Long-Term Monitoring Plan

Coliseum Boulevard Plume Site
Montgomery, Alabama

Submitted By:

Alabama Department of Transportation
1409 Coliseum Boulevard
Montgomery, Alabama

September 2008
R1 – October 2011
R2 – September 2012
R3 – September 2014

Long-Term Monitoring Plan

Revision 3
September 2014

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COLISEUM BOULEVARD PLUME SITE
MONTGOMERY, ALABAMA

SUBMITTED BY:

ALABAMA DEPARTMENT OF TRANSPORTATION
1409 COLISEUM BOULEVARD
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LIST OF ABBREVIATIONS

ADEM	Alabama Department of Environmental Management
AEIRG	Alabama Environmental Investigation and Remediation Guidance
ALDOT	Alabama Department of Transportation
BDY	Boundary Well
CBP	Coliseum Boulevard Plume
CME	Corrective Measures Evaluation
CMIP	Corrective Measures Implementation Plan
CP	Compliance Point
CMT	Continuous Multi-channel Tubing Well
EFF	Effectiveness (Well)
EPA	Environmental Protection Agency
GTS	Geostatistical, Temporal, and Spatial
ICB	Institutional Control Boundary
LTM	Long-term Monitoring Plan
MCL	Maximum Contaminant Level
NPDES	National Pollutant Discharge Elimination System
OS	Off SitePH12 Probehole 12 Area
PSV	Preliminary Screening Value
SWA	South West Treatment Area
TCE	Trichloroethylene

1. INTRODUCTION

1.1. PURPOSE

The Voluntary Settlement Agreement between the Alabama Department of Environmental Management (ADEM) and the Alabama Department of Transportation (ALDOT) for the Coliseum Boulevard Plume (CBP) was executed in December 2011. The Agreement required the submittal and approval of four (4) Corrective Measures Implementation Plans (CMIPs), as follows:

- Kilby Ditch/Low-Lying Area CMIP
- Institutional Control Plan
- Long-Term Monitoring Plan
- Southwest Treatment Area CMIP

Each of these plans have been approved by ADEM and implemented by ALDOT. This revision is limited to certain operational and maintenance requirements that have changed (since approval of the CMIPs) as the systems have stabilized (for example, locations of monitoring points, frequency of samples, etc.). The Long-Term Monitoring Plan (LTM Plan) provides for the continued monitoring and management of groundwater and surface water in an area of Montgomery, Alabama that is known as the Coliseum Boulevard Plume (CBP). The LTM Plan provides the procedures that the Alabama Department of Transportation (ALDOT) will utilize to comply with the amended "Settlement Agreement for Voluntary Response ("Agreement") between the Alabama Department of Environmental Management (ADEM) and the ALDOT that was placed on public notice on September 30, 2011.

The LTM Plan provides for monitoring in areas where corrective measures have been implemented (Kilby Ditch / Low-Lying Area, Southwest Area, Institutional Control Boundary), see Figure 1-1. The LTM monitoring will be used to:

- Evaluate the effectiveness of the corrective measures;
- Monitor TCE concentrations and trends for comparison to the site-wide groundwater model; and,

- Provide a surface water monitoring network to evaluate the effectiveness of corrective measures and determine compliance with ADEM discharge requirements.

The LTM Plan also provides for long-term monitoring of the CBP with:

- Effectiveness (EFF) monitoring wells to evaluate groundwater and plume conditions;
- Boundary (BDY) monitoring wells to assure the CBP is bounded by the Institutional Control Boundary (ICB); and,
- Surface water compliance and effectiveness monitoring locations to determine compliance and corrective measure effectiveness.

Additionally, the LTM Plan documents the transition of the CBP monitoring network from an assessment-oriented monitoring program to a corrective measure monitoring program in accordance with the Agreement. Section 2 presents the proposed groundwater and surface water monitoring locations. Section 3 presents the monitoring and data evaluation plan.

1.2. BACKGROUND

The CBP is an area in north Montgomery, Alabama where the shallow groundwater contains trichloroethylene (TCE). Groundwater remains below the ground surface throughout the CBP except for three areas where groundwater discharges to surface water: Kilby Ditch / Low-Lying Area in the northeast part of the CBP; the ALDOT-owned former sand and gravel mine in the Southwest part of the CBP; and the Zoo pond / Zoo ditch in the northern part of the CBP. The ALDOT has accepted responsibility for monitoring and management of the CBP by remedial approaches that generally include the following:

- Manage and control groundwater at the CBP;
- Treat TCE-containing surface water prior to discharge from the CBP;
- Restrict access to groundwater via institutional controls; and,
- Restrict access to surface water via engineering controls.

ALDOT has implemented the following response actions as described in the "Site-Wide Corrective Measures Evaluation Report, July 2008" (CME):

- Cover West Kilby Ditch and stabilize Main Kilby Ditch;
- Retain or reposition security fencing along Main Kilby Ditch;
- Construct a Wetland Treatment System and perimeter security fencing in the Low-Lying Area;
- Hydraulic control in the Southwestern Area of the CBP;
- Monitor surface water and groundwater quality; and,
- Implement institutional controls to restrict access to and prevent use of groundwater.

Figure 1-2 presents an overview of the investigations, Corrective Measures Implementation Plans, and annual reports that support the development of the LTM Plan. Reports document the nature and extent of the CBP through the soil, sediment, soil vapor, air, groundwater and surface water. Corrective Measures Implementation Plans present actions by ALDOT to prevent access to groundwater through administrative and engineering controls. Quarterly status reports were prepared to document assessment activities and effectiveness of implemented corrective measures.

2. DEVELOPMENT OF THE LONG-TERM MONITORING NETWORK

2.1. ASSESSMENT MONITORING NETWORK

The monitoring well network used to assess the CBP consisted of 150 wells and 40 piezometers (Table 2-1). Surface water monitoring is performed throughout the CBP. Both groundwater and surface water results have been presented in investigation and status reports that document CBP assessment activities.

2.1.1. SHALLOW MONITORING WELLS

100-Series and 200-Series monitoring wells were constructed to determine the horizontal and vertical extents of the TCE within the shallow saturated zone. This zone, which is described in the July 2008 CME Report, is the saturated zone above the first distinct clay beneath the water table. The 100-Series wells screen the upper part of this shallow saturated zone. The 200-Series wells screen the middle and lower parts of this shallow saturated zone. Many of the shallow-zone monitoring wells are in clusters with screens that are 5 to 10 feet long and monitor the upper, middle, and lower part of the shallow saturated zone. Continuous multichannel tubing (CMT) wells were constructed to assess the vertical distribution of TCE in the area of Fairgrounds Road and Broadway Street. This is the area of higher TCE concentrations in the CBP. Pump test and observation wells were installed for aquifer testing to gather pertinent information and development of a site-specific groundwater model.

2.1.2. DEEP MONITORING WELLS

Nine (9) deep monitoring wells are within the CBP. Eight (8) 300-Series monitoring wells are screened within the deep saturated zone, which is the water-bearing unit between the first distinct clay and the top of the underlying Gordo Formation. The ninth deep monitoring well, a 400-Series well, is screened in the upper Gordo Formation. Deep monitoring well locations are as follows:

- Monitoring wells MW-339 through MW-342 are within the Fairgrounds Road and Broadway Street Area;
- Monitoring well MW-311 is within the southwest part of the CBP;

- Monitoring wells MW-357 and MW-457 are near a former production-well that was at the Montgomery Zoo;
- Monitoring well MW-304 is on ALDOT property at the main ALDOT complex and near Coliseum Boulevard, and;
- Monitoring well MW-358 is at the Bama Budweiser of Montgomery, Inc. facility (1700 Emory Folmar Boulevard) within the northeast portion of the CBP.

2.2. LONG-TERM MONITORING NETWORK DESIGN

2.2.1. MONITORING NETWORK OPTIMIZATION

In accordance with the Agreement, the monitoring network required transition from an assessment monitoring network to a corrective measures monitoring network. Spatial, trend, temporal, and qualitative analyses were used to evaluate the assessment monitoring well network and transition it to a long-term, corrective measures network.

2.2.2. SPATIAL ANALYSIS (WELL LOCATIONS)

TCE spatial analysis was performed through evaluation of TCE distributions throughout the CBP and correlation of TCE concentrations between monitoring wells. This analysis resulted in identifying the optimum number of wells and well locations for corrective measures monitoring. A quantitative analysis was conducted by using “spatial tolerance” to determine if a monitoring well should be used for long-term monitoring.

Spatial tolerance is used to associate a level of precision with spatial data and reflects the distance that two or more points can be apart and still represent the same area. The method reduces the number of monitoring wells in a point dataset but identifies the best monitoring well distribution to monitor TCE. Spatial tolerance analysis was performed separately for 100-Series and 200-Series wells, and the following steps were performed to select long-term monitoring wells:

1. Series-100 and Series-200 assessment monitoring well data were removed, one at a time, from the assessment monitoring well network. After removal of the monitoring well data, the TCE concentrations were re-contoured.

2. The interpolated (contoured) value (TCE concentration) at each eliminated monitoring well location was compared to the original TCE concentrations that were contoured with the monitoring well data not removed.

3. The monitoring well was selected for potential removal from the long-term network if the absolute difference between the interpolated TCE concentration and the original value was minimal, and the TCE contouring resolution was retained.

4. An optimized monitoring well system that horizontally and vertically defined the CBP and retained TCE contouring resolution similar to that of the original 150 well network is proposed for Long Term Monitoring. The optimized monitoring well system is referred to as an the Effectiveness Monitoring Well Network (EFF monitoring well).

The following 64 of the original 150 assessment monitoring wells were removed from the EFF monitoring well network:

- 15 “100A/200B/200C-Series” monitoring wells
- 20 “100/200/300/400-Series Cluster” monitoring wells
- 9 “Pump Test” and “Observation” monitoring wells
- 13 “A-Series” monitoring wells
- 7 “CMT” Wells.

As approved by the ADEM on August 23, 2011, the seven CMT wells were permanently abandoned as described in the “Boundary Well Installation and Continuous Multichannel Tubing Well Abandonment Plan” dated June 2011.

All nine (9) “deep” wells were retained as EFF monitoring wells (eight 300-Series wells and one 400-Series well).

100-Series and 200-Series monitoring wells were analyzed separately; however, some 100-Series and 200-Series monitoring wells are nested pairs. If either one of the 100- or 200-Series well was retained as an EFF monitoring well as a result of spatial analysis, both the 100- or 200-Series monitoring wells were retained as an EFF monitoring well. Table 2-1 and 2-2 summarize the EFF

monitoring wells. Figure 2-1 shows the 100-, 200-, 300-, and 400-Series wells that comprise the EFF monitoring well network.

To summarize, 86 of the 150 assessment monitoring wells were retained as EFF monitoring wells for long-term water quality monitoring of the CBP. The 64 assessment monitoring wells eliminated from the EFF monitoring well network and water-quality monitoring will be retained for measurements of water levels, with the exception of the seven (7) CMT Wells that will be plugged and abandoned in October 2011. Piezometers (40) will be retained for measurements of water levels.

2.2.3. TEMPORAL ANALYSIS (OPTIMUM SAMPLE COLLECTION SCHEDULE)

The optimum sampling schedule for the EFF monitoring well network was developed by using trend, iterative thinning, and variogram analyses of historical data. The temporal analysis included evaluating the TCE trend for all 150 monitoring wells and optimizing the sampling frequency based on the results.

2.2.3.1. TREND ANALYSIS

Trend analysis was used to analyze water quality data for increasing or decreasing trends and to confirm plume movement predicted by conceptual and numeric groundwater models. Trend analysis has been conducted annually for groundwater data collected from the assessment monitoring well network and submitted to ADEM (Coliseum Boulevard Plume Analysis of TCE Trends, Annual Reports). The results consistently show decreasing trends or no trends in TCE concentrations for 80 percent of the assessment monitoring wells.

Based on the trend analyses, the time between sampling events can be calculated to account for TCE movement within the CBP.

2.2.3.2. ITERATIVE THINNING ANALYSIS

Iterative Thinning was utilized to select an optimum sampling frequency that correlates with the TCE trends. The computer software *Geostatistical Temporal/Geospatial (GTS) Algorithm Software for Optimization of Long-Term Monitoring Networks version 0.6* developed by the United States Air Force Center for Environmental Excellence (AFCEE) was utilized for the iterative

thinning Analysis. The following approach was used for iterative thinning:

1. Compile historical TCE data (sample date and TCE concentration) for each monitoring well,
2. Determine the historic, current, and average sample collection frequency,
3. Use GTS software to fit a trend to the sampling frequency,
4. Iteratively remove, at random, certain fractions of the original data,
5. Re-estimate the trend based on the reduced dataset to determine whether the trend remains within established confidence limits,
6. Continue until the new trend falls outside the confidence limits, and,
7. Stop removing data and determine a new, optimized sampling frequency/interval based on the removed data.

Results of the Iterative Thinning calculations for the assessment monitoring well network resulted in an optimized sampling schedule of 26 weeks (e.g., semi-annually) between sampling events.

2.2.3.3. VARIOGRAM

A variogram analysis was performed by using the *Smoothed Variogram Editor* of the GTS software to confirm the findings of the iterative thinning analysis and to evaluate whether the TCE data exhibited temporal correlations. A variogram is a plot of the variance of each point (TCE concentration) in the data set (with respect to other points in the data set) versus the time between the sample collection dates (in weeks). The change in the slope of the variogram confirmed the results of the Iterative Thinning calculation by showing a correlation of a 26 week, or semi-annual, sampling schedule.

2.3. Effectiveness Well Optimization

As part ALDOT's on-going monitoring program, ALDOT monitored quarterly from 2001 through 2011 and semiannually since 2011. With implementation of remedial measures, plume migration in the northeast and southwest has stabilized. As expected, increases in TCE concentrations have been documented in the annual trend reports along the northeast/southwest plume axis due to the capture of TCE in the PH12 area. Because of plume stability, ALDOT proposes a revised monitoring schedule:

First semi-annual period (January)

Well Types	Number of Wells
Background Wells	2
Boundary Wells	14
Effectiveness Wells	84

Second semi-annual period (July)

Well Types	Number of Wells
Background Wells	0
Boundary Wells	14
Effectiveness Wells	23

Specific monitoring wells to be included in the optimized monitoring program are included in Tables 2-3A and 2-3B. Specific rational for the monitoring well network modification is shown in Table 2-4 and the semi-annual and annual sample locations are shown on Figures 2-2 and 2-3.

Based on future long-term monitoring results, the well network optimization will be continuously evaluated using the following general parameters:

- Wells with TCE groundwater concentrations below the groundwater protection standard;
- Wells with either a stable or decreasing TCE concentration trend based on the annual trend evaluation;

- Wells in an area of low advection where the groundwater is moving very slowly relative to the northeast and southwest areas of the CBP, and annual monitoring is sufficient to characterize changes in concentration, and;
- Other spatial or temporal conditions that may support modification to the sample frequency, number of monitored wells and/or well locations.

2.4. BOUNDARY WELL NETWORK

A Boundary Well (BDY) Network of 14 BDY monitoring wells was installed in October 2011 to monitor the effectiveness of corrective measures and institutional controls. The BDY Well Network design relied upon the site-wide groundwater model to identify groundwater flow paths and probable TCE migration pathways relative to the position of institutional control parcels and corrective measures. As approved by the ADEM on August 23, 2011, the BDY monitoring wells were installed and sampled as described in the "Boundary Well Installation and Continuous Multichannel Tubing Well Abandonment Plan" dated June 2011. BDY wells are shown on Figure 2-1.

2.5. SURFACE WATER MONITORING NETWORK

2.5.1. CORRECTIVE MEASURE MONITORING

Surface water monitoring will be performed to verify the effectiveness of corrective measures and to determine if surface-water quality meets compliance requirements.

2.5.1.1. COMPLIANCE SAMPLE LOCATIONS

In accordance with the Agreement, surface-water compliance points are at the:

1. confluence of the Lower Kilby Ditch with Three Mile Branch (LLCP-1); and,
2. NPDES permitted discharge in the Southwest Area (SWA DSN001)

Samples will be collected at these two (2) locations every two weeks in accordance with the National Pollutant Discharge Elimination System (NPDES) permit. The TCE regulatory compliance limits are

stipulated in the existing NPDES permit and the Agreement (see Figures 2-4 and 2-5). On July 31, 2013, surface water compliance point DSN001 was relocated to the end of the riprap ditch, at the former location of SWA-5. The former location of DSN001 was renamed FG (Flood Gate)(R3-September 2014).

2.5.1.2. EFFECTIVENESS SAMPLE LOCATIONS

Samples will be collected quarterly at the following locations to monitor surface- water quality throughout the CBP (see Table 3-3).

WETLAND EAST OF BAMA BUDWEISER FACILITY

One surface water monitoring point will be located at the wetland located east of the Bama Budweiser facility (BB, see Figure 2-4).

LOW-LYING AREA AND THREE MILE BRANCH

This monitoring will include samples collected from LLA-1 through LLA-11 in the Lower Kilby Ditch area and the Wetland Treatment Area. Samples will also be collected from Three Mile Branch. Samples will be collected at the following locations:

- LLA-1 Upstream of constructed wetland;
- LLA-2 Discharge from constructed wetland;
- LLA-3 Internal constructed wetland;
- LLA-4 Small tributary south of existing wetland;
- LLA-5 Groundwater interceptor trench pond;
- LLA-6 Groundwater interceptor trench before confluence with Lower Kilby Ditch;
- LLA-7 Lower Kilby Ditch after confluence with groundwater interceptor trench;
- LLA-8 Existing wetland;
- LLA-9 Unnamed tributary immediately south of Northern Boulevard
- LLA-10 Surface water south of Northern Boulevard groundwater seeps from west of unnamed tributary

- LLA-11 Discharge from Russell Distribution facility stormwater/groundwater
- TMB-1 Three Mile Branch upstream of the confluence with Lower Kilby ditch;
- TMB-2 Three Mile Branch upstream of the confluence with Lower Kilby Ditch at North Boulevard;
- TMB-3 Three Mile Branch downstream of the confluence with the Lower Kilby Ditch.

MONTGOMERY ZOO POND AND DITCH

Surface water monitoring samples will continue to be collected from the Montgomery Zoo pond (ZP) and ditch (ZD) (see Figure 2-4).

SOUTHWEST AREA

Surface water monitoring in the Southwest Area will be conducted at the following locations (see Figure 2-5):

- SWA-1: Dewatering Pond
- SWA-2: Transfer Pond
- SWA-3: Inlet structure at Discharge Pond from Transfer Pond
- SWA-4: Outlet structure at Discharge Pond

2.5.1.3. Voluntary Sample Locations

ALDOT monitors surface water at locations FG and O1 (see Figure 2-5) on a voluntary basis. Both sample locations are downstream from compliance point DSN001. Samples collected at FG are used to monitoring water quality discharged to the city of Montgomery storm water conveyance to Cypress Creek. Water quality from storm water entering the natural wetlands along portions of Lower Wetumpka Road is monitored at O1. ALDOT has elected to continue voluntary monitoring at these locations; however, these sample locations may be discontinued in the future.

3. LONG-TERM MONITORING

3.1. SAMPLING PROCEDURES

Sampling during long-term monitoring will be in accordance with the following ADEM, EPA, and previously approved guidance:

- The most recent version of the Alabama Environmental Investigation and Remediation Guidance (AEIRG);
- EPA Region 4 Science and Ecosystem Support Division (SESD) Field Branches Quality System and Technical Procedures (replaces the Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (EISOPQAM); and,
- ALDOT Work Plans and Addendums approved previously by the ADEM.

3.2. EFFECTIVENESS MONITORING AND DATA ANALYSIS

3.2.1. EFF MONITORING WELL TREND ANALYSIS

Samples will be collected semiannually from the EFF monitoring wells. Time-series plots and intrawell Shewhart-Cumulative Sum (CUSUM) control charts will be used annually to evaluate trends in TCE concentrations for each EFF monitoring well. Time-series plots will also provide for visual interpretations of trends. Trends will be evaluated only for wells where TCE was detected for a sufficient number of sampling events (four consecutive events above the laboratory method detection limit) to develop valid trends.

The site-wide groundwater model was used to predict the maximum TCE concentrations at each EFF monitoring well through year 2039. Each EFF monitoring well was assigned a TCE concentration limit based on the model-predicted TCE concentration at the well through 2039 (see Table 3-1). In the event that a new EFF monitoring well is needed, a TCE concentration limit will be developed for the new EFF monitoring ell based on the modeled concentration at the EFF monitoring well location.

A site-wide model verification review will be conducted every five (5) years. Data collected from semiannual sampling events will be used

to verify the Site-wide model, evaluate effectiveness of corrective measures, and evaluate the sample collection frequency.

3.2.2. EFF MONITORING WELL CONCENTRATION LIMITS

The TCE concentration limit is the maximum concentration expected to be detected for each EFF monitoring well based on the site-wide groundwater model. TCE concentration limits have been developed for each EFF monitoring well. The TCE concentration in the groundwater sample from each EFF monitoring well will be compared to the model-predicted TCE concentration limit at the EFF monitoring well (see Table 3-1).

3.2.3. EFF MONITORING WELL DATA ANALYSIS

In accordance with the Agreement, sample results from EFF monitoring wells will be compared to the EFF concentration limit for each EFF Well (see Table 3-1 and Figure 3-1). Action items based on this comparison are:

1. Sample results below the EFF concentration limit for the monitoring well indicate that the TCE concentrations are within the site-wide groundwater model calculated values and no additional assessment or corrective measures are required. Semiannual sampling at the EFF monitoring well will continue.
2. If a sample result from an EFF monitoring well exceeds the TCE concentration limit for the EFF monitoring well, a verification sample will be collected from the EFF monitoring well and analyzed within 30 days of ALDOT's receipt of the final laboratory data from the semiannual sampling event.
3. If the TCE concentration in the verification sample is below the TCE concentration limit for the EFF monitoring well, semiannual monitoring will resume. ALDOT will include all verification sample results to ADEM in the Annual Report (see Section 4).
4. If the TCE concentration in the verification sample is greater than the TCE concentration limit for the EFF monitoring well, ALDOT will notify ADEM of the verified exceedance within 30 days of receipt of the final laboratory data. The ALDOT notification letter report will include results of the semiannual sampling, verification sampling, and notification that ALDOT will begin quarterly sampling at the EFF monitoring well.

5. ALDOT will collect samples for four (4) consecutive quarters from the EFF monitoring well showing a verified exceedance. ALDOT will begin quarterly sampling of the EFF monitoring well within 90 days of the date of the notification letter report to ADEM. If TCE concentrations remain below the TCE concentration limit in the EFF monitoring well during the four consecutive quarterly sampling events, quarterly monitoring will cease and the and the sample collection schedule at the EFF monitoring well will return to semiannual. An assessment of an exceedance will be performed concurrently with quarterly monitoring.

The data analysis process and methodology for the EFF monitoring well network are presented in Figure 3-1. Table 3-1 provides the EFF monitoring well designation and TCE concentration limits.

3.3. BDY MONITORING WELL DATA ANALYSIS

BDY monitoring wells were sampled quarterly for the first year following installation, then semiannually. In accordance with the Agreement, the following criteria will be used to evaluate data collected from each BDY well:

1. The concentration limit for the CBP constituents of concern will be the Alabama Drinking Water Standard maximum contaminant level (MCL) or ADEM Preliminary Screening Value (PSV) (Table 3-2).
2. If a BDY monitoring well sample result exceeds an MCL or PSV for a CBP constituent of concern, a verification sample will be collected and analyzed within 30 days of receipt of the final laboratory data from the semiannual sampling event.
3. Semiannual monitoring will resume if the CBP constituent of concern concentration is below the MCL or PSV in the verification sample. ALDOT will include all verification sampling results to ADEM in the Annual Report (see Section 4).
4. If the CBP constituent of concern concentration in the verification sample is greater than the MCL or PSV, ALDOT will notify ADEM of the verified exceedance within 30 days of receipt of final laboratory data. The ALDOT notification letter

report will include results of the semiannual sampling, verification sampling, and notification that ALDOT will begin quarterly sampling.

5. ALDOT will collect samples for the four consecutive quarters from the BDY monitoring well with an exceedance. Quarterly sampling of the BDY monitoring well will begin within 90 days of the date of the notification letter report to ADEM. If the CBP constituent of concern concentration remains below the MCL or PSV for the BDY monitoring well during the four consecutive quarterly sampling events, the BDY monitoring well will return to semiannual monitoring schedule.
6. An Assessment Plan to evaluate the groundwater within the part of the CBP where the exceedance occurred will be submitted to ADEM. The Assessment Plan will be implemented and the results reported on a mutually agreed schedule.
7. Corrective measures will be implemented if justified by the results of the Assessment. A corrective measure will be implemented to maintain control of the CBP by preventing the expansion of the CBP beyond the Institutional Control Boundary and/or include modification to the Institutional Control Program, as needed.

The data analysis process and methodology for the BDY monitoring well system is presented in Figure 3-2. Table 2-2 provides the BDY monitoring well designation. Table 3-2 provides the BDY well concentration limits (MCL or PSV) for each CBP constituent of concern.

3.4. SURFACE WATER COMPLIANCE MONITORING

Surface water samples will be collected every two weeks at the Kilby Ditch/Low-Lying Area and Southwest Area discharges. The surface water compliance monitoring schedule is provided in Table 3-3. Surface water compliance monitoring will be performed in accordance with NPDES permits.

4. REPORTING

ALDOT will report the effectiveness of the corrective action program annually. These reports will be submitted to ADEM on April 1st of each calendar year for data collected during the prior calendar year. The reports will include data from groundwater and surface water monitoring, an analysis of the data, and any conclusions regarding the effectiveness of the monitoring program. If the analysis of the data warrants any change to the corrective action program, ALDOT will include recommendations for revisions in the annual report.

4.1. GROUNDWATER MONITORING REPORTS

Analytical reports will include the analytical method and the method reporting limit (RL) for each constituent reported. ALDOT will maintain an archive of all Reports in accordance with the Institutional Control Program. Groundwater monitoring reports will include, but not be limited to, the following information:

- Detailed site history or reference to previously submitted site history.
- Descriptions of corrective measures activities and groundwater and surface water monitoring activities,
- A map of the groundwater monitoring system,
- Potentiometric surface maps,
- Isoconcentration maps,
- Tables of EFF and BDY monitoring well depths and elevations
- Descriptions of annual activities to include:
  - Trend analysis
  - Time vs. concentration plots
  - Comparisons of TCE concentrations to concentration limits
  - Sampling procedures and protocol
  - Investigative derived waste management

4.2. CORRECTIVE ACTION REPORTING

At least 180 days prior to each ten-year anniversary of the effective date of the Agreement, ALDOT and ADEM will conduct a comprehensive review of the Long-Term Monitoring Plan and modify, if necessary.

4.3. SURFACE WATER REPORTING

ALDOT will retain calibration and maintenance records, copies of reports, and records of data used for reports, for at least three years from the date of the sample collection, report, or application. All records will be kept at a central repository and available for public inspection.

In accordance with the NPDES permit for the Southwest Area, semi-monthly results of surface water monitoring at SWA DSN001 will be presented in Discharge Monitoring Reports submitted to ADEM on or before the 28th day of January, April, July, and October.

All surface water monitoring reports will be submitted in accordance with ADEM's established rules and regulations, and in accordance with the SW CMIP, Kilby Ditch CMIP, NPDES Permit, and the Long-Term Monitoring Plan.

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Tables

Long-Term Monitoring Plan

COLISEUM BOULEVARD PLUME SITE
MONTGOMERY, ALABAMA

ALABAMA
DEPARTMENT OF TRANSPORTATION

Table 2-1. Assessment Monitoring Wells and Piezometers [1], [2]

Monitoring Well Identifier	Ground Surface Elevation (feet AMSL[3])	Screen Top Interval		Screen Bottom Interval	
		(feet bgs[4])	(feet AMSL[3])	(feet bgs[4])	(feet AMSL[2])
A-Series Wells					
MW-1	215.16	14.0	201.16	63.0	152.16
MW-1A	213.99	32.8	181.19	42.8	171.19
MW-2	218.84	16.0	202.84	70.0	148.84
MW-2A	206.24	34.5	171.74	44.5	161.74
MW-3	211.23	15.0	196.23	51.5	159.73
MW-3A	209.85	30.5	179.35	40.5	169.35
MW-4	214.14	13.0	201.14	62.0	152.14
MW-4A	213.27	38.5	174.77	48.5	164.77
MW-5	218.18	14.5	203.68	53.5	164.68
MW-5A	200.26	14.2	186.06	24.2	176.06
MW-6	218.82	15.5	203.32	59.5	159.32
MW-7	218.05	20.0	198.05	64.0	154.05
MW-8	218.72	17.0	201.72	61.0	157.72
MW-9	217.20	17.0	200.20	56.0	161.20
Pumping Test Wells					
Pump Test Well	206.00	9.0	197.00	28.0	178.00
PW-1	221.61	33.5	188.11	53.0	168.61
PW-2	210.71	19.0	191.71	38.5	172.21
PW-3	200.46	16.0	184.46	26.0	174.46
PW-4	211.11	45.0	166.11	70.0	141.11
Observation Wells					
OW-1	206.01	9.0	197.01	28.0	178.01
OW-2	203.05	9.5	193.55	28.5	174.55
OW-3	203.53	8.5	195.03	29.5	174.03
OW-4	200.52	8.0	192.52	22.0	178.52
SWTA Performance Observation Wells					
P-1	130.19	9.0	121.19	12.0	118.19
P-2	128.01	9.0	119.01	12.0	116.01
P-3	130.89	9.0	121.89	12.0	118.89
P-4	123.64	8.0	115.7	11.0	112.7
PZ-26	162.93	49.0	113.93	64.0	98.93
100/200/300/400-Series Wells					
MW-101	202.67	8.0	194.67	12.0	190.67
MW-201	203.00	23.0	180.00	27.0	176.00
MW-102	200.72	9.5	191.22	13.5	187.22
MW-202	200.81	19.0	181.81	23.0	177.81
MW-103	207.10	12.0	195.10	16.0	191.10
MW-203	206.96	29.0	177.96	33.0	173.96
MW-104	217.80	21.5	196.30	30.5	187.30
MW-204	218.00	57.0	161.00	63.5	154.50
MW-304	218.00	72.0	146.00	86.0	132.00
MW-105	217.00	20.5	196.50	26.5	190.50

Table 2-1. Assessment Monitoring Wells and Piezometers [1], [2]

Monitoring Well Identifier	Ground Surface Elevation (feet AMSL[3])	Screen Top Interval		Screen Bottom Interval	
		(feet bgs[4])	(feet AMSL[3])	(feet bgs[4])	(feet AMSL[2])
MW-205	217.00	46.5	170.50	55.5	161.50
MW-106	223.00	24.5	198.50	33.5	189.50
MW-206	223.00	45.0	178.00	54.0	169.00
MW-107	223.00	25.5	197.50	34.5	188.50
MW-207	223.00	58.0	165.00	67.0	156.00
MW-108	213.00	15.5	197.50	24.5	188.50
MW-208	213.00	47.0	166.00	51.0	162.00
MW-109	221.00	23.5	197.50	32.5	188.50
MW-209	221.00	60.5	160.50	69.5	151.50
MW-210	189.00	4.5	184.50	8.5	180.50
MW-111	211.84	36.5	175.34	45.5	166.34
MW-211	212.14	71.5	140.64	80.5	131.64
MW-311	211.04	88.5	122.54	93.0	118.04
MW-112	221.00	25.5	195.50	34.5	186.50
MW-212	221.00	61.5	159.50	70.5	150.50
MW-113	207.00	11.0	196.00	20.0	187.00
MW-213	208.00	31.5	176.50	35.5	172.50
MW-214	172.00	3.0	169.00	7.0	165.00
MW-214A	172.00	9.5	162.50	18.5	153.50
MW-115	212.00	15.5	196.50	24.5	187.50
MW-215	212.00	30.0	182.00	39.0	173.00
MW-116	194.00	9.5	184.50	18.5	175.50
MW-216	194.00	31.0	163.00	40.0	154.00
MW-117	219.00	34.5	184.50	43.5	175.50
MW-217	209.00	65.0	144.00	74.0	135.00
MW-118	203.00	9.5	193.50	18.5	184.50
MW-218	204.00	35.0	169.00	39.0	165.00
MW-219	203.00	10.0	193.00	19.0	184.00
MW-220	219.00	22.0	197.00	31.0	188.00
MW-221	184.00	15.0	169.00	26.0	158.00
MW-221C	184.15	65.0	119.15	75.0	109.15
MW-122	215.00	17.5	197.50	26.5	188.50
MW-222	215.00	48.0	167.00	57.0	158.00
MW-123	217.00	16.5	200.50	25.5	191.50
MW-223	217.00	60.5	156.50	69.5	147.50
MW-124	219.00	24.5	194.50	38.5	180.50
MW-224	220.00	44.5	175.50	53.5	166.50
MW-125	207.00	15.5	191.50	24.5	182.50
MW-225	207.00	31.0	176.00	40.0	167.00
MW-226	203.60	11.3	192.35	20.5	183.10

Table 2-1. Assessment Monitoring Wells and Piezometers [1], [2]

Monitoring Well Identifier	Ground Surface Elevation (feet AMSL[3])	Screen Top Interval		Screen Bottom Interval	
		(feet bgs[4])	(feet AMSL[3])	(feet bgs[4])	(feet AMSL[2])
MW-227	206.00	18.0	188.00	27.0	179.00
MW-128	212.00	17.0	195.00	26.0	186.00
MW-228	213.00	41.0	172.00	50.0	163.00
MW-129	215.00	18.0	197.00	27.0	188.00
MW-229	215.00	30.5	184.50	39.5	175.50
MW-130	216.00	18.5	197.50	27.5	188.50
MW-230	216.00	42.0	174.00	51.0	165.00
MW-131	206.00	17.0	189.00	23.5	182.50
MW-231	206.00	28.5	177.50	32.5	173.50
MW-132	216.00	19.5	196.50	28.5	187.50
MW-232	216.00	46.0	170.00	55.0	161.00
MW-133	205.00	9.0	196.00	18.0	187.00
MW-233	205.00	26.0	179.00	30.0	175.00
MW-134	210.00	11.5	198.50	25.5	184.50
MW-234	210.00	35.0	175.00	39.0	171.00
MW-153	239.03	104.0	135.03	113.5	125.53
MW-154	245.13	95.6	149.53	105.1	140.03
MW-155	216.32	89.0	127.32	99.0	117.32
MW-156	184.96	68.0	116.96	77.5	107.46
MW-339	223.39	99.0	124.39	108.5	114.89
MW-340	215.19	81.5	133.69	91.0	124.19
MW-341	212.00	50.0	162.00	54.5	157.50
MW-342	216.00	81.5	134.50	86.0	130.00
MW-357	206.84	54.5	152.34	63.5	143.34
MW-457	207.21	122.9	84.36	147.0	60.21
MW-158	190.74	23.0	167.74	33.0	157.74
MW-258	191.10	43.0	148.10	48.0	143.10
MW-358	191.11	43.0	148.11	48.0	143.11
MW-259	181.94	56.5	125.44	66.5	115.44
MW-260	188.99	65.0	123.99	75.0	113.99
MW-261	195.35	61.0	134.35	71.0	124.35
MW-262	177.47	66.5	110.97	76.5	100.97
MW-263	182.24	58.0	124.24	68.0	114.24
MW-264	182.07	58.5	123.57	68.5	113.57
MW-265	181.44	56.0	125.44	66.0	115.44
100A/200B/200C-Series Wells					
MW-135A	217.95	31.0	186.95	35.5	182.45
MW-235B	217.73	40.0	177.73	44.5	173.23
MW-235C	217.44	50.0	167.44	54.5	162.94
MW-136A	211.37	20.0	191.37	24.5	186.87

Table 2-1. Assessment Monitoring Wells and Piezometers [1], [2

Monitoring Well Identifier	Ground Surface Elevation (feet AMSL[3])	Screen Top Interval		Screen Bottom Interval	
		(feet bgs[4])	(feet AMSL[3])	(feet bgs[4])	(feet AMSL[2])
MW-236B	211.29	27.0	184.29	31.5	179.79
MW-236C	210.98	34.0	176.98	38.5	172.48
MW-137A	213.62	32.0	181.62	36.5	177.12
MW-237B	213.74	41.0	172.74	45.5	168.24
MW-237C	213.62	48.0	165.62	52.5	161.12
MW-138A	223.64	34.0	189.64	38.5	185.14
MW-238B	223.44	44.0	179.44	48.0	175.44
MW-238C	223.55	50.0	173.55	54.5	169.05
MW-143A	201.93	8.0	193.93	13.0	188.93
MW-243B	201.93	18.0	183.93	23.0	178.93
MW-144A	214.51	21.0	193.51	31.0	183.51
MW-244B	214.51	37.0	177.51	47.0	167.51
MW-244C	214.51	52.0	162.51	62.0	152.51
MW-145A	282.74	96.0	186.74	106.0	176.74
MW-146A	200.46	10.0	190.46	15.0	185.46
MW-246B	200.46	19.0	181.46	24.0	176.46
MW-147A	201.10	10.0	191.10	15.0	186.10
MW-247B	201.10	20.0	181.10	25.0	176.10
MW-148A	210.70	36.5	174.20	82.0	128.70
MW-248B	211.28	37.5	173.78	47.0	164.28
MW-248C	211.52	61.5	150.02	71.0	140.52
MW-149A	210.58	13.0	197.58	23.0	187.58
MW-249B	210.58	32.0	178.58	37.0	173.58
MW-249C	210.58	41.0	169.58	46.0	164.58
MW-150A	207.99	8.0	199.99	18.0	189.99
MW-250B	207.99	22.0	185.99	27.0	180.99
MW-250C	207.99	31.0	176.99	36.0	171.99
MW-151A	202.04	7.0	195.04	17.0	185.04
MW-251B	202.04	23.0	179.04	28.0	174.04
MW-152A	204.99	8.0	196.99	18.0	186.99
MW-252B	204.99	23.0	181.99	33.0	171.99

NOTES:

[1] Shaded cell indicates the well is an EFF well. The well is used for collection of water quality and groundwater elevation measurements (see Table 2.2 for a list of EFF wells).

[2] Non-shaded cell indicates that only groundwater elevations will be collected from the well.

[3] Above mean sea level.

[4] Below ground surface.

**7 CMT Wells not included*

Table 2-1. Assessment Monitoring Wells and Piezometers [1]

Piezometer Location	Ground Surface Elevation (feet AMSL[2])	Screen Top Interval		Screen Bottom Interval	
		(feet bgs[3])	(feet AMSL[2])	(feet bgs[3])	(feet AMSL[2])
PZ-1	221.26	21.5	199.76	30.5	190.76
PZ-2	207.3	15.5	191.8	24.5	182.8
PZ-3	220.67	24	196.67	34	186.67
PZ-4	216.66	26.5	190.16	35.5	181.16
PZ-5	204.82	15	189.82	19.8	185.02
PZ-6	212.55	23	189.55	27.8	184.75
PZ-7	206.22	17	189.22	21.8	184.42
PZ-8	209.58	17	192.58	21.8	187.78
PZ-9	205.28	17	188.28	21.8	183.48
PZ-10	214.37	23	191.37	27.8	186.57
PZ-11	212.0	27	185.0	31.8	180.2
PZ-12	212.56	20	192.56	25	187.56
PZ-13	208.3	20	188.3	25	183.3
PZ-14	204.83	15	189.83	20	184.83
PZ-15	220.62	44	176.62	49	171.62
PZ-16	193.47	8	185.47	13	180.47
PZ-17	203.95	19	184.95	24	179.95
PZ-18	193.22	61	132.22	70	123.22
PZ-19	186.49	53	133.49	63	123.49
PZ-20	184.8	57	127.8	67	117.8
PZ-21	167.87	59	108.87	69	98.87
PZ-22	182.89	2	180.89	12	170.89
PZ-23	173.8	14	159.8	23.5	150.3
PZ-24	208.57	14	194.57	23.5	185.07
PZ-25	182.88	4	178.88	8.5	174.38
PD-1	206.33	10	196.33	19.8	186.53
PD-2	201.86	13	188.86	17.8	184.06
PD-3	202.62	15	187.62	19.8	182.82
PD-4	202.22	10	192.22	20	182.22
PD-101	200.83	12.5	188.33	16.5	184.33
PD-102	205.55	16.5	189.05	20.5	185.05
PD-103	208.55	18.5	190.05	22.5	186.05
PD-104	200.33	11	189.33	14	186.33
PD-105	199.39	12	187.39	15	184.39
PD-106	199.73	14.5	185.23	17.5	182.23
PD-107	205.87	17.5	188.37	20.5	185.37
PD-108	205.82	14.5	191.32	17.5	188.32
PD-109	204.59	7	197.59	12	192.59
FBPZ-1	215.4	19	196.4	28.5	186.9
FBPZ-2	215.93	17	198.93	26.5	189.43

NOTES:
[1] *Piezometers will be used for groundwater elevation measurements only.*
[2] *Below ground surface.*
[3] *Above mean sea level.*

Table 2-2. Effectiveness, Boundary and Background Monitoring Wells

WELL NUMBER	WELL TYPE	MONITORED ZONE
MW-104	EFF	Shallow
MW-106	EFF	Shallow
MW-108	EFF	Shallow
MW-109	EFF	Shallow
MW-111	EFF	Shallow
MW-113	EFF	Shallow
MW-115	EFF	Shallow
MW-116	EFF	Shallow
MW-117	EFF	Shallow
MW-118	EFF	Shallow
MW-123	EFF	Shallow
MW-125	EFF	Shallow
MW-128	EFF	Shallow
MW-129	EFF	Shallow
MW-130	EFF	Shallow
MW-131	EFF	Shallow
MW-132	EFF	Shallow
MW-133	EFF	Shallow
MW-134	EFF	Shallow
MW-136A	EFF	Shallow
MW-137A	EFF	Shallow
MW-143A	EFF	Shallow
MW-144A	EFF	Shallow
MW-150A	EFF	Shallow
MW-153	EFF	Shallow
MW-154	EFF	Shallow
MW-155	EFF	Shallow
MW-156	EFF	Shallow
MW-204	EFF	Shallow
MW-206	EFF	Shallow
MW-208	EFF	Shallow
MW-209	EFF	Shallow
MW-210	EFF	Shallow
MW-211	EFF	Shallow
MW-213	EFF	Shallow
MW-215	EFF	Shallow
MW-216	EFF	Shallow
MW-217	EFF	Shallow
MW-218	EFF	Shallow
MW-219	EFF	Shallow
MW-221	EFF	Shallow
MW-221C	EFF	Shallow
MW-223	EFF	Shallow
MW-225	EFF	Shallow
MW-228	EFF	Shallow
MW-229	EFF	Shallow
MW-230	EFF	Shallow
MW-231	EFF	Shallow
MW-232	EFF	Shallow
MW-233	EFF	Shallow
MW-234	EFF	Shallow
MW-235B	EFF	Shallow
MW-135A	EFF	Shallow
MW-235C	EFF	Shallow
MW-236B	EFF	Shallow
MW-236C	EFF	Shallow
MW-237B	EFF	Shallow
MW-237C	EFF	Shallow
MW-243B	EFF	Shallow
MW-244B	EFF	Shallow
MW-244C	EFF	Shallow
MW-146A	EFF	Shallow
MW-246B	EFF	Shallow
MW-147A	EFF	Shallow
MW-247B	EFF	Shallow
MW-250B	EFF	Shallow
MW-250C	EFF	Shallow
MW-259	EFF	Shallow
MW-260	EFF	Shallow
MW-261	EFF	Shallow
MW-262	EFF	Shallow
MW-263	EFF	Shallow
MW-264	EFF	Shallow
MW-265	EFF	Shallow
MW-5A	EFF	Shallow
MW-304	EFF	Deep
MW-311	EFF	Deep
MW-339	EFF	Deep
MW-340	EFF	Deep
MW-341	EFF	Deep
MW-342	EFF	Deep
MW-357	EFF	Deep
MW-358	EFF	Deep
MW-457	EFF	Deep
BDY-1	BDY	Shallow
BDY-2	BDY	Shallow
BDY-3	BDY	Shallow
BDY-4	BDY	Shallow
BDY-5	BDY	Shallow
BDY-6	BDY	Shallow
BDY-7	BDY	Shallow
BDY-8	BDY	Shallow
BDY-9	BDY	Shallow
BDY-10	BDY	Shallow
BDY-11	BDY	Shallow
BDY-12	BDY	Shallow
BDY-13	BDY	Shallow
BDY-14	BDY	Shallow
MW-112	BKG	Shallow
MW-212	BKG	Shallow

EFF – Corrective Action Effectiveness Monitoring Well
BDY – Boundary Monitoring Well
BKG – Background Well

Table 2-3A. Semi-Annual (January & July) Sampling Program Effectiveness and Boundary Monitoring Wells

WELL NUMBER	WELL TYPE	MONITORED ZONE
MW-111	EFF	Shallow
MW-116	EFF	Shallow
MW-117	EFF	Shallow
MW-123	EFF	Shallow
MW-125	EFF	Shallow
MW-153	EFF	Shallow
MW-156	EFF	Shallow
MW-211	EFF	Shallow
MW-216	EFF	Shallow
MW-217	EFF	Shallow
MW-221	EFF	Shallow
MW-221C	EFF	Shallow
MW-223	EFF	Shallow
MW-225	EFF	Shallow
MW-237C	EFF	Shallow
MW-250C	EFF	Shallow
MW-260	EFF	Shallow
MW-262	EFF	Shallow
MW-263	EFF	Shallow
MW-264	EFF	Shallow
MW-265	EFF	Shallow
MW-357	EFF	Deep
MW-358	EFF	Deep
BDY-01R	BDY	Shallow
BDY-02	BDY	Shallow
BDY-03	BDY	Shallow
BDY-04	BDY	Shallow
BDY-05	BDY	Shallow
BDY-06	BDY	Shallow
BDY-07	BDY	Shallow
BDY-08	BDY	Shallow
BDY-09	BDY	Shallow
BDY-10	BDY	Shallow
BDY-11R	BDY	Shallow
BDY-12	BDY	Shallow
BDY-13	BDY	Shallow
BDY-14	BDY	Shallow

Table 2-3B. Annual (January-only) Sampling Program
Effectiveness and Background Monitoring Wells

WELL NUMBER	WELL TYPE	MONITORED ZONE
MW-5A	EFF	Shallow
MW-104	EFF	Shallow
MW-106	EFF	Shallow
MW-108	EFF	Shallow
MW-109	EFF	Shallow
MW-113	EFF	Shallow
MW-115	EFF	Shallow
MW-118	EFF	Shallow
MW-128	EFF	Shallow
MW-129	EFF	Shallow
MW-130	EFF	Shallow
MW-131	EFF	Shallow
MW-132	EFF	Shallow
MW-133	EFF	Shallow
MW-134	EFF	Shallow
MW-135A	EFF	Shallow
MW-136A	EFF	Shallow
MW-137A	EFF	Shallow
MW-143A	EFF	Shallow
MW-144A	EFF	Shallow
MW-146A	EFF	Shallow
MW-147A	EFF	Shallow
MW-150A	EFF	Shallow
MW-154	EFF	Shallow
MW-155	EFF	Shallow
MW-204	EFF	Shallow
MW-206	EFF	Shallow
MW-208	EFF	Shallow
MW-209	EFF	Shallow
MW-210	EFF	Shallow
MW-213	EFF	Shallow
MW-215	EFF	Shallow
MW-218	EFF	Shallow
MW-219	EFF	Shallow
MW-228	EFF	Shallow
MW-229	EFF	Shallow
MW-230	EFF	Shallow
MW-231	EFF	Shallow
MW-232	EFF	Shallow
MW-233	EFF	Shallow
MW-234	EFF	Shallow
MW-235B	EFF	Shallow
MW-235C	EFF	Shallow
MW-236B	EFF	Shallow
MW-236C	EFF	Shallow
MW-237B	EFF	Shallow
MW-243B	EFF	Shallow
MW-244B	EFF	Shallow
MW-244C	EFF	Shallow
MW-246B	EFF	Shallow
MW-247B	EFF	Shallow
MW-250B	EFF	Shallow
MW-259	EFF	Shallow
MW-261	EFF	Shallow
MW-304	EFF	Deep
MW-311	EFF	Deep
MW-339	EFF	Deep
MW-340	EFF	Deep
MW-341	EFF	Deep
MW-342	EFF	Deep
MW-457	EFF	Deep
MW-112	BKG	Shallow
MW-212	BKG	Shallow

Table 2-4. Rational for Monitoring Well Network Sampling Modification

Wells with TCE Less than the GPS Effectiveness Wells	**Wells with No TCE Trend or Decreasing TCE Trend** Effectiveness Wells	**Wells in Low Advection Areas (near PH12)** Effectiveness Wells
MW-104	MW-106	MW-108
MW-204	MW-206	MW-208
MW-109	MW-210	MW-128
MW-209	MW-113	MW-228
MW-118	MW-213	MW-130
MW-218	MW-115	MW-230
MW-144A	MW-215	MW-131
MW-244B	MW-129	MW-231
MW-244C	MW-229	MW-132
MW-219	MW-133	MW-232
MW-154	MW-233	MW-135A
MW-155	MW-134	MW-235B
MW-259	MW-234	MW-235C
MW-261	MW-143A	MW-136A
MW-304	MW-243B	MW-236B
MW-311	MW-146A	MW-236C
MW-339	MW-246B	MW-137A
MW-340	MW-147A	MW-237B
MW-341	MW247	
MW-342	MW-150A	
MW-467	MW-250B	
	MW-5A	
Background Wells		
MW-112		
MW-212		

GPS – Groundwater Protection Standard for TCE is 0.005 mg/L

Table 3-1. Effectiveness Well Concentration Action Limits

WELL NUMBER	TCE CONCENTRATION LIMIT (mg/L)
MW-106	20
MW-206	20
MW-137A	20
MW-237B	20
MW-237C	20
MW-131	15
MW - 123	15
MW - 223	15
MW- 231	15
MW-135A	15
MW-235B	15
MW-235C	15
MW-136A	15
MW-236B	15
MW-236C	15
MW-150A	15
MW-250B	15
MW-250C	15
MW-108	5
MW-208	5
MW-129	5
MW-229	5
MW-130	5
MW-230	5
MW-132	5
MW-232	5
MW-143A	5
MW-243B	5
MW-146A	5
MW-246B	5
MW-147A	5
MW-247B	5
MW-128	1
MW-228	1
MW-134	1
MW-234	1
MW-153	1
MW-5A	0.5
MW-113	0.5
MW-213	0.5
MW-111	0.5
MW-211	0.5
MW-117	0.5
MW-217	0.5
MW-133	0.5
MW-233	0.5

WELL NUMBER	TCE CONCENTRATION LIMIT (mg/L)
MW-210	0.5
MW-221	0.5
MW-221C	0.5
MW-156	0.5
MW-259	0.5
MW-260	0.5
MW-263	0.5
MW-264	0.5
MW-265	0.5
MW-154	0.5
MW-155	0.5
MW-125	0.5
MW-225	0.5
MW-144A	0.5
MW-244B	0.5
MW-244C	0.5
MW-261	0.5
MW-109	0.1
MW-209	0.1
MW-115	0.1
MW-215	0.1
MW-116	0.1
MW-216	0.1
MW-118	0.1
MW-218	0.1
MW-219	0.1
MW-262	0.1
MW-311	0.005
MW-339	0.005
MW-340	0.005
MW-341	0.005
MW-342	0.005
MW-104	0.005
MW-204	0.005
MW-304	0.005
MW-112	0.005
MW-212	0.005
MW-357	0.005
MW-457	0.005
MW-358	0.005

Table 3-2. Boundary Well Concentration Action Limits

BOUNDARY WELL COCs	ACTION LIMITS (MG/L)
Chloroform	0.08
1,1-Dichloroethene	0.007
cis-1,2-Dichlroroethene	0.07
Trichloroethene	0.005
Vinyl Chloride	0.002
1,1-Dichloroethane	0.081
Carbon Tetrachloride	0.005
Chloroethane	0.0046
Tetrachloroethylene	0.005
Methylene Chloride	0.005

* From ADEM Alabama Risk-Based Corrective Action Guidance Manual, Preliminary Screening Values, Table 2-2, April 2008

Table 3-3 Surface Water Sample Locations

Low-Lying Area Compliance Point

POINT IDENTIFICATION	POINT DESCRIPTION	MONITORING SCHEDULE	NORTHING AND EASTING[2]	MONTHLY AVERAGE TCE CONCENTRATION ALLOWABLE (PPB)[1]
LLCP-1	Lower Kilby Ditch at the confluence with Three Mile Branch	Every Two Weeks	N 700218.85 E 525429.50	37.38

[1] PPB = parts per billion (micrograms per liter)
[2] State Plane, Alabama East, NAD 1983 (Feet)

Southwest Area Compliance Point

POINT IDENTIFICATION	POINT DESCRIPTION	MONITORING SCHEDULE	NORTHING AND EASTING[2]	MONTHLY AVERAGE TCE CONCENTRATION ALLOWABLE (PPB)[1]
DSN001	Southwest Area	Every Two Weeks	N 691836.91 E 513660.36	37.94/17.47

[1] PPB = parts per billion (micrograms per liter)
[2] State Plane, Alabama East, NAD 1983 (Feet)

Low-Lying Area Effectiveness Monitoring Points

POINT IDENTIFICATION	POINT DESCRIPTION	MONITORING SCHEDULE	NORTHING AND EASTING[1]
LLA-1	Low-Lying Area- upstream of constructed wetland	Quarterly	N 699878.64 E 523381.01
LLA-2	Low-Lying Area- discharge from constructed wetland	Quarterly	N 699990.71 E 523684.38
LLA-3	Low-Lying Area- internal constructed wetland	Quarterly	N 699996.83 E 523854.62
LLA-4	Low-Lying Area- small tributary south of existing wetland	Quarterly	N 699800.83 E 524107.32
LLA-5	Low-Lying Area- groundwater interceptor trench pond	Quarterly	N 700254.35 E 523639.42
LLA-6	Low-Lying Area- groundwater interceptor trench before confluence with lower Kilby Ditch	Quarterly	N 700096.52 E 524805.57
LLA-7	Low-Lying Area- lower Kilby Ditch after confluence with groundwater interceptor trench	Quarterly	N 700196.52 E 525265.81
LLA-8	Low-Lying Area- existing wetland	Quarterly	N 699976.44 E 524421.23
LLA-9	Unnamed tributary immediately south of Northern Boulevard	Quarterly	N 699480.97 E 524158.67
LLA-10	Surface water south of Northern Boulevard groundwater seeps from west of unnamed tributary	Quarterly	N 699478.84 E 524186.09
LLA-11	Discharge from Russell Distribution facility storm water/groundwater	Quarterly	N 699471.75 E 524191.21

[1] State Plane, Alabama East, NAD 1983 (Feet)

Table 3-3 Surface Water Sample Locations

Southwest Area Effectiveness Monitoring Points

POINT IDENTIFICATION	POINT DESCRIPTION	MONITORING SCHEDULE	NORTHING AND EASTING[1]
SWA-1	Dewatering Pond	Quarterly	N 693491.68 E 512941.54
SWA-2	Transfer Pond	Quarterly	N 692895.39 E 512861.25
SWA-3	Inlet structure at Discharge Pond from Transfer Pond	Quarterly	N 692992.61 E 513529.03
SWA-4	Outlet structure at Discharge Pond	Quarterly	N 692628.30 E 513642.34

[1]State Plane, Alabama East, NAD 1983 (Feet)

Southwest Area Voluntary Monitoring Points

POINT IDENTIFICATION	POINT DESCRIPTION	MONITORING SCHEDULE	NORTHING AND EASTING[1]
FG	Flood Gate	Periodic	N 690614.84 E 513480.17
O1	Lower Wetumpka Road Ditch Discharge to Wetland	Periodic	N 690784.23 E 514493.47

[1]State Plane, Alabama East, NAD 1983 (Feet)

Other Effectiveness Monitoring Points

POINT IDENTIFICATION	POINT DESCRIPTION	MONITORING SCHEDULE	NORTHING AND EASTING[1]
BB	Stream and Wetland East of Bama Budweiser Facility	Quarterly	N 698785.41 E 525518.23
ZP	Zoo Pond	Quarterly	N 699530.88 E 519019.93
ZD	Zoo Ditch	Quarterly	N 699527.48 E 519807.66

[1]State Plane, Alabama East, NAD 1983 (Feet)

Three Mile Branch Monitoring Points

POINT IDENTIFICATION	POINT DESCRIPTION	MONITORING SCHEDULE	NORTHING AND EASTING[1]
TMB-1	Upstream Point	Quarterly	N 698070.74 E 525787.38
TMB-2	Upstream at North Boulevard	Quarterly	N 699431.09 E 525939.61
TMB-3	Downstream Point	Quarterly	N 700374.82 E 525444.65

[1]State Plane, Alabama East, NAD 1983 (Feet)

Figures

Long-Term Monitoring Plan

COLISEUM BOULEVARD PLUME SITE
MONTGOMERY, ALABAMA

Lower Kilby Ditch

Low Lying Area

Main Kilby Ditch

West Kilby Ditch

Southwest Treatment Area

N

Legend

- Institutional Control Parcels
- Kilby Ditch and Low Lying Area
- Southwest Treatment Area

Southwest Treatment Area Surface Water Features

- Dewatering Pond
- Transfer Pond
- Discharge Pond
- Constructed Wetland

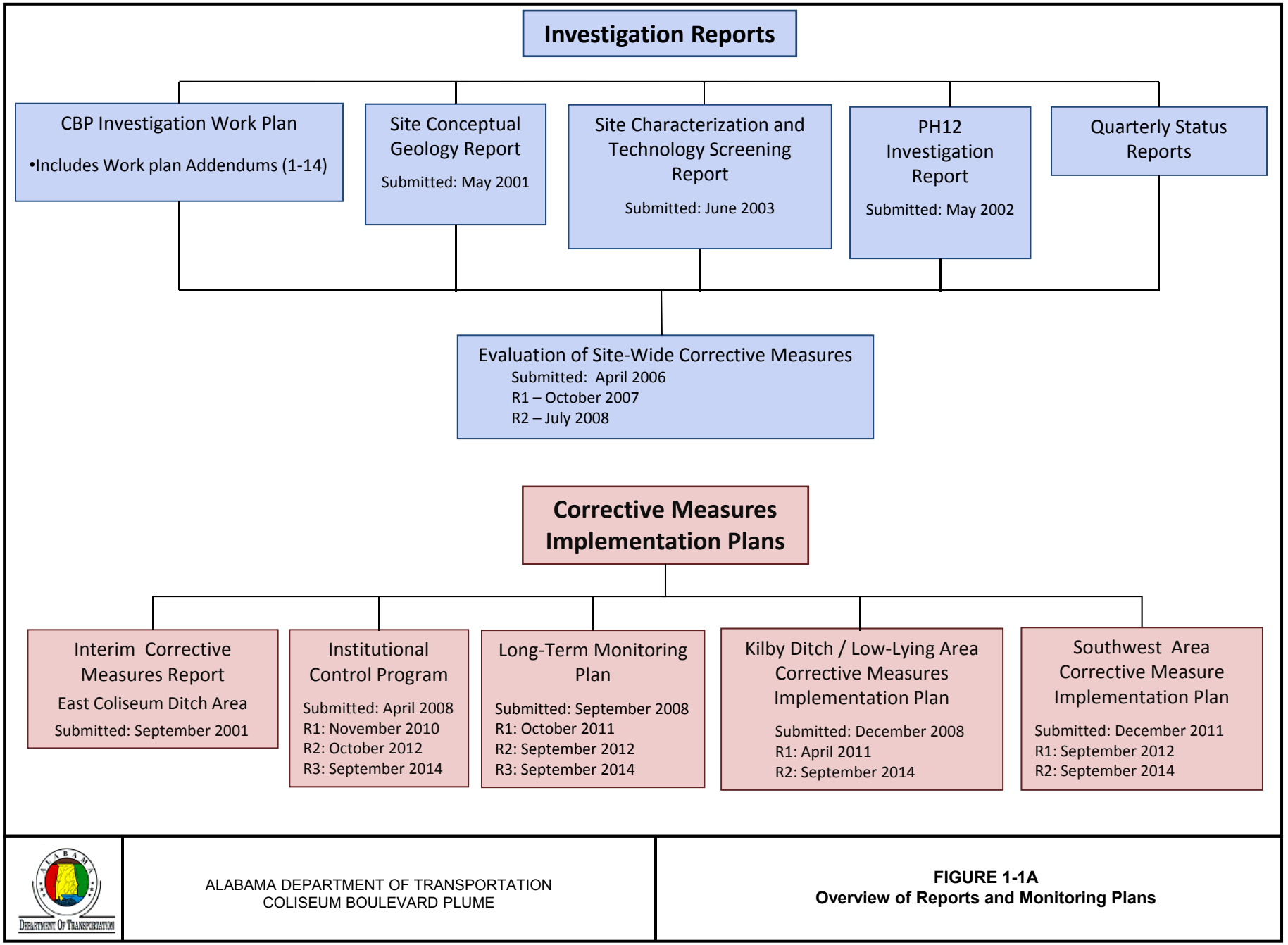
1,000 500 0 1,000 2,000 3,000 4,000 Feet

ALABAMA DEPARTMENT OF TRANSPORTATION
COLISEUM BOULEVARD PLUME

COLISEUM BOULEVARD PLUME CORRECTIVE MEASURES AREA

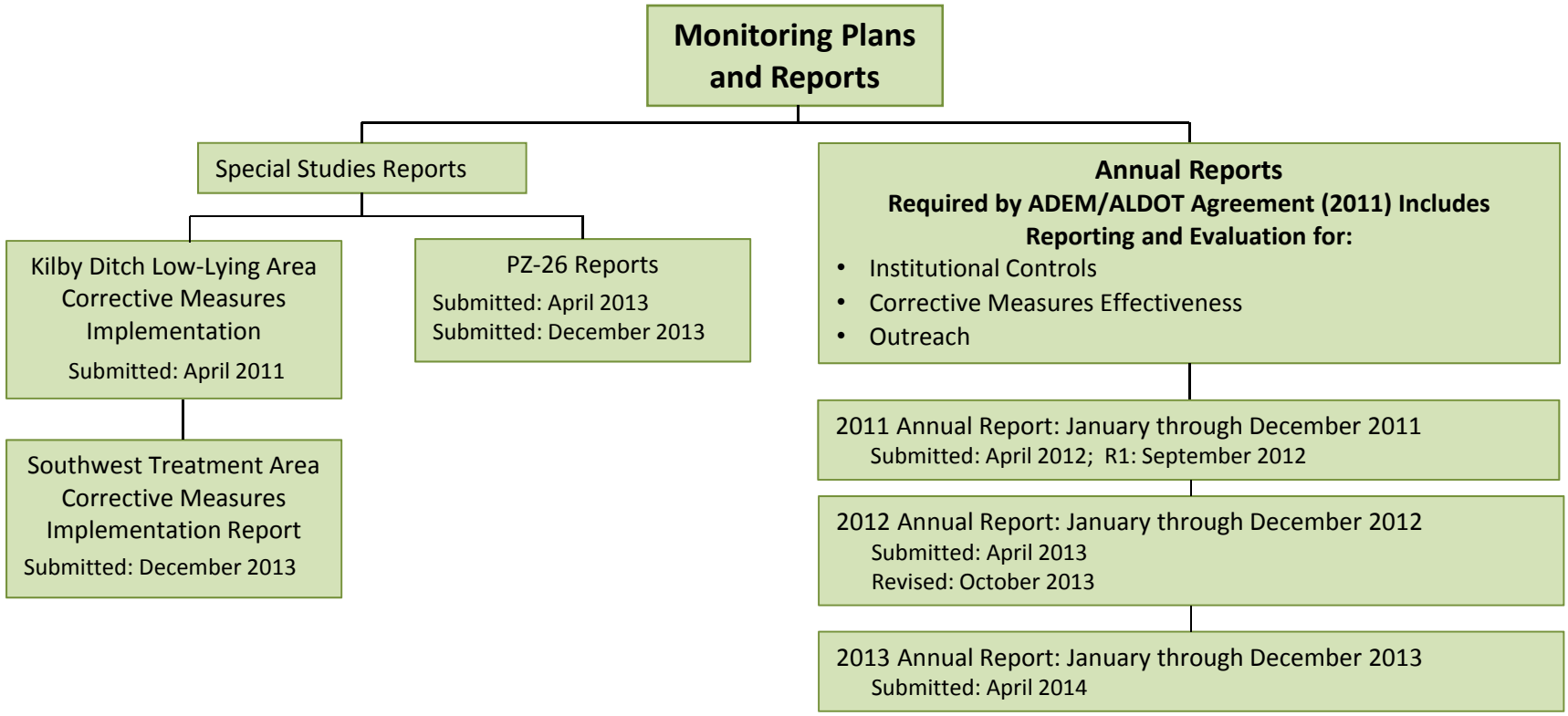
Figure 1-1

SEPTEMBER 2014



ALABAMA DEPARTMENT OF TRANSPORTATION
COLISEUM BOULEVARD PLUME

FIGURE 1-1A
Overview of Reports and Monitoring Plans



ALABAMA DEPARTMENT OF TRANSPORTATION
COLISEUM BOULEVARD PLUME

FIGURE 1-1B
Overview of Annual and Special Reports

BDY-04
BDY-05
BDY-03
BDY-02
MW-210
MW-219
MW-5A
BDY-06
BDY-01R
MW-115 / 215
MW-215
MW-358
MW-146A / 246A
MW-143A / 243B
MW-133 / 233
MW-147A / MW-247B
MW-125 / 225
MW-116 / 216
MW-118 / 218
MW-357
MW-457
MW-134 / 234
MW-113 / 213
BDY-14
BDY-07
MW-131 / 231
MW-129 / 229
MW-136A / 236B / 236C
MW-150A / 250B / 250C
MW-341
MW-130 / 230
MW-128 / 228
MW-342
MW-108 / 208
MW-135A / 235B / 235C
MW-339
MW-340
MW-106 / 206
MW-132 / 232
MW-104 / 204
MW-304
BDY-08
MW-117 / 217
MW-137A / 237B / 237C
MW-109 / 209
BDY-13
MW-112
MW-212
MW-123 / 223
MW-111 / 211 / 311
MW-311
MW-262
BDY-09
MW-265
MW-144A / 244B / 244C
MW-144 / MW144C
BDY-12
MW-221 / 221C
MW-153
MW-154
MW-264
MW-260
MW-156
MW-155
MW-263
MW-259
Dewatering Pond
Transfer Pond
BDY-10
MW-261
Discharge Pond
BDY-11R
Discharge Ditch

N

Legend

- LTM Boundary Wells (BDY)
- LTM Effectivness Wells (EFF)
- LTM Background Wells (BKG)

Low Lying Area Surface Water Features

- Constructed Wetland
- Wetland Stream Channel

Southwest Treatment Area Surface Water Features

- Dewatering Pond
- Transfer Pond
- Discharge Pond
- Piping and Discharge Channels
- Southwest Treatment Area
- Kilby Ditch / Low Lying Area
- Institutional Control Parcels

1,000 500 0 1,000 2,000 3,000 4,000 Feet

ALABAMA DEPARTMENT OF TRANSPORTATION

LONG TERM GROUNDWATER MONITORING WELLS

SEPTEMBER 2014

Figure 2-1

N

Dewatering Pond

Transfer Pond

Discharge Pond

Discharge Ditch

Legend

- LTM Boundary Wells (BDY)
- January and July (Semi-Annual) Sampling
- January (Annual) Sampling

Low Lying Area Surface Water Features

- Constructed Wetland
- Wetland Stream Channel

Southwest Treatment Area Surface Water Features

- Dewatering Pond
- Transfer Pond
- Discharge Pond
- Piping and Discharge Channels
- Southwest Treatment Area
- Kilby Ditch / Low Lying Area
- Institutional Control Parcels

1,000 500 0 1,000 2,000 3,000 4,000 Feet

ALABAMA DEPARTMENT OF TRANSPORTATION

SEMI-ANNUAL (JANUARY AND JULY) SAMPLING PROGRAM WELLS

September 2014

Figure 2-2

N

Dewatering Pond

Transfer Pond

Discharge Pond

Discharge Ditch

Legend

- LTM Boundary Wells (BDY)
- LTM Effectivness Wells (EFF)
- LTM Background Wells (BKG)

Low Lying Area Surface Water Features

- Constructed Wetland
- Wetland Stream Channel

Southwest Treatment Area Surface Water Features

- Dewatering Pond
- Transfer Pond
- Discharge Pond
- Piping and Discharge Channels
- Southwest Treatment Area
- Kilby Ditch / Low Lying Area
- Institutional Control Parcels

1,000 500 0 1,000 2,000 3,000 4,000 Feet

ALABAMA DEPARTMENT OF TRANSPORTATION

ANNUAL (JANUARY-only) SAMPLING PROGRAM WELLS

September 2014

Figure 2-3

ALABAMA DEPARTMENT OF TRANSPORTATION
COLISEUM BOULEVARD PLUME

ZP, ZD, AND LLA SURFACE WATER MONITORING LOCATIONS

September 2014

Figure 2-4

N

Dewatering Pond

SWA-1

Pump

Transfer Pond

SWA-3

Discharge Pond

SWA-2

Pump

SWA-4

T-Valve Junction Box

Auxiliary Treatment Basin

Discharge Ditch

DSN001 (NPDES AL0081167) formerly SWA-5

Wetlands

O1

FG

Legend

Long Term Monitoring Surface Water Locations

- SWTA Effectiveness (SWA)
- SWTA Compliance Point (DSN001)
- Voluntary Surface Water Monitoring Point
- Underground Pipe
- Discharge Ditch
- Southwest Treatment Area

Aerial Photo Source: NRCS NAIP 2013

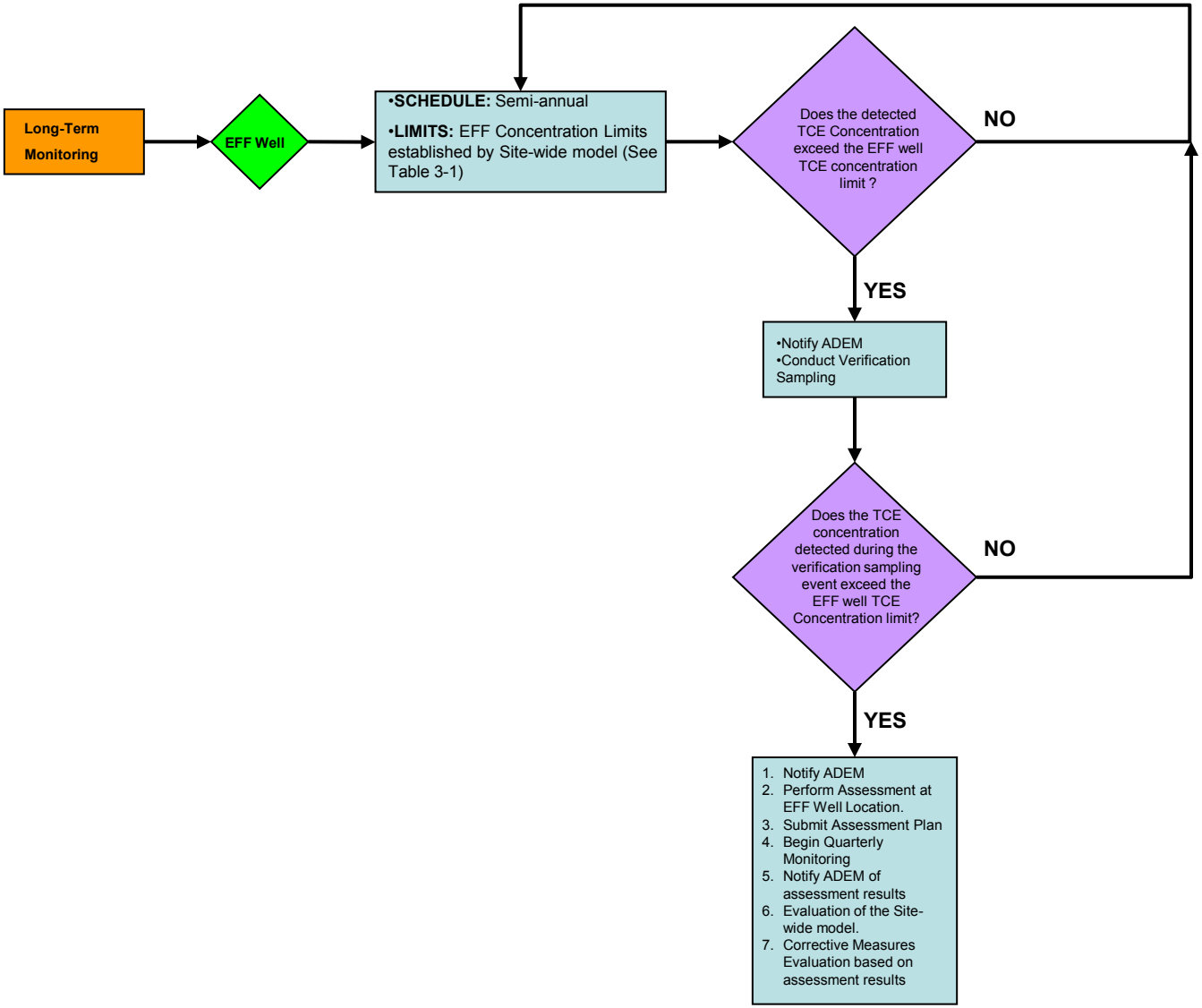
250 125 0 250 500 750 1,000 Feet

ALABAMA DEPARTMENT OF TRANSPORTATION
COLISEUM BOULEVARD PLUME

SURFACE WATER MONITORING AND COMPLIANCE POINTS

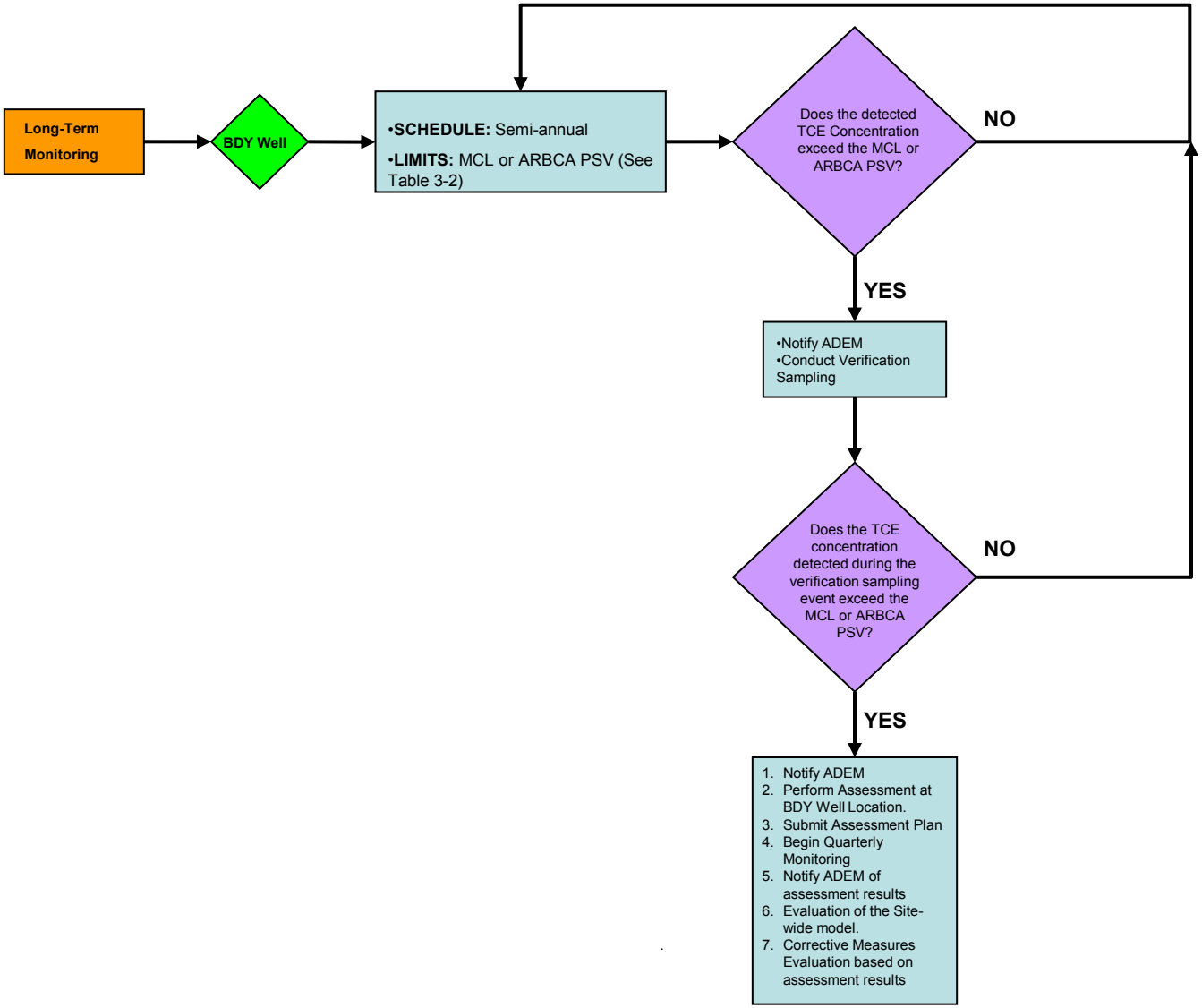
SEPTEMBER 2014

Figure 2-5



ALABAMA DEPARTMENT OF TRANSPORTATION
COLISEUM BOULEVARD PLUME

FIGURE 3-1
EFFECTIVENESS MONITORING NETWORK EVALUATION



ALABAMA DEPARTMENT OF TRANSPORTATION
COLISEUM BOULEVARD PLUME

FIGURE 3-2
BOUNDARY WELL MONITORING NETWORK EVALUATION