A system audit was performed on 2 November 2009 to determine the status of all wells from each of the three sites that feed into the SBBGWTP (SS029, SS030, FT005). Wells EW04x29, EW05x29, EW01x30, and EW711x30 were all malfunctioning, and all but EW711x30 was taken off line. In December 2009, well EW01x30 was placed back online after replacing its faulty pressure transducer. EW04x29 was likewise returned to service following repair to its flowmeter. The pump in well EW05x29 is damaged and needs to be replaced along with its associated VFD, so that well remains offline.

EW05x29 will be brought back online once replacement parts can be ordered and installed.

Optimization Activities

All of the FT005 extraction wells remained offline following completion of sediment removal work in September 2009. These extraction wells will remain off line for the remainder of the interim period (through December 2010) in accordance with the *2008 Annual Remedial Process Optimization Report for the Central Groundwater Treatment Plant, North Groundwater Treatment Plant, and South Base Boundary Groundwater Treatment Plant*, or until monitoring data indicate that one or more extraction wells should be brought back online.

As part of ongoing optimization efforts at Site SS030, well EW03x30 will be brought back online. This well was originally taken out of service in February 2004 due to low VOC concentrations in the vicinity of that well. Groundwater extraction from all wells within Site SS030, including EW03x30 will maximize capture of the Site SS030 VOC plume. It is anticipated that EW03x30 will be returned to service in January 2010.

No other optimization activities were performed.

Table 1
Summary of Groundwater Analytical Data for December 2009 – South Base Boundary Groundwater Treatment Plant

Constituent	Instantaneous Maximum[a] (µg/L)	Detection Limit (µg/L)	N/C	3 December 2009 (µg/L)	
				Influent	Effluent
Halogenated Volatile Organics					
Bromodichloromethane	5.0	0.15	0	ND	ND
Carbon Tetrachloride	0.5	0.14	0	ND	ND
Chloroform	5.0	0.16	0	ND	ND
Dibromochloromethane	5.0	0.13	0	ND	ND
1,1-Dichloroethane	5.0	0.19	0	ND	ND
1,2-Dichloroethane	0.5	0.15	0	ND	ND
1,1-Dichloroethene	5.0	0.19	0	ND	ND
cis-1,2-Dichloroethene	5.0	0.19	0	2.5	ND
trans-1,2-Dichloroethene	5.0	0.33	0	ND	ND
Methylene Chloride	5.0	0.66	0	ND	ND
Tetrachloroethene	5.0	0.21	0	ND	ND
1,1,1-Trichloroethane	5.0	0.14	0	ND	ND
1,1,2-Trichloroethane	5.0	0.20	0	ND	ND
Trichloroethene	5.0	0.19	0	41.6	ND
Vinyl Chloride	0.5	0.18	0	ND	ND
Non-Halogenated Volatile Organics					
Benzene	1.0	0.17	0	ND	ND
Ethylbenzene	5.0	0.22	0	ND	ND
Toluene	5.0	0.14	0	ND	ND
Xylenes	5.0	0.23 – 0.5	0	ND	ND
Other					
Total Petroleum Hydrocarbons – Gasoline	50	8.5	0	NM	ND
Total Petroleum Hydrocarbons – Diesel	50	50	0	NM	ND
Total Suspended Solids (mg/L)	NE	1.0	0	42	NM

[a] In accordance with Appendix B of the *Travis AFB South Base Boundary Groundwater Treatment Plant Operations and Maintenance Manual* (CH2M HILL, 2004).

J = analyte concentration is considered an estimated value
mg/L = milligrams per liter
N/C = number of samples out of compliance with discharge limits
ND = not detected
NE = not established
NM = not measured
µg/L = micrograms per liter

Central Groundwater Treatment Plant Monthly Data Sheet

Report Number: 125 **Reporting Period: 25 November 2009 – 4 January 2010** **Date Submitted: 15 January 2010**

This data sheet includes the following: results for the operation of the Central Groundwater Treatment Plant (CGWTP), West Treatment and Transfer Plant (WTTP), and thermal oxidation (ThOx) system (previously referred to as the two-phase extraction [TPE] system). A summary of flow rates for the CGWTP, WTTP, ThOx, and extraction wells EW01x16, EW02x16, EW03x16, EW605x16, and EW610x16; a brief description of any shutdowns or significant events related to the systems, and a summary of analytical results for selected samples collected are also included on this data sheet.

Operations Summary – December 2009

Operating Time:		Percent Uptime:		Electrical Power Usage:	
CGWTP:	961 hours	**CGWTP:**	100%	**CGWTP:**	1,740 kWh
WTTP:	Water: 836 hours	**WTTP:**	Water: 87.6%	**WTTP:**	15,957 kWh
	Vapor: 0 hours		Vapor: 0%		
ThOx:	751 hours	**ThOx:**	78.1%	**ThOx:**	9,105 kWh

ThOx: Natural Gas Usage: 3,172 therms

Gallons Treated: **2.0 million gallons**

Gallons Treated Since January 1996: **422 million gallons**

VOC Mass Removed:

5.59 lbs (groundwater only)[a]

19.57 lbs (vapor only)[b]

VOC Mass Removed Since January 1996:

2,467 lbs from groundwater

8,668 lbs from vapor

ThOx DRE: 100%

Rolling 12-Month Cost per Pound of Mass Removed: $1,535[c]

Monthly Cost per Pound of Mass Removed: $404 [c]

[a] Calculated using Demember 2009 EPA Method SW8260B analytical results.
[b] Total VOC vapor mass removed was calculated using EPA Method TO-14 analytical results for the ThOx system.
[c] Costs include operations and maintenance, reporting, analytical laboratory, project management, and electric and natural gas costs related to operation of the system. Lower costs reflect utility cost savings since the UV/Ox system has been taken off line, and high vapor-phase mass removal.

DRE = destruction removal efficiency

Flow Rates

Average Groundwater Flow Rate: **34.0 gpm**[a]

Location	Average Flow Rate	
	Groundwater (gpm)[b]	Soil Vapor (scfm)
EW01x16	23.0	NA
EW02x16	6.8	NA
EW03x16	1.2	NA[c]
EW605x16	13.1	NA[c]
EW610x16	Off line[d]	NA[c]
WTTP	6.6[e]	Off line
ThOx	0.04[e]	63.3

[a] as measured by the effluent discharge to the storm drain divided by the operating time during the month.
[b] as measured by extraction well totalizer divided by the operating time.
[c] soil vapor was extracted from this well; however, the flow rates are not measured at individual wells at SS016.
[d] Well offline due to malfunctioning level sensors in well. Will be repaired once access is available on parking apron.
[e] as measured by the effluent groundwater pumped to the CGWTP divided by the operating time.

gpm = gallons per minute
NA = not applicable/not available
scfm = standard cubic feet per minute

Flow Rates

Average Flow Rate from the WIOU, DP039, and LF008 Extraction Wells (gpm)[a]							
SD037/ SD043				SD033/SD034/ DP039		LF008/SD036	
EW599x37	1.1	EW705x37	0.8	EW501x33	0.3	EW719x08	Off line[c]
EW700x37	3.3	EW706x37	0.7	EW503x33	0.9	EW720x08	Off line[c]
EW701x37	1.3	EW707x37	0.7	EW01x34	0.5	EW721x08	Off line[c]
EW702x37	0.8	EW510x37	4.6	EW03x34	0.3	EW593x36	0.6
EW703x37	0.2	EW511x37	1.0	EW563x39	Off line[b]	EW594x36	1.3
EW704x37	0.3	EW555x43	0.1	EW782x39	Off line[b]	EW595x36	0.9

gpm—gallons per minute

[a] Extraction well flow rates are based on the average of readings during December 2009.
[b] Extraction wells were shut off to facilitate the Bioreactor Sustainability Study at Site DP039.
[c] Extraction wells shut off to support a rebound study at Site LF008.

Shutdown/Restart Summary

Location	Shutdown		Restart		Cause
	Date	Time	Date	Time	
CGWTP (Groundwater):					
CGWTP	No system shutdowns (December 2009)				
WTTP (Groundwater):					
WTTP	30 December 2009	10:30	5 January 2010	08:30	Power outage affecting the WTTP through at least December 31, 2009
WTTP (Vapor):					
WTTP	24 August 2009				SVE system shut down for rebound study
ThOx (Vapor):					
ThOx	25 November 2009		4 January 2010		Various system shutdowns throughout the month due to low natural gas pressure and flame out alarms; typical in fall/winter.
ThOx	30 December 2009	10:30	4 January 2010	16:00	Power outage affecting the ThOx system through at least 31 December 2009

CGWTP = Central Groundwater Treatment Plant
WTTP = West Treatment and Transfer Plant
ThOx = Thermal Oxidation System

Summary of O&M Activities

Monthly groundwater and vapor sampling at the CGWTP was performed on 3 December 2009. Groundwater sample results are summarized in Table 1. The total VOC concentration (342.8 µg/L) in the December 2009 CGWTP influent groundwater sample has decreased since November 2009 (415.2 µg/L) sample was taken. No VOCs were detected in the effluent sample.

The December 2009 monitoring period includes several days from January 2010 due to a power outage that affected several areas across the base, including the WTTP and ThOx. As a result of the power outage, several instrument meters could not be read between December 30 and January 04.

Following construction paving work on the parking apron just south of the ThOx unit, wells EW605x16 and EW610x16 were brought back online. EW610x16 was unable to run consistently, likely due to one or more fouled water level sensors located in the well. Additionally, while EW605x16 was able to run, the totalizer and flowmeter (same unit) was not reading any flow through the unit. On 30 December 2009, the flowmeter was cleaned and the well was returned to normal service with a proper reading of flow and gallons of water processed reading on the flowmeter. Access issues have limited the opportunity to service the water level sensors in EW610x16, and this well remains off line. It is anticipated that EW610x16 will be serviced and brought back on line in January 2010.

Optimization Activities

In an effort to optimize mass removal efforts from the WTTP groundwater extraction system, each groundwater extraction well feeding the WTTP system was analyzed to determine which wells were likely candidates for a rebound study. As mentioned in the annual RPO report, wells identified for a rebound study will be taken offline and monitored during this rebound period. Further details regarding which wells are to be involved in the rebound study will be presented in the forthcoming 2009 Annual Remedial Process Optimization Report.

No other optimizations were performed in December 2009.

Table 1
Summary of Groundwater Analytical Data for December 2009 – Central Groundwater Treatment Plant

Constituent	Instantaneous Maximum[a] (µg/L)	Detection Limit (µg/L)	4 November 2009 (µg/L) N/C	Influent	After Carbon 1 Effluent	After Carbon 2 Effluent	System Effluent
Halogenated Volatile Organics							
Bromodichloromethane	5.0	0.15	0	ND	ND	ND	ND
Carbon Tetrachloride	0.5	0.14	0	ND	ND	ND	ND
Chloroform	5.0	0.16	0	ND	ND	ND	ND
1,2-Dichlorobenzene	5.0	0.08	0	0.53 J+	ND	ND	ND
1.3-Dichlorobenzene	5.0	0.15	0	0.68 J+	ND	ND	ND
1,4-Dichlorobenzene	5.0	0.15	0	0.37 J+	ND	ND	ND
1,1-Dichloroethane	5.0	0.15	0	ND	ND	ND	ND
1,2-Dichloroethane	0.5	0.15	0	ND	ND	ND	ND
1,1-Dichloroethene	5.0	0.19	0	0.8 J+	ND	ND	ND
cis-1,2-Dichloroethene	5.0	0.95	0	90.7	ND	ND	ND
trans-1,2-Dichloroethene	5.0	0.33	0	4 J+	ND	ND	ND
Methylene Chloride	5.0	0.66	0	ND	ND	ND	ND
Tetrachloroethene	5.0	0.21	0	0.88	ND	ND	ND
1,1,1-Trichloroethane	5.0	0.14	0	ND	ND	ND	ND
1,1,2-Trichloroethane	5.0	0.2	0	ND	ND	ND	ND
Trichloroethene	5.0	0.95	0	241	ND	ND	ND
Vinyl Chloride	0.5	0.18	0	1.3 J+	ND	ND	ND
Non-Halogenated Volatile Organics							
Benzene	1.0	0.17	0	ND	ND	ND	ND
Ethylbenzene	5.0	0.22	0	ND	ND	ND	ND
Toluene	5.0	0.14	0	ND	ND	ND	ND
Total Xylenes	5.0	0.5 – 0.23	0	ND	ND	ND	ND

[a] In accordance with Appendix G of the *Travis AFB Central Groundwater Treatment Plant Operations and Maintenance Manual* (URS Group, Inc., 2002).

J = analyte concentration is considered an estimated value
N/C = number of samples out of compliance with discharge limits
ND = not detected
µg/L = micrograms per liter

Travis AFB
DP039 Bioreactor Demonstration Update

Presented by:

Doug Downey, P.E.
Principal Technologist, CH2M HILL

January 27, 2010

Site DP39 Bioreactor Demonstration

- Funded by AFCEE BAA Program
- Title: Sustainable Bioreactors to Achieve Remedy In Place
- PI: Doug Downey PM: Travis Young
- Project Started: 27 Sept 2008
- Project End Date: 30 March 2011 (AFCEE gave 6 month extension)
- Demonstration Location: Site DP39 Travis AFB, CA
- Project addresses source area soil and groundwater primarily contaminated with TCE using in situ bioremediation supplemented with a solar-powered recirculation pump

Technical Objectives

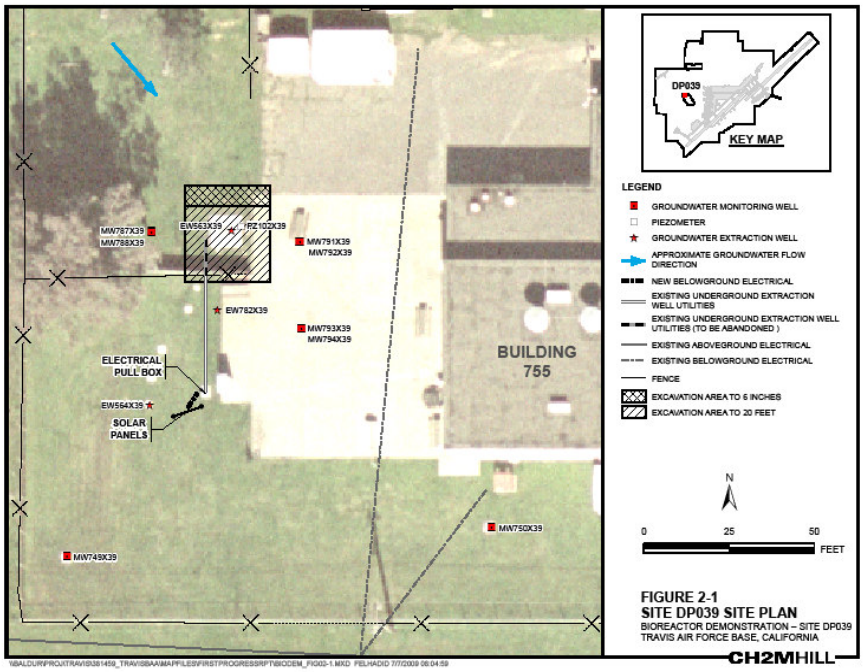
- Demonstrate that an in situ bioreactor with groundwater recirculation can effectively reduce TCE and its daughter products in a source area that was partially remediated with an energy intensive dual-phase extraction technology.
- Demonstrate that solar energy can reliably meet the total power requirements of this remediation project and minimize greenhouse gas emissions.
- Demonstrate that the in situ bioreactor is a cost efficient and sustainable “remedy in place” that can replace the pump and treat interim remedy.
- Use this design and the knowledge gained in this demonstration to promote sustainable technologies on other AF sites.

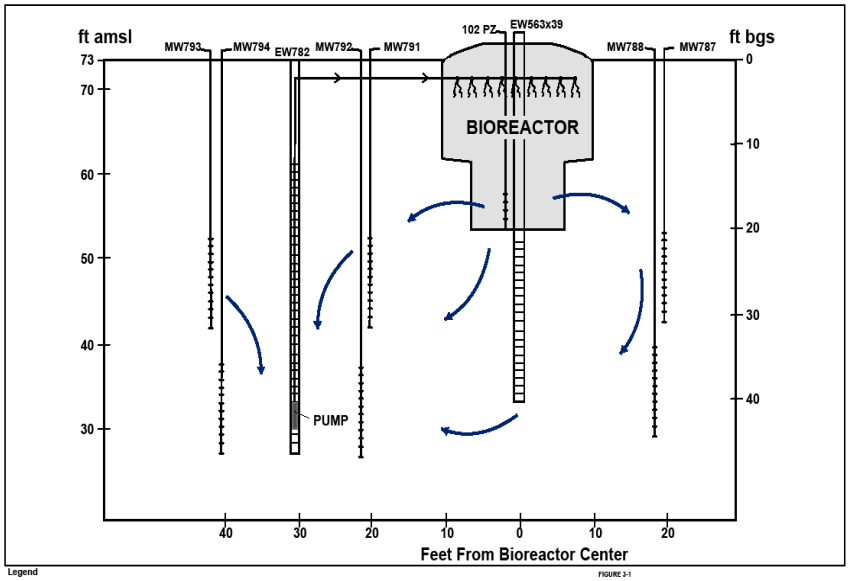
3

Technical Approach

- Soil was removed from the source area and the excavation was filled with a mixture of tree mulch, gravel, iron pyrite, and gypsum. The in situ bioreactor provides the ingredients needed to enhance reductive dechlorination and promote abiotic reactions favorable to TCE destruction.
- Using a solar-powered pump, contaminated groundwater from the TCE source area is recirculated through the bioreactor. This treats the TCE in the groundwater and moves organic rich water through the surrounding aquifer.
- Complete semi-annual monitoring to track bioreactor progress

4


MW787X39
MW788X39
EW563X39
PZ102X39
MW791X39
MW792X39
EW782X39
MW793X39
MW794X39
ELECTRICAL PULL BOX
EW564X39
SOLAR PANELS
BUILDING 755
MW750X39
MW749X39
DP039
KEY MAP
LEGEND
GROUNDWATER MONITORING WELL
PIEZOMETER
GROUNDWATER EXTRACTION WELL
APPROXIMATE GROUNDWATER FLOW DIRECTION
NEW BELOWGROUND ELECTRICAL
EXISTING UNDERGROUND EXTRACTION WELL UTILITIES
EXISTING UNDERGROUND EXTRACTION WELL UTILITIES (TO BE ABANDONED)
EXISTING ABOVEGROUND ELECTRICAL
EXISTING BELOWGROUND ELECTRICAL
FENCE
EXCAVATION AREA TO 6 INCHES
EXCAVATION AREA TO 20 FEET
N
0
25
50
FEET
FIGURE 2-1
SITE DP039 SITE PLAN
BIOREACTOR DEMONSTRATION – SITE DP039
TRAVIS AIR FORCE BASE, CALIFORNIA
CH2MHILL


ft amsl
ft bgs
MW793
MW794
EW782
MW792
MW791
102 PZ
EW563x39
MW788
MW787
BIOREACTOR
PUMP
73
70
60
50
40
30
0
10
20
30
40
40
30
20
10
0
10
20
Feet From Bioreactor Center
Legend
Groundwater Flow Direction
FIGURE 2-1
Bioreactor Demonstration Area Cross Section
Bioreactor Demonstration - Site DP039
Travis AFB, California
CH2MHILL

Groundwater Distribution Piping Being Placed On Top of Bioreactor

7

Solar Panels Power the Groundwater Recirculation System

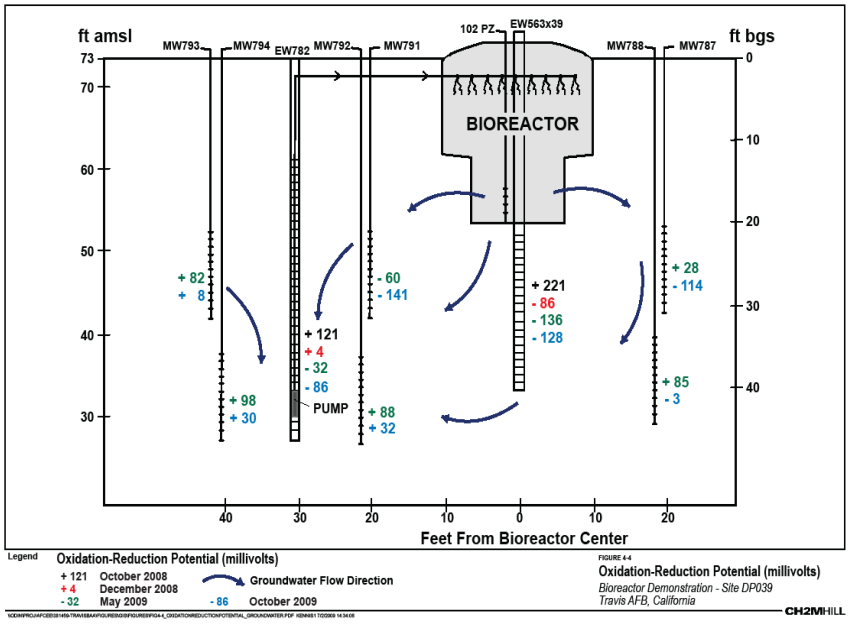
8

Progress/Schedule

- Baseline Sampling Completed in Dec 08
- Began Bioreactor Operations in Jan 09
- First Performance Monitoring Event in May 09
- Fructose Recharge Early Sept 09
- Second Monitoring Event Late Oct 09
- Third Monitoring Event Apr 10
- Fourth Monitoring Event Oct 10
- Final Report and Recommendations Jan 11

9

ORP



TOC In Groundwater

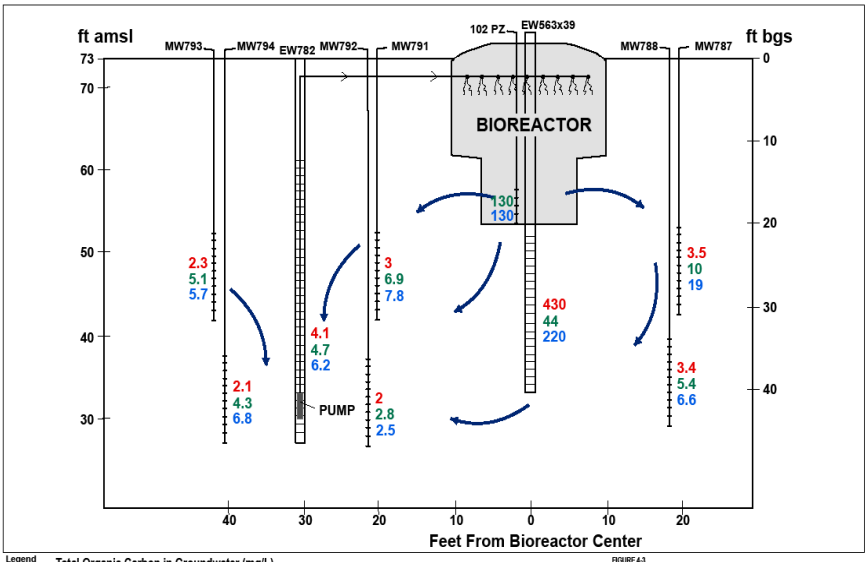


FIGURE 4-3
Total Organic Carbon in Groundwater (mg/L)
Bioreactor Demonstration - Site DP039
Travis AFB, California

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TCE In Groundwater

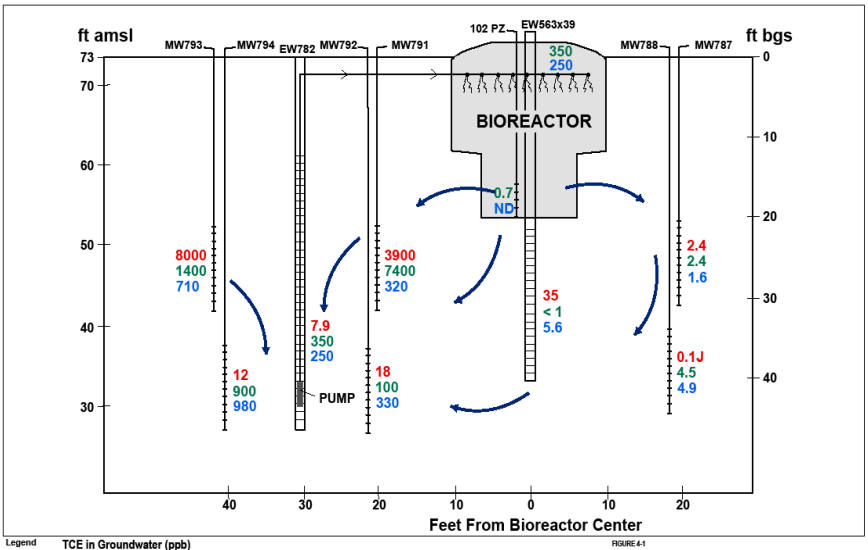

FIGURE 4-1
TCE in Groundwater (ppb)
Bioreactor Demonstration - Site DP039
Travis AFB, California

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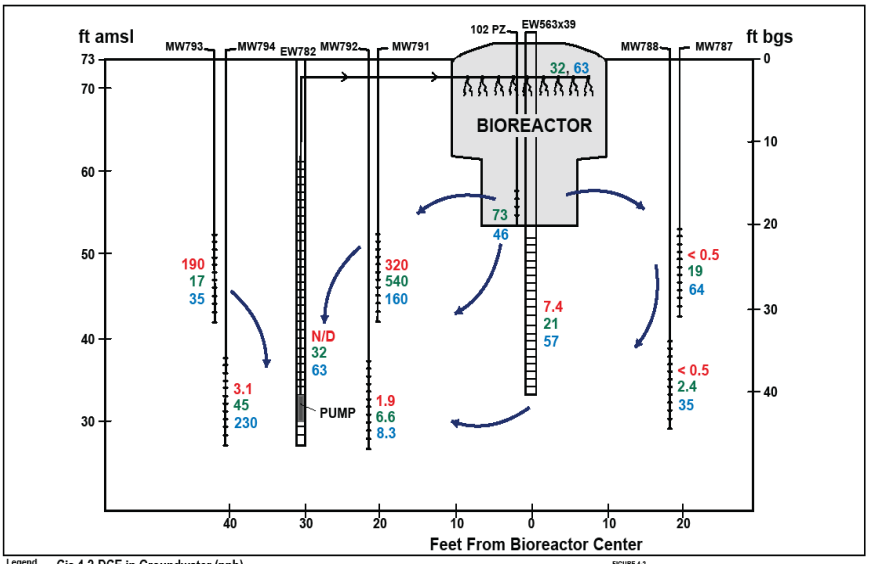
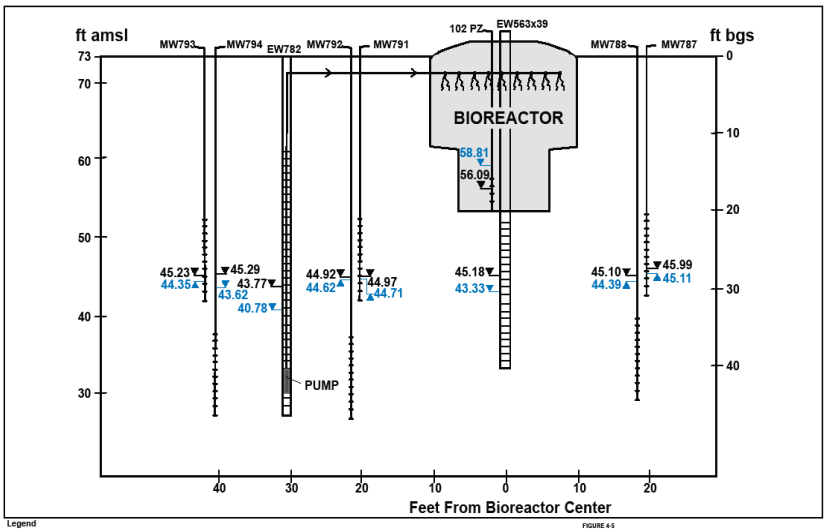
Cis-DCE In Groundwater



Water Levels



Summary of Performance

- The solar-powered pump is very reliable and has recirculated over 220,000 gallons of water(2 gpm during sunlight hours)
- ORP continues to drop in all monitoring wells indicating organic substrate is slowly spreading and creating anaerobic conditions within 30 feet of the bioreactor
- Estimated 75% reduction of TCE in aquifer based on all performance monitoring wells
- Now achieving 99% TCE destruction and 77% total molar reduction in the bioreactor
- Minimal vinyl chloride formation (< 5 ug/L)

15

Issues

- Goal of 20 mg/L TOC has not yet been achieved in all wells
- Recirculation of organic substrate is a slow process due to low vertical permeability through silt and clay layers and due to natural substrate demand
- Annual substrate recharge needed (vegoil, whey, fructose)
- < $5000 per recharge due to simple gravity feed into top of bioreactor

Technology Transfer

- EPA Region 9 has highlighted this project as an example of sustainable remediation innovation
- Travis AFB has received positive press from a local newspaper article featuring the solar-powered bioreactor
- Project accepted for presentation at the AFCEE Tech Transfer Workshop and Battelle Monterey Conference
- Travis AFB and Beale AFB have several sites where bioreactors could be applied

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2009 Field Investigations Summary and Next Steps

Travis Air Force Base, California

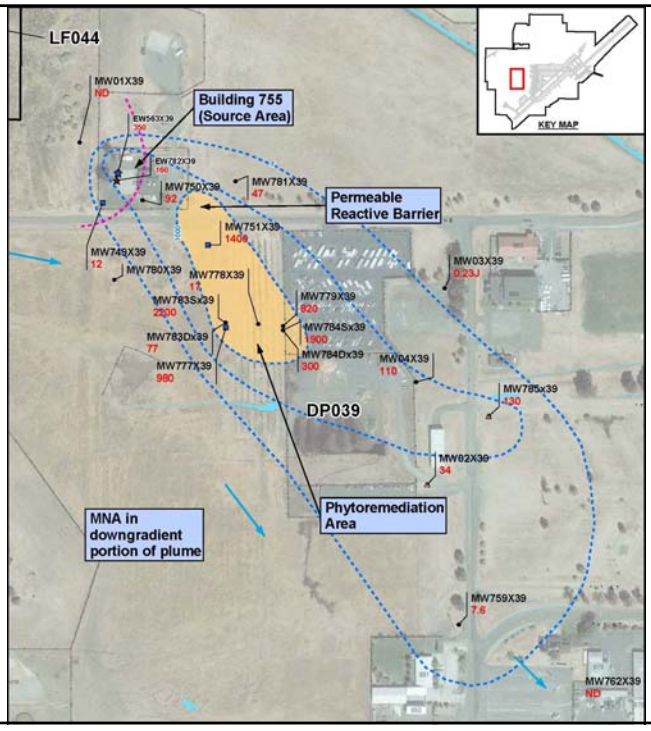
January 27, 2010

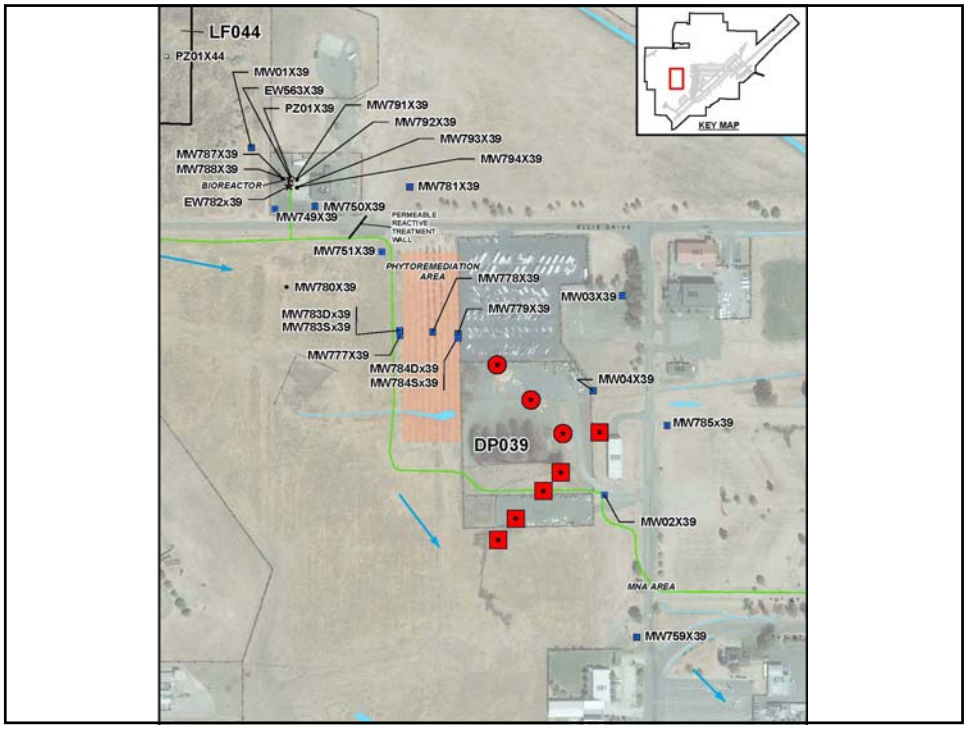
Investigations Conducted

- Site DP039 Mid-Plume
- Site SS016 Source Area
- Site SS030 Eastern Edge of Plume
- Site SD036 Hot Spot
- Site SD037 Hot Spot
- Site ST027B Plume Characterization

Site DP039 Description

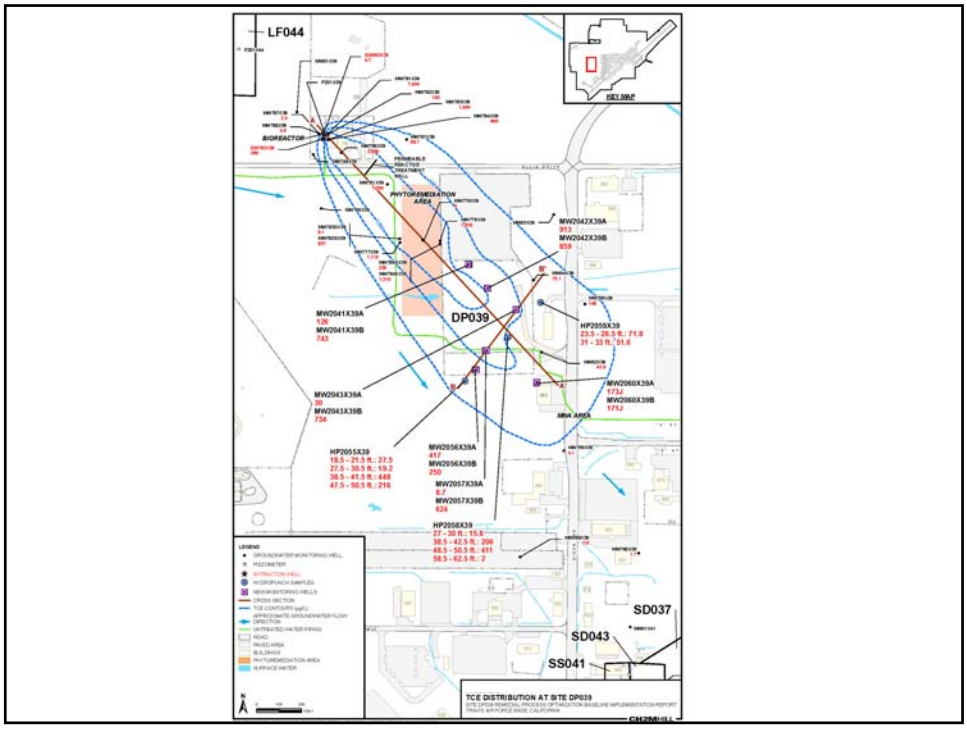
- Located in the WABOU
- Contaminant plume of TCE originates near Building 755
- Remedial processes in the area have included a bioreactor, permeable reactive barrier, phytoremediation, SVE, GET, and MNA

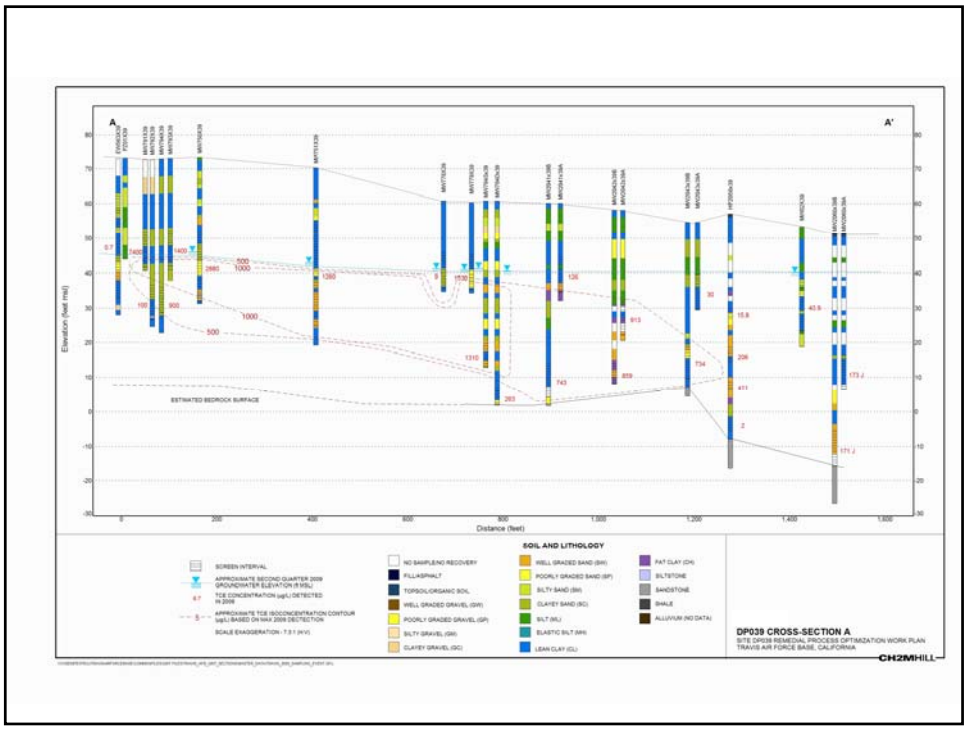


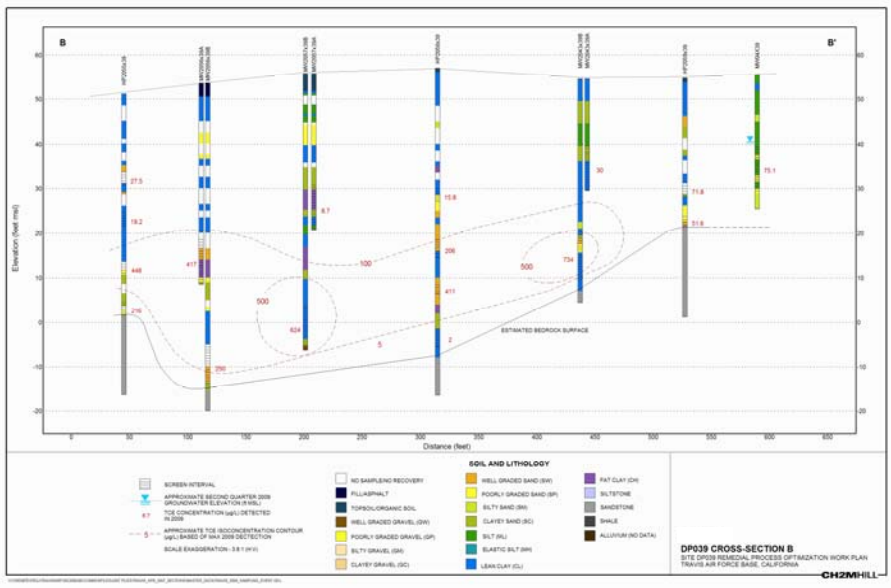


Investigation Results – DP039

- The 500 µg/L plume is defined in all directions and vertically
- The TCE concentrations >500 µg/L were found further to the southeast than anticipated
- Bedrock encountered at about 50 to 60 ft bgs across the planned biobarrier area

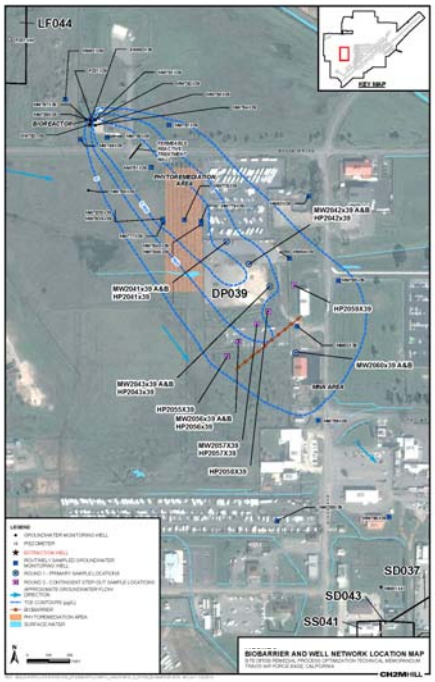

LF044
BIOREACTOR
PHYTOREMEDIATION AREA
DP039
MW2042X39A
913
MW2042X39B
859
MW2041X39A
126
MW2041X39B
743
HP2055X39
23.5 - 25.5 ft.: 71.8
31 - 33 ft.: 31.6
MW2060X39A
173 J
MW2060X39B
171 J
MW2043X39A
30
MW2043X39B
734
MW2056X39A
417
MW2056X39B
250
MW2057X39A
6.7
MW2057X39B
624
HP2056X39
27 - 30 ft.: 15.8
38.5 - 42.5 ft.: 206
48.5 - 50.5 ft.: 411
58.5 - 62.5 ft.: 2
HP2055X39
18.5 - 21.5 ft.: 27.5
27.5 - 30.5 ft.: 19.2
38.5 - 41.5 ft.: 448
47.5 - 50.5 ft.: 216
SD037
SD043
SS041
TCE DISTRIBUTION AT SITE DP039
CH2MHILL

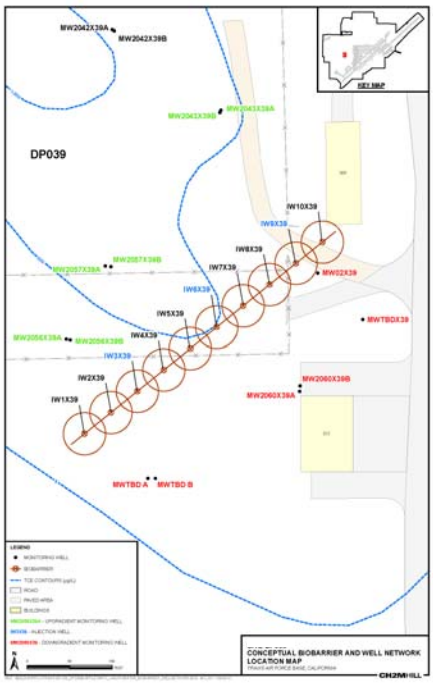

A
A'
Elevation (feet msl)
Distance (feet)
ESTIMATED BEDROCK SURFACE
SOIL AND LITHOLOGY
DP039 CROSS-SECTION A
SITE DP039 REMEDIAL PROCESS OPTIMIZATION WORK PLAN
TRAVIS AIR FORCE BASE, CALIFORNIA
CH2MHILL



Site DP039—Next Steps

- Install 3 new monitoring wells to complement the existing well pairs (for total of 15 wells in the performance monitoring network)
- Install 10 EVO injection wells across the plume, downgradient of the 500 µg/L contour
- Inject about 25,000 lbs of EVO to form the biobarrier
- Initiate performance monitoring of the remedy optimization
- Prepare a completion report after EVO injection is finished
- Evaluate ongoing progress in GSAP reports


LF044
KEY MAP
BIOREACTOR
PHYTOREMEDIATION AREA
MW2042x39 A&B
HP2042x39
DP039
MW2041x39 A&B
HP2041x39
HP2055X39
MW2060x39 A&B
MW2043x39 A&B
HP2043x39
HP2055X39
MW2056x39 A&B
HP2056x39
MW2057X39
HP2057X39
HP2058X39
SD037
SD043
SS041
BIOBARRIER AND WELL NETWORK LOCATION MAP
CH2MHILL

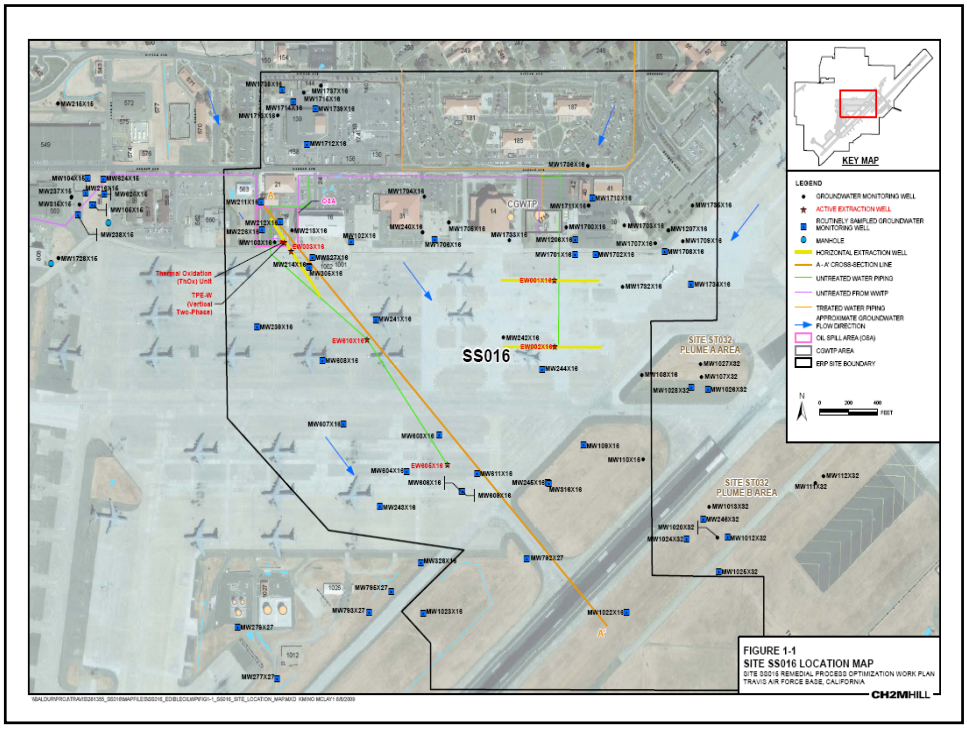

MW2042X39A
MW2042X39B
KEY MAP
DP039
IW10X39
IW9X39
IW8X39
IW7X39
MW02X39
IW6X39
IW5X39
MWTBDX39
IW4X39
IW3X39
IW2X39
IW1X39
MW2060X39B
MW2060X39A
MWTBD A
MWTBD B
CONCEPTUAL BIOBARRIER AND WELL NETWORK LOCATION MAP
CH2MHILL

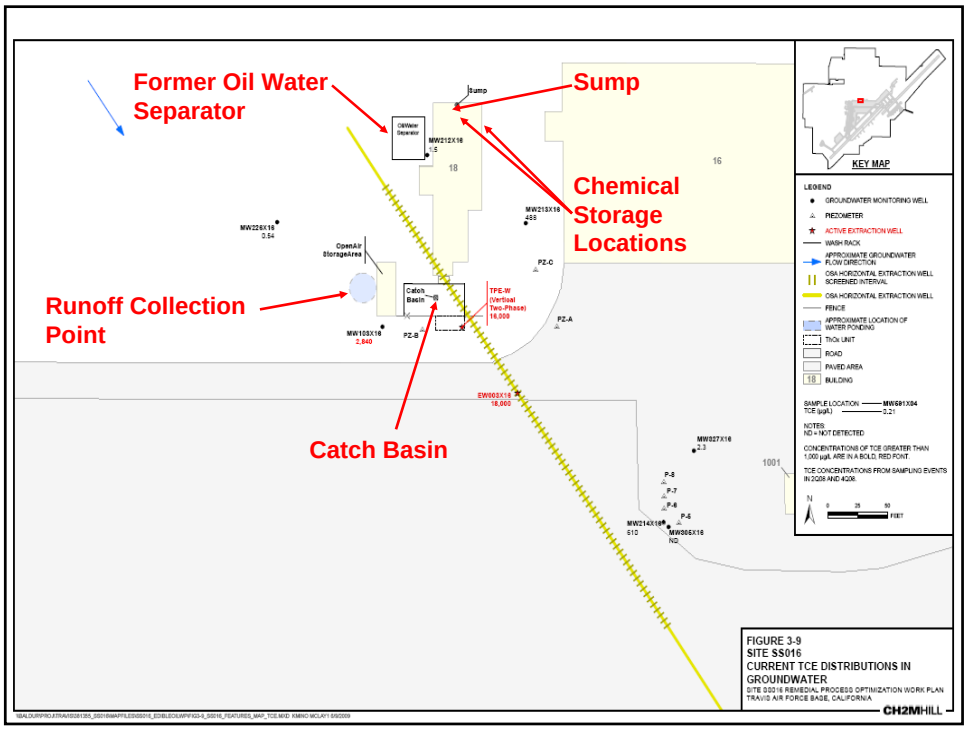
Site DP039 Performance Monitoring Plan

- **Monitoring Well Network**
  -six (6) upgradient wells (MW2056x39A&B, MW2057x39A&B, and MW2043x39A&B)
  -three (3) performance wells (IW3x39, IW6x39, and IW9x39)
  -six (6) compliance wells (MW2060A&B, MW02x39, new well pair to the southwest, and new well to the northeast)
- **Analytes**
  -VOCs, Dissolved Hydrocarbon Gasses, Total Organic Carbon, Nitrate/Nitrite, Sulfate, Chloride, Sulfide, Ferrous Iron, Alkalinity, pH, ORP, Temperature, EC, DO
- **Frequency**
  -Pre-Installation: All wells sampled in baseline event
  -Post-Installation: Semi-Annually for first two (2) years, Annually thereafter

Site SS016 OSA Description

- OSA located in the northwest corner of Site SS016
- Contaminant plume of trichloroethene (TCE) begins in OSA and travels southeast beneath active runway
- Existing remedial processes include both groundwater and soil vapor extraction and treatment
- Groundwater extraction system designed to capture VOC concentrations greater than 1,000 µg/L
- 5-year reviews in 2003 and 2008 concluded that the source control objective for Site SS016 is being met


SS016
SITE ST032 PLUME A AREA
SITE ST032 PLUME B AREA
CGWTP
Thermal Oxidation (ThOx) Unit
TPE-W (Vertical Two-Phase)
KEY MAP
LEGEND
GROUNDWATER MONITORING WELL
ACTIVE EXTRACTION WELL
ROUTINELY SAMPLED GROUNDWATER MONITORING WELL
MANHOLE
HORIZONTAL EXTRACTION WELL
A - A' CROSS-SECTION LINE
UNTREATED WATER PIPING
UNTREATED FROM WWTP
TREATED WATER PIPING
APPROXIMATE GROUNDWATER FLOW DIRECTION
OIL SPILL AREA (OSA)
CGWTP AREA
ERP SITE BOUNDARY
FIGURE 1-1
SITE SS016 LOCATION MAP
SITE SS016 REMEDIAL PROCESS OPTIMIZATION WORK PLAN
TRAVIS AIR FORCE BASE, CALIFORNIA
CH2MHILL

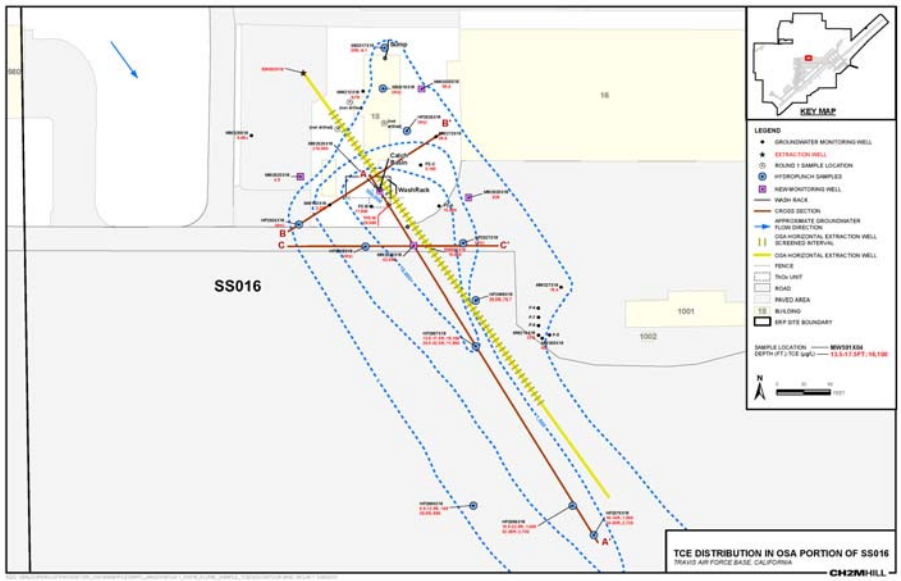

Former Oil Water Separator
Sump
Chemical Storage Locations
Runoff Collection Point
Catch Basin
Open Air Storage Area
KEY MAP
LEGEND
GROUNDWATER MONITORING WELL
PIEZOMETER
ACTIVE EXTRACTION WELL
WASH RACK
APPROXIMATE GROUNDWATER FLOW DIRECTION
OSA HORIZONTAL EXTRACTION WELL SCREENED INTERVAL
OSA HORIZONTAL EXTRACTION WELL
FENCE
APPROXIMATE LOCATION OF WATER PONDING
ThOx UNIT
ROAD
PAVED AREA
BUILDING
NOTES:
ND = NOT DETECTED
CONCENTRATIONS OF TCE GREATER THAN 1,000 µg/L ARE IN A BOLD, RED FONT.
TCE CONCENTRATIONS FROM SAMPLING EVENTS IN 2Q09 AND 4Q09.
FIGURE 3-9
SITE SS016
CURRENT TCE DISTRIBUTIONS IN GROUNDWATER
SITE SS016 REMEDIAL PROCESS OPTIMIZATION WORK PLAN
TRAVIS AIR FORCE BASE, CALIFORNIA
CH2MHILL

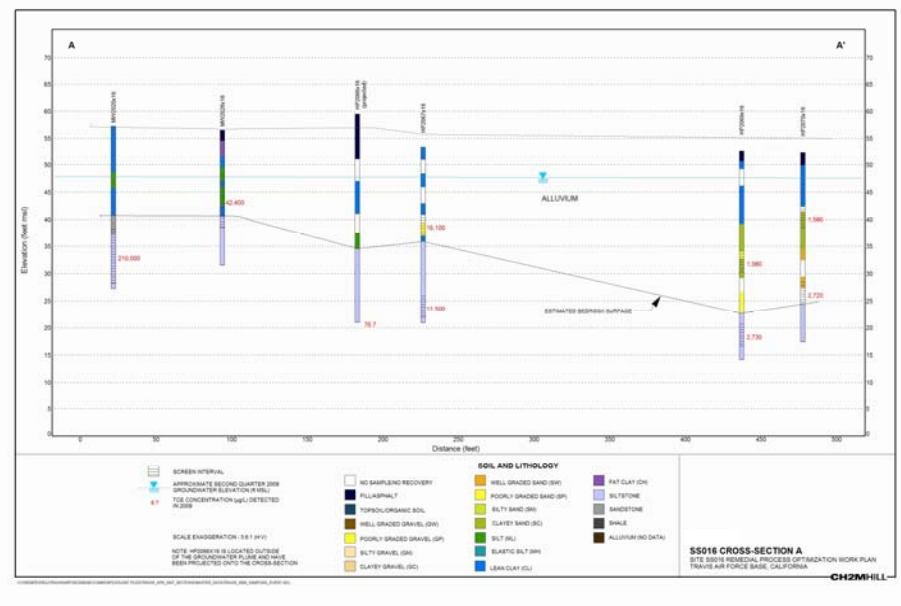
Work Plan Phased Approach

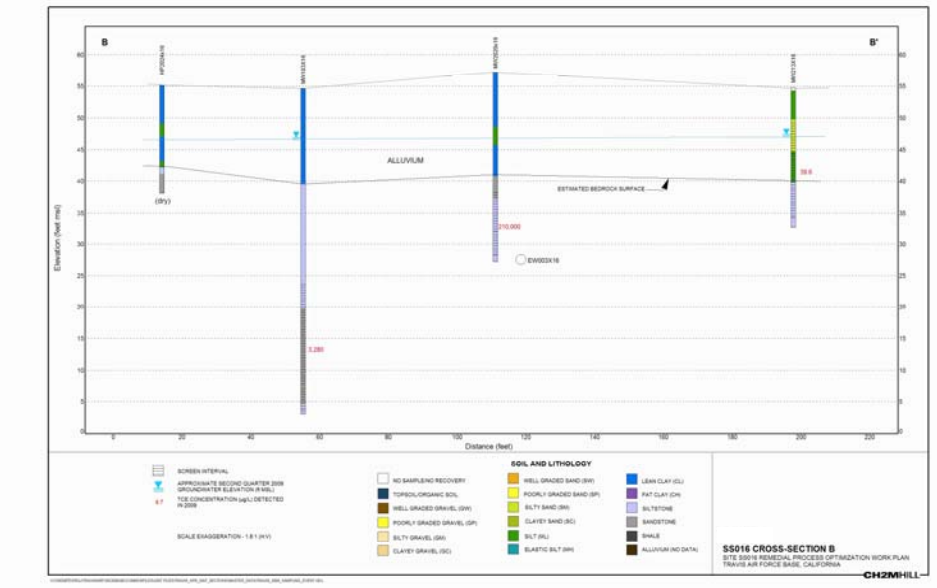
- Phase 1 – Site characterization and plume delineation
  - Define the TCE plume to 1,000 µg/L
  - Confirm source area(s)
- Phase 2 – Remediation Optimization
  - Utilize findings during characterization activities to optimize injection of Emulsified Vegetable Oil (EVO)

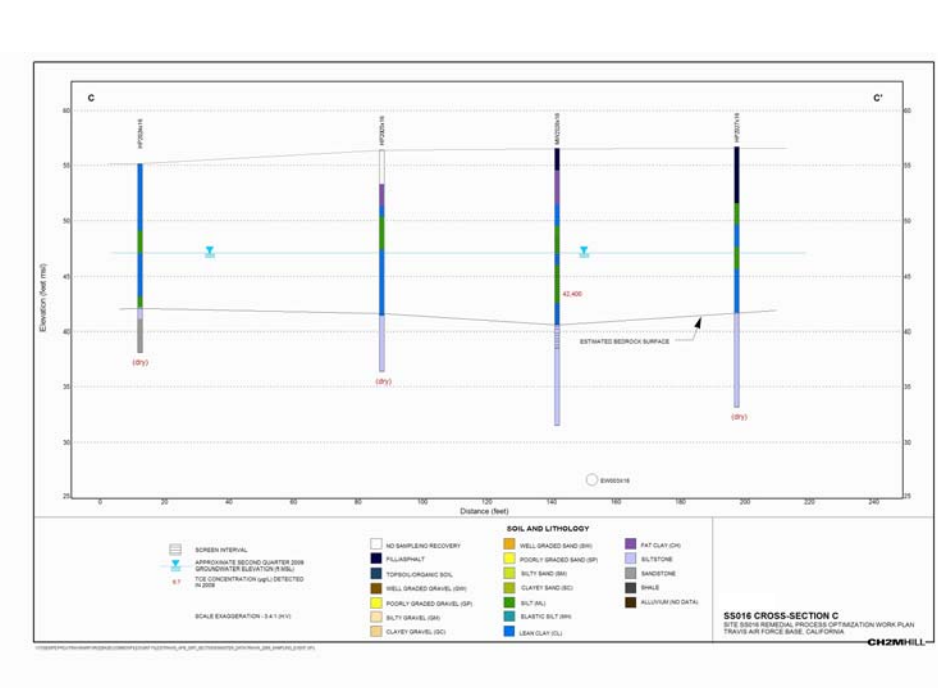
Investigation Results – SS016

- Source of TCE plume appears to be the Wash Rack
- The 1,000 µg/L TCE plume is defined in the source area
- Bedrock (siltstone & sandstone) is shallow ~15 ft bgs across the source area
- The alluvium is mostly clay and silt, and is dry for the most part
- TCE found in shallow fractured bedrock


SS016
KEY MAP
LEGEND
GROUNDWATER MONITORING WELL
EXTRACTION WELL
ROUND 1 SAMPLE LOCATION
HYDROPUNCH SAMPLES
NEW MONITORING WELL
WASH RACK
CROSS SECTION
APPROXIMATE GROUNDWATER FLOW DIRECTION
OSA HORIZONTAL EXTRACTION WELL SCREENED INTERVAL
OSA HORIZONTAL EXTRACTION WELL
FENCE
TICKs UNIT
ROAD
PAVED AREA
BUILDING
ERP SITE BOUNDARY
SAMPLE LOCATION
DEPTH (FT.) TCE (µg/L)
WashRack
A
A'
B
B'
C
C'
1001
1002
TCE DISTRIBUTION IN OSA PORTION OF SS016
TRAVIS AIR FORCE BASE, CALIFORNIA
CH2MHILL

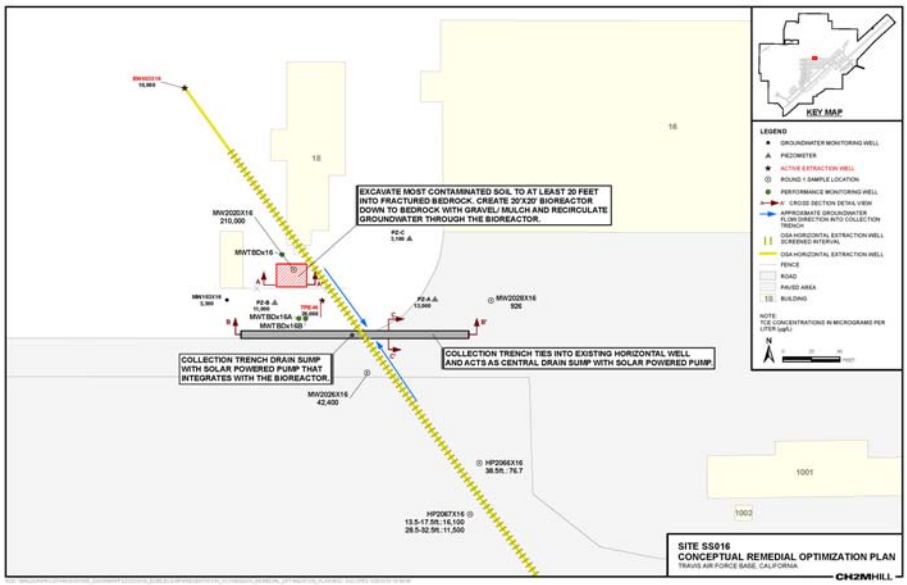

A
A'
Elevation (feet msl)
Distance (feet)
ALLUVIUM
ESTIMATED BEDROCK SURFACE
42,400
210,000
16,100
11,500
76.7
1,080
2,730
1,580
2,720
SOIL AND LITHOLOGY
NO SAMPLE/NO RECOVERY
FILL/ASPHALT
TOPSOIL/ORGANIC SOIL
WELL GRADED GRAVEL (GW)
POORLY GRADED GRAVEL (GP)
SILTY GRAVEL (GM)
CLAYEY GRAVEL (GC)
WELL GRADED SAND (SW)
POORLY GRADED SAND (SP)
SILTY SAND (SM)
CLAYEY SAND (SC)
SILT (ML)
ELASTIC SILT (MH)
LEAN CLAY (CL)
FAT CLAY (CH)
SILTSTONE
SANDSTONE
SHALE
ALLUVIUM (NO DATA)
SS016 CROSS-SECTION A
SITE SS016 REMEDIAL PROCESS OPTIMIZATION WORK PLAN
TRAVIS AIR FORCE BASE, CALIFORNIA
CH2MHILL

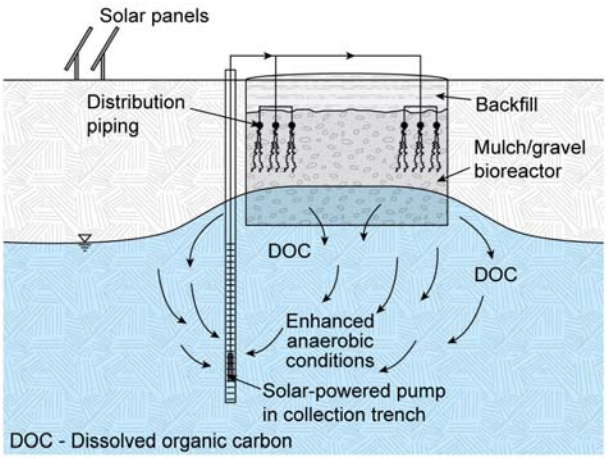

B
B'
ALLUVIUM
ESTIMATED BEDROCK SURFACE
(dry)
3,280
210,000
EW003X16
59.6
Elevation (feet msl)
Distance (feet)
SOIL AND LITHOLOGY
NO SAMPLE/NO RECOVERY
TOPSOIL/ORGANIC SOIL
WELL GRADED GRAVEL (GW)
POORLY GRADED GRAVEL (GP)
SILTY GRAVEL (GM)
CLAYEY GRAVEL (GC)
WELL GRADED SAND (SW)
POORLY GRADED SAND (SP)
SILTY SAND (SM)
CLAYEY SAND (SC)
SILT (ML)
ELASTIC SILT (MH)
LEAN CLAY (CL)
FAT CLAY (CH)
SILTSTONE
SANDSTONE
SHALE
ALLUVIUM (NO DATA)
SCREEN INTERVAL
APPROXIMATE SECOND QUARTER 2009 GROUNDWATER ELEVATION (ft MSL)
TCE CONCENTRATION (ug/L) DETECTED IN 2009
SCALE EXAGGERATION - 1.8:1 (H:V)
SS016 CROSS-SECTION B
SITE SS016 REMEDIAL PROCESS OPTIMIZATION WORK PLAN
TRAVIS AIR FORCE BASE, CALIFORNIA
CH2MHILL


C
C'
(dry)
(dry)
(dry)
42,400
ESTIMATED BEDROCK SURFACE
EW003X16
Elevation (feet msl)
Distance (feet)
SOIL AND LITHOLOGY
NO SAMPLE/NO RECOVERY
FILL/ASPHALT
TOPSOIL/ORGANIC SOIL
WELL GRADED GRAVEL (GW)
POORLY GRADED GRAVEL (GP)
SILTY GRAVEL (GM)
CLAYEY GRAVEL (GC)
WELL GRADED SAND (SW)
POORLY GRADED SAND (SP)
SILTY SAND (SM)
CLAYEY SAND (SC)
SILT (ML)
ELASTIC SILT (MH)
LEAN CLAY (CL)
FAT CLAY (CH)
SILTSTONE
SANDSTONE
SHALE
ALLUVIUM (NO DATA)
SCREEN INTERVAL
APPROXIMATE SECOND QUARTER 2009 GROUNDWATER ELEVATION (ft MSL)
TCE CONCENTRATION (ug/L) DETECTED IN 2009
SCALE EXAGGERATION - 3.4:1 (H:V)
SS016 CROSS-SECTION C
SITE SS016 REMEDIAL PROCESS OPTIMIZATION WORK PLAN
TRAVIS AIR FORCE BASE, CALIFORNIA
CH2MHILL

Site SS016—Next Steps

- Excavate the highly contaminated soil in Wash Rack area (at least 20'x20'x20') down to below bedrock interface – Remove large mass of TCE in soil
- Create a gravel/mulch bioreactor in the excavation
- Install a collection trench across the source area plume and tie into the existing horizontal well (EW03x16)
- Excavate sump in trench and recirculate groundwater through the bioreactor with solar-powered pump
- Install two new wells to complement existing monitoring of the effectiveness of the bioreactor
- Prepare completion report after optimization is accomplished
- Evaluate ongoing progress in GSAP reports





Detail A–A'
Bioreactor Cross-section

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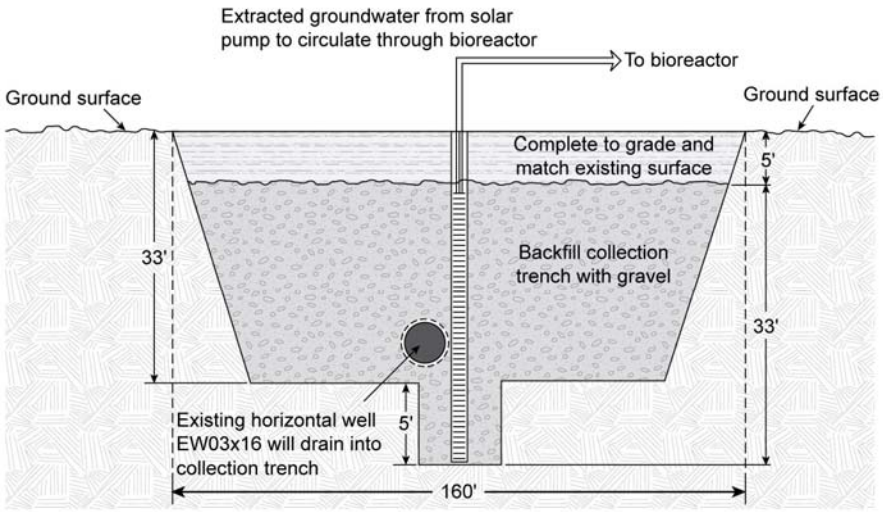

Detail B–B'
Collection Trench Cross-section

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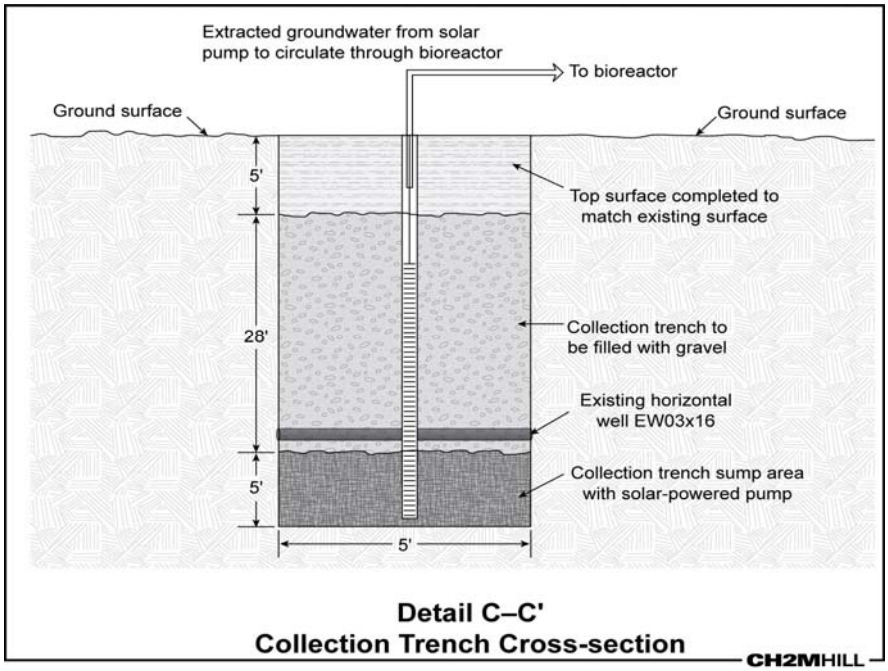


Site SS016 Performance Monitoring Plan

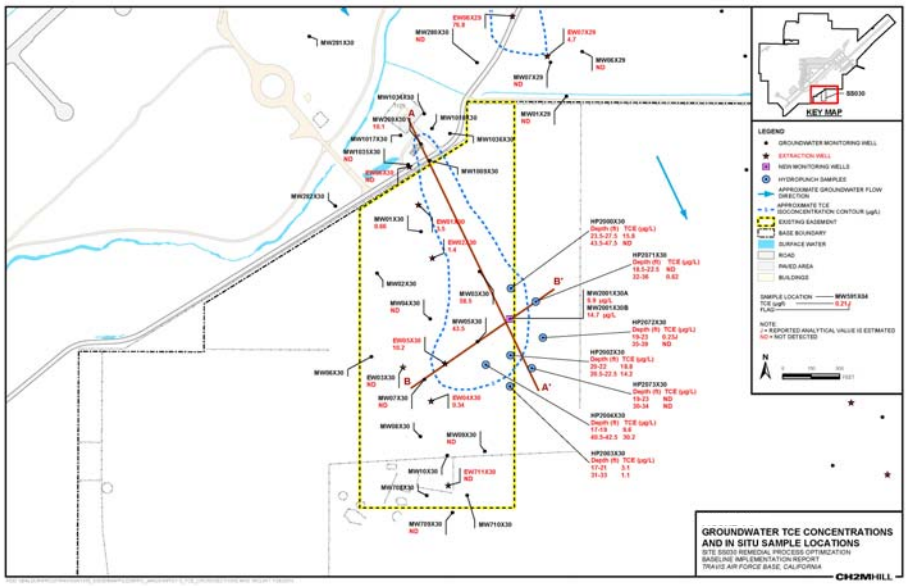
- **Monitoring Well Network**
  -two (2) downgradient from bioreactor, upgradient from collection trench (PZ-B and TPE-W)
  -one (1) downgradient from bioreactor and collection trench (MW2026x16)
  -one (1) upgradient from the bioreactor (new well:TBD1x16)
  -one (1) new well installed in the collection trench (new well:TBD2x16)
- **Analytes**
  -VOCs, Dissolved Hydrocarbon Gasses, Total Organic Carbon, Nitrate/Nitrite, Sulfate, Chloride, Sulfide, Ferrous Iron, Alkalinity, pH, ORP, Temperature, EC, DO
- **Frequency**
  -Pre-Installation: All wells sampled in baseline event
  -Post-Installation: Semi-Annually for first two (2) years, Annually thereafter

Site SS030 Description

- One of 3 off-base groundwater plumes
- Located in southern part of the Base
- TCE is the only contaminant detected above the IRG
- Air Force has existing easement that covers the previously known extent of the off-base plume
- Groundwater IRA objectives specified in the IROD included off-base remediation using extraction wells to remove the TCE to below the IRG of 5 μg/L

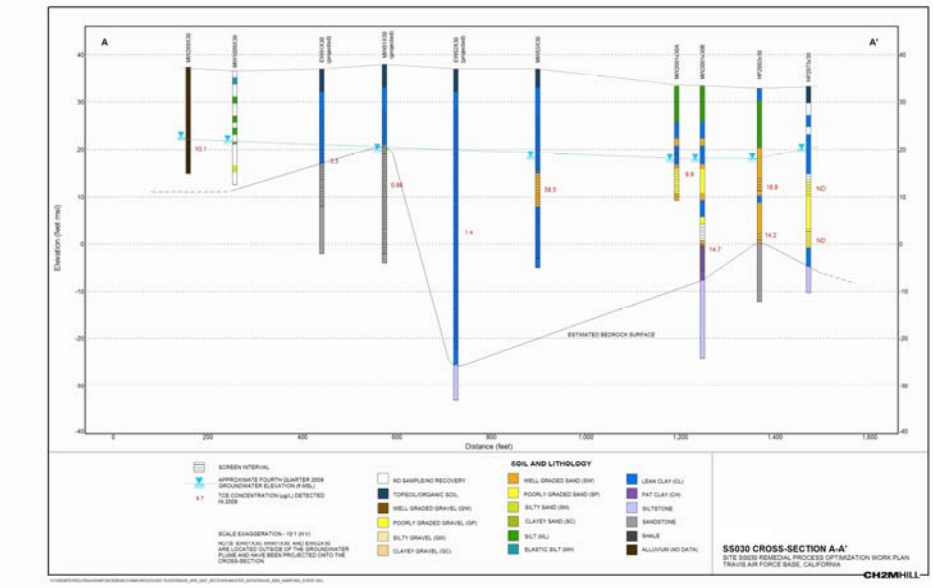
Site SS030 Description (cont'd)

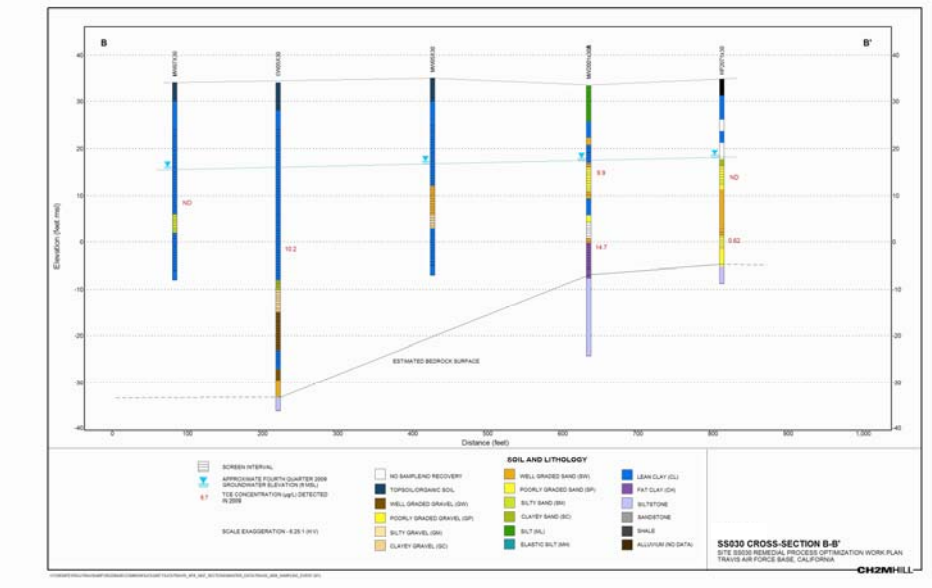
- Second Five-Year Review: increasing TCE concentrations on the east side of the plume indicate contamination may be escaping hydraulic capture
- Insufficient monitoring wells to assess the extent of contamination and the local groundwater flow direction

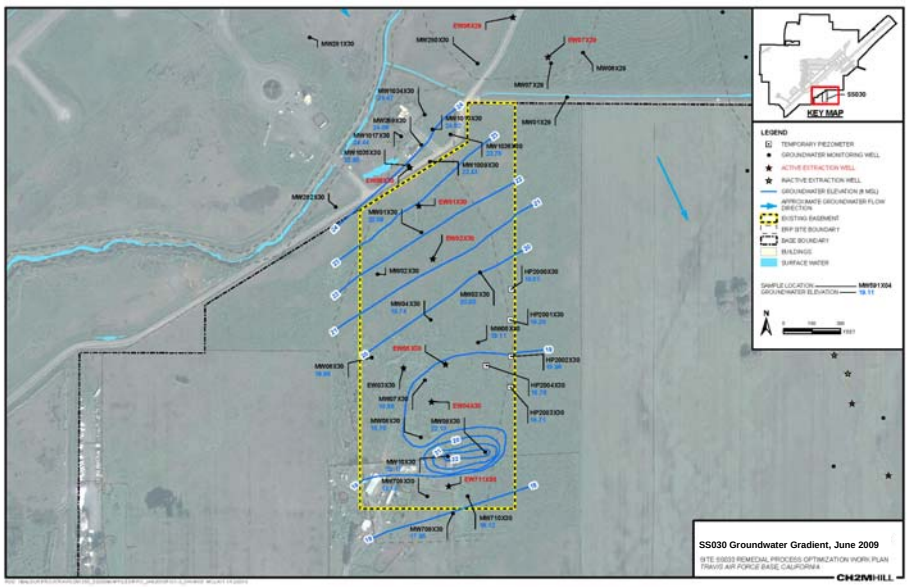


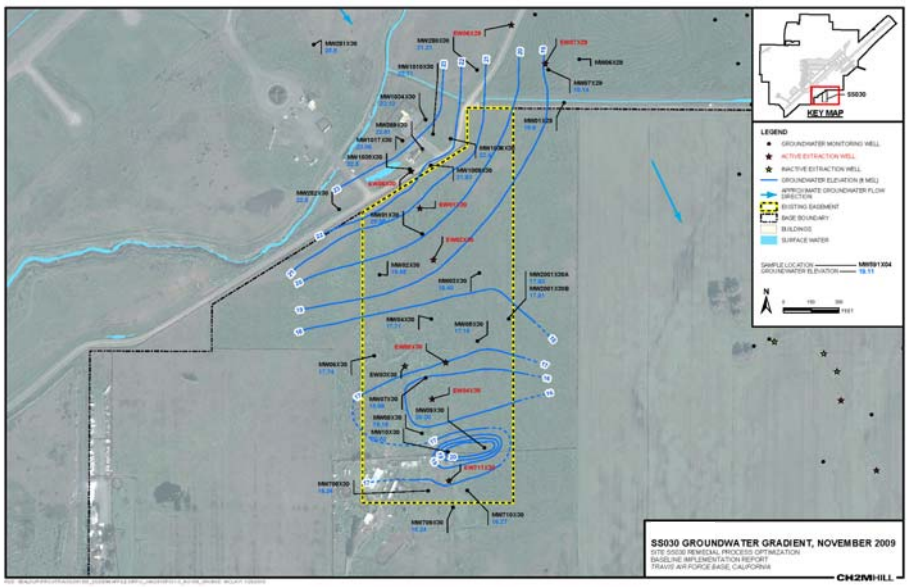
Site SS030 Investigation

- Collected hydropunch samples from 5 borings on eastern side of plume/easement
- 3 of 4 hydropunch samples on the easement boundary were greater than the IRG for TCE
- Obtained right-of-entry to conduct investigation to the east
- Collected hydropunch samples from 3 borings just to east of the easement
- All samples collected east of the easement boundary were below the IRG for TCE
- Installed monitoring well pair on easement boundary (location MW2001x30) to provide ongoing monitoring on the eastern edge of the plume
- Sample results from MW2001 well pair are 10 and 15 µg/L TCE (slightly above the IRG)


A
A'
Elevation (feet msl)
Distance (feet)
ESTIMATED BEDROCK SURFACE
SOIL AND LITHOLOGY
SS030 CROSS-SECTION A-A'
SITE SS030 REMEDIAL PROCESS OPTIMIZATION WORK PLAN
TRAVIS AIR FORCE BASE, CALIFORNIA
CH2MHILL


B
B'
Elevation (feet msl)
Distance (feet)
ESTIMATED BEDROCK SURFACE
SOIL AND LITHOLOGY
SS030 CROSS-SECTION B-B'
SITE SS030 REMEDIAL PROCESS OPTIMIZATION WORK PLAN
TRAVIS AIR FORCE BASE, CALIFORNIA
CH2MHILL


KEY MAP
SS030
LEGEND
SS030 Groundwater Gradient, June 2009
SITE SS030 REMEDIAL PROCESS OPTIMIZATION WORK PLAN
TRAVIS AIR FORCE BASE, CALIFORNIA
CH2MHILL

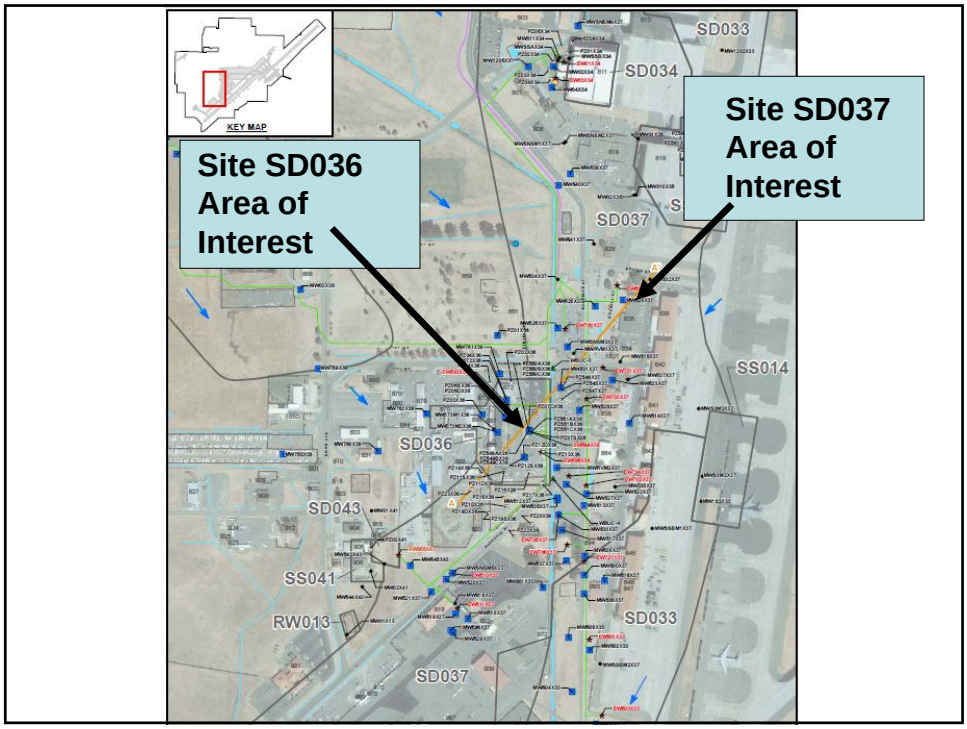

KEY MAP
SS030
LEGEND
SS030 GROUNDWATER GRADIENT, NOVEMBER 2009
SITE SS030 REMEDIAL PROCESS OPTIMIZATION
BASELINE IMPLEMENTATION REPORT
TRAVIS AIR FORCE BASE, CALIFORNIA
CH2MHILL

Site SS030 Next Steps

- Maximize groundwater extraction at the site – restart EW03x30
- Monitor groundwater levels and TCE concentrations across the site during annual GSAP event in May/June 2010
- Determine if additional monitoring wells and extraction wells are needed to obtain capture of the SS030 TCE plume following the GSAP event

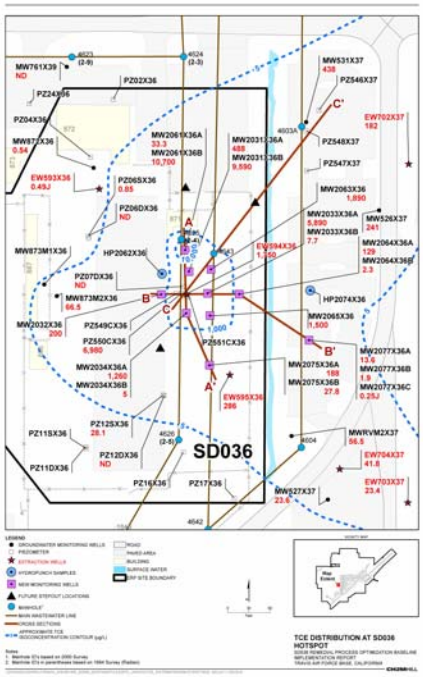
Site SD036 and SD037 Description

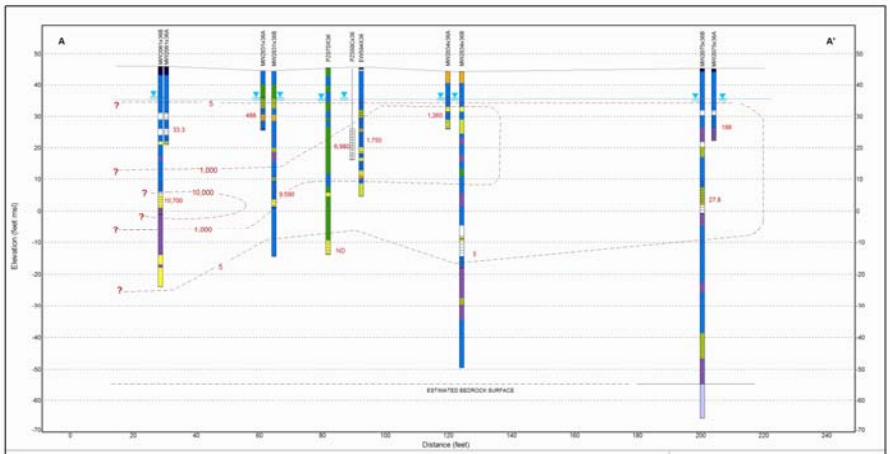
- Located in the WIOU in the western portion of the base
- Hot spot (>1,000 µg/L) of trichloroethene (TCE) concentrated in one small area near sanitary sewer line at each site
- Existing remedial processes in the area include both groundwater and soil vapor extraction and treatment

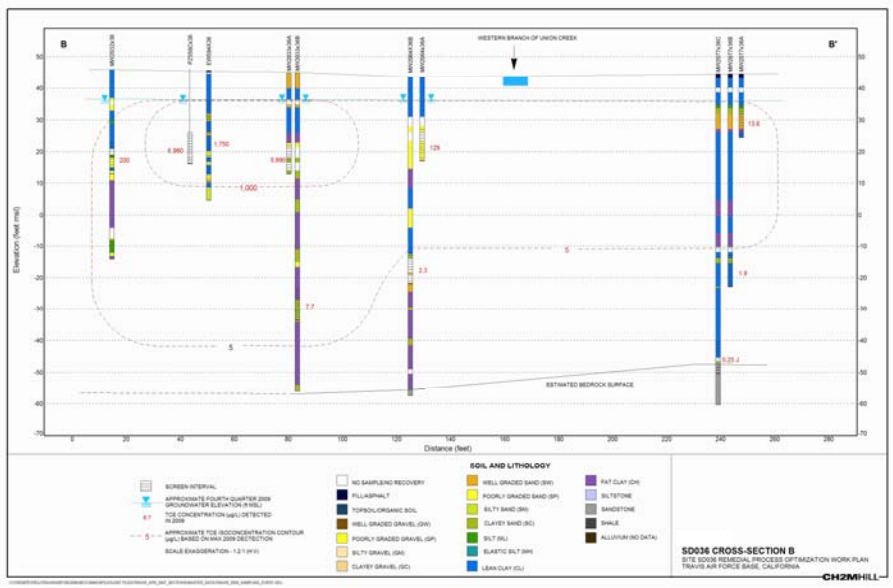


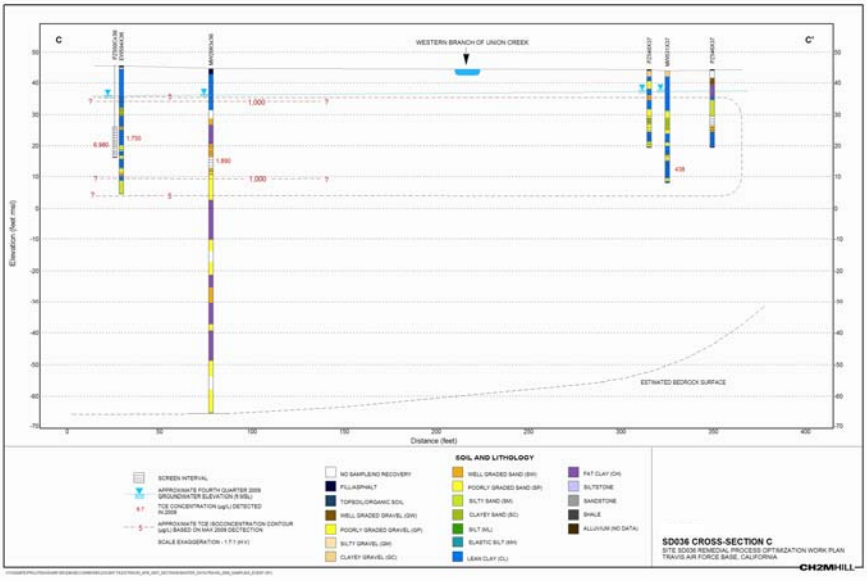
Investigation Results – SD036

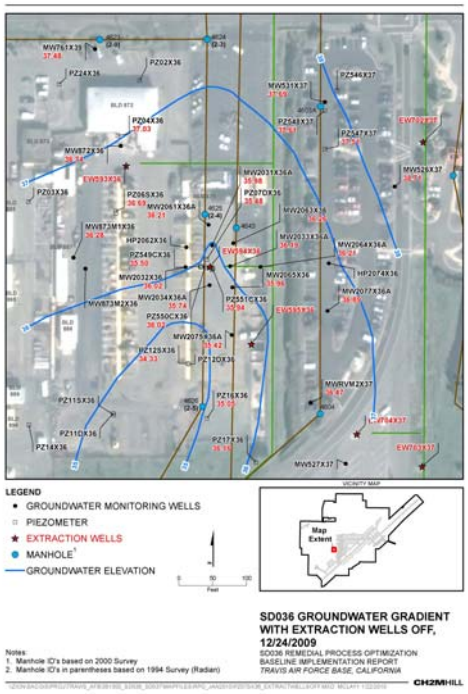
- Bedrock deeper than anticipated (~100 ft bgs)
- 1,000 µg/L TCE plume defined to east, south, and west
- Found TCE over 10,000 µg/L in northern portion of hot spot
- More investigation needed to southwest, north, and northeast of the hot spot


SD036
MW761X39 ND
PZ02X36
PZ24X36
PZ04X36
MW873X36 0.54
EW593X36 0.49J
PZ06SX36 0.85
PZ06DX36 ND
MW873M1X36
HP2062X36
PZ07DX36 ND
MW873M2X36 66.5
MW2032X36 290
PZ549CX36
PZ550CX36 6,980
MW2034X36A 1,260
MW2034X36B 5
PZ11SX36 28.1
PZ11DX36
PZ12SX36 28.1
PZ12DX36 ND
PZ16X36
PZ17X36
MW2061X36A 33.3
MW2061X36B 10,700
MW2031X36A 485
MW2031X36B 9,590
PZ551CX36 1,000
EW594X36 1,750
MW531X37 438
PZ546X37
EW702X37 182
PZ548X37
PZ547X37
MW2063X36 1,890
MW2033X36A 5,890
MW2033X36B 7.7
MW526X37 241
MW2064X36A 129
MW2064X36B 2.3
HP2074X36
MW2065X36 1,500
MW2075X36A 199
MW2075X36B 27.8
MW2077X36A 13.6
MW2077X36B 1.9
MW2077X36C 0.25J
EW595X36 286
MWRVM2X37 56.5
EW704X37 41.8
EW703X37 23.4
MW527X37 23.4
A
A'
B
B'
C
C'
TCE DISTRIBUTION AT SD036 HOTSPOT


A
A'
Elevation (feet msl)
Distance (feet)
ESTIMATED BEDROCK SURFACE
SOIL AND LITHOLOGY
SD036 CROSS-SECTION A
SITE SD036 REMEDIAL PROCESS OPTIMIZATION WORK PLAN
TRAVIS AIR FORCE BASE, CALIFORNIA
CH2MHILL


B
B'
WESTERN BRANCH OF UNION CREEK
ESTIMATED BEDROCK SURFACE
Elevation (feet msl)
Distance (feet)
SOIL AND LITHOLOGY
SCREEN INTERVAL
NO SAMPLE/NO RECOVERY
FILL/ASPHALT
TOPSOIL/ORGANIC SOIL
WELL GRADED GRAVEL (GW)
POORLY GRADED GRAVEL (GP)
SILTY GRAVEL (GM)
CLAYEY GRAVEL (GC)
WELL GRADED SAND (SW)
POORLY GRADED SAND (SP)
SILTY SAND (SM)
CLAYEY SAND (SC)
SILT (ML)
ELASTIC SILT (MH)
LEAN CLAY (CL)
FAT CLAY (CH)
SILTSTONE
SANDSTONE
SHALE
ALLUVIUM (NO DATA)
SD036 CROSS-SECTION B
SITE SD036 REMEDIAL PROCESS OPTIMIZATION WORK PLAN
TRAVIS AIR FORCE BASE, CALIFORNIA
CH2MHILL


C
C'
WESTERN BRANCH OF UNION CREEK
ESTIMATED BEDROCK SURFACE
Elevation (feet msl)
Distance (feet)
SOIL AND LITHOLOGY
SCREEN INTERVAL
NO SAMPLE/NO RECOVERY
FILL/ASPHALT
TOPSOIL/ORGANIC SOIL
WELL GRADED GRAVEL (GW)
POORLY GRADED GRAVEL (GP)
SILTY GRAVEL (GM)
CLAYEY GRAVEL (GC)
WELL GRADED SAND (SW)
POORLY GRADED SAND (SP)
SILTY SAND (SM)
CLAYEY SAND (SC)
SILT (ML)
ELASTIC SILT (MH)
LEAN CLAY (CL)
FAT CLAY (CH)
SILTSTONE
SANDSTONE
SHALE
ALLUVIUM (NO DATA)
SD036 CROSS-SECTION C
SITE SD036 REMEDIAL PROCESS OPTIMIZATION WORK PLAN
TRAVIS AIR FORCE BASE, CALIFORNIA
CH2MHILL

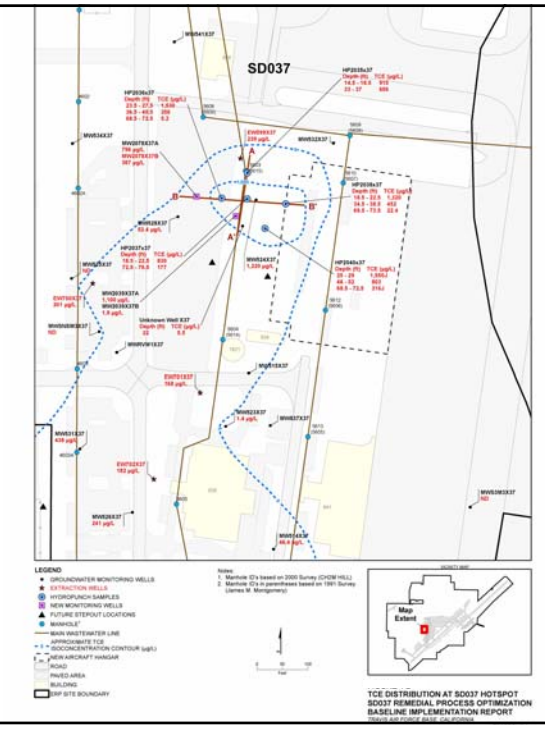


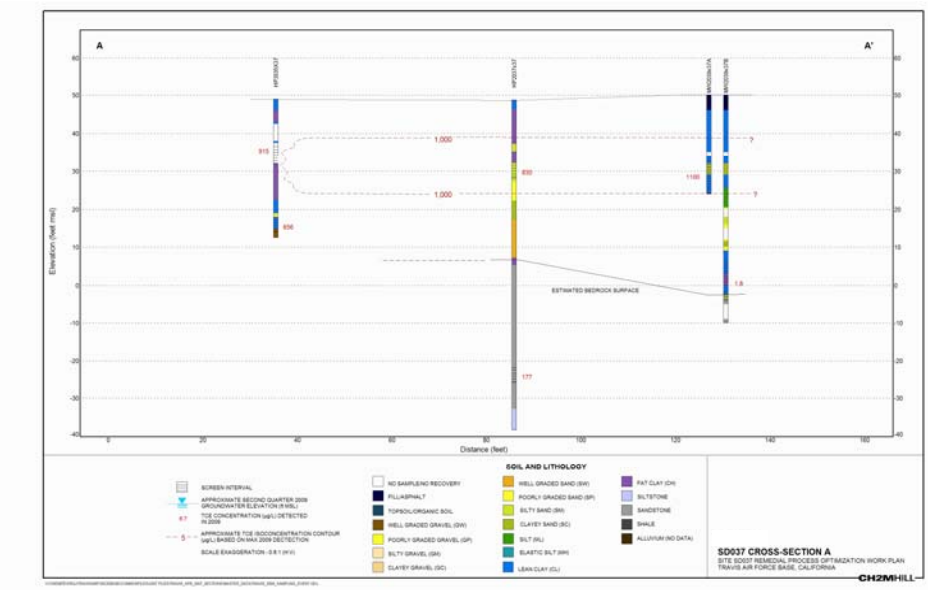
SD036—Next Steps

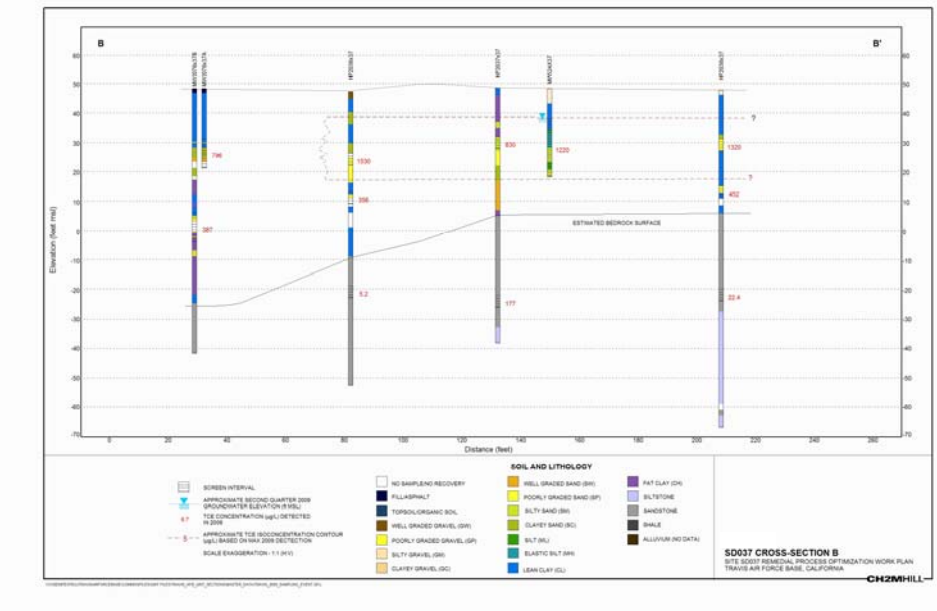
- Need to step out to the southwest, north, & northeast
- After hot spot is defined, optimize the EVO injection design
- Prepare summary of the investigation data, and identify locations of EVO injection points and monitoring network
- Conduct remedy optimization (presumably EVO injection) followed by implementation of performance monitoring
- Prepare completion report after EVO injection is accomplished
- Evaluate ongoing progress in GSAP reports

Investigation Results – SD037

- Bedrock encountered at about 45 to 70 ft bgs
- 1,000 µg/L TCE plume defined laterally and vertically except to the east, beneath the new 2-bay hangar
- No TCE concentrations significantly greater than 1,000 µg/L
- The “unknown well” with TCE at 5 µg/L disregarded since new well pair shows shallow TCE at 1,100 µg/L

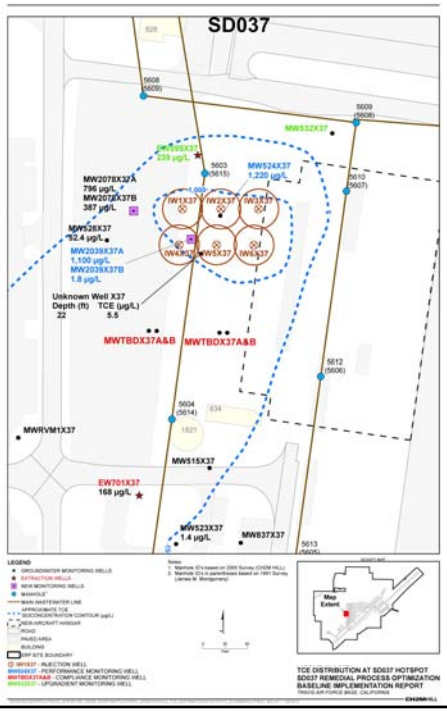



A
A'
Elevation (feet msl)
Distance (feet)
1,000
1,000
915
856
830
1180
177
1.8
ESTIMATED BEDROCK SURFACE
SOIL AND LITHOLOGY
NO SAMPLE/NO RECOVERY
FILL/ASPHALT
TOPSOIL/ORGANIC SOIL
WELL GRADED GRAVEL (GW)
POORLY GRADED GRAVEL (GP)
SILTY GRAVEL (GM)
CLAYEY GRAVEL (GC)
WELL GRADED SAND (SW)
POORLY GRADED SAND (SP)
SILTY SAND (SM)
CLAYEY SAND (SC)
SILT (ML)
ELASTIC SILT (MH)
LEAN CLAY (CL)
FAT CLAY (CH)
SILTSTONE
SANDSTONE
SHALE
ALLUVIUM (NO DATA)
SD037 CROSS-SECTION A
SITE SD037 REMEDIAL PROCESS OPTIMIZATION WORK PLAN
TRAVIS AIR FORCE BASE, CALIFORNIA
CH2MHILL


B
B'
Elevation (feet msl)
Distance (feet)
796
387
1330
356
5.2
830
177
1220
1320
402
22.4
ESTIMATED BEDROCK SURFACE
SOIL AND LITHOLOGY
NO SAMPLE/NO RECOVERY
FILL/ASPHALT
TOPSOIL/ORGANIC SOIL
WELL GRADED GRAVEL (GW)
POORLY GRADED GRAVEL (GP)
SILTY GRAVEL (GM)
CLAYEY GRAVEL (GC)
WELL GRADED SAND (SW)
POORLY GRADED SAND (SP)
SILTY SAND (SM)
CLAYEY SAND (SC)
SILT (ML)
ELASTIC SILT (MH)
LEAN CLAY (CL)
FAT CLAY (CH)
SILTSTONE
SANDSTONE
SHALE
ALLUVIUM (NO DATA)
SD037 CROSS-SECTION B
SITE SD037 REMEDIAL PROCESS OPTIMIZATION WORK PLAN
TRAVIS AIR FORCE BASE, CALIFORNIA
CH2MHILL

Site SD037—Next Steps

- Install downgradient well pairs at two locations
- Install 6 EVO injection wells in hot spot
- Inject 36,000 lbs of EVO and monitor effectiveness
- Initiate performance monitoring of the remedy optimization
- Prepare completion report after EVO injection is accomplished
- Evaluate ongoing progress in GSAP reports



Site SD037 Performance Monitoring Plan

- **Monitoring Well Network**

  -two (2) upgradient wells (EW599x37 and MW532x37)

  -three (3) performance wells (MW2039x37A, MW2039x37B, and MW524x37)

  -four (4) compliance wells (two (2) new well pairs to the south and southeast of the treatment zone)
- **Analytes**

  -VOCs, Dissolved Hydrocarbon Gasses, Total Organic Carbon, Nitrate/Nitrite, Sulfate, Chloride, Sulfide, Ferrous Iron, Alkalinity, pH, ORP, Temperature, EC, DO
- **Frequency**

  -Pre-Installation: All wells sampled in baseline event

  -Post-Installation: Semi-Annually for first two (2) years, Annually thereafter

Questions/Comments?

Travis AFB
Groundwater Program

Management Overview Briefing

RPM Meeting

January 27, 2009

Completed Documents

Documents

- Basewide Health & Safety Plan (HSP)
- Action Plan
- 2007/2008 GSAP Annual Report
- LF007C RPO Work Plan
- LF008 Rebound Study Work Plan
- SS014 Tier 1 POCO Evaluation WP
- ST027B Site Characterization WP
- SS030 RPO Work Plan
- ST032 POCO Technical Memo
- DP039 Bioreactor Work Plan
- 2008 Annual GWTP RPO Report
- Passive Diffusion Bag (PDB) Technical Memo
- RD/RA QAPP Update
- ST032 Tier 1 POCO Evaluation WP
- Phytostabilization Demonstration Tech Memo
- ***Model QAPP***
- ***LF008 Rebound Test Tech Memo***

Documents

- ***Comprehensive Site Evaluation Phase II Work Plan***
- ***Field Sampling Plan (FSP)***
- ***SS016 RPO Work Plan***
- ***ST018 POCO RA Work Plan***

Completed Field Work

Field Work

- ST027B Gore Sorber Survey – Ph 1
- ST027B Field Sampling – Phase 2
- GSAP 2008 Semi-annual Event
- ST027B Installation of Wells – Phase 3
- SS014 Site Characterization
- LF008 Rebound Study
- GSAP Annual Sampling Event
- SS030 Site Characterization – Ph 1
- ST027 Site Characterization -Ph 3
- ST014 Monitor Well Install - Subsite 3
- SD001/SD033 Sediment RA
- SS016 Site Characterization (source area)

Field Work

- ***DP039 Site Characterization (mid plume)***
- ***ST018 Site Characterization***
- ***SS030 Site Characterization (Off-site VOC Plume)***
- ***DP039 Site Characterization (for Biobarrier Placement)***

In-Progress Documents & Field Work

Documents

- Natural Attenuation Assessment Report (NAAR) (Draft)
- SD036/SD037 RPO Work Plan (Draft)
- DP039 RPO Work Plan (Draft)
- ***2008/2009 GSAP Annual Report (Draft)***
- ***Vapor Intrusion Assessment Report (Draft)***
- ***Quarterly Newsletter – January 2010 (Draft)***

Field Work

Upcoming Documents & Field Work

Documents

• ***FT005 Data Gap Work Plan***	***February***
• ***Union Creek Sites SD001 & SD033 Remedial Action***	***March***
• ST027B Site Characterization Report	March
• Focused Feasibility Study (FFS)	April
• ***2009 GWTP RPO Annual Report***	***April***

Field Work

• LF007C Site Characterization (Wetlands)	TBD
• ***SD036 Site Characterization (north & east)***	***TBD***
• ***DP039 Biobarrier Installation***	***TBD***
• ***SD037 EOS Injection***	***TBD***
• ***SS016 Bioreactor & Cutoff Wall Installation***	***TBD***
• ***ST018 GETS Installation***	***TBD***
• ***SS015 Site Characterization***	***TBD***
• ***SS014 & ST032 Q1 2010 MNA Sampling***	***March***
• ***2009 GSAP Annual Event***	***May***