SIBW Monitored Natural Attenuation Monitoring Report

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From:	Larry Phillips, R.G., ITSI Gilbane Company
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Subject:	**Monitored Natural Attenuation Monitoring Report, First Semi-Annual Sampling Event 2012, South Indian Bend Wash Superfund Site, Tempe, Arizona**
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1.0 INTRODUCTION AND BACKGROUND

ITSI Gilbane Company (ITSI Gilbane) has prepared this Monitored Natural Attenuation Monitoring Report to summarize the results of the semi-annual groundwater sampling event conducted in March and April 2012 for the South Indian Bend Wash Superfund Site (SIBW) on behalf of the United States Environmental Protection Agency (EPA), Region 9. ITSI Gilbane conducted these activities under Remedial Action Contract (RAC) number EP-S9-08-03, Task Order 0008.

1.1 Background

Groundwater contamination was discovered at the Indian Bend Wash (IBW) Site in 1981, when elevated levels of volatile organic compounds (VOCs) including trichloroethene (TCE), tetrachloroethene (also known as perchloroethene [PCE]), and chloroform were found in Scottsdale-area drinking water wells. EPA and the Arizona Department of Environmental Quality (ADEQ) have been involved in investigations and cleanup activities at the SIBW Site since the initial discovery of VOCs in the groundwater in 1981. The IBW Site was placed on the National Priority List (NPL) in 1983 and, as part of the strategy developed to remediate the Site, IBW was divided into the North IBW (NIBW) and the SIBW areas.

On September 30, 1998, EPA issued a Record of Decision (ROD) defining the remedy to address VOCs in groundwater in the SIBW western, central, and eastern plumes. The original remedy selected for the western plume was groundwater extraction and treatment. A monitored natural attenuation (MNA) remedy was selected for the central and eastern plumes.

At the time the 1998 ROD was issued, EPA did not have sufficient data to demonstrate that the contaminant levels in the western plume were decreasing by natural attenuation and that cleanup standards could be met within a reasonable time frame. Since that time, EPA has gathered a significant amount of groundwater data for the western plume, including data from three monitoring wells installed in 2001. A ROD Amendment, finalized in September 2004, was developed to document the change of remedy for the western plume from extraction and treatment to MNA.

The SIBW Site, shown on Figure 1, includes approximately three square miles of groundwater for cleanup. As defined by the 1998 ROD, the Site is bounded by Apache Boulevard to the south, Rural Road to the west, Loop 101-Price Freeway to the east, and the Salt River to the north. The SIBW Site includes land developed for residential, commercial, and industrial uses. The area between Apache Boulevard and University Drive is primarily residential. North of University Drive, the Site is largely retail and commercial, including light industrial and auto repair/scrap facilities. Industrial activities in the area include circuit and electronics manufacturing, metal plating, plastics manufacturing, and dry cleaning.

The groundwater table fluctuates more than 50 feet at the Site. These fluctuations in groundwater levels can either leave residual areas of contamination when the water table falls, or cause vadose zone contaminants to become dissolved in the groundwater when the groundwater table rises (EPA ROD, 1998). The geological formations underlying the SIBW are divided into three alluvial units, designated as the Upper Alluvial Unit (UAU) Middle Alluvial Unit (MAU), and Lower Alluvial Unit (LAU), which are described below.

The 1998 ROD established the compliance boundary for the central and western UAU areas of contamination approximately 2,000 feet south of Broadway Road, bounded by Loop 101-Price Freeway to the east and Dorsey Lane to the west. The 1998 ROD also established the compliance boundary for the MAU areas of contamination approximately 2,000 feet east of monitoring well SIBW-57MC, bounded on the north by Rio Salado Parkway and on the south by Apache Boulevard.

1.1.1 Upper Alluvial Unit

The UAU is distributed across the entire SIBW area, and generally has a uniform thickness. The UAU typically is found near or at the ground surface and extends to approximately 110 to 170 feet below ground surface (bgs). The UAU normally is divided into an upper layer of clay and sandy silt and a lower layer dominated by sand, gravel, cobbles, and boulders. The upper layer typically is not present near the Salt River channel, and thickens to more than 20 feet south of the channel.

Groundwater flow directions in the UAU are south to southwest during non-river flow conditions in the Salt River. Flow directions shift to the south to southeast during river flow conditions in the Salt River, when aquifer recharge influences groundwater flow directions. Groundwater flow through the UAU originates mainly from Salt River recharge (during flow events); lateral inflow moves vertically downward, eventually entering the MAU.

1.1.2 Middle Alluvial Unit

The MAU consists primarily of clay and sandy silt, with significant interbedded layers of sand-gravel mixtures. These coarser-grained interbedded layers generally represent the zones with higher hydraulic conductivity in the MAU. Weak to strong calcium carbonate cementation also is present in the MAU. The interbedded stratigraphy encountered within the MAU is subdivided into subunits A, B, and C. MAU Subunit A is very thin and discontinuous; consequently, no EPA wells are screened in this subunit. The groundwater flow direction in MAU Subunit B is generally west to east, but insufficient data exist to characterize the flow direction fully. The groundwater flow direction in MAU Subunit C varies from due north to east, with northeast appearing to be the predominant flow direction.

1.1.3 Lower Alluvial Unit

The LAU underlies the MAU and, for most of the SIBW area, exceeds the depths explored during the remedial investigation (RI). The LAU extends from approximately 500 feet bgs to an undetermined depth in the SIBW (the base of the LAU typically was not encountered in RI soil borings). The lithology of the LAU is consistent with that of a conglomerate, dominated by weakly cemented gravel, sand, silt, and rock fragments. Groundwater flow directions in the LAU cannot be estimated accurately using the limited existing data.

1.2 Groundwater Plumes

Currently, groundwater samples are collected and analyzed and groundwater elevations are calculated on a semi-annual basis for the SIBW Site. The contaminants of concern, as established in the ROD, are cis-1,2-dichloroethene (cis-1,2-DCE), PCE, and TCE. All contaminants of concern have been reported at concentrations near or below their respective maximum contaminant levels (MCLs) in recent Site groundwater samples. The MCLs for the Site contaminants of concern are as follows:

- PCE = 5 micrograms per liter (ug/L);
- TCE = 5 ug/L;
- cis-1,2-DCE = 70 ug/L.

The primary contaminant of concern in the western and eastern plumes is TCE, whereas the primary contaminant of concern in the central plume is PCE.

Cis-1,2-DCE has been detected in the eastern plume, and is believed to be a by-product of TCE dechlorination. Monitoring well locations associated with the SIBW Site are presented on Figure 1.

Laboratory analytical results for the contaminants of concern associated with SIBW reported in samples collected for the first semi-annual sampling event of 2012 are presented in Table 1. Detections of contaminants of concern at concentrations greater than or equal to 1.0 ug/L from the first semi-annual sampling event for 2012 were used to create the approximate PCE and TCE concentration contours shown on Figure 2, Groundwater Contaminant Concentration Map.

2.0 MARCH AND APRIL 2012 ANALYTICAL RESULTS

Groundwater sampling at SIBW is conducted in accordance with the sampling frequencies identified in Table 5-2 of the *Field Sampling Plan, Remedial Action, South Indian Bend Wash Tempe, Arizona* (ITSI, 2009). The first round of semi-annual sampling in 2012 was conducted from March 29 through April 13, 2011. A total of 33 wells were scheduled to be sampled this round. Wells SIBW-27U and SIBW-40U could not be sampled, as the dedicated pumps in these wells are non-operational and have not been removed. A portable pump was used to sample seven wells during this sampling event: SIBW-3U, SIBW-10U, SIBW-31U, SIBW-41U, SIBW-46MC, SIBW-48U, and SIBW-55MC. The dedicated pumps in these wells were non-operational and have been removed.

Prior to sampling, depth to groundwater measurements were collected from all wells currently included in the SIBW groundwater sampling program. These depth-to-groundwater measurements were used to create groundwater potentiometric maps for the UAU (Figure 3-A) and for the MAU (Figure 3-B).

2.1 Contaminant of Concern Evaluation

Groundwater samples were collected from 31 monitoring wells and analyzed for VOCs by EPA Contract Laboratory Program (CLP) Method SOM01.2 by A4 Scientific, Inc. (A4), in The Woodlands, Texas. Table 1 presents the analytical results for the contaminants of concern for the 31 groundwater monitoring wells sampled. All results less than the method detection limit are considered non-detect. Results between the method detection limit and the laboratory reporting limit, 0.5 ug/L, are estimated results. These results are shown on Figure 2, but are not used as part of the PCE and TCE concentration contours. To remain consistent with previous sampling events, only results greater than or equal to 1.0 ug/L were used to create the PCE and TCE concentration contours shown on Figure 2.

Figure 2 shows contaminant concentration contours for PCE and TCE at concentrations greater than 1.0 ug/L. The highest concentration of TCE was detected in monitoring well SW-3 at 7.1 ug/L. The highest concentration of PCE was detected in monitoring well SIBW-64U at 4.7 ug/L. Results for the first semi-annual sampling event for 2012 are summarized as follows:

Cis-1,2-DCE was detected in four monitoring wells in the MAU eastern plume at concentrations greater than 0.5 ug/L but less than the MCL of 70 ug/L. These monitoring wells were SIBW-11MC at 1.0 ug/L, SIBW-56MC at 0.52 ug/L, SIBW-58MC at 1.3 ug/L, and SW-3 at 1.6 ug/L.

PCE was detected in seven monitoring wells in the UAU central plume at a concentration greater than 0.5 ug/L but less than the MCL of 5 ug/L. These monitoring wells were PD-2 at 0.69 ug/L, SIBW-39U at 0.63 ug/L, SIBW-60U at 1.2 ug/L, SIBW-61U at 4.2 ug/L, SIBW-64U at 4.7 ug/L, SIBW-65U at 1.2 ug/L, and SIBW-66U at 1.2 ug/L.

PCE was detected in two wells located in the MAU eastern plume at concentrations greater than 0.5 ug/L but less than the MCL of 5 ug/L. These two monitoring wells were SW-3 at 0.67 ug/L and SIBW-58MC at 0.54 ug/L.

TCE was detected in three monitoring wells located in the UAU western plume at concentrations greater than 0.5 ug/L, but less than the MCL of 5 ug/L. These monitoring wells were SIBW-28U at 0.75 ug/L, SIBW-60U at 1.6 ug/L, and SIBW-64U at 1.0 ug/L.

TCE was detected in two monitoring wells located in the MAU eastern plume at a concentration greater than 0.5 ug/L but less than the MCL of 5 ug/L. These monitoring wells were SIBW-13MC at 2.0 ug/L, and SIBW-56MC at 2.9 ug/L. TCE was detected in three monitoring wells located in the MAU eastern plume at concentrations greater than the MCL of 5 ug/L. These monitoring wells were SIBW-11MC at 5.3 ug/L, SIBW-58MC at 5.7 ug/L, and SW-3 at 7.1 ug/L.

2.1.1 Western Plume

TCE is the primary contaminant of concern in the groundwater in the UAU western plume. The UAU western plume originally was defined by monitoring wells SIBW-5U, SIBW-23U, SIBW-24U, SIBW-40U, and SIBW-28U. Recently TCE has been detected downgradient from SIBW-28U in monitoring wells SIBW-60U and SIBW-64U. The TCE concentrations in monitoring wells SIBW-60U and SIBW-64U are now greater than the TCE concentration detected in SIBW-28U.

During this sampling event, well SIBW-28U had a TCE concentration of 0.75 ug/L. As presented on Figure 4-A, the TCE concentration in monitoring well SIBW-28U has been below the MCL of 5 ug/L since October 2004.

TCE was not detected above the laboratory reporting limit in monitoring wells SIBW-5U or SIBW-23U during this sampling event. The TCE concentration for well SIBW-5U has been below the MCL since February 2004 (Figure 4-B). The TCE concentration for well SIBW-23U has been below the MCL since July 2001 (Figure 4-C).

Well SIBW-24U was removed from the sampling program in 2008. Well SIBW-40U no longer can be sampled due to a non-functioning pump that cannot be removed due to the proximity of overhead utilities.

TCE was detected in wells SIBW-60U at 1.6 ug/L and SIBW-64U at 1.0 ug/L. Well SIBW-60U had shown a decrease in TCE concentration from March 2011 (2.4 ug/L) to September 2011 (0.95 ug/L); however, the TCE concentration increased to 1.6 ug/L during the first 2012 sampling event (see Figure 4-D), which is the highest concentration of TCE detected in the UAU western plume this sampling round. Wells SIBW-60U and SIBW-64U were installed as sentinel wells for the UAU central plume. Downgradient migration of groundwater containing TCE from the western plume likely is resulting in detections of TCE in these two wells. SIBW-60U and SIBW-64U are considered representative wells for both the UAU central and western plumes. Figure 2 illustrates the current estimated extent of the TCE in the UAU western plume.

The following table lists the TCE detections for the UAU western plume for the last four sampling rounds:

WELL	TCE (ug/L)			
	Dec-10	Mar-11	Sep-11	Mar-12
SIBW-5U	NA	**0.59**	**0.24 J**	**0.48 J**
SIBW-23U	NA	**0.56**	**0.15 J**	**0.15 J**
SIBW-28U	**1.3**	**1.5**	**0.54**	**0.75**
SIBW-60U	NA	**2.4**	**0.95**	**1.6**
SIBW-64U	**0.66**	**0.81**	**0.39 J**	**1.0**
Regulatory Criteria (ug/L)				
MCL	5			

J = estimated Result
MCL = Maximum Contaminant Level
NA = not analyzed (not sampled)
TCE = trichloroethene
ug/L = micrograms per liter

2.1.2 Central Plume

PCE is the primary contaminant of concern present in the UAU central groundwater plume. The UAU central plume currently is defined by multiple wells; this includes five wells located south of the compliance boundary: SIBW-60U, SIBW-61U, SIBW-64U, SIBW-65U, and SIBW-66U.

Data from well SIBW-60U indicate an increase in PCE concentration from March 2010 (1.1 ug/L) to March 2011 (1.9 ug/L), before the sampling frequency was changed from annual to semi-annual. The PCE concentration in well SIBW-60U decreased slightly over the last year, to 1.2 ug/L during the first 2012 sampling event (see Figure 4-D).

PCE was detected in well SIBW-61U at concentrations above the MCL in past monitoring events, most recently in March 2011 (see Figure 4-E). Groundwater monitoring well SIBW-61U had shown a rising trend in PCE concentration, with PCE detections above the MCL from March 2010 to March 2011. SIBW-61U has shown a decreasing trend in PCE concentration since March 2011, with PCE detections at 4.6 ug/L and 4.2 ug/L for September 2011 and March 2012, respectively.

The PCE concentration in well SIBW-64U for this sampling event was 4.7 ug/L. This was the highest PCE concentration reported for any groundwater monitoring well sampled for this event. The PCE concentration in well SIBW-64U decreased in the September 2011 sampling event, but increased this sampling round to approximately the same level as one year ago (the March 2011 sampling event; see Figure 4-F).

PCE was detected in well SIBW-65U at concentrations above the MCL in May 2006 (see Figure 4-G). Well SIBW-65U showed a decrease in PCE concentration from 2.1 ug/L in March 2011 to 0.74 ug/L in September 2011. The PCE concentration in well SIBW-65U increased this sampling event to 1.2 ug/L.

Well SIBW-66U is the most recently installed well. It was placed downgradient of the western and central UAU plumes south of monitoring well SIBW-65U. SIBW-66U indicated a potential increasing trend in PCE, from 1.4 ug/L in September 2010, when it was first sampled, to 1.7 ug/L in March 2011 (see Figure 4-H). The PCE concentration in SIBW-66U for the September 2011 sampling event was 0.58 ug/L. PCE concentration this sampling event increased to 1.2 ug/L.

Monitoring wells PD-2, SIBW-39U, and SW-1 are located to the northeast of the current central plume location. For the current sampling event, PCE was detected in well PD-2 at a concentration of 0.69 ug/L and in well SIBW-39U at a concentration of 0.63 ug/L. Well SW-1 did not have a PCE concentration above the laboratory reporting limit during this sampling event. Monitoring wells SIBW-39U and SW-1 historically have had detections of PCE above the MCL. However, as presented on Figures 4-I and 4-J, respectively, these wells have shown a downward trend, and PCE concentrations have been below the MCL of 5 ug/L since April 2001 and January 2005, respectively.

Wells SIBW-38U and SIBW-59U are located north of the current central plume location. PCE was not detected above the laboratory reporting limit in these two wells for this sampling round. As presented on Figure 4-K, well SIBW-38U has been below the MCL of 5 ug/L since October 2007. Monitoring well SIBW-26U was not sampled during this sampling event, as it currently is scheduled to be sampled on bi-annual odd years.

The following table lists the PCE detections for the UAU central plume for the last four sampling rounds:

WELL	PCE (ug/L)			
	Dec-10	Mar-11	Sep-11	Mar-12
PD-2	NA	**0.95**	**0.45 J**	**0.69**
SIBW-26U	NA	**0.62**	NA	NA
SIBW-38U	NA	**0.32 J**	< 0.50	**0.21 J**
SIBW-39U	NA	**1.1**	**0.41 J**	**0.63**
SIBW-59U	NA	**0.34 J**	NA	< 0.50
SIBW-60U	NA	**1.9**	**0.67**	**1.2**
SIBW-61U	**6.3**	**7.6**	**4.6**	**4.2**
SIBW-64U	**3.9**	**4.8**	**2.0**	**4.7**
SIBW-65U	**1.1**	**2.1**	**0.74**	**1.2**
SIBW-66U	**1.6**	**1.7**	**0.58**	**1.2**
SW-1	NA	**0.98**	**0.43 J**	< 0.50
Regulatory Criteria (ug/L)				
MCL	5			

J = estimated result
MCL = Maximum Contaminant Level
NA = not analyzed (not sampled)
PCE = tetrachloroethene
ug/L = micrograms per liter
< 0.50 = less than the method detection limit (non-detect)
= result above the MCL

2.1.3 Eastern Plume

TCE is the primary contaminant of concern in the groundwater in the MAU eastern plume. Two wells sampled in this sampling event in the MAU eastern plume had TCE concentrations above the reporting limit of 0.5 ug/L, but below the MCL of 5 ug/L: SIBW-13MC at 2.0 ug/L and SIBW-56MC at 2.9 ug/L. Three wells sampled in this sampling event in the eastern plume had TCE concentrations above the MCL of 5 ug/L; SIBW-11MC at 5.3 ug/L, SIBW-58MC at 5.7 ug/L, and SW-3 at 7.1 ug/L.

TCE and PCE concentration trend plots and groundwater elevations for monitoring wells SIBW-11MC, SIBW-56MC, SIBW-58MC, and SW-3 can be found on Figures 4-L, 4-M, 4-N, 4-O, and 4-P, respectively. Figure 2 illustrates the extent of TCE in the MAU eastern plume.

Although TCE is the primary contaminant of concern in the MAU eastern plume, two wells also had detections of PCE above the laboratory reporting limit of 0.5 ug/L for this sampling event: SIBW-58MC at 0.54 ug/L and SW-3 at 0.67 ug/L. However, none of the reported concentrations were above the MCL.

The following table lists the TCE detections for the MAU eastern plume for the last four sampling rounds:

WELL	cis-1,2-DCE (ug/L)				TCE (ug/L)			
	Dec-10	Mar-11	Dec-11	Mar-12	Dec-10	Mar-11	Dec-11	Mar-12
SIBW-11MC	1.1	1.3	1.3	1.0	6.8	8.1	8.0	5.3
SIBW-13MC	0.42 J	0.46 J	NA	0.30 J	2.9	3.4	1.2	2.0
SIBW-56MC	0.61	0.72	0.66	0.52	3.7	4.3	4.0	2.9
SIBW-58MC	1.5	1.7	1.7	1.3	7.2	8.9	8.6	5.7
SW-3	1.6	1.7	1.6	1.6	6.4	7.5	7.0	7.1
Regulatory Criteria (ug/L)								
MCL	70				5			

cis-1,2-DCE = cis-1,2-dichloroethene
J = estimated result
MCL = Maximum Contaminant Level
NA = not analyzed (not sampled)
TCE = trichloroethene
ug/L = micrograms per liter
= result above the MCL

2.2 Groundwater Elevation and Flow Direction Evaluation

Based on data from representative wells screened in the UAU and the MAU, groundwater elevations generally declined between 1994 and 2004. However, from 2004 to 2012, elevations in representative SIBW wells screened in the UAU and the MAU have risen: elevations in the UAU monitoring wells sampled during this sampling event have risen from 31 to 35 feet over the past eight years, while the elevations in the MAU wells have risen from 70 to 90 feet over the same period. These trends can be seen in the TCE and PCE concentration trend plots and groundwater elevations included on Figures 4-A through 4-P.

Groundwater contours were developed using groundwater elevations calculated from depth-to-water measurements taken at each of the monitoring wells currently included in the SIBW groundwater sampling program. Groundwater elevation contours on Figure 3-A show that groundwater flow direction in the UAU is to the south-southwest. This is consistent with historical data, which show the groundwater flow direction being influenced by the seasonal Salt River flow. When the Salt River is flowing, the groundwater flow direction in the UAU shifts from the south-southwest to the south-southeast (EPA ROD, 1998).

Figure 3-B shows groundwater elevation contours in the MAU, with groundwater flowing from north-northeast to north-northwest. The 1998 ROD stated that the groundwater flow direction in the MAU was inconclusive; however, a general trend to the east was noted.

3.0 CONCLUSIONS AND RECOMMENDATIONS

The concentration of TCE in wells SIBW-28U, SIBW-60U, and SIBW-64U in the UAU western plume increased since the September 2011 sampling event. The concentration of TCE in monitoring well SIBW-64U has shown an increasing trend, which is most likely due to downgradient migration of groundwater containing TCE. The TCE concentration in well SIBW-60U increased from the last sampling event in September 2011, but is lower than the TCE concentration detected a year ago in the March 2011 sampling event. The highest PCE concentration detected in the UAU central plume was 4.7 ug/L in well SIBW-64U. All contaminants of concern concentrations in the UAU western plume continue to be below the MCL.

The PCE concentration in well SIBW-61U (central plume) continues to decrease from above the MCL in March 2011 to below the MCL for the September 2011 and this sampling round. PCE concentrations increased in wells PD-2, SIBW-38U, SIBW-39U, SIBW-60U, SIBW-64U, SIBW-65U, and SIBW-66U; however, all concentrations of contaminants of concern in the UAU central plume have been below the MCL for the last two sampling rounds.

Concentrations of TCE in wells SIBW-11MC and SIBW-58MC in the eastern plume decreased for this sampling event. The TCE concentration in well SW-3 increased from 7.0 ug/L in September 2011 to 7.1 ug/L for this sampling event. This was the highest concentration of TCE detected during this sampling event. TCE concentrations in wells SIBW-11MC, SIBW-58MC, and SW-3 continue to remain above the MCL.

Groundwater contours show the groundwater flow direction in the UAU to the south-southwest, which is consistent with historical data. Groundwater elevation contours for the MAU show groundwater flowing from north-northeast to north-northwest, indicating that surrounding development may be influencing the flow pattern.

Since 2004, groundwater elevations in representative SIBW wells screened in the UAU and the MAU have risen. Groundwater elevations in monitoring wells sampled during this sampling round in the UAU have risen from 31 feet to 34 feet, and the groundwater elevations in the MAU have risen from 71 feet to 79 feet, over this eight-year period.

Based upon the results of this sampling event and the analytical results of past sampling events, ITSI recommends the following:

1. Properly abandon the following 25 wells, as they are no longer included in the sampling program and are no longer associated with the current locations of the plumes:

- SIBW-1U, SIBW-2U, SIBW-4U, SIBW-7U, SIBW-8U, SIBW-9U, SIBW-14MC, SIBW-15MB, SIBW-18MB, SIBW-20U, SIBW-22U, SIBW-24U, SIBW-25U, SIBW-29U, SIBW-32U, SIBW-36U, SIBW-37U, SIBW-43U, SIBW-44U, SIBW-45U, SIBW-49U, SIBW-50U, SIBW-51U, SIBW-52U, and SIBW-53U.

2. Change the sampling frequency of the following wells, based on the current locations of the plumes and recent laboratory analytical results:
   - Change the sampling frequency of SIBW-59U from biannual even to semi-annual to monitor the western edge of the UAU western plume.
   - Change the sampling frequency of SIBW-12L from annual to biannual odd.
   - Change the sampling frequency of PD-3 from annual to biannual odd.
   - Change the sampling frequency of SIBW-48U from semi-annual to biannual odd.
   - Change the sampling frequency of SIBW-41U from annual to biannual even.
   - Change the sampling frequency of SIBW-42U from annual to biannual even.
   - Change the sampling frequency of SIBW-27U from annual to biannual even.

The next sampling event in the Semi-Annual Groundwater Monitoring Program is scheduled for September 2012. Wells to be sampled in the September 2012 sampling event will include all wells with the sampling frequencies identified in Table 5-2 of the *Field Sampling Plan, Remedial Action, South Indian Bend Wash Tempe, Arizona* (ITSI, 2009), unless a modification of sampling schedule based on the recommendations listed above is accepted by EPA.

4.0 REFERENCES

EPA, 1998. Record of Decision, VOCs in Groundwater Operable Unit, Indian Bend Wash Superfund Site, South Area, Tempe, Arizona. September.

EPA, 2004. Record of Decision Amendment for the South Indian Bend Wash Superfund Site Groundwater Operable Unit, Tempe, Arizona. June.

ITSI, 2009. Field Sampling Plan, Remedial Action, South Indian Bend Wash, Tempe, Arizona.

ITSI, 2010. Monitor Well Installation Report, South Indian Bend Wash Superfund Site. November.

ATTACHMENTS

Tables

Table 1 Groundwater Sampling Analytical Results, First Semi-Annual Sampling Event, 2012

Figures

Figure 1 Well Location Map

Figure 2 Groundwater Contamination Concentrations Map, First Semi-Annual Sampling Event, 2012

Figure 3-A Groundwater Potentiometric Map, Upper Alluvial Unit, First Semi-Annual Sampling Event, 2012

Figure 3-B Groundwater Potentiometric Map, Middle Alluvial Unit, First Semi-Annual Sampling Event, 2012

Figure 4-A Concentrations and Groundwater Elevations for SIBW Over Time, SIBW-28U, Western Plume

Figure 4-B Concentrations and Groundwater Elevations for SIBW Over Time, SIBW-5U, Western Plume

Figure 4-C Concentrations and Groundwater Elevations for SIBW Over Time, SIBW-23U, Western Plume

Figure 4-D Concentrations and Groundwater Elevations for SIBW Over Time, SIBW-60U, Central Plume

Figure 4-E Concentrations and Groundwater Elevations for SIBW Over Time, SIBW-61U, Central Plume

Figure 4-F Concentrations and Groundwater Elevations for SIBW Over Time, SIBW-64U, Central Plume

Figure 4-G Concentrations and Groundwater Elevations for SIBW Over Time, SIBW-65U, Central Plume

Figure 4-H Concentrations and Groundwater Elevations for SIBW Over Time, SIBW-66U, Central Plume

Figure 4-I Concentrations and Groundwater Elevations for SIBW Over Time, SIBW-39U, Central Plume

Figure 4-J Concentrations and Groundwater Elevations for SIBW Over Time, SW-1, Central Plume

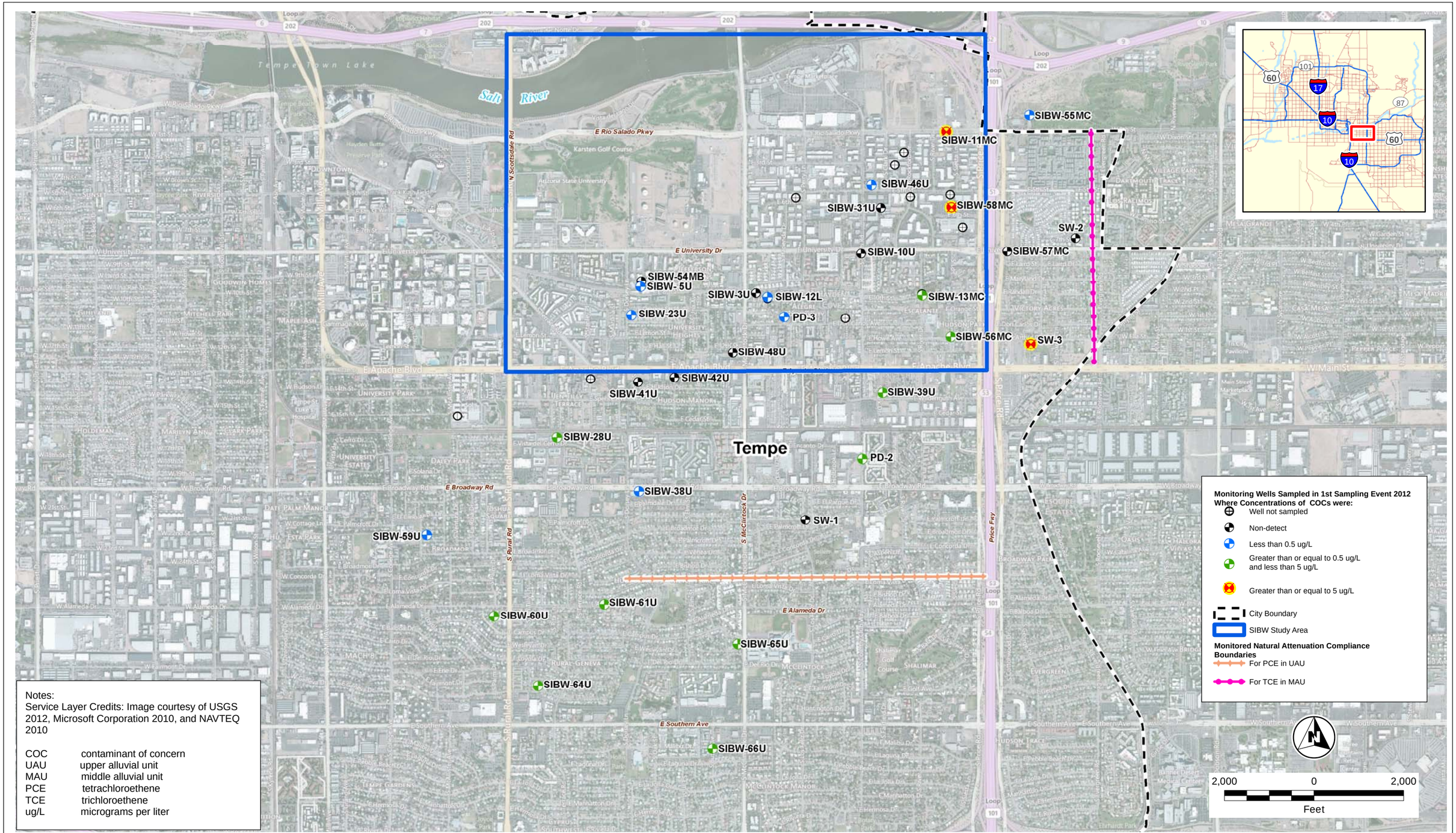
TABLES

TABLE 1
Groundwater Sampling Analytical Results
First Semi-annual Sampling Event 2012

WELL	cis-1,2-Dichloroethene	Tetrachloroethene	Trichloroethene
PD-2	<0.50	**0.69**	<0.50
PD-3	<0.50	<0.50	**0.27 J**
SIBW- 3U	<0.50	<0.50	<0.50
SIBW- 5U	**0.46 J**	<0.50	**0.48 J**
SIBW- 10U	<0.50	<0.50	<0.50
SIBW-11MC	**1.0**	**0.46 J**	**5.3**
SIBW-12L	<0.50	<0.50	**0.29 J**
SIBW-13MC	**0.30 J**	**0.26 J**	**2.0**
SIBW-23U	<0.50	**0.10 J**	**0.15 J**
SIBW-28U	<0.50	**0.23 J**	**0.75**
SIBW-31U	<0.50	<0.50	<0.50
SIBW-38U	<0.50	**0.21 J**	<0.50
SIBW-39U	<0.50	**0.63**	<0.50
SIBW-39U DUP	<0.50	**0.63**	<0.50
SIBW-41U	<0.50	<0.50	<0.50
SIBW-42U	<0.50	<0.50	<0.50
SIBW-46U	<0.50	**0.34 J**	<0.50
SIBW-48U	<0.50	<0.50	<0.50
SIBW-54MB	<0.50	<0.50	<0.50
SIBW-55MC	<0.50	**0.14 J**	<0.50
SIBW-56MC	**0.52**	**0.32 J**	**2.9**
SIBW-57MC	<0.50	<0.50	<0.50
SIBW-58MC	**1.3**	**0.54**	**5.7**
SIBW-59U	<0.50	<0.50	**0.18 J**
SIBW-60U	**0.32 J**	**1.2**	**1.6**
SIBW-61U	<0.50	**4.2**	<0.50
SIBW-64U	<0.50	**4.7**	**1.0**
SIBW-65U	<0.50	**1.2**	<0.50
SIBW-66U	<0.50	**1.2**	<0.50
SW-1	<0.50	<0.50	<0.50
SW-1 DUP	<0.50	**0.82**	<0.50
SW-2	<0.50	<0.50	<0.50
SW-3	**1.6**	**0.67**	**7.1**
SW-3 DUP	**1.4**	**0.63**	**5.5**
	Criteria (ug/L)		
MCL	70	5	5
Arizona AWQS	70	5	5

All results are in micrograms per liter (ug/L)
< 0.50 = result below the laboratory reporting limit (non-detect)
AWQS = Aquifer Water Quality Standard
J = estimated Value
MCL = maximum contaminant level
NA = not analyzed (not sampled)
Well screened in the middle alluvial unit (MAU)
Result above the maximum contaminant level

FIGURES



Notes:
Service Layer Credits: Image courtesy of USGS 2012, Microsoft Corporation 2010, and NAVTEQ 2010

COC	contaminant of concern
UAU	upper alluvial unit
MAU	middle alluvial unit
PCE	tetrachloroethene
TCE	trichloroethene
ug/L	micrograms per liter

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SIBW Monitored Natural Attenuation Monitoring Report - First Semi-annual Sampling Event 2012
South Indian Bend Wash Superfund Site, US EPA Region 9
Tempe, Arizona

FIGURE 1
Well Location Map

G:\ArcGIS\EPA\SIBW\PROJECTS\Apr2012\SiteLocsApr12.mxd 10/16/2012 [11:16 AM] LWEBER, ITSI

WELL	cis-1,2-Dichloroethene	Tetrachloroethene	Trichloroethene
PD-2	<0.50	**0.69**	<0.50
PD-3	<0.50	<0.50	**0.27 J**
SIBW- 3U	<0.50	<0.50	<0.50
SIBW- 5U	**0.46 J**	<0.50	**0.48 J**
SIBW- 10U	<0.50	<0.50	<0.50
SIBW-11MC	**1.0**	**0.46 J**	**5.3**
SIBW-12L	<0.50	<0.50	**0.29 J**
SIBW-13MC	**0.30 J**	**0.26 J**	**2.0**
SIBW-23U	<0.50	**0.10 J**	**0.15 J**
SIBW-28U	<0.50	**0.23 J**	**0.75**
SIBW-31U	<0.50	<0.50	<0.50
SIBW-38U	<0.50	**0.21 J**	<0.50
SIBW-39U	<0.50	**0.63**	<0.50
SIBW-39U DUP	<0.50	**0.63**	<0.50
SIBW-41U	<0.50	<0.50	<0.50
SIBW-42U	<0.50	<0.50	<0.50
SIBW-46U	<0.50	**0.34 J**	<0.50
SIBW-48U	<0.50	<0.50	<0.50
SIBW-54MB	<0.50	<0.50	<0.50
SIBW-55MC	<0.50	**0.14 J**	<0.50
SIBW-56MC	**0.52**	**0.32 J**	**2.9**
SIBW-57MC	<0.50	<0.50	<0.50
SIBW-58MC	**1.3**	**0.54**	**5.7**
SIBW-59U	<0.50	<0.50	**0.18 J**
SIBW-60U	**0.32 J**	**1.2**	**1.6**
SIBW-61U	<0.50	**4.2**	<0.50
SIBW-64U	<0.50	**4.7**	**1.0**
SIBW-65U	<0.50	**1.2**	<0.50
SIBW-66U	<0.50	**1.2**	<0.50
SW-1	<0.50	<0.50	<0.50
SW-1 DUP	<0.50	**0.82**	<0.50
SW-2	<0.50	<0.50	<0.50
SW-3	**1.6**	**0.67**	**7.1**
SW-3 DUP	**1.4**	**0.63**	**5.5**
	Criteria (ug/L)		
MCL	70	5	5
Arizona AWQS	70	5	5

All results are in micrograms per liter (ug/L)
< 0.50 = result below the laboratory reporting limit (non-detect)
AWQS = Aquifer Water Quality Standard
J = estimated Value
MCL = maximum contaminant level
NA = not analyzed (not sampled)
Well screened in the middle alluvial unit (MAU)
Result above the maximum contaminant level

Notes:
Service Layer Credits: Image courtesy of USGS 2012, Microsoft Corporation 2010, and NAVTEC

AWQ	aquifer water quality standard
COC	contaminant of concern
UAU	upper alluvial unit
MAU	middle alluvial unit
MCL	maximum contaminant level
ND	not detected
PCE	tetrachloroethene
TCE	trichloroethene
ug/L	micrograms per liter
J	indicates estimated result
*	indicates not detected at the reporting limit

Monitoring Wells Sampled in1st Sampling Event 2012 Where Concentrations of COCs were:
- Well not sampled
- Non Detect
- Less than 0.5 ug/L
- Greater than or equal to 0.5 ug/L and less than 5 ug/L
- Greater than or equal to 5 ug/L
- PCE UAU Central Plume Concentration Contour in ug/L
- TCE MAU Eastern Plume Concentration Contour in ug/L
- TCE UAU Western Plume Concentration Contour in ug/L
- City Boundary

Monitored Natural Attenuation Compliance Boundaries
- For PCE in UAU
- For TCE in MAU

2,000 0 2,000
Feet

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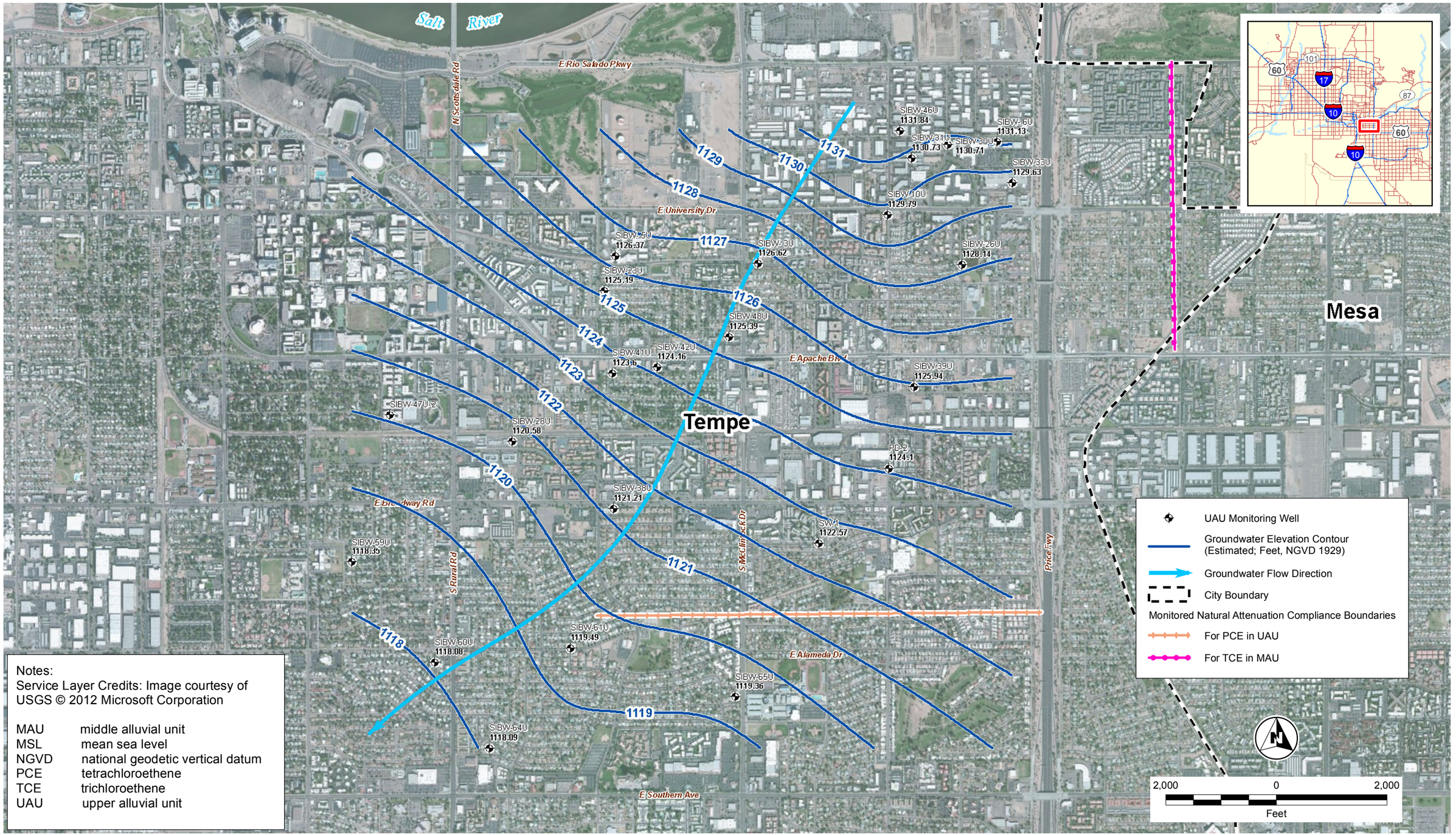
South Indian Bend Wash Superfund Site, US EPA Region 9
Tempe, Arizona

FIGURE 2
Groundwater Contamination Concentrations Map

G:\ArcGIS\EPA\SIBW\PROJECTS\Apr2012\GWContPlumesApr12.mxd 10/16/2012 [11:02 AM] LWEBER, ITSI



Notes:
Service Layer Credits: Image courtesy of USGS © 2012 Microsoft Corporation

MAU	middle alluvial unit
MSL	mean sea level
NGVD	national geodetic vertical datum
PCE	tetrachloroethene
TCE	trichloroethene
UAU	upper alluvial unit

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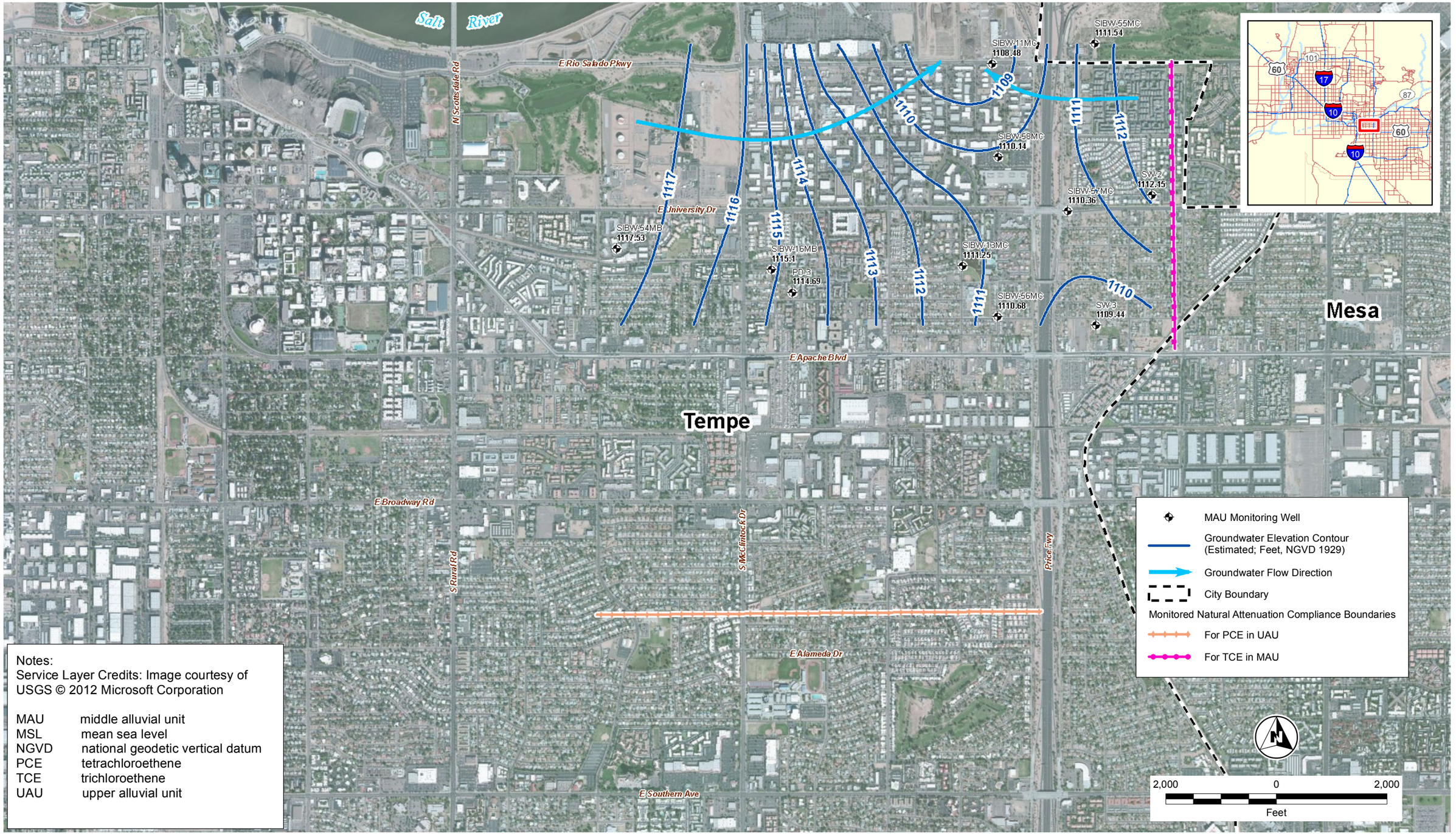
SIBW Monitored Natural Attenuation Monitoring Report - First Semi-annual Sampling Event 2012
South Indian Bend Wash Superfund Site, US EPA Region 9
Tempe, Arizona

FIGURE 3-A
Groundwater Potentiometric Map,
Upper Alluvial Unit

G:\ArcGIS\EPA\SIBW\PROJECTS\Apr2012\GWElevUAUApr12.mxd 10/15/2012 [18:11 PM] LWEBER, ITSI



Notes:
Service Layer Credits: Image courtesy of USGS © 2012 Microsoft Corporation

MAU	middle alluvial unit
MSL	mean sea level
NGVD	national geodetic vertical datum
PCE	tetrachloroethene
TCE	trichloroethene
UAU	upper alluvial unit

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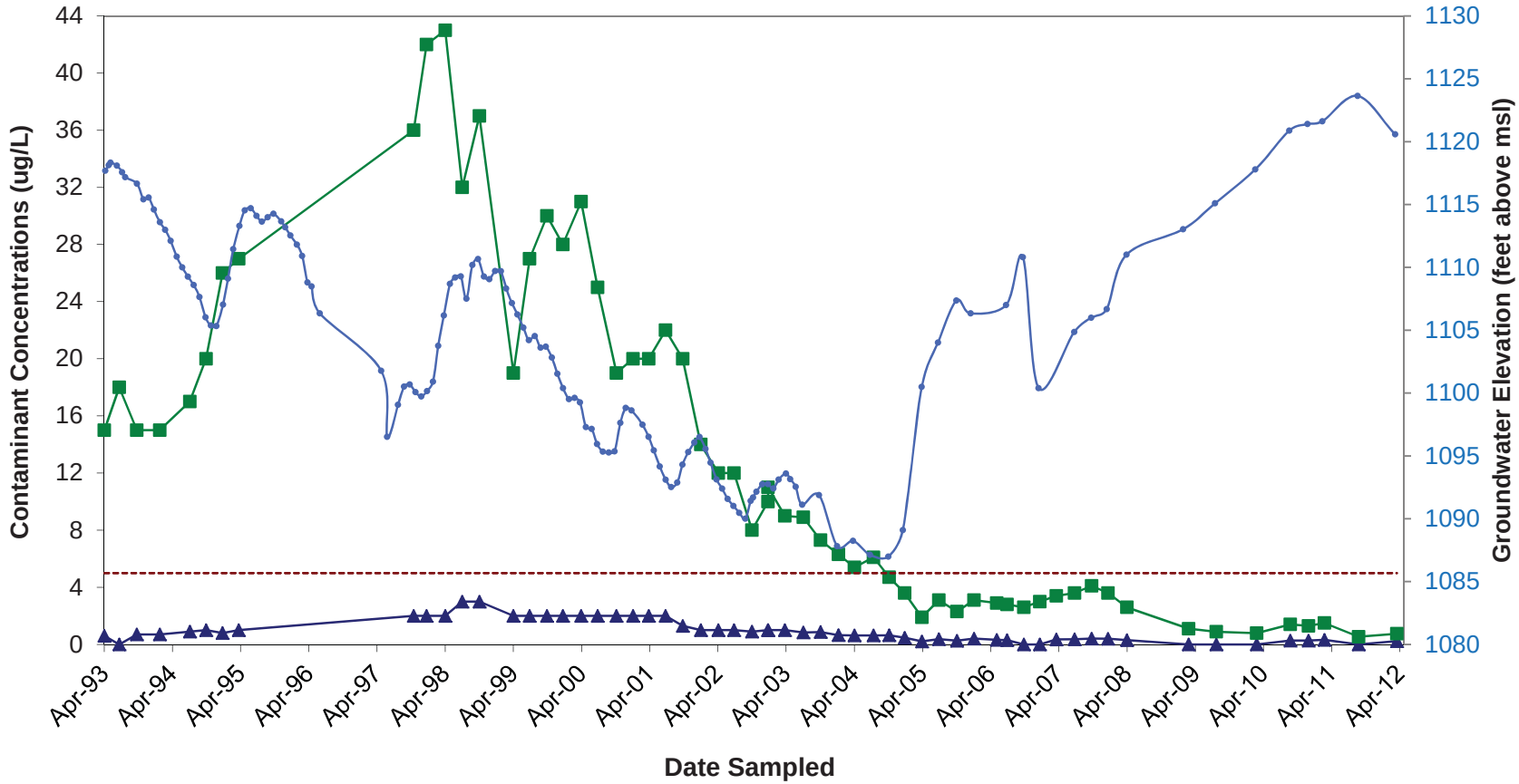
SIBW Monitored Natural Attenuation Monitoring Report - First Semi-annual Sampling Event 2012
South Indian Bend Wash Superfund Site, US EPA Region 9
Tempe, Arizona

FIGURE 3-B
Groundwater Potentiometric Map,
Middle Alluvial Unit

G:\ArcGIS\EPA\SIBW\PROJECTS\Apr2012\GWElevMAUApr12.mxd 10/15/2012 [18:07 PM] LWEBER, ITSI



Note For analytes not detected above the laboratory reporting limits, the concentration was set to zero.

ug/L micrograms per liter
MCL maximum contaminant level
msl mean sea level

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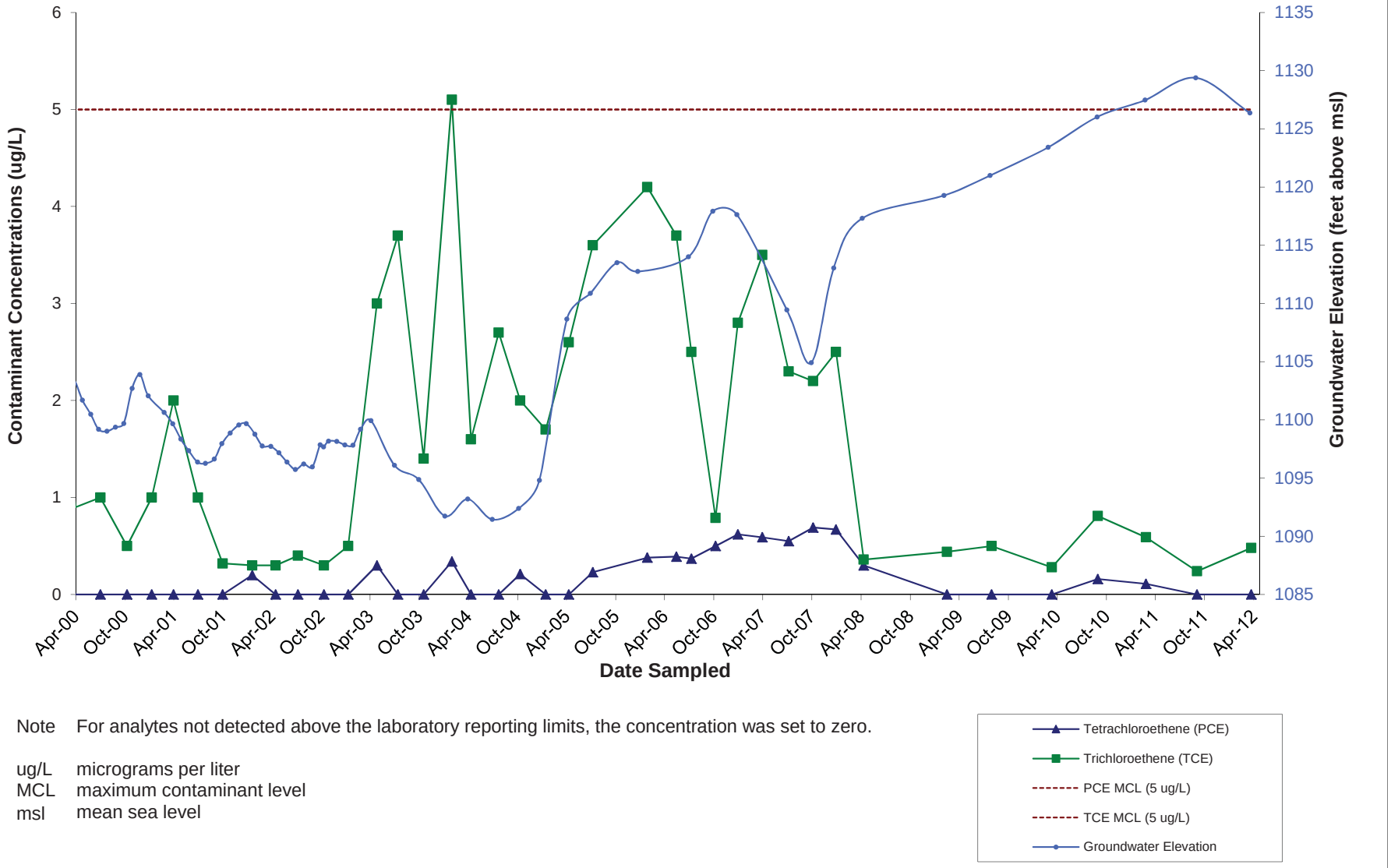
SIBW Monitored Natural Attenuation Monitoring Report - First Semi-annual Sampling Event 2012
Concentrations and Groundwater Elevations for SIBW Over Time
South Indian Bend Wash, Arizona

Figure 4-A
SIBW-28U
Western Plume
April 1993- April 2012

O:\0009 TO 8 South IBW\5.0 Tech Rpts\April 2012 Sampling\MNAMR\Figures\Figure 4-A SIBW-28U



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ug/L micrograms per liter
MCL maximum contaminant level
msl mean sea level

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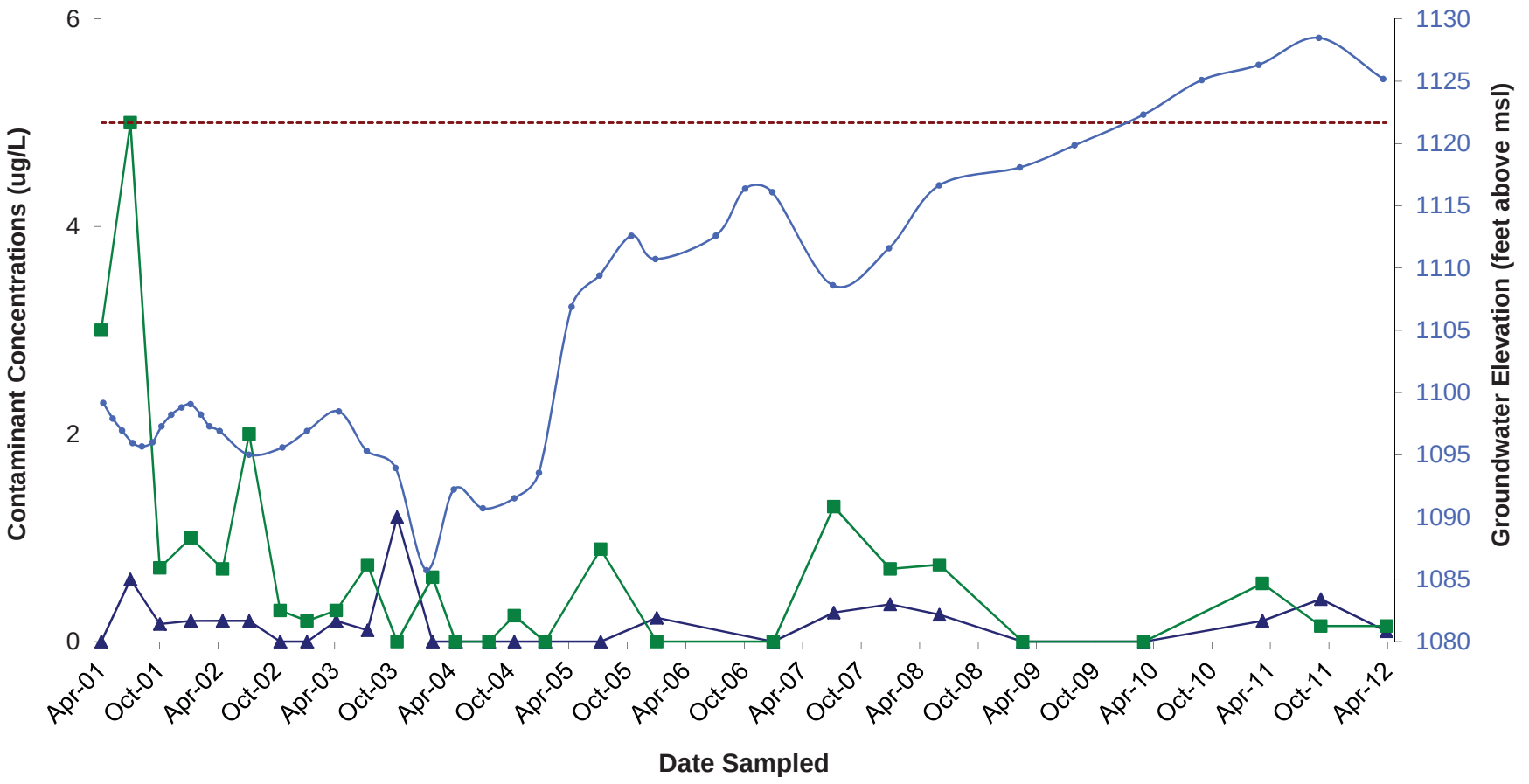
SIBW Monitored Natural Attenuation Monitoring Report - First Semi-annual Sampling Event 2012
Concentrations and Groundwater Elevations for SIBW Over Time
South Indian Bend Wash, Arizona

Figure 4-B
SIBW-5U
Western Plume
April 2000 - April 2012

O:\0009 TO 8 South IBW\5.0 Tech Rpts\April 11 Sampling\MNAMR\Figures\Figure 4-B SIBW-5U



Note For analytes not detected above the laboratory reporting limits, the concentration was set to zero.

ug/L micrograms per liter
MCL maximum contaminant level
msl mean sea level

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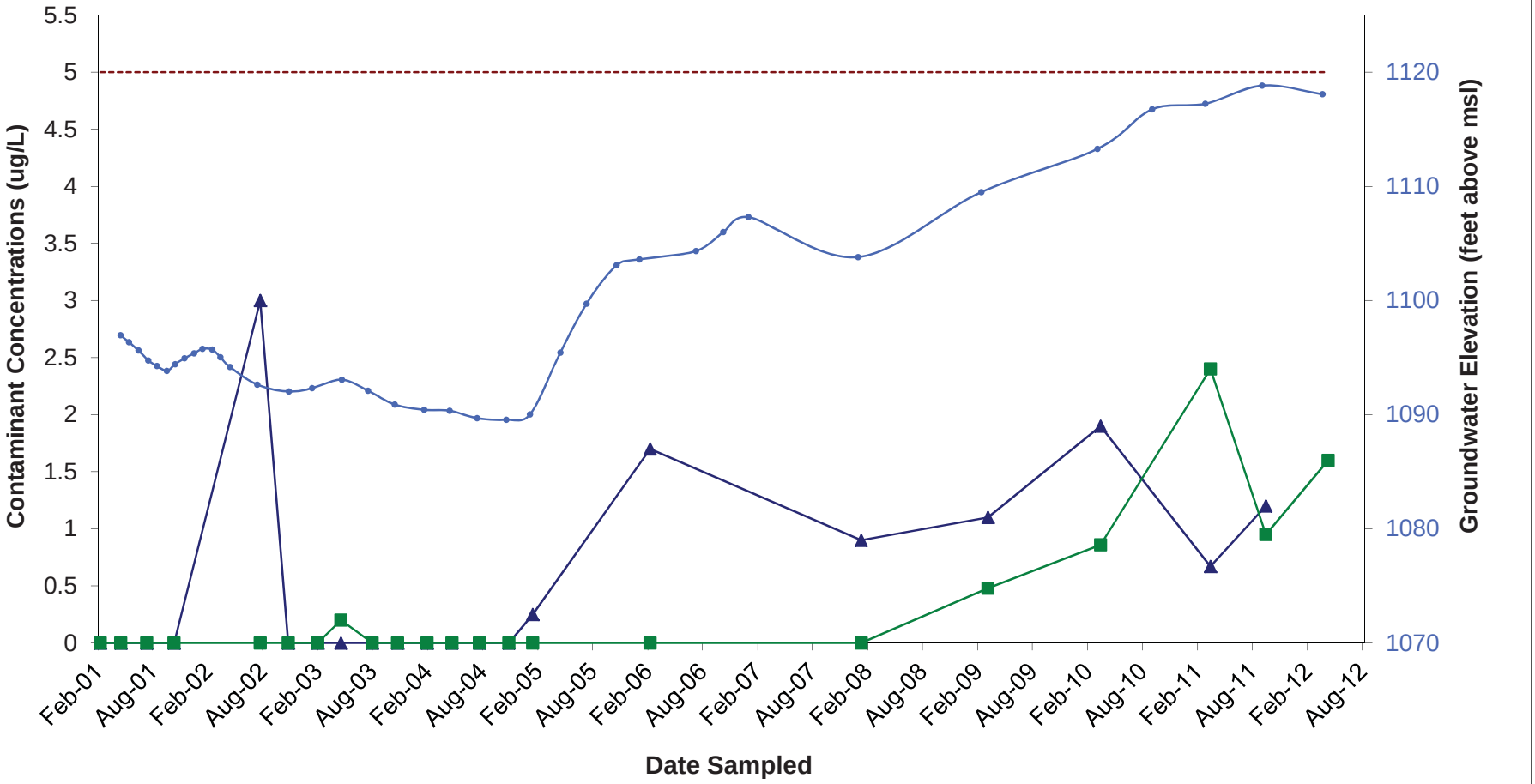
SIBW Monitored Natural Attenuation Monitoring Report - First Semi-annual Sampling Event 2012
Concentrations and Groundwater Elevations for SIBW Over Time
South Indian Bend Wash, Arizona

Figure 4-C
SIBW-23U
Western Plume
April 2001-April 2012

O:\0009 TO 8 South IBW\5.0 Tech Rpts\April 11 Sampling\MNAMR\Figures\Figure 4-C SIBW-23U



Note For analytes not detected above the laboratory reporting limits, the concentration was set to zero.

ug/L micrograms per liter
MCL maximum contaminant level
msl mean sea level

O:\0009 TO 8 South IBW\5.0 Tech Rpts\April 12 Sampling\MNAMR\Figures\Figure 4-D SIBW-60U

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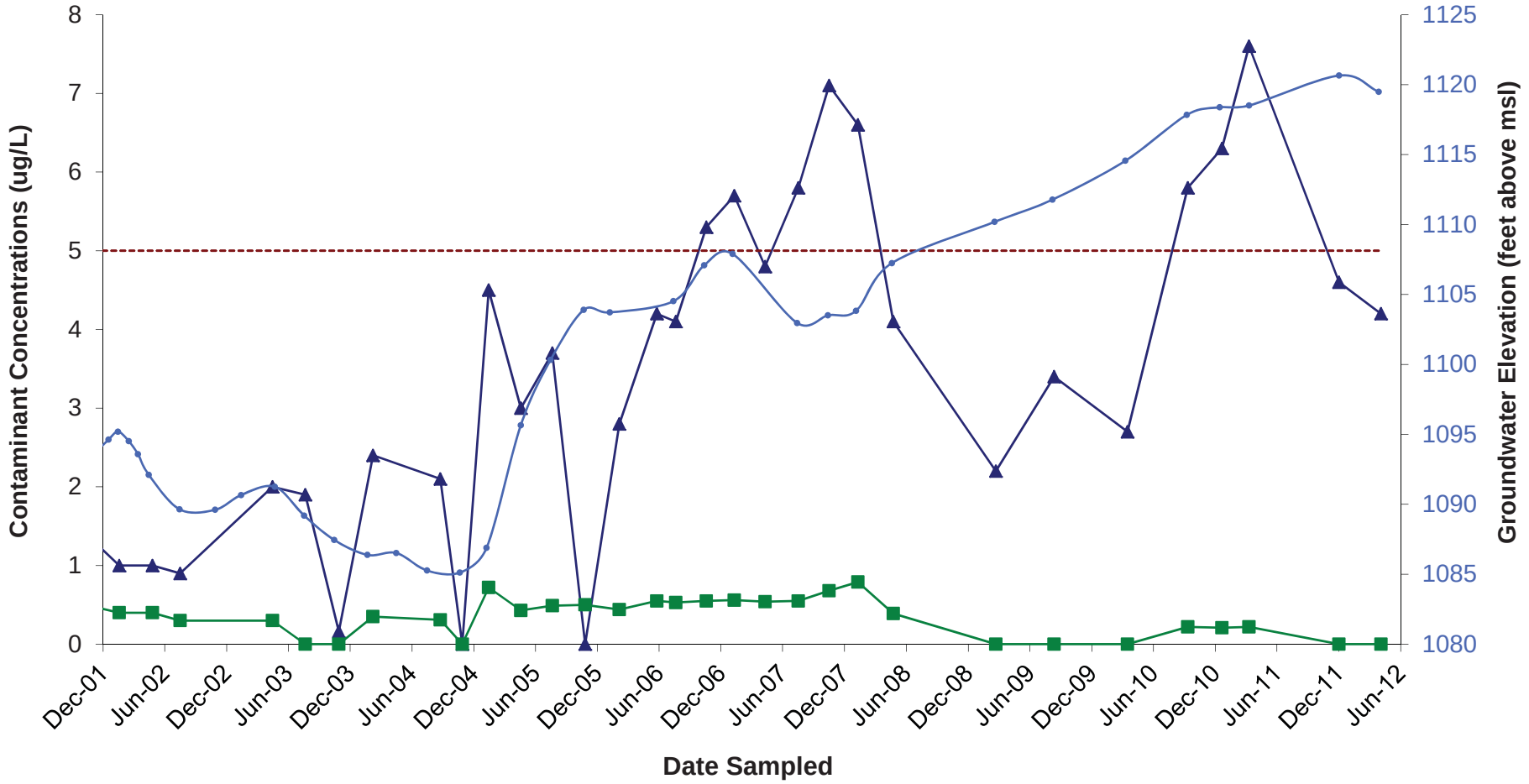
SIBW Monitored Natural Attenuation Monitoring Report - First Semi-annual Sampling Event 2012
Concentrations and Groundwater Elevations for SIBW Over Time
South Indian Bend Wash, Arizona

Figure 4-D
SIBW-60U
Central Plume
February 2001-April 2012



Note For analytes not detected above the laboratory reporting limits, the concentration was set to zero.

ug/L micrograms per liter
MCL maximum contaminant level
msl mean sea level

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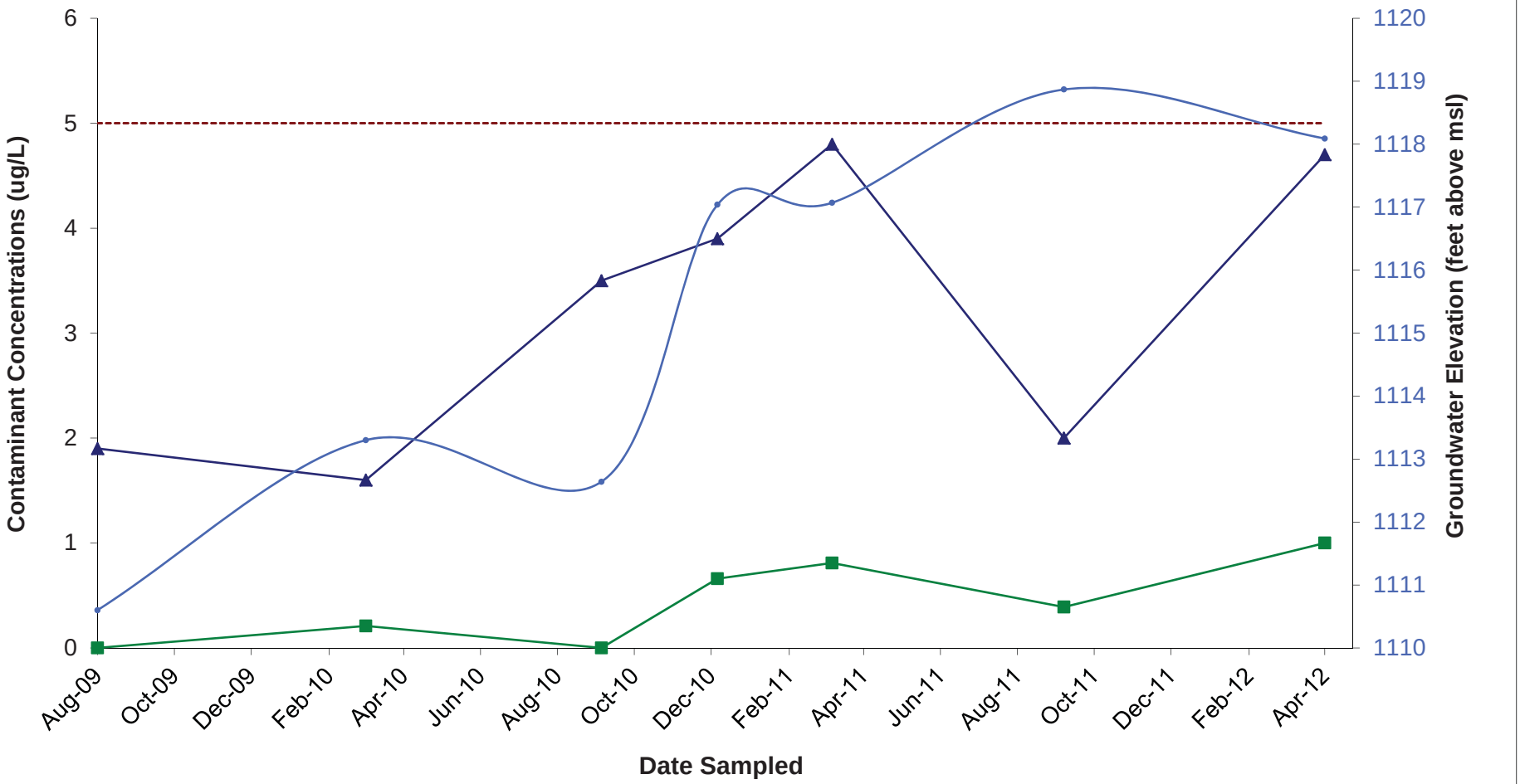
SIBW Monitored Natural Attenuation Monitoring Report - First Semi-annual Sampling Event 2012
Concentrations and Groundwater Elevations for SIBW Over Time
South Indian Bend Wash, Arizona

Figure 4-E
SIBW-61U
Central Plume
December 2001-April 2012

O:\0009 TO 8 South IBW\5.0 Tech Rpts April 12 Sampling\MNAMR\Figures\Figure 4-E SIBW-61U



Note For analytes not detected above the laboratory reporting limits, the concentration was set to zero.

ug/L micrograms per liter
MCL maximum contaminant level
msl mean sea level

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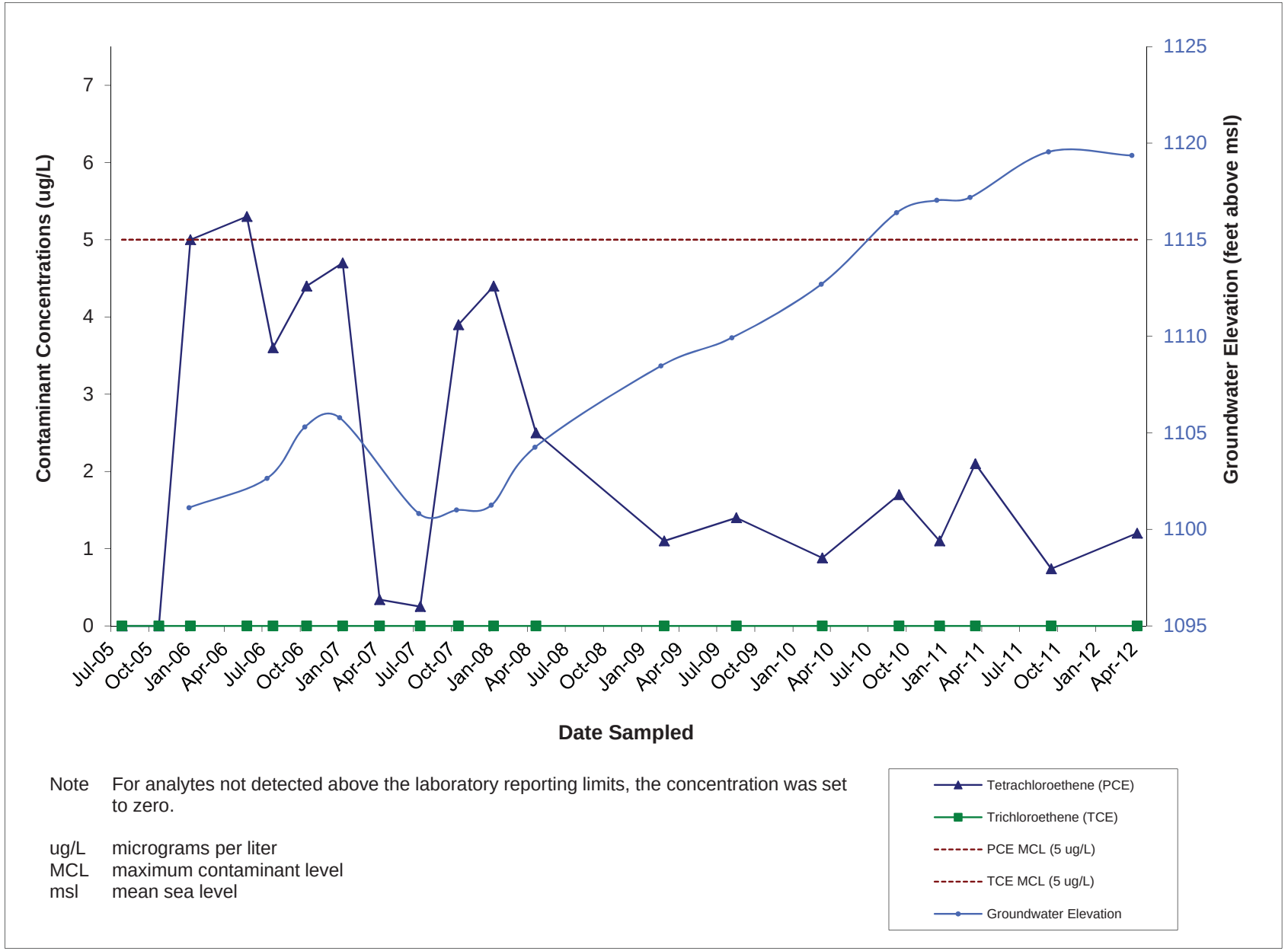
SIBW Monitored Natural Attenuation Monitoring Report - First Semi-annual Sampling Event 2012
Concentrations and Groundwater Elevations for SIBW Over Time
South Indian Bend Wash, Arizona

Figure 4-F
SIBW-64U
Central Plume
August 2009 - April 2012

O:\0009 TO 8 South IBW\5.0 Tech Rpts\april 12 Sampling\MNAMR\Figures\Figure 4-F SIBW-64U



Note For analytes not detected above the laboratory reporting limits, the concentration was set to zero.

ug/L micrograms per liter
MCL maximum contaminant level
msl mean sea level

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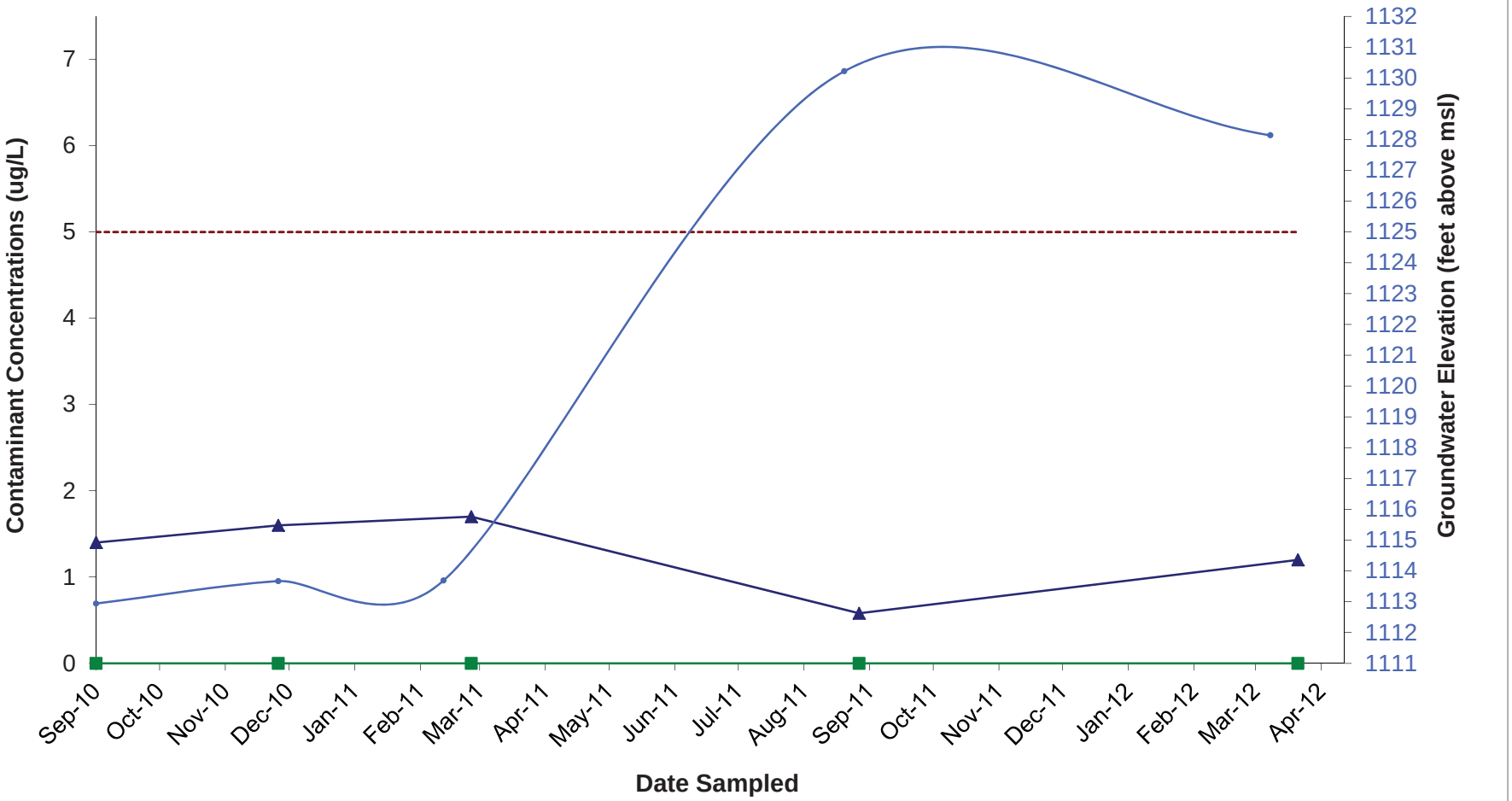
SIBW Monitored Natural Attenuation Monitoring Report - First Semi-annual Sampling Event 2012
Concentrations and Groundwater Elevations for SIBW Over Time
South Indian Bend Wash, Arizona

Figure 4-G
SIBW-65U
Central Plume
July 2005-April 2012

O:\0009 TO 8 South IBW\5.0 Tech Rpts\April 12 Sampling\MNAMR\Figures\Figure 4-G SIBW-65U



Note For analytes not detected above the laboratory reporting limits, the concentration was set to zero.

ug/L micrograms per liter
MCL maximum contaminant level
msl mean sea level

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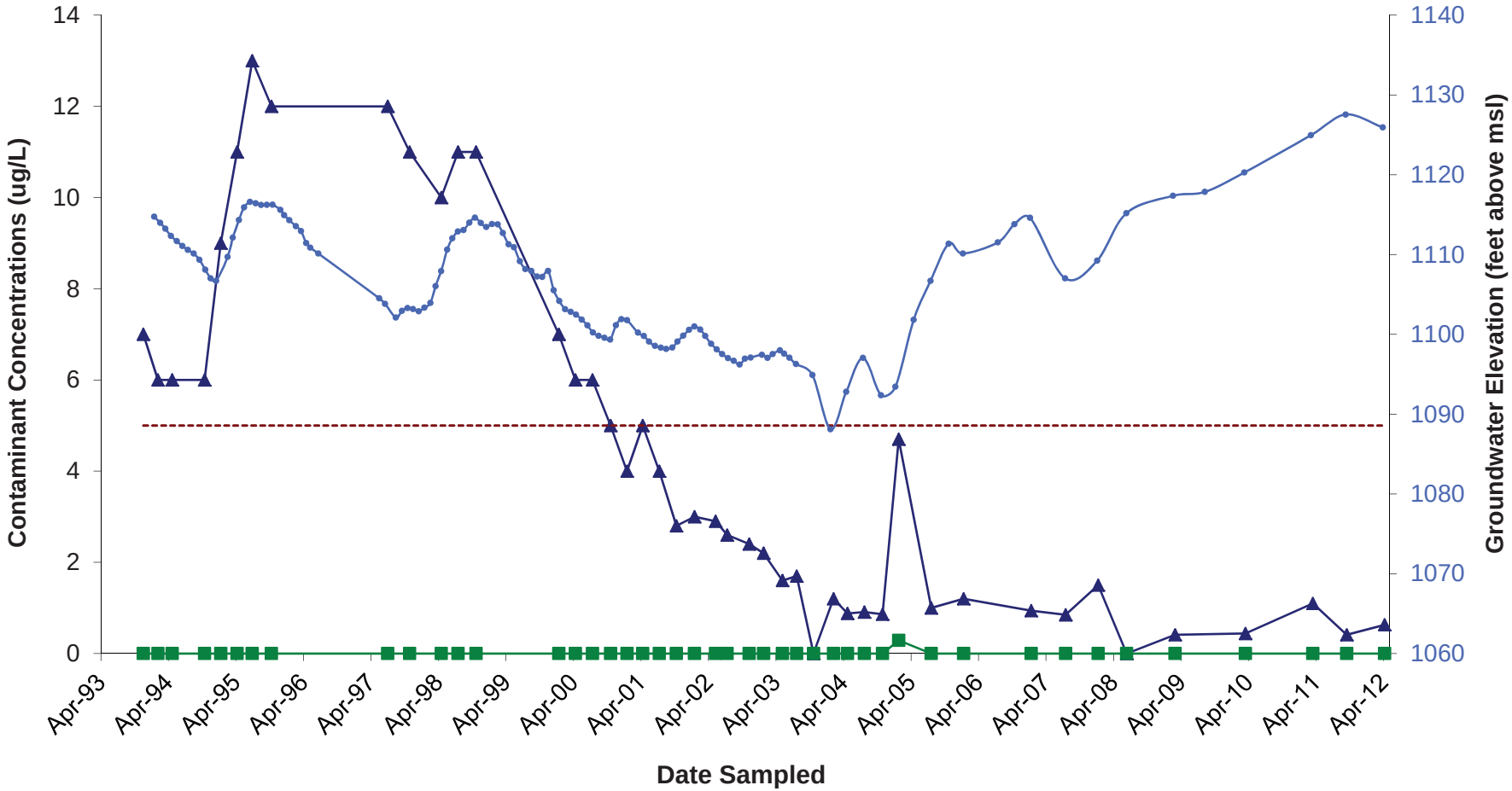
SIBW Monitored Natural Attenuation Monitoring Report - First Semi-annual Sampling Event 2012
Concentrations and Groundwater Elevations for SIBW Over Time
South Indian Bend Wash, Arizona

Figure 4-H
SIBW-66U
Central Plume
September 2010-April 2012

O:\0009 TO 8 South IBW\5.0 Tech Rpts\April 12 Sampling\MNAMR\Figures\Figure 4-H SIBW-66U



Note For analytes not detected above the laboratory reporting limits, the concentration was set to zero.

ug/L micrograms per liter
MCL maximum contaminant level
msl mean sea level

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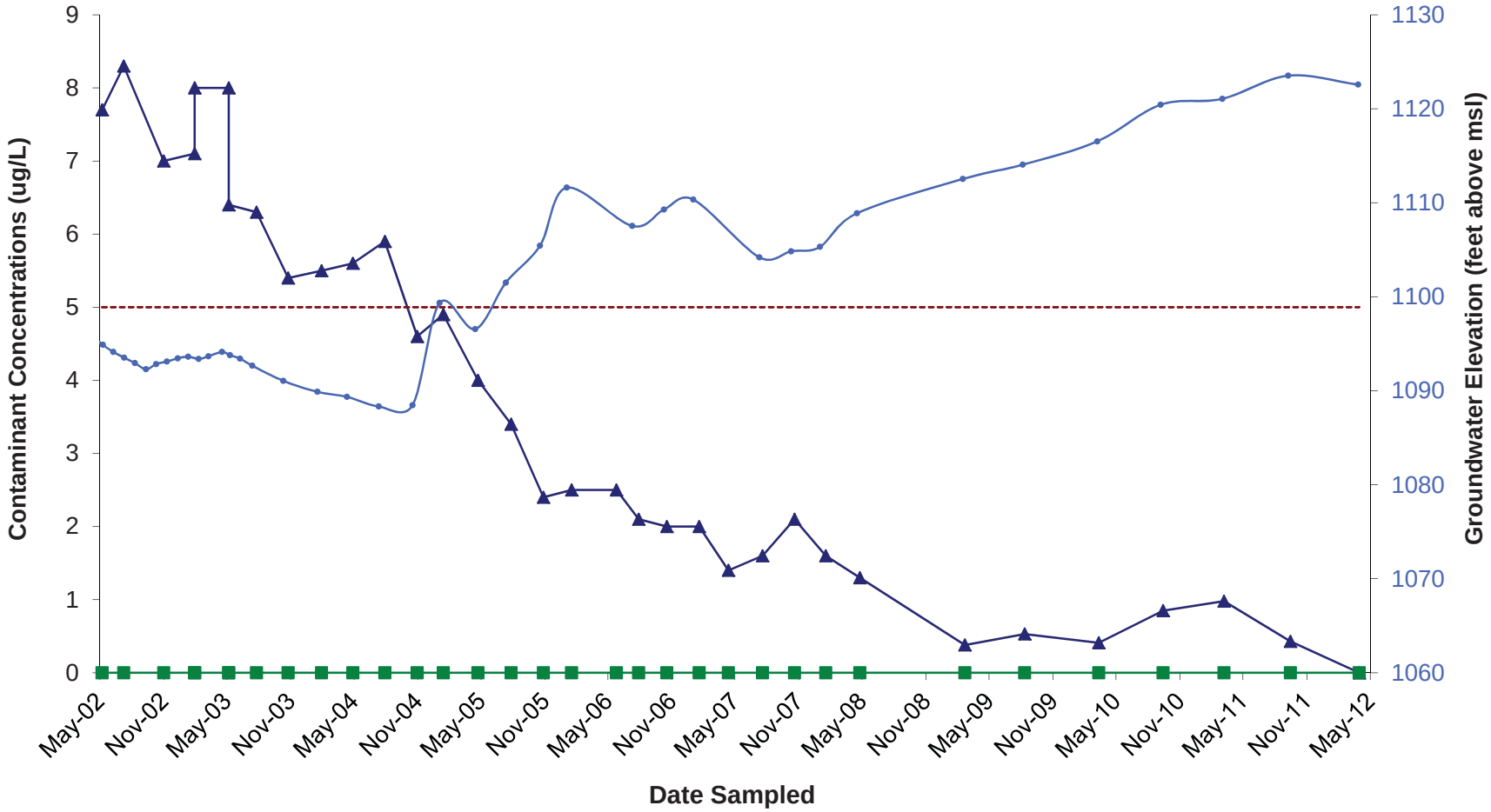
SIBW Monitored Natural Attenuation Monitoring Report - First Semi-annual Sampling Event 2012
Concentrations and Groundwater Elevations for SIBW Over Time
South Indian Bend Wash, Arizona

Figure 4-I
SIBW-39U
Central Plume
April 1993-April 2012

O:\0009 TO 8 South IBW\5.0 Tech Rpts\April 12 Sampling\MNAMR\Figures\Figure 4-I SIBW-39U



Note For analytes not detected above the laboratory reporting limits, the concentration was set to zero.

ug/L micrograms per liter
MCL maximum contaminant level
msl mean sea level

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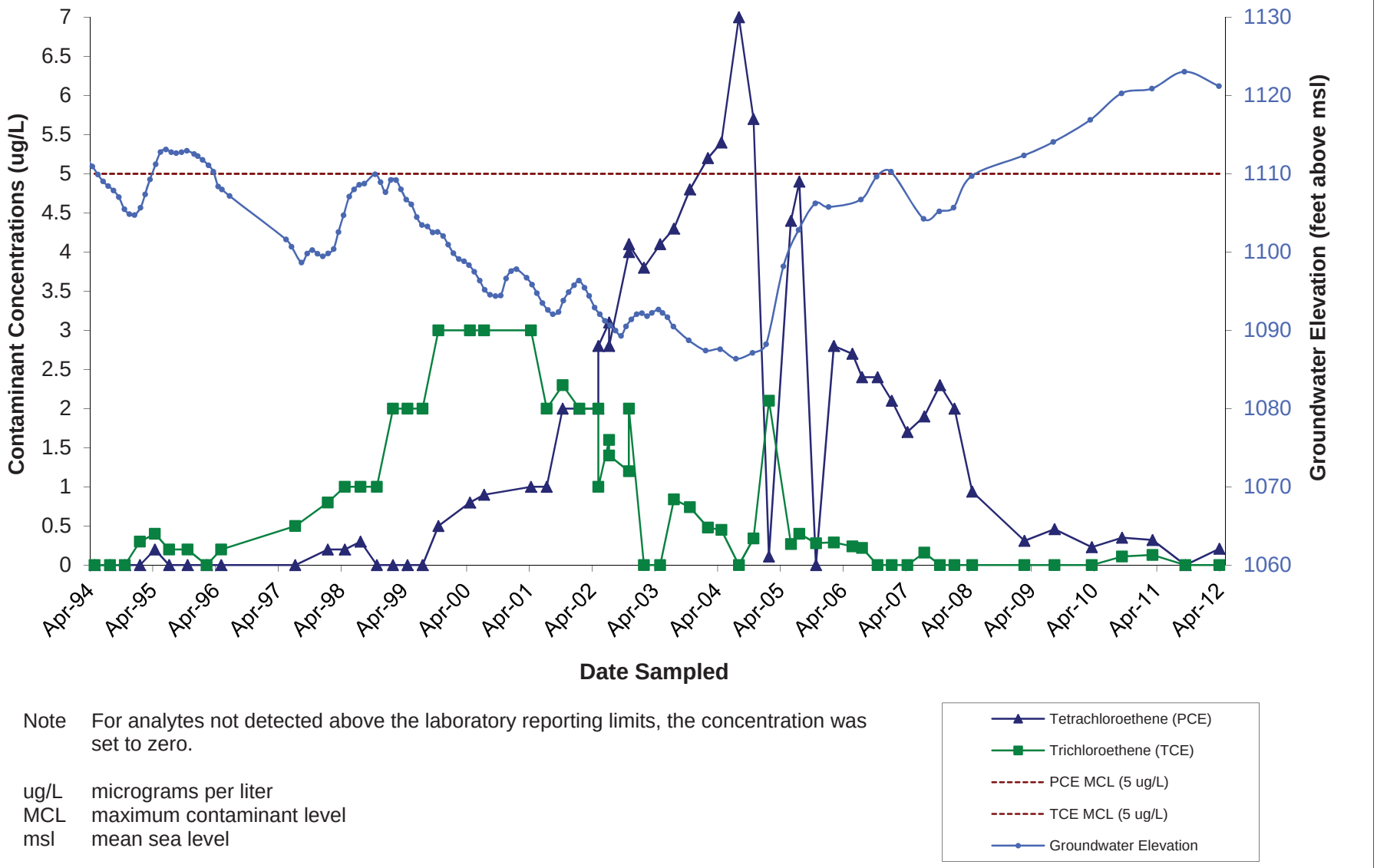
SIBW Monitored Natural Attenuation Monitoring Report - First Semi-annual Sampling Event 2012
Concentrations and Groundwater Elevations for SIBW Over Time
South Indian Bend Wash, Arizona

Figure 4-J
SW-1
Central Plume
May 2002 - April 2012

O:\0009 TO 8 South IBW\5.0 Tech Rpts\April 12 Sampling\Data Summary Report\Figures\Figure 4-J SW-1



Note For analytes not detected above the laboratory reporting limits, the concentration was set to zero.

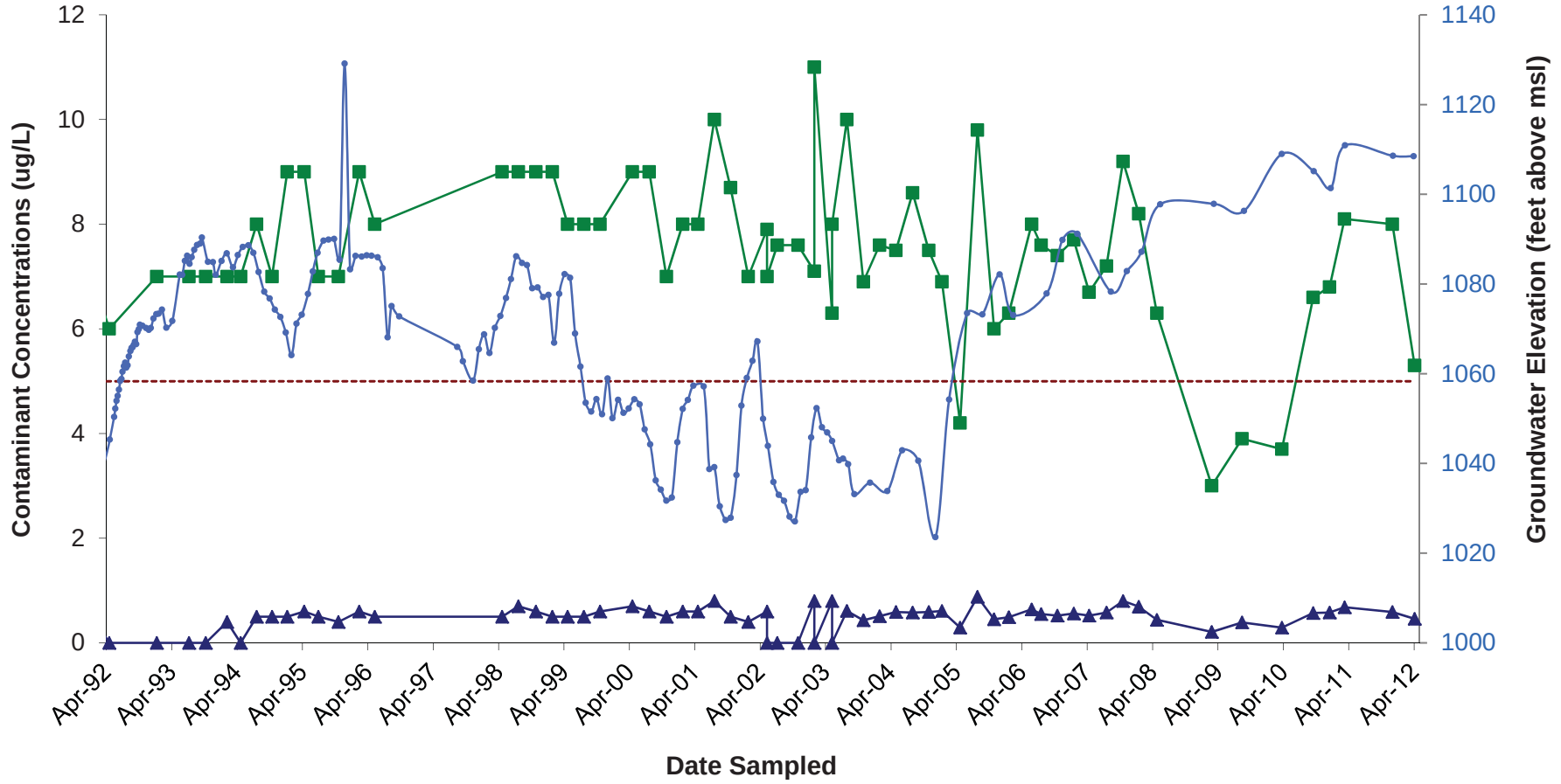
ug/L micrograms per liter
MCL maximum contaminant level
msl mean sea level

ITSI Gilbane

SIBW Monitored Natural Attenuation Monitoring Report - First Semi-annual Sampling Event 2012
Concentrations and Groundwater Elevations for SIBW Over Time
South Indian Bend Wash, Arizona

Figure 4-K
SIBW-38U
Central Plume
April 1994-April 2012

O:\0009 TO 8 South IBW\5.0 Tech Rpts\April 12 Sampling\Data Summary Report\Figures\Figure 4-K SIBW-38U



Note For analytes not detected above the laboratory reporting limits, the concentration was set to zero.

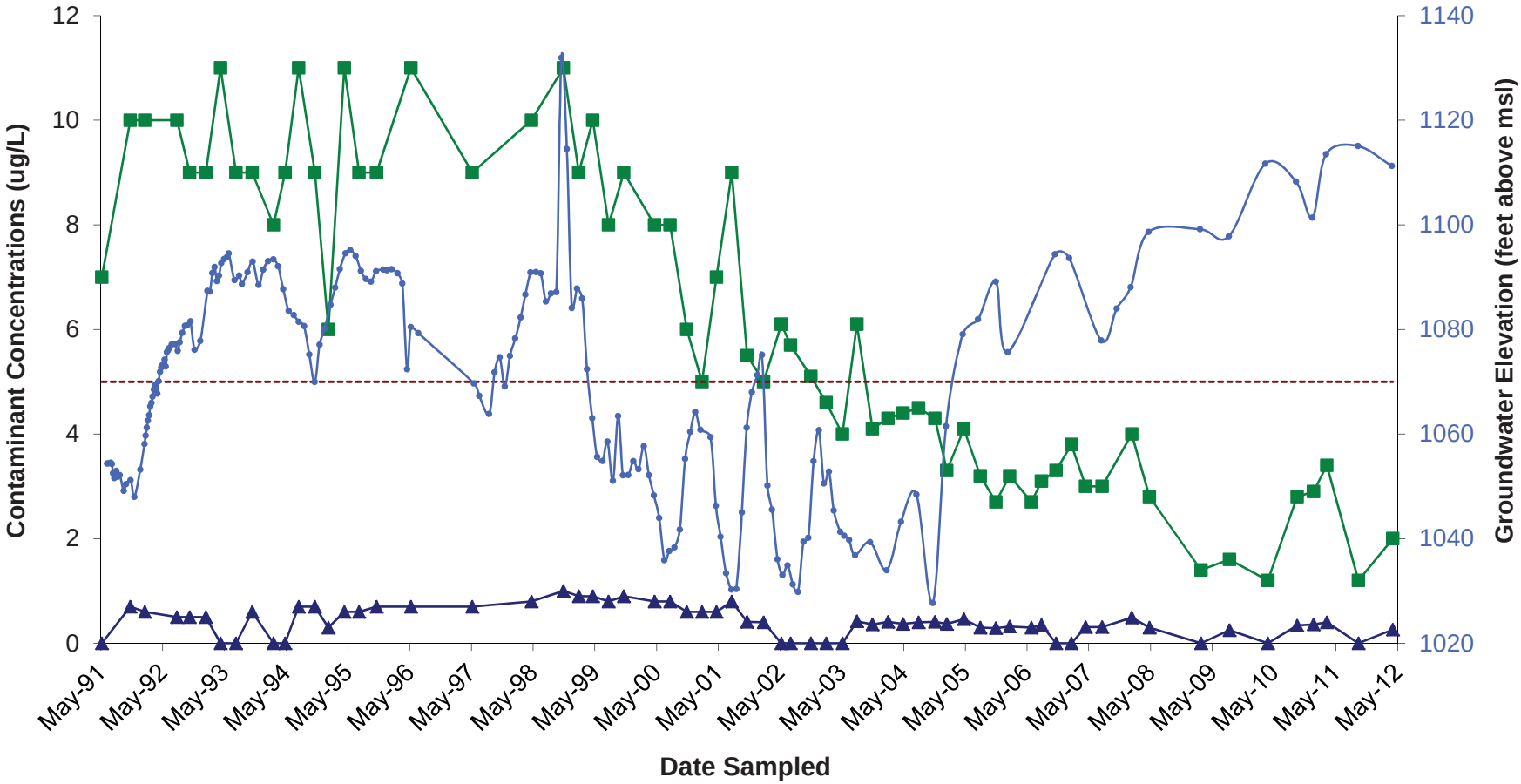
ug/L micrograms per liter
MCL maximum contaminant level
msl mean sea level

ITSI Gilbane

SIBW Monitored Natural Attenuation Monitoring Report - First Semi-annual Sampling Event 2012
Concentrations and Groundwater Elevations for SIBW Over Time
South Indian Bend Wash, Arizona

Figure 4-L
SIBW-11MC
Eastern Plume
April 1992-April 2012

O:\0009 TO 8 South IBW\5.0 Tech Rpts\April 12 Sampling\MNAMR\Figures\Figure 4-L SIBW-11MC



Note For analytes not detected above the laboratory reporting limits, the concentration was set to zero.

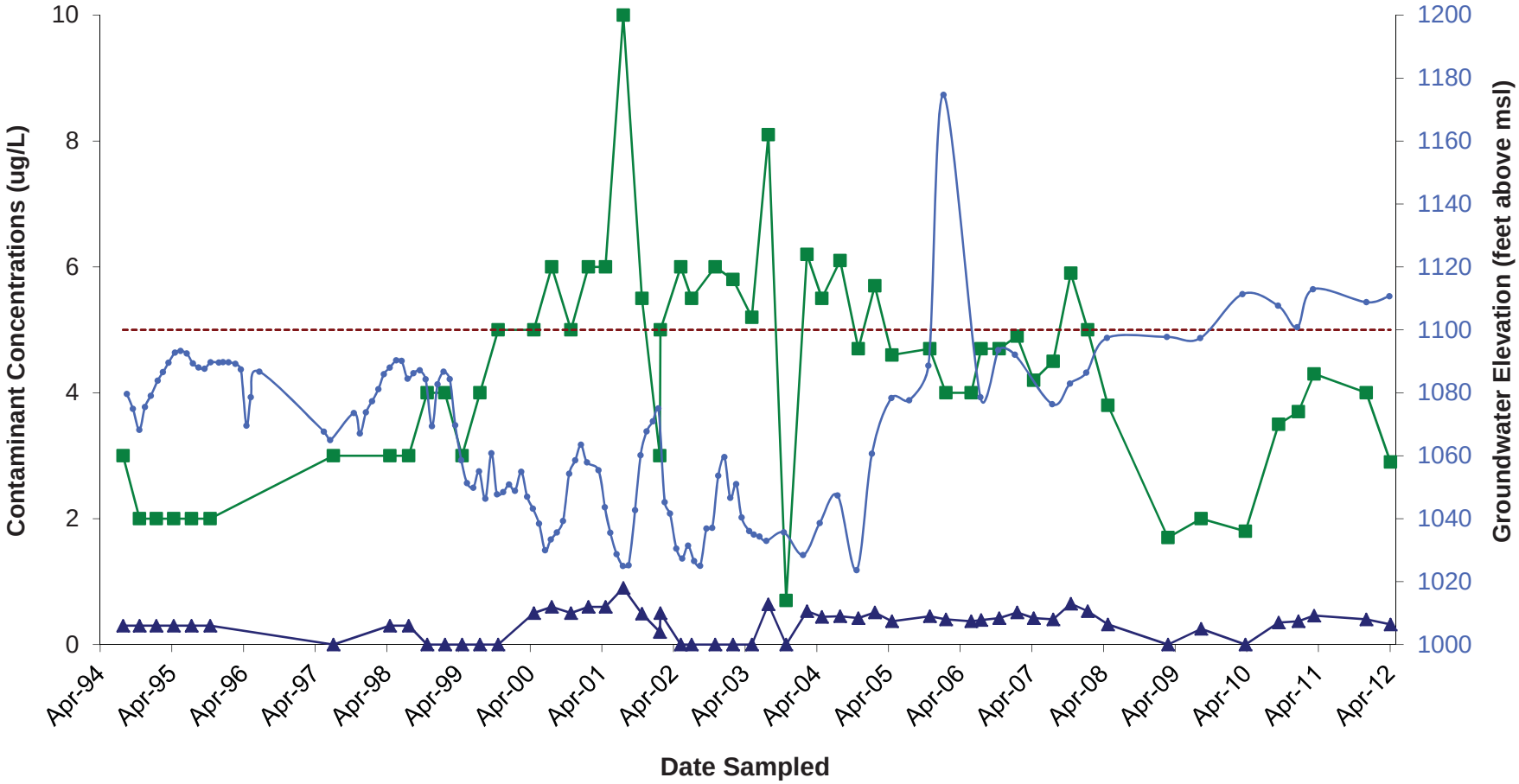
ug/L micrograms per liter
MCL maximum contaminant level
msl mean sea level

ITSI Gilbane

SIBW Monitored Natural Attenuation Monitoring Report - First Semi-annual Sampling Event 2012
Concentrations and Groundwater Elevations for SIBW Over Time
South Indian Bend Wash, Arizona

Figure 4-M
SIBW-13MC
Eastern Plume
May 1991-April 2012

O:\0009 TO 8 South IBW\5.0 Tech Rpts\April 12 Sampling\MNAMR\Figures\Figure 4-M SIBW-13MC



Note For analytes not detected above the laboratory reporting limits, the concentration was set to zero.

ug/L micrograms per liter
MCL maximum contaminant level
msl mean sea level

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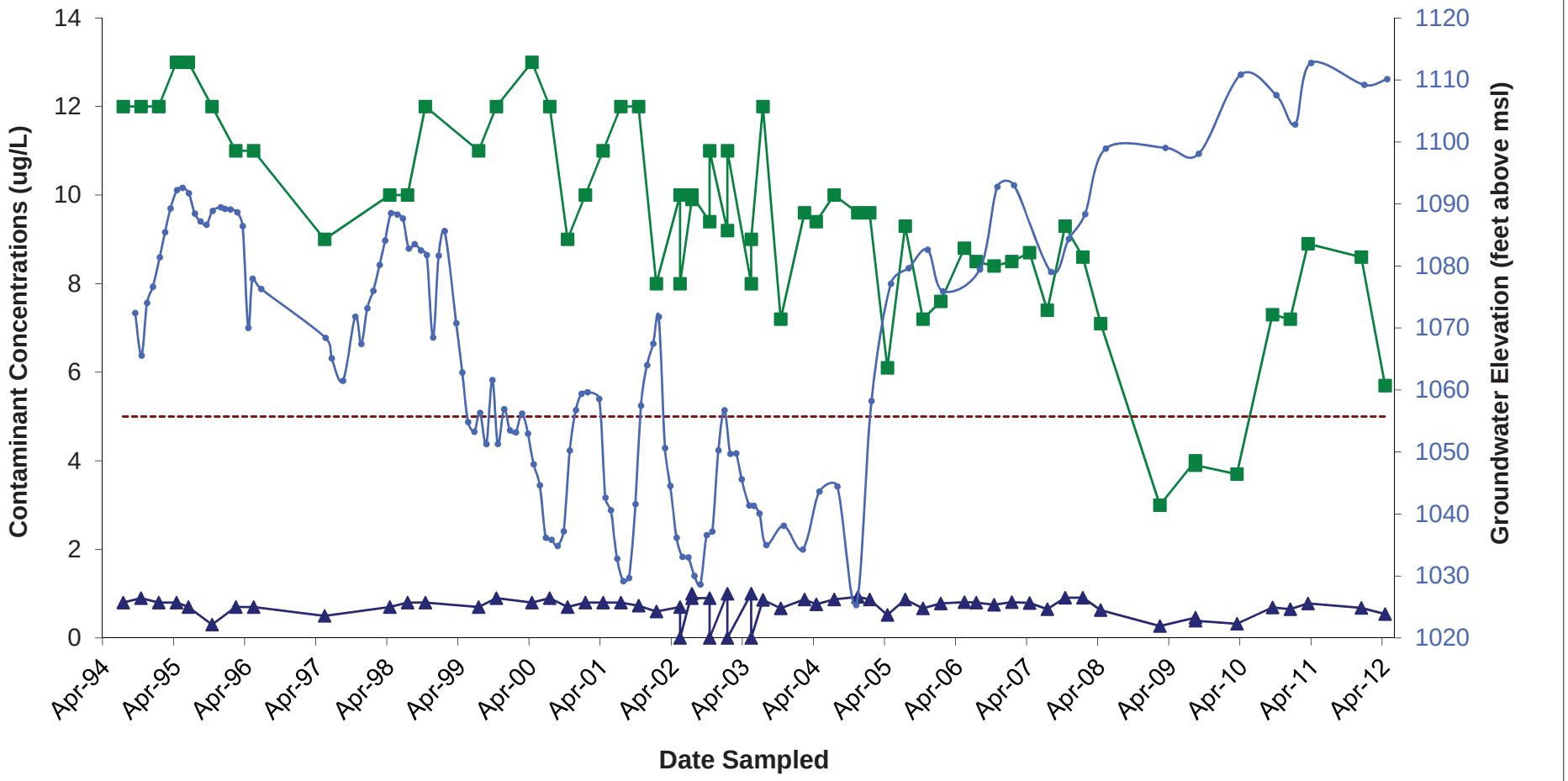
SIBW Monitored Natural Attenuation Monitoring Report - First Semi-annual Sampling Event 2012
Concentrations and Groundwater Elevations for SIBW Over Time
South Indian Bend Wash, Arizona

Figure 4-N
SIBW-56MC
Eastern Plume
April 1994-April 2012

O:\0009 TO 8 South IBW\5.0 Tech Rpts\April 12 Sampling\MNAMR\Figures\Figure 4-N SIBW-56MC



Note For analytes not detected above the laboratory reporting limits, the concentration was set to zero.

ug/L micrograms per liter
MCL maximum contaminant level
msl mean sea level

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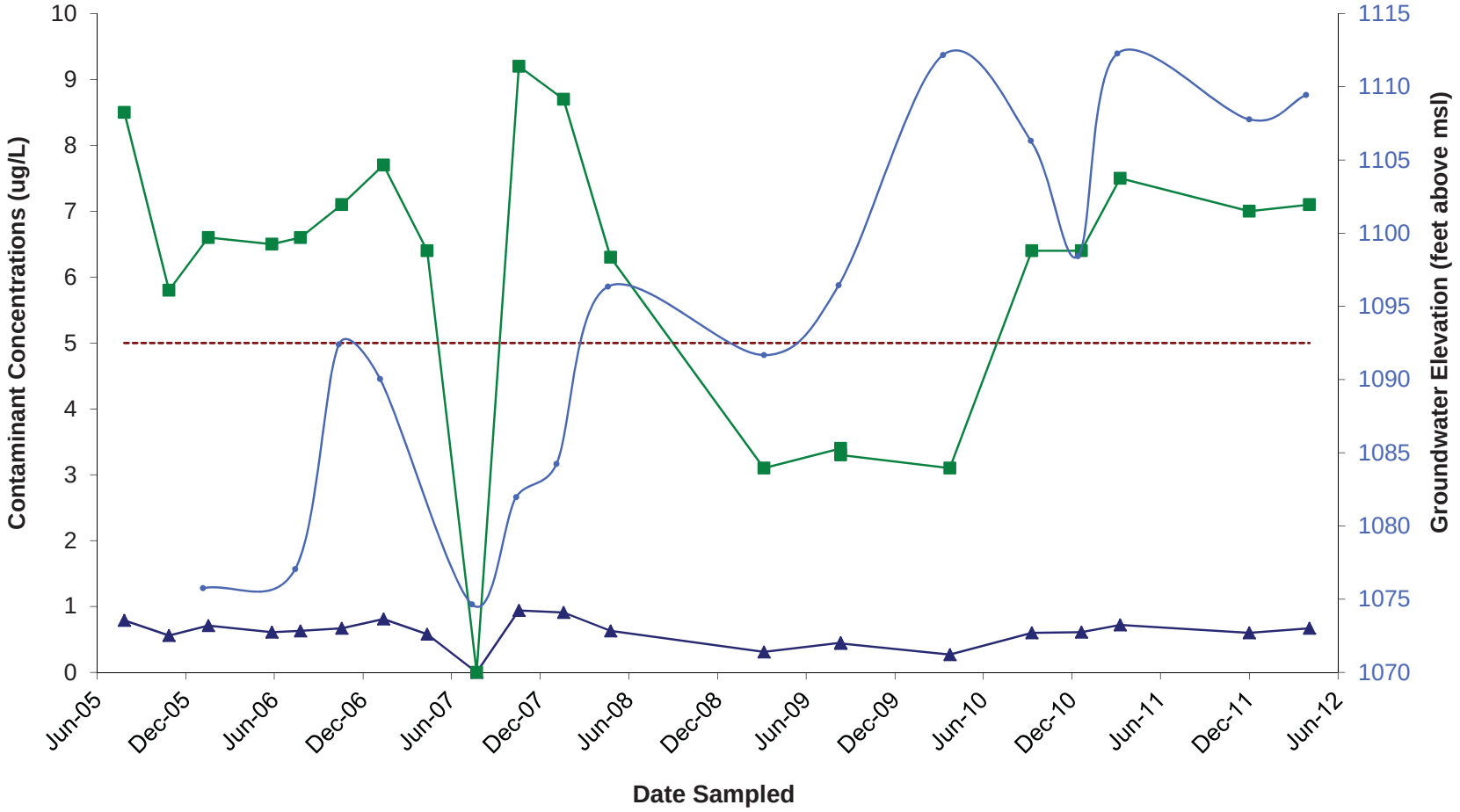
SIBW Monitored Natural Attenuation Monitoring Report - First Semi-annual Sampling Event 2012
Concentrations and Groundwater Elevations for SIBW Over Time
South Indian Bend Wash, Arizona

Figure 4-O
SIBW-58MC
Eastern Plume
April 1994-April 2012

O:\0009 TO 8 South IBW\5.0 Tech Rpts\April 12 Sampling\MNAMR\Figures\Figure 4-O SIBW-58MC



Note For analytes not detected above the laboratory reporting limits, the concentration was set to zero.

ug/L micrograms per liter
MCL maximum contaminant level
msl mean sea level

ITSI Gilbane

SIBW Monitored Natural Attenuation Monitoring Report - First Semi-annual Sampling Event 2012
Concentrations and Groundwater Elevations for SIBW Over Time
South Indian Bend Wash, Arizona

Figure 4-P
SW-3
Eastern Plume
June 2005-April 2012

O:\0009 TO 8 South IBW\5.0 Tech Rpts\April 12 Sampling\MNAMR\Figures\Figure 4-P SW-3