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
R4 – June 2019 (r-7/10/2020)

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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
ARBCA	Alabama Risk-Based Corrective Action
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 Site
PH12	Probehole 12 Area
RBTL	Risk Based Target Level
RSL	Regional Screening Level
SWA	South West Treatment Area
TCE	Trichloroethylene
VIS	Vapor Intrusion Screening (Well)
VISL	Vapor Intrusion Screening Level

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 (LTM) Plan
- Southwest Treatment Area CMIP

Each of these plans have been approved by ADEM and implemented by ALDOT. The LTM Plan provides the procedures that ALDOT will utilize to comply with the amended "Settlement Agreement for Voluntary Response ("Agreement") between ADEM and ALDOT, effective March 10, 2015.

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, plume conditions, and the potential for vapor intrusion;
- 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.

Figures 1-2A and 1-2B present 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 and construction activities and effectiveness of implemented corrective measures. Following completion of construction, Annual reports are submitted to document effectiveness of the 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). Effectiveness (84 wells), Boundary (14 wells), and Background wells (2 wells) are listed on Table 2-2. 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 was proposed for Long Term Monitoring. The optimized monitoring well system is referred to as 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-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 2-2 summarizes 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, 84 of the 150 assessment monitoring wells were retained as EFF monitoring wells plus 2 as Background 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 are retained for measurements of water levels, with the exception of the seven (7) CMT Wells that were plugged and abandoned in October 2011. Additionally, piezometers used for water level measurements and groundwater elevation mapping are retained (see Table 2-1).

2.2.3. TEMPORAL ANALYSIS (OPTIMUM SAMPLE COLLECTION SCHEDULE)

The optimum sampling schedule for the EFF monitoring well network was updated in revision 4 of the LTM (June 2019) by using trend analysis of historical data. The temporal analysis included evaluating the TCE trend for all EFF monitoring wells and optimizing the sampling frequency based on the results.

2.2.4. 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 a majority of the EFF monitoring wells.

To re-assess sampling frequency, trend analysis was completed for the 22 EFF wells that have been sampled semi-annually under revision 3 (September 2014) of the LTM Plan. Trend statistics were calculated using the Shewhart Statistic for all samples (semi-annual, first quarter and third quarter samples) and compared to the trend statistics for results from the first quarter sampling only (annual). TCE was not detected in four of the EFF wells (MW-123, MW-221, MW-262, and MW-358) plus the two background wells for the duration of

the Long Term Monitoring program (2011 through 2018) and were not included in the trend analysis. There was no change in the trend statistics for any of the remaining 18 EFF wells at the annual sampling frequency. Semi-annual sampling does not change the results or conclusions compared to annual sampling and is not needed to assess effectiveness of the remedy.

Based on the sampling frequency re-assessment, the time between sampling events can be modified to annually (first quarter only) for the EFF and Background wells. Boundary wells will continue to be monitored semi-annually. A subset of the shallow effectiveness wells is also designated as Vapor Intrusion Screening (VIS) monitoring wells. VIS wells with calculated Risk Based Target Levels (RBTLs) will be monitored semi-annually. VIS wells are described in Section 3.5.

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, the size of the CBP decreased by 20 percent between 2009 and 2018. 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 from the PH12 area at the SWTA. Based on the re-assessment of the trends based on annual versus semi-annual sampling frequency, a semi-annual sampling frequency for the EFF wells do not provide useful information above the annual sampling frequency. As such, and based on consultations with ADEM, ALDOT proposes a revised monitoring schedule:

First semi-annual period (First Quarter)

Well Types	Number of Wells
Background Wells	2
Boundary Wells	14
Effectiveness Wells	84[1]

Second semi-annual period (Third Quarter)

Well Types	Number of Wells
Background Wells	0
Boundary Wells	14
Effectiveness Wells	VIS wells[2]

[1] Includes Effectiveness wells that are also designated as VIS wells (see Section 3.5).

[2] Only VIS wells with established RBTLs will be sampled Third Quarter (see Section 3.5).

Specific monitoring wells to be included in the optimized monitoring program are included in Tables 2-3A and 2-3B. 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 and the Settlement Agreement. 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 (see Figure 2-4). Samples will also be collected from Three Mile Branch (see Figure 2-4). 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 general accordance with the accepted procedures as outlined in the most recent guidance published by ADEM and/or the EPA (see LTM Technical Memorandum for Groundwater Sampling Methods). These documents include:

- 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; 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 annually 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 well 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 annual 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. Annual 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 annual sampling event.
3. If the TCE concentration in the verification sample is below the TCE concentration limit for the EFF monitoring well, annual 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 annual

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. 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 sample collection schedule at the EFF monitoring well will return to annual. 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 Regional Screening Level (RSL) (Table 3-2).
2. If a BDY monitoring well sample result exceeds an MCL or RSL 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 RSL 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 RSL, 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. If the CBP constituent of concern concentration remains below the MCL or RSL 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 are 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 RSL) 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 the NPDES permit and the Agreement.

3.5. VAPOR INTRUSION EVALUATION

ALDOT has performed vapor intrusion assessment since 2002 and has provided vapor intrusion evaluation in Annual Reports, specifically Table 3-5 of each Annual Report. In 2017, ADEM in its Alabama Risk-Based Corrective Action (ARBCA) Guidance Manual (ADEM, 2017) adopted the use of the EPA Vapor Intrusion Screening Level (VISL) calculator to determine groundwater screening levels for

vapor intrusion. EPA and ADEM have made technical documents and tools available to support the ongoing development of its vapor intrusion evaluation programs (ADEM, 2017). ALDOT has incorporated the vapor intrusion evaluation procedures that are provided in the ARBCA to supplement the existing evaluation of the vapor intrusion pathway. These procedures include the following:

1. Groundwater samples will be collected routinely from 24 of the EFF monitoring wells for vapor intrusion screening. This subset of 24 EFF monitoring wells are referred to as "VIS wells". VIS wells have screen intervals within three feet of the water table for screening TCE groundwater concentrations to VISLs. Each VIS well used for the vapor intrusion evaluation is representative of an undeveloped, residential, or commercial property. VIS wells are provided in Table 3-4 and shown in Figure 3-3.
2. Groundwater concentrations during the current year will be compared to baseline TCE groundwater concentrations in the VIS wells. Baseline TCE concentrations in VIS wells were determined during previous vapor sampling and assessment completed in 2002. A summary table for comparisons of groundwater concentrations to baseline groundwater concentrations will be provided in each Annual Report.
3. A residential or commercial VISL is calculated for TCE using the most recent edition of the EPA VISL calculator. TCE concentrations in each VIS well are compared to the VISLs. A summary table for comparisons of TCE concentrations to VISLs will be provided in each Annual Report.

3.5.1. RISK-BASED TARGET LEVELS

In accordance with the ARBCA, ALDOT will establish groundwater RBTLs for TCE in VIS wells that exceed the VISL and cumulative risk. RBTLs will be established using the ARBCA benchmarks for hazard index of 1.0 and cumulative risk of $1.0x10^{-5}$.

3.5.2. RISK-BASED TARGET LEVEL EVALUATION

ALDOT will collect groundwater samples from VIS wells with calculated RBTLs on a semi-annual schedule. A summary table of groundwater concentrations and comparisons to established RBTLs will be provided with each Annual Report. Although not required by the ARBCA, ALDOT will reevaluate RBTLs every five years to

coincide with the schedule for review and verification of the site-wide groundwater model.

1. RBTLs will be developed for VIS wells that exceed the VISL and cumulative risk.
2. If a sample from a VIS monitoring well with a calculated RBTL exceeds the RBTL, 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 concentration is below the RBTL in the verification sample. ALDOT will include all verification sampling results to ADEM in the Annual Report.
4. If the concentration in the verification sample is greater than the RBTL, 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 four consecutive quarters from the monitoring well with an exceedance. If the CBP constituent of concern concentration remains below the RBTL for the VIS monitoring well during the four consecutive quarterly sampling events, the VIS monitoring well will return to a semiannual monitoring schedule.
6. An Assessment Plan to evaluate the groundwater within the part of the CBP where the exceedance of the RBTL 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 reduce risk from VI and/or include modification to the Institutional Control Program, as needed.

The data analysis process and methodology for the VIS monitoring wells with calculated RBTLs are presented in Figure 3-4.

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
  - Vapor Intrusion Screening Level evaluation
  - 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, results of surface water monitoring every two weeks 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.

5. REFERENCES

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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 / VIS	Shallow
MW-106	EFF / VIS	Shallow
MW-108	EFF / VIS	Shallow
MW-109	EFF / VIS	Shallow
MW-111	EFF / VIS	Shallow
MW-113	EFF / VIS	Shallow
MW-115	EFF / VIS	Shallow
MW-116	EFF / VIS	Shallow
MW-117	EFF / VIS	Shallow
MW-118	EFF / VIS	Shallow
MW-123	EFF / VIS	Shallow
MW-125	EFF / VIS	Shallow
MW-128	EFF / VIS	Shallow
MW-129	EFF / VIS	Shallow
MW-130	EFF / VIS	Shallow
MW-131	EFF	Shallow
MW-132	EFF / VIS	Shallow
MW-133	EFF / VIS	Shallow
MW-134	EFF / VIS	Shallow
MW-136A	EFF	Shallow
MW-137A	EFF	Shallow
MW-143A	EFF / VIS	Shallow
MW-144A	EFF / VIS	Shallow
MW-150A	EFF / VIS	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 / VIS	Shallow
MW-246B	EFF	Shallow
MW-147A	EFF / VIS	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 / VIS	Shallow
MW-212	BKG	Shallow

EFF – Corrective Action Effectiveness Monitoring Well
BDY – Boundary Monitoring Well
BKG – Background Well
VIS – Vapor Intrusion Screening Groundwater Monitoring Well

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

WELL NUMBER	WELL TYPE	MONITORED ZONE
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-104	EFF / VIS	Shallow
MW-106	EFF / VIS	Shallow
MW-108	EFF / VIS	Shallow
MW-109	EFF / VIS	Shallow
MW-111	EFF / VIS	Shallow
MW-113	EFF / VIS	Shallow
MW-115	EFF / VIS	Shallow
MW-116	EFF / VIS	Shallow
MW-117	EFF / VIS	Shallow
MW-118	EFF / VIS	Shallow
MW-123	EFF / VIS	Shallow
MW-125	EFF / VIS	Shallow
MW-128	EFF / VIS	Shallow
MW-129	EFF / VIS	Shallow
MW-130	EFF / VIS	Shallow
MW-131	EFF	Shallow
MW-132	EFF / VIS	Shallow
MW-133	EFF / VIS	Shallow
MW-134	EFF / VIS	Shallow
MW-136A	EFF	Shallow
MW-137A	EFF	Shallow
MW-143A	EFF / VIS	Shallow
MW-144A	EFF / VIS	Shallow
MW-150A	EFF / VIS	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

WELL NUMBER	WELL TYPE	MONITORED ZONE
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 / VIS	Shallow
MW-246B	EFF	Shallow
MW-147A	EFF / VIS	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
MW-112	BKG / VIS	Shallow
MW-212	BKG	Shallow

- MW-357 to be sampled quarterly until the TCE concentration is less than the effectiveness concentration.
- Wells with RBTLs will be sampled semi-annually with the First Quarter and Third Quarter wells

(r-4/17/2020)

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	0.0028**
Carbon Tetrachloride	0.005*
Chloroethane	2.1**
Tetrachloroethylene	0.005*
Methylene Chloride	0.011**

* From ADEM Alabama Drinking Water Standard Maximum Contaminant Level (MCL) ADEM Code r. 335-7
** From Regional Screening Level (RSL) Summary Table (TR=1E-06, HQ=0.1) April 2019. Note the RSLs/MCLs in effect at the time of sample collection will be used to compare to the analytical results.

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 699482.79 E 524098.67
LLA-10	Surface water south of Northern Boulevard groundwater seeps from west of unnamed tributary	Quarterly	N 699435.54 E 523917.64
LLA-11	Discharge from Russell Distribution facility storm water/groundwater	Quarterly	N 699358.30 E 524077.62

[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)

Table 3-4 Vapor Intrusion Screening Groundwater Monitoring Wells

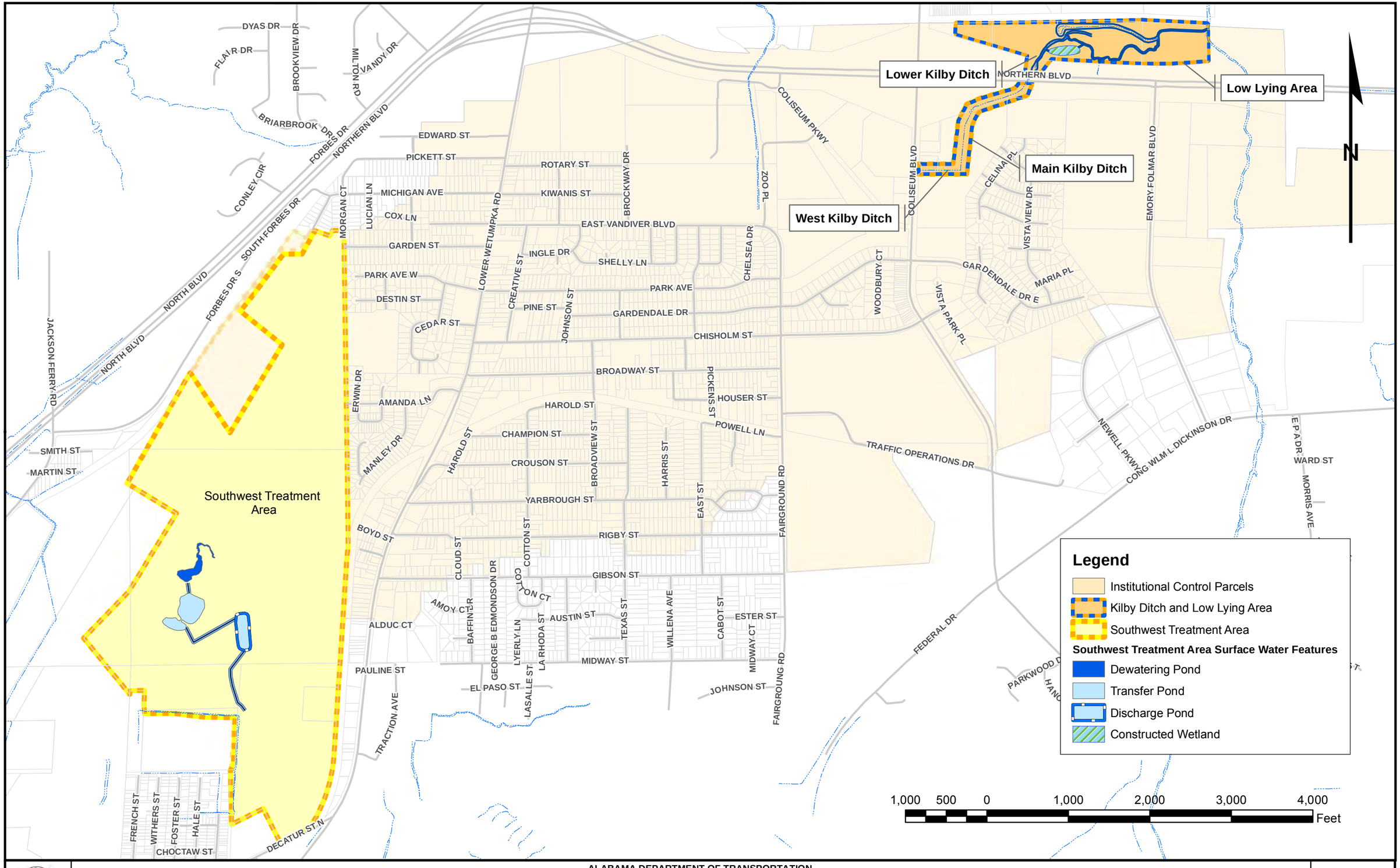
VIS Well Location
MW-104
MW-106
MW-108
MW-109
MW-111
MW-112
MW-113
MW-115
MW-116
MW-117
MW-118
MW-123
MW-125
MW-128
MW-129
MW-130
MW-132
MW-133
MW-134
MW-143A
MW-144A
MW-146A
MW-147A
MW-150A

All vapor intrusion screening wells will be sampled First Quarter Event
Wells with RBTLs will be sampled First Quarter and Third Quarter Events

Figures

Long-Term Monitoring Plan

COLISEUM BOULEVARD PLUME SITE
MONTGOMERY, ALABAMA

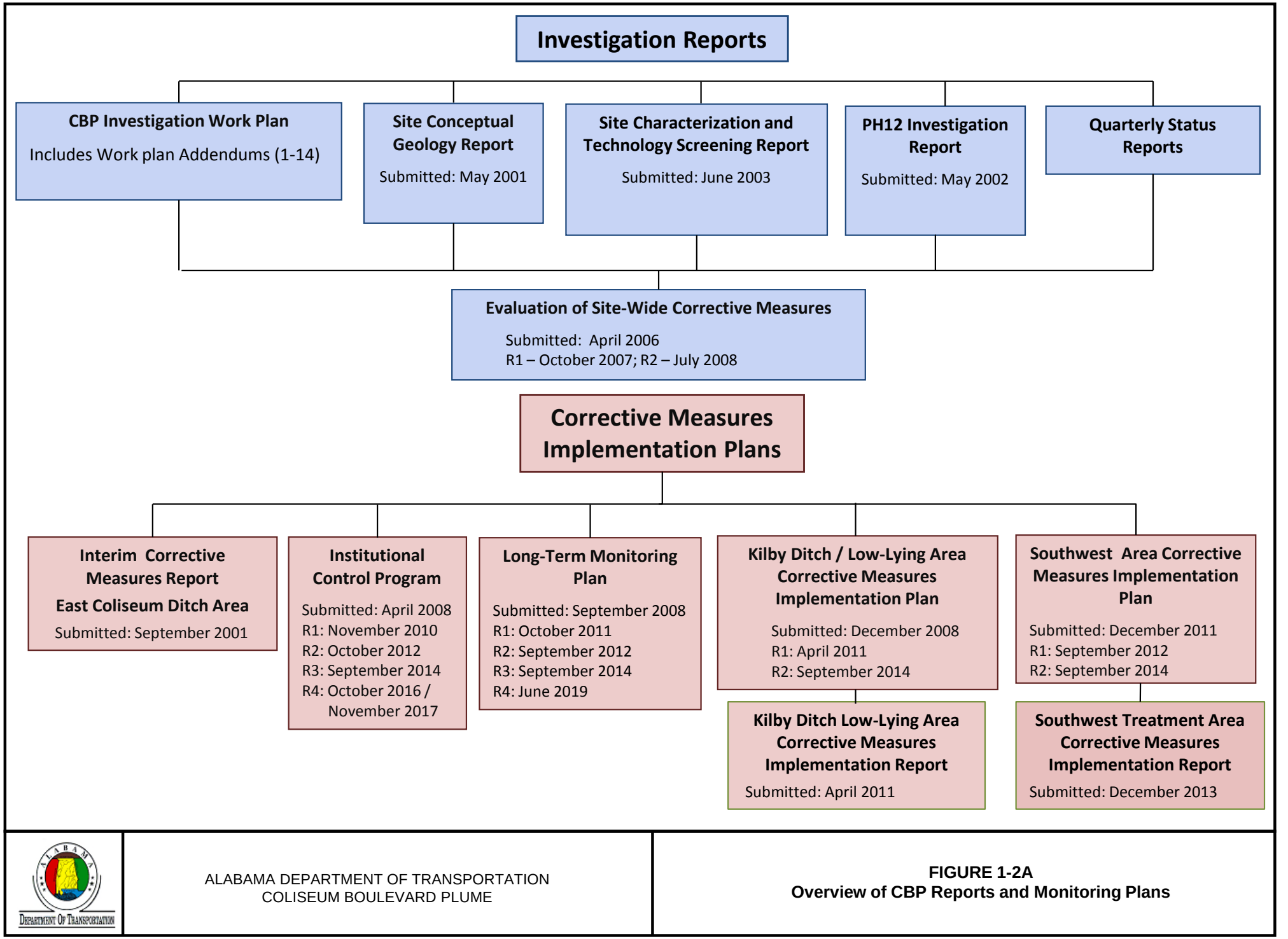


ALABAMA DEPARTMENT OF TRANSPORTATION
COLISEUM BOULEVARD PLUME

COLISEUM BOULEVARD PLUME CORRECTIVE MEASURES AREA

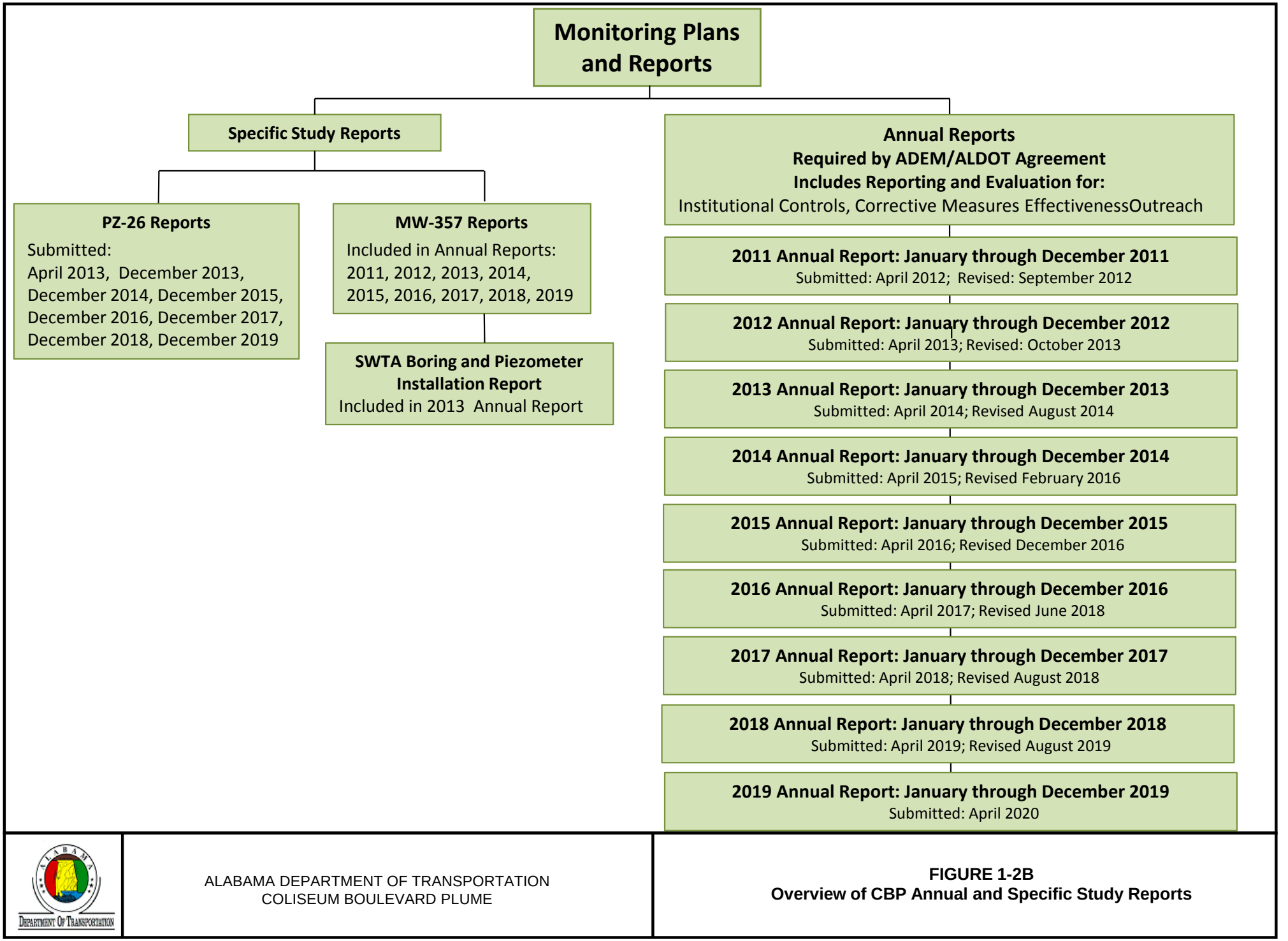
Figure 1-1

JUNE 2019



ALABAMA DEPARTMENT OF TRANSPORTATION
COLISEUM BOULEVARD PLUME

FIGURE 1-2A
Overview of CBP Reports and Monitoring Plans



ALABAMA DEPARTMENT OF TRANSPORTATION
COLISEUM BOULEVARD PLUME

FIGURE 1-2B
Overview of CBP Annual and Specific Study Reports

BDY-04
BDY-05
BDY-03
BDY-02
MW-210
MW-219
MW-5A
BDY-06
BDY-01R
MW-358
MW-115 / 215
MW-215
MW-146A / 246B
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-339
MW-135A / 235B / 235C
BDY-08
MW-104 / 204
MW-340
MW-106 / 206
MW-304
MW-132 / 232
MW-117 / 217
MW-137A / 237B / 237C
MW-109 / 209
BDY-13
MW-112
MW-212
MW-123 / 223
MW-111 / 211 / 311
MW-262
BDY-09
MW-311
MW-265
MW-144A / 244B / 244C
BDY-12
MW-221 / 221C
MW-153
MW-264
MW-154
MW-260
MW-156
MW-155
MW-263
MW-259
Dewatering Pond
BDY-10
Transfer Pond
MW-261
Discharge Pond
BDY-11 (abandoned)
Discharge Ditch
BDY-11R

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

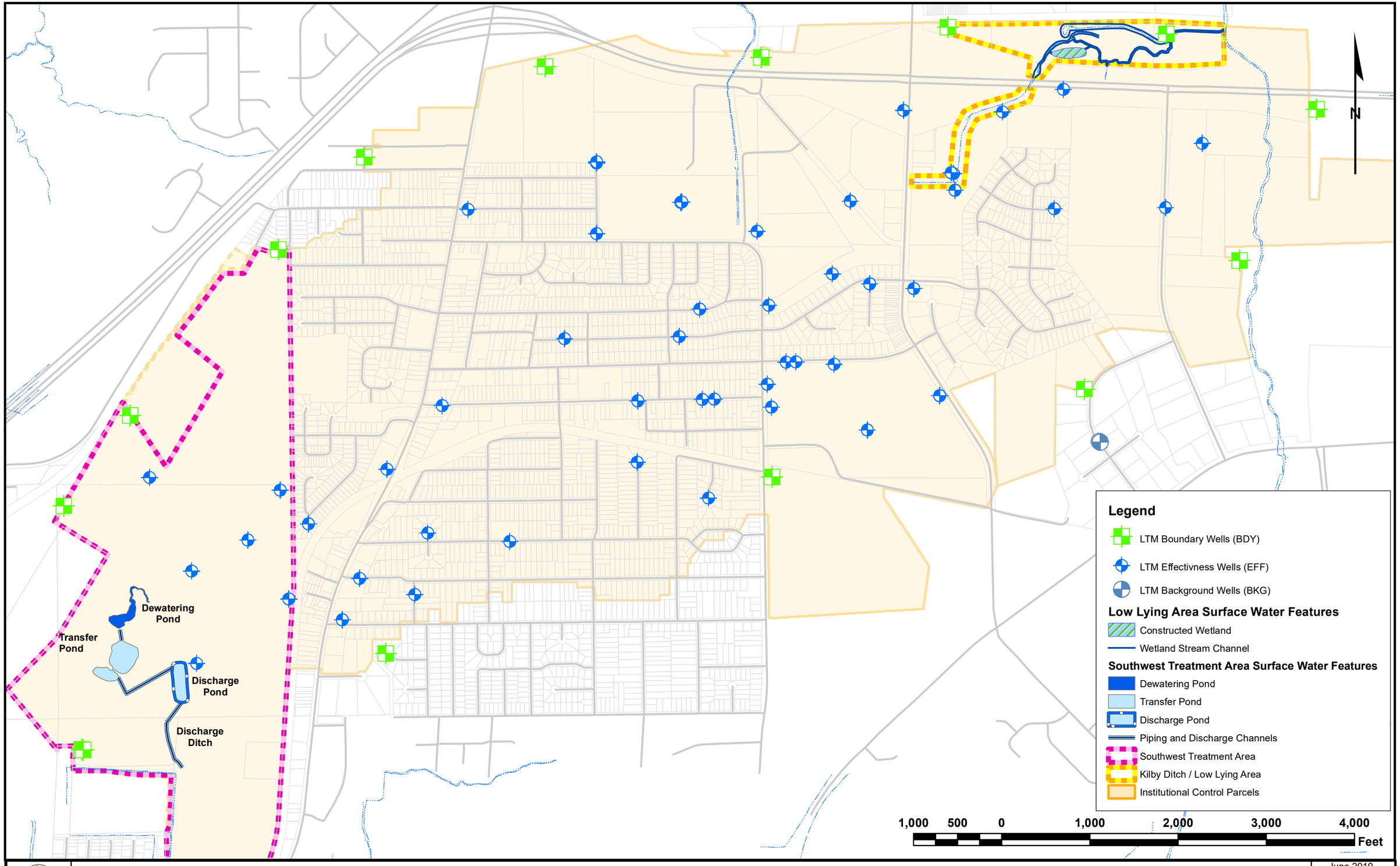
1,000 500 0 1,000 2,000 3,000 4,000 Feet

ALABAMA DEPARTMENT OF TRANSPORTATION

LONG TERM GROUNDWATER MONITORING WELLS

June 2019
(rev Apr 2020)

Figure 2-1



ALABAMA DEPARTMENT OF TRANSPORTATION

LONG TERM MONITORING PROGRAM WELLS - FIRST QUARTER EVENT

June 2019
(rev Apr 2020)

Figure 2-2

N

Dewatering Pond

Transfer Pond

Discharge Pond

Discharge Ditch

Legend

LTM Boundary Wells (BDY)

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

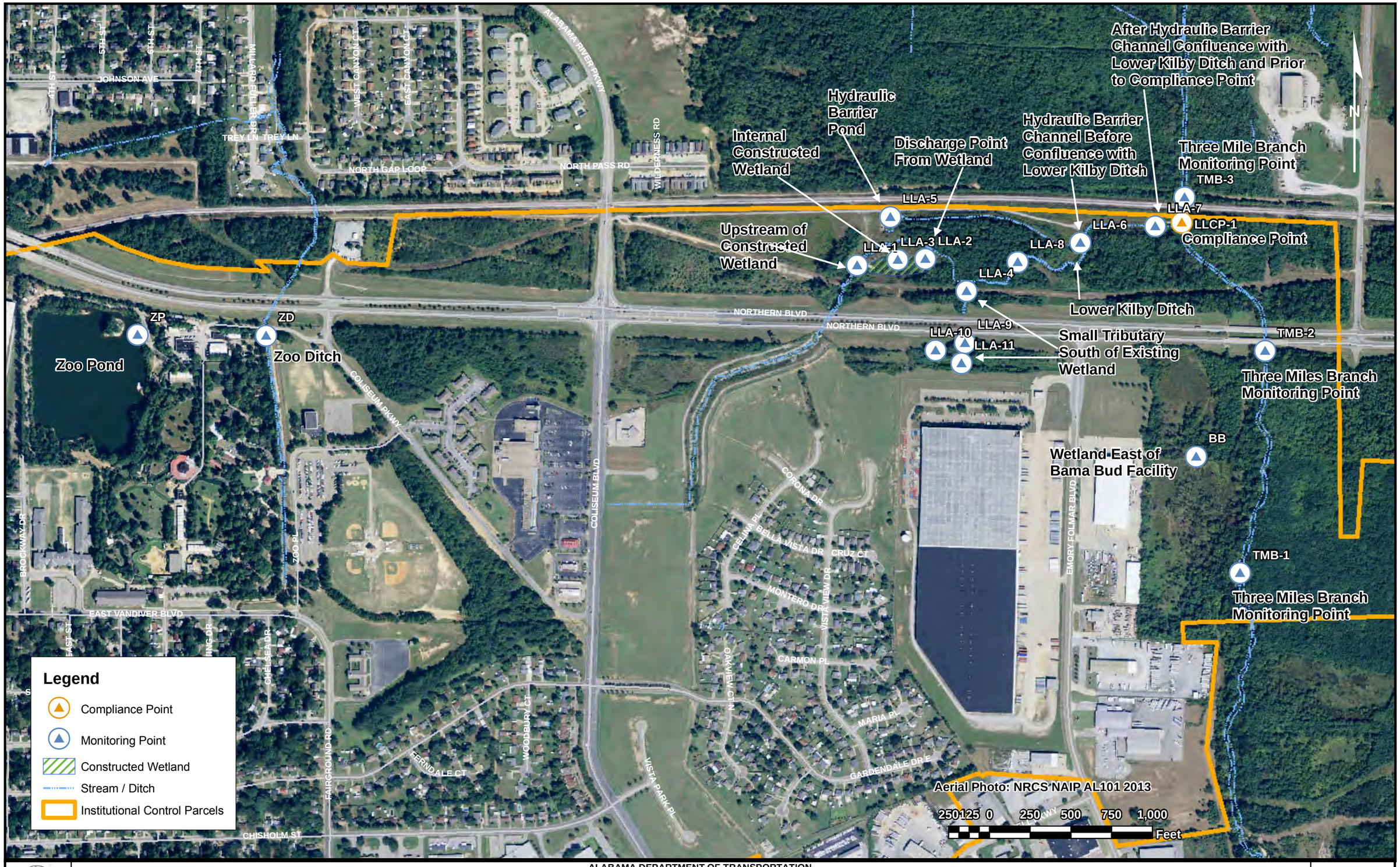
Note: Wells with RBTLs will be sampled with the Third Quarter wells

ALABAMA DEPARTMENT OF TRANSPORTATION

LONG TERM MONITORING PROGRAM WELLS - THIRD QUARTER EVENT

June 2019
(rev Mar 2020)

Figure 2-3



ALABAMA DEPARTMENT OF TRANSPORTATION
COLISEUM BOULEVARD PLUME

ZP, ZD, AND LLA SURFACE WATER MONITORING LOCATIONS

June 2019

Figure 2-4

N

Dewatering Pond

SWA-1

Transfer Pond

SWA-3

Discharge Pond

SWA-2

SWA-4

T-Valve
Junction Box

Auxiliary Treatment Basin

Discharge Ditch

DSN001 (NPDES AL0081167)

Wetlands

O1

FG

250 125 0 250 500 750 1,000
Feet

Legend

Long Term Monitoring Surface Water Locations

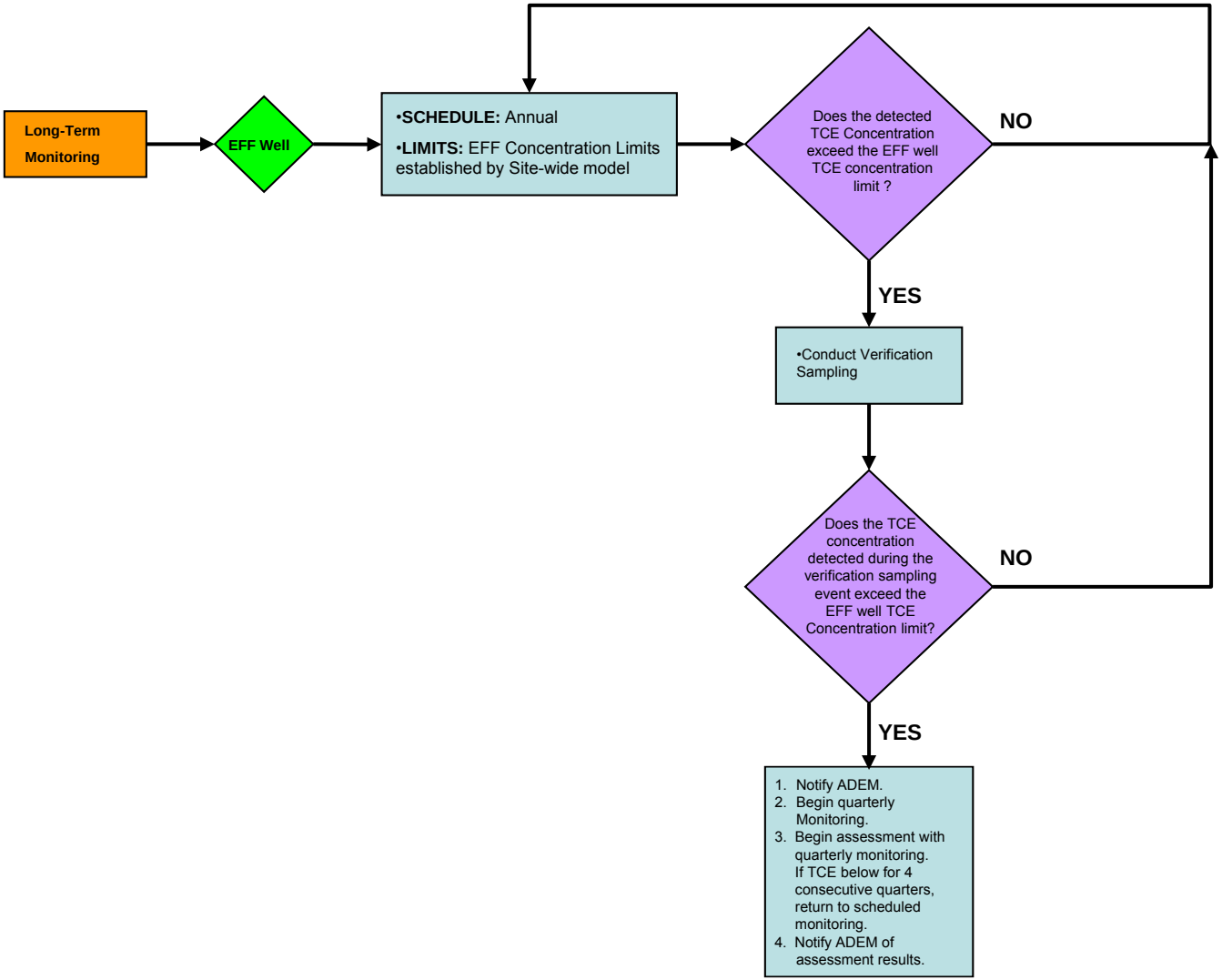
- SWTA Effectiveness Point (SWA)
- SWTA Compliance Point (DSN001)
- Voluntary Surface Water Monitoring Point
- Underground Pipe
- Discharge Ditch
- Southwest Treatment Area

ALABAMA DEPARTMENT OF TRANSPORTATION
COLISEUM BOULEVARD PLUME

SURFACE WATER MONITORING LOCATIONS IN SOUTHWEST TREATMENT AREA

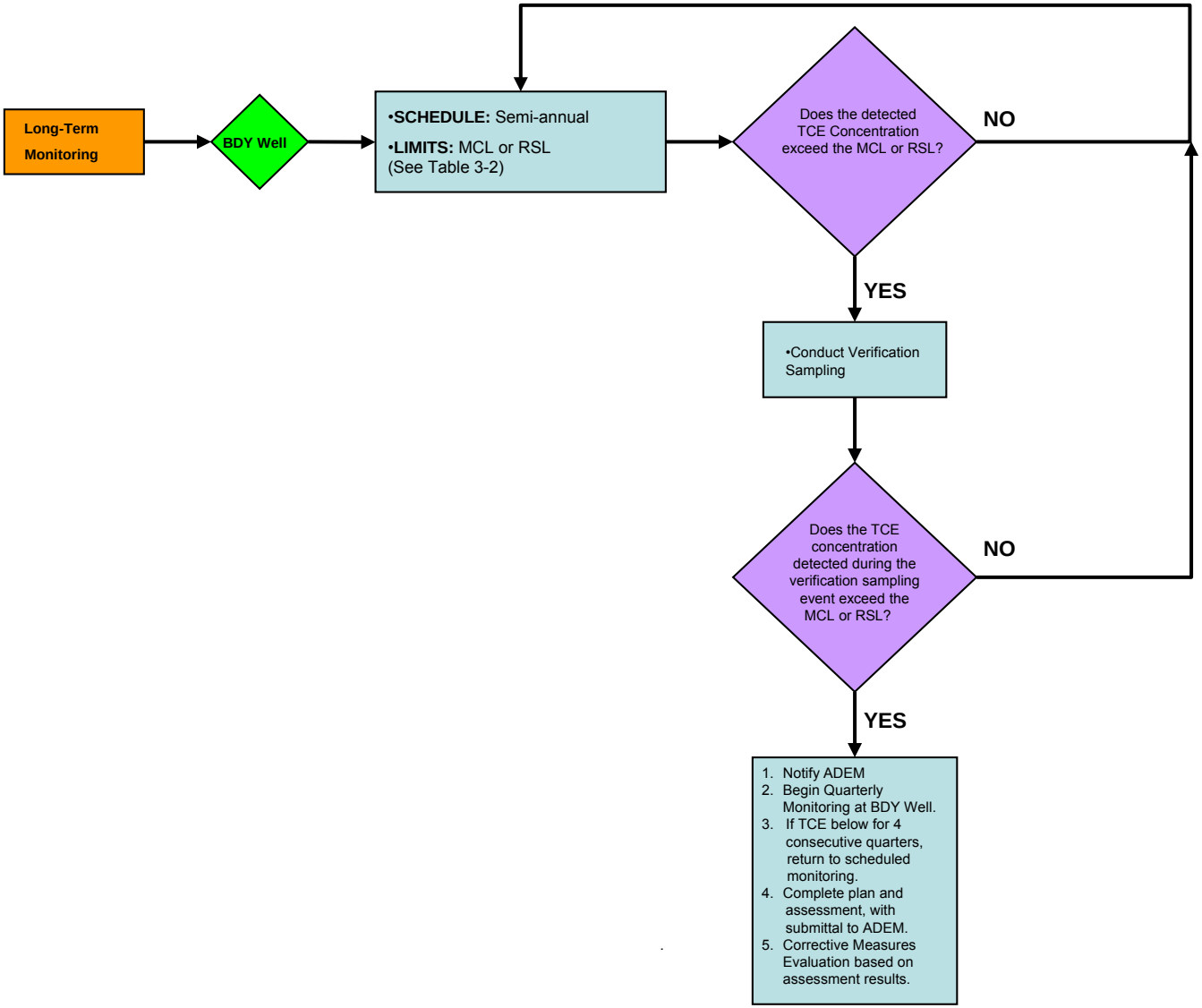
June 2019

Figure 2-5



ALABAMA DEPARTMENT OF TRANSPORTATION
COLISEUM BOULEVARD PLUME

FIGURE 3-1
EFFECTIVENESS MONITORING NETWORK EVALUATION
rev April 2020



ALABAMA DEPARTMENT OF TRANSPORTATION
COLISEUM BOULEVARD PLUME

FIGURE 3-2
BOUNDARY WELL MONITORING NETWORK EVALUATION

rev April 2020

Legend

- Vapor Intrusion Screening Groundwater Monitoring Well
- Kilby Ditch and Low Lying Area
- Southwest Treatment Area
- Streams and Ditches
- Institutional Control Boundary

MW-115
MW-118
MW-134
MW-113
MW-133
MW-146A
MW-147A
MW-143A
MW-125
MW-116
MW-150A
MW-129
MW-128
MW-130
MW-108
MW-104
MW-117
MW-132
MW-106
MW-109
MW-112
MW-111
MW-123
MW-144A

Dewatering Pond
Transfer Pond
Discharge Pond
Discharge Ditch

N

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

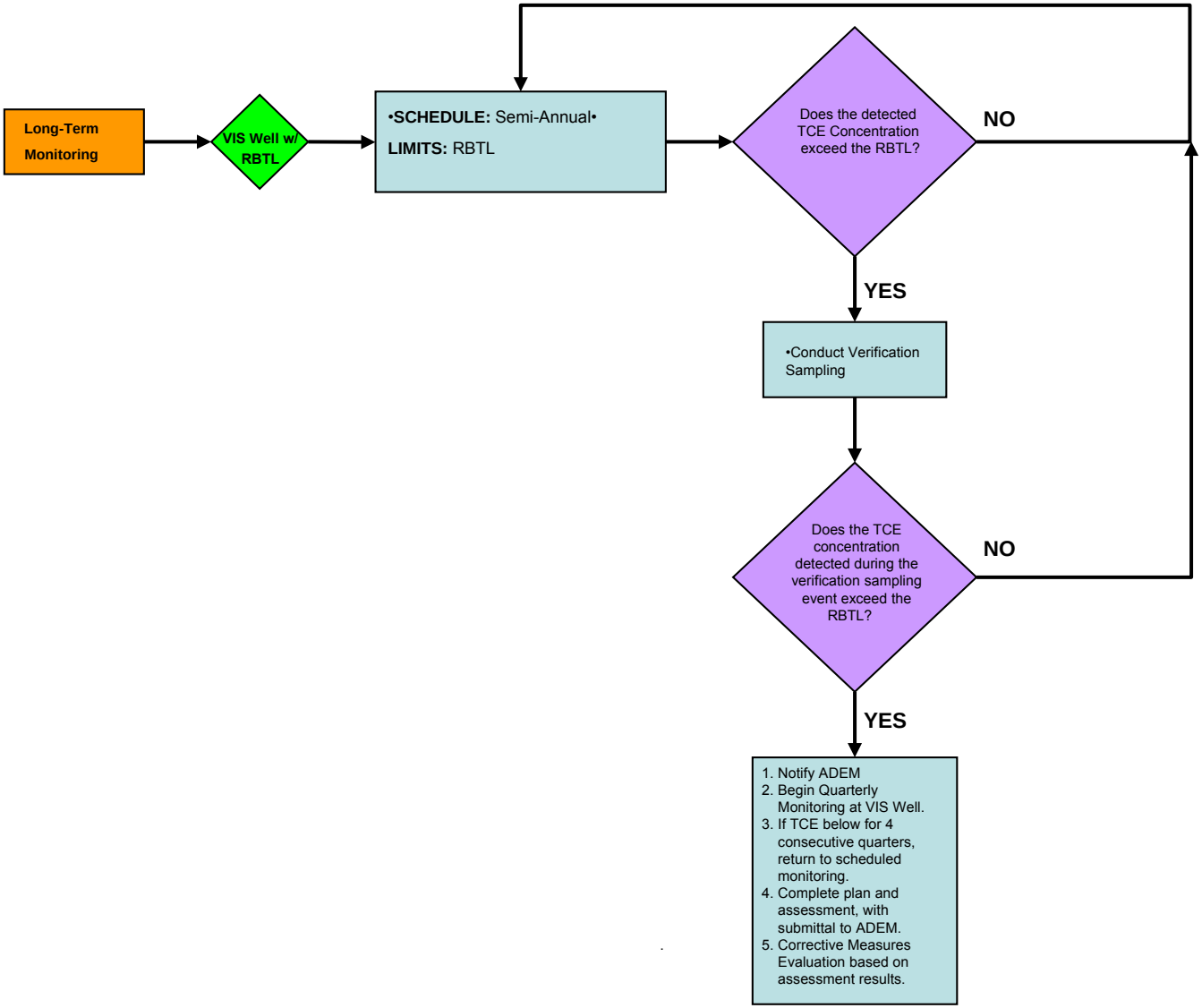
Note: All vapor intrusion screening wells will be sampled First Quarter Event
Wells with RTBLs will be sampled First Quarter and Third Quarter Events

DRAFT ATTORNEY-CLIENT PRIVILEGED
ALABAMA DEPARTMENT OF TRANSPORTATION
COLISEUM BOULEVARD PLUME

Vapor Intrusion Screening Groundwater Monitoring Wells

JUNE 2019
(rev Apr 2020)

FIGURE 3-3



ALABAMA DEPARTMENT OF TRANSPORTATION
COLISEUM BOULEVARD PLUME

FIGURE 3-4
RBTL MONITORING NETWORK EVALUATION

rev April 2020