Boundary Well Installation

and

Continuous Multichannel Tubing Well Abandonment

Coliseum Boulevard Plume Site
Montgomery, Alabama

Submitted By:

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Acronyms Used in the Report

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
CMT	Continuous Multichannel Tubing Well
EFF	Effectiveness Well
LTM	Long-Term Monitoring
MCL	Maximum Contaminant Level
PID	Photo Ionization Detector
PSV	Alabama Risk-Based Corrective Action Preliminary Screening Value
PVC	Polyvinyl Chloride (Pipe)
RCRA	Resource Conservation Recovery Act
TCE	Trichloroethylene
TCLP	Toxic Characteristic Leaching Procedure
USEPA	United States Environmental Protection Agency

1. Boundary Well Installation

The following scope of work is in general accordance with monitoring well installation procedures approved by the Alabama Department of Environmental Management (ADEM) in the Work Plan for Rapid Response, Interim Corrective Measures and Comprehensive Site Assessment (Work Plan). Specifically, monitoring well installation procedures are provided in Addendum 6 of the Work Plan. The scope of work described in Section 1 for the Boundary well network is intended to supplement the previously approved procedures for monitoring well installations. The scope of work will be completed in accordance with: 1) the previously approved Addendum 6; 2) the most recent edition of the Alabama Environmental Investigation and Remediation Guidance (AEIRG); and, 3) "Design and Installation of Monitoring Wells" guidance by the United States Environmental Protection Agency (USEPA) Region 4 Science and Ecosystems Support Division, February 2008.

1.1. Background

A Long-Term Monitoring Plan (LTM Plan) has been developed and provides for the continued monitoring of corrective measures in an area in Montgomery, Alabama that is referred to as the Coliseum Boulevard Plume (CBP). The proposed LTM monitoring will be used to:

- Evaluate the effectiveness of the corrective measures;
- Establish TCE concentrations and monitor trends for comparison to the site-wide groundwater model; and,
- Provide a surface water monitoring network to determine compliance with ADEM discharge requirements.

The LTM Plan includes three components to be used for long-term monitoring of the CBP:

- Effectiveness (EFF) monitoring wells to evaluate groundwater and CBP conditions;
- Boundary (BDY) monitoring wells to monitor corrective measures and institutional controls,; and,
- Surface water compliance and other monitoring locations.

EFF well and surface water monitoring locations are already established for long-term monitoring. The BDY well network will be installed to complete the Long-term monitoring network for the CBP.

1.2. General

The BDY well network will consist of 14 BDY wells. Each BDY well has been located to monitor the effectiveness of corrective measures and institutional controls. The BDY network design relied upon the site-wide model to identify dominate groundwater flow paths and CBP migration pathways relative to the position of institutional controls and corrective measures. The BDY network is designed to provide a system of monitoring wells to confirm that the CBP remains within institutional controls and treatment areas.

Each BDY location will consist of one monitoring well that is screened in the shallow saturated zone above the first restrictive clay. The screen interval of each BDY well will be installed from the top of the first restrictive clay upwards to intersect at least two-thirds of the shallow saturated zone. Each BDY well will have a dedicated bladder pump installed in the well for groundwater purging and sampling.

1.3. Locations

To facilitate the placement of the BDY Network, the existing numerical site-wide groundwater flow and contaminant fate and transport model developed for previous CBP investigations was utilized to determine CBP migration under various hydraulic conditions. Based on the results, 14 BDY wells are placed at the following locations:

- Three (3) BDY wells are placed downgradient of the Southwest Treatment Area to verify groundwater concentrations are within acceptable regulatory requirements in areas hydraulically downgradient of control and treatment.
- One (1) BDY well was placed downgradient of the Kilby Ditch and Low-Lying Treatment Area corrective measures to verify groundwater concentrations are within acceptable regulatory requirements in areas hydraulically downgradient of control and treatment.
- One (1) BDY well is placed at a location recommended by the ADEM, corresponding to a point on the east side of Three Mile Branch at the northeast edge of the CBP.
- The remaining nine (9) BDY wells are placed along the perimeter of the CBP in areas to intersect groundwater flow paths throughout the CBP site.

The approximate coordinates of each BDY well are provided in Table 1. Figure 1 shows the location of each BDY well. Final monitoring well locations, the land surface and top of casing will be surveyed to the nearest 0.01 foot by a Professional Land Surveyor and provided in the Long-Term Monitoring Plan or Status Reports.

1.4. Technical Specifications

1.4.1. General

Installation and completion of the BDY wells will be performed based on the following specifications.

- Advance soil conductivity or cone penetrometer probes at each location not previously assessed to evaluate the depth to the first restrictive clay layer.
- Drill borings at each BDY well location to determine the thickness of the saturated zone above the first restrictive clay layer.
- Collect soil samples during boring advancement for the purpose of geologic logging and PID screening.
- Install two-inch diameter groundwater monitoring wells.
- Install above ground or flush mount protective casing/shroud.
- Perform surveying by a professional surveyor.
- Install dedicated pumps and sampling equipment in the BDY location.
- Develop completed wells.
- Perform a slug/bail test at each well following sampling.
- Collect a ground water sample from each well following development

1.4.2. Monitoring Well Nomenclature

Monitoring well nomenclature is provided in Table 1 and shown on the attached Figure 1. Each BDY well installed will receive a BDY identifier (e.g., BDY-14). The BDY identifier designates:

- The well as a boundary well for compliance with the Agreement and LTM Plan requirements.
- The well is screened to intersect two-thirds of the saturated zone above the first restrictive clay.

- Dedicated sampling equipment is to be installed and maintained in the well.

1.4.3. Boring Advancement

Test (exploratory) borings using soil conductivity or cone penetrometer probes will be installed within 20 feet of each BDY well location to determine the top of the first distinct clay. BDY well installation and well construction (e.g., screen length) will be determined based on lithology encountered, thickness of the saturated zone, and depth to the first distinct clay.

Borings for BDY wells will be performed using sonic drilling techniques. A core barrel will be advanced in five (5) to ten (10) foot intervals to collect an undisturbed soil sample. Once the sample barrel reaches the end of its sample depth, the overdrive casing will be advanced to the depth of the sample barrel and then the sample barrel will be removed. This method of boring advancement will continue to the designated boring depth. Undisturbed soil samples will be collected from the core barrel using plastic sleeves. The lithology of the soil cores will be described.

1.4.4. Sample Collection

Soil samples will be collected for purposes of geologic logging and PID screening. The core samples will be field screened using a PID or comparable field screening tool. If at any of the boring locations the core exhibits an unusually high PID reading, that section of the core will be sampled for laboratory analysis. Samples will be analyzed for volatile organic compounds (VOCs).

1.4.5. Casing and Screen

All casing and screen shall consist of two-inch diameter Schedule 40 flush threaded PVC. Each screen length will be initially determined by the field geologist based on information and data from the exploratory boring. The final screen length will be determined upon consideration of the saturated thickness of the aquifer above the first restrictive clay during exploration, in addition to estimated groundwater elevations mapped at the BDY location and estimated water level measured from the exploratory boring. Each screen will be set above the first restrictive clay and screen two-thirds of the saturated thickness of the aquifer overlying this clay (e.g., the screen length is dependent on total saturated zone thickness). Screen will consist of 0.010 slot PVC.

1.4.6. Filter Pack

The material used as a filter pack will consist of clean, well rounded, quartz sand graded to the size range appropriate for the screened interval. The filter pack will extend from the bottom of the well screen to two feet above the top of the well screen.

1.4.7. Bentonite Seal

A bentonite seal will be installed above the sand pack consisting of high-grade sodium bentonite, in a pellet form, with a minimum diameter of 1/4 inch and a maximum diameter of 1/2 inch. The bentonite seal will extend two feet above the filter pack.

1.4.8. Grouting

After adequate bentonite pellet hydration, the remainder of the annular space above the seal will be grouted to the surface using cement/bentonite (5%) mixture. The grout will be pumped into the borehole using the tremie method.

1.4.9. Well Protection

Each BDY will be protected using locking caps with a lock and key. Surface completions at each well location will consist of either flush mount or stickup construction.

- **Stickup construction:** A 2-foot by 2-foot by 4-inch concrete pad with 4-inch by 4-inch by 5-foot stainless steel stickup protective casing. Steel stickup casing may be needed at BDY wells installed near corrective measure treatment areas or areas where water may collect at the surface. Three protective bollards will be placed around any well with a stickup protective casing. Bollards will be constructed of 4-inch diameter steel pipe, filled with concrete.

- **Flush mount construction**: A 2-foot by 2-foot by 4-inch concrete pad with a new 10-inch or larger watertight flush mount manhole protector (shroud).For wells installed in City of Montgomery streets, the 2-foot by 2-foot by 4-inch concrete pad will be completed a minimum of 2 inches below grade. Asphalt will be placed above the concrete pad to land surface.

1.4.10. Well Development

No sooner than 24 hours after completion, the wells will be developed either by pumping or surge block methods to reduce turbidity and will continue until the water is stable with respect to turbidity, specific conductance, and temperature. A minimum of three well volumes will be evacuated. Specific conductance, pH, turbidity, and temperature readings will be measured before, during, and after development and recorded in the field log books. Wells will be considered developed when turbidity, pH, temperature, and conductivity readings have stabilized for three readings and all are within 10 percent of the previous two readings.

1.4.11. In-Situ Permeability Test (Slug Tests)

Slug tests will be performed at select wells installed under this work plan. The data collected from the slug tests will be used to refine the site-wide model. The following general procedures will be used:

- Groundwater levels within the wells will be measured prior to the performance of the slug tests.
- To achieve an instantaneous change in water level, a slug will be removed from each well resulting in a change of the water level in the well.
- A Hermit data logger and transducer will be used to measure water level changes resulting from the introduction or removal of the slug.
- Data from the Hermit data logger will be downloaded into an appropriate database and values of hydraulic conductivity will be calculated for the well tested.

1.4.12. Surveying

A Professional Land Surveyor will survey each location to tie the BDY locations into the existing monitoring network. The top of casing and ground surface elevations will be surveyed to the nearest 0.01 foot.

1.4.13. Equipment Installation

Dedicated sampling equipment consisting of a bladder pump, tubing, and wellhead connections will be installed at each BDY well location. Installation of dedicated equipment in each BDY well will minimize investigative derived wastes and the potential for cross-contamination between EFF and/or BDY locations.

1.5. Groundwater Monitoring

Each BDY well will be sampled quarterly for CBP constituents during the first year following installation. BDY wells will be sampled semi-annually after one year following installation. Groundwater elevations will be measured in each well during the sampling event. Groundwater samples will be collected and analyzed in accordance with methods previously approved by the ADEM in CBP Work Plans and Addendums. Data evaluation and reporting requirements are provided in the Long-Term Monitoring Plan for the CBP. A report detailing installation, well construction, and lithology encountered will be provided to the ADEM.

1.6. Investigative Derived Waste

1.6.1. Soil Cuttings

Drill cuttings generated during monitoring well installation will be containerized in U.S. Department of Transportation (DOT) approved, 55-gallon steel drums with the contents identified on weather-resistant labels attached to drum exteriors. The containerized soil cuttings will be analyzed for TCLP and RCRA constituents to determine its waste classification for disposal purposes.

If analytical results are less than TCLP and RCRA regulatory limits, then the containerized soil cuttings will be disposed or handled as a nonhazardous waste. This proposed disposal method is consistent with EPA and AEIRG guidance. If the results are greater than TCLP/RCRA limits, then the containerized soil cuttings will be disposed of as RCRA hazardous waste.

1.6.2. Groundwater

Groundwater collected from monitoring wells during purging, development and sampling activities will be collected in DOT 55-gallon steel drums. As previously approved by the ADEM, the containerized water will be treated at the ALDOT wastewater treatment unit near Kilby Ditch and discharged into a sanitary sewer inlet on ALDOT property.

1.6.3. Waste Personal Protective Equipment

Depending on the levels of personal protection used during the field investigation, some disposable personal protective equipment (PPE) will be generated. Every attempt will be made to wash surface contamination off so that PPE (e.g., latex gloves and other disposable items) may be disposed of as ordinary trash. Nonhazardous disposable items will be contained and disposed of in a dumpster or via a licensed waste hauler, as appropriate.

1.6.4. Decontamination Fluids

Decontamination fluids containing solvents (e.g., isopropanol) will be drummed and disposed of properly.

1.6.5. Drum Management

A log of the drums and drum contents will be maintained. The contents will be evaluated upon receipt of laboratory analytical data obtained during field investigations. If any drum is suspected to contain hazardous material, the drum will be securely sealed (e.g., capped and banded). ALDOT will submit necessary waste approvals to the ADEM for certification prior to transporting or disposing of a hazardous waste or special waste.

2. Continuous Multichannel Tubing Well Abandonment

The scope of work for Section 2 includes abandonment procedures for the Continuous Multichannel Tubing (CMT) wells. The scope of work will be completed in accordance with the most recent edition of the AEIRG and the "Design and Installation of Monitoring Wells" guidance document by USEPA Region 4 Science and Ecosystems Support Division, February 2008.

2.1. Background

The CBP monitoring well network is being transformed from an assessment network to a long-term network. The initial purpose of the CMT wells was to characterize the vertical distribution of dissolved TCE within the PH12 area. The small diameter (about 0.5 inch) of each tube channel and very short length of each sampling port (about 4 inches) provide information on the vertical distribution of TCE over small vertical intervals. This design is markedly different from conventional monitoring wells that will be used for the LTM program. As a consequence, results from the CMT wells are not comparable to results from the EFF or BDY wells and are therefore not useful for the purpose of long-term monitoring of the CBP.

2.2. General

The CMT wells were constructed of 1.7-inch diameter CMT tubing. Each well contains up to seven discrete sampling intervals, with the length of sampling intervals ranging between four to five feet based on the targeted stratigraphic interval. In each sampling interval, ports are opened at one-foot spacing. For example, a four-foot long screened interval typically consists of three ports. Ports are wrapped with stainless steel gauze and surrounded by filter pack material or natural filter pack from formation collapse during installation. Bentonite pellets were placed approximately one foot above and below each sampling interval to form a seal and isolate the intervals. CMT locations, well depths, screen intervals, and elevations are provided in Table 2.

The CMT wells will be abandoned by advancing a roller cone bit or similar to depth and introducing cement/bentonite grout into the clean borehole using the tremie method. The top two feet of each borehole will be poured with concrete for a surface plug and the ground surface completed to match the surrounding ground surface. The location of the CMT wells is shown in Figure 2.

2.3. Technical Specifications

2.3.1. Drilling

Due to the construction of the CMT wells (see Section 2.2), the wells will have a tendency to twist or break off in the borehole if over-drilled and an attempt is made to pull the casing. Therefore, the wells will be abandoned by sonic or auger drilling to completely remove all well materials. This drilling method will remove the well materials from the subsurface as small cuttings that can be brought to the surface through the sonic casing or on rotating auger flights.

2.3.2. Grout

After completely removing the CMT tube and well material, the clean borehole will be backfilled with cement/bentonite grout. The grout will be placed in the clean borehole from the bottom to the top by grouting with the positive displacement (tremie) method.

2.3.3. Surface Completion

The top two feet of the borehole will be poured with concrete for a secure surface seal (plug). The concrete surface plug may be recessed to allow for future construction or current surface conditions such as landscaping or pavement.

2.3.4. Final Abandonment Report

A final well abandonment report will be submitted to ADEM upon completion of the approved abandonment and include the following:

- Description of each CMT well abandoned;
- CMT well identifier and order of abandonment;
- Date that each well was abandoned and the name of the personnel overseeing the abandonment;
- Site map with locations of abandoned wells;
- Description of the final method used to abandon each well; and,

2.4. Investigative Derived Waste

Investigative derived waste will be handled in accordance with the procedures provided in Section 1.6.

Table 1. Boundary monitoring well information

WELL NUMBER	WELL TYPE	WELL NORTHING[1]	WELL EASTING[1]	GROUND ELEVATION (ft. MSL)	TOP-OF-RISER ELEVATION (ft. MSL)	SCREENED INTERVAL (ft. MSL)	
BDY-1	Boundary	516332.192247	699308.155895	TBD[2]	TBD	TBD	TBD
BDY-2	Boundary	517688.877169	699853.182491	TBD	TBD	TBD	TBD
BDY-3	Boundary	520237.562723	699915.919372	TBD	TBD	TBD	TBD
BDY-4	Boundary	521974.589969	700170.787933	TBD	TBD	TBD	TBD
BDY-5	Boundary	524817.354627	700245.287967	TBD	TBD	TBD	TBD
BDY-6	Boundary	526488.079926	699351.565170	TBD	TBD	TBD	TBD
BDY-7	Boundary	525551.204949	697589.463533	TBD	TBD	TBD	TBD
BDY-8	Boundary	524030.570494	696410.928402	TBD	TBD	TBD	TBD
BDY-9	Boundary	520347.352266	694629.161311	TBD	TBD	TBD	TBD
BDY-10	Boundary	515959.692042	693174.450016	TBD	TBD	TBD	TBD
BDY-11	Boundary	512544.453398	691974.607281	TBD	TBD	TBD	TBD
BDY-12	Boundary	512313.111176	694783.258771	TBD	TBD	TBD	TBD
BDY-13	Boundary	512913.032552	695873.311980	TBD	TBD	TBD	TBD
BDY-14	Boundary	514524.586034	697700.523463	TBD	TBD	TBD	TBD

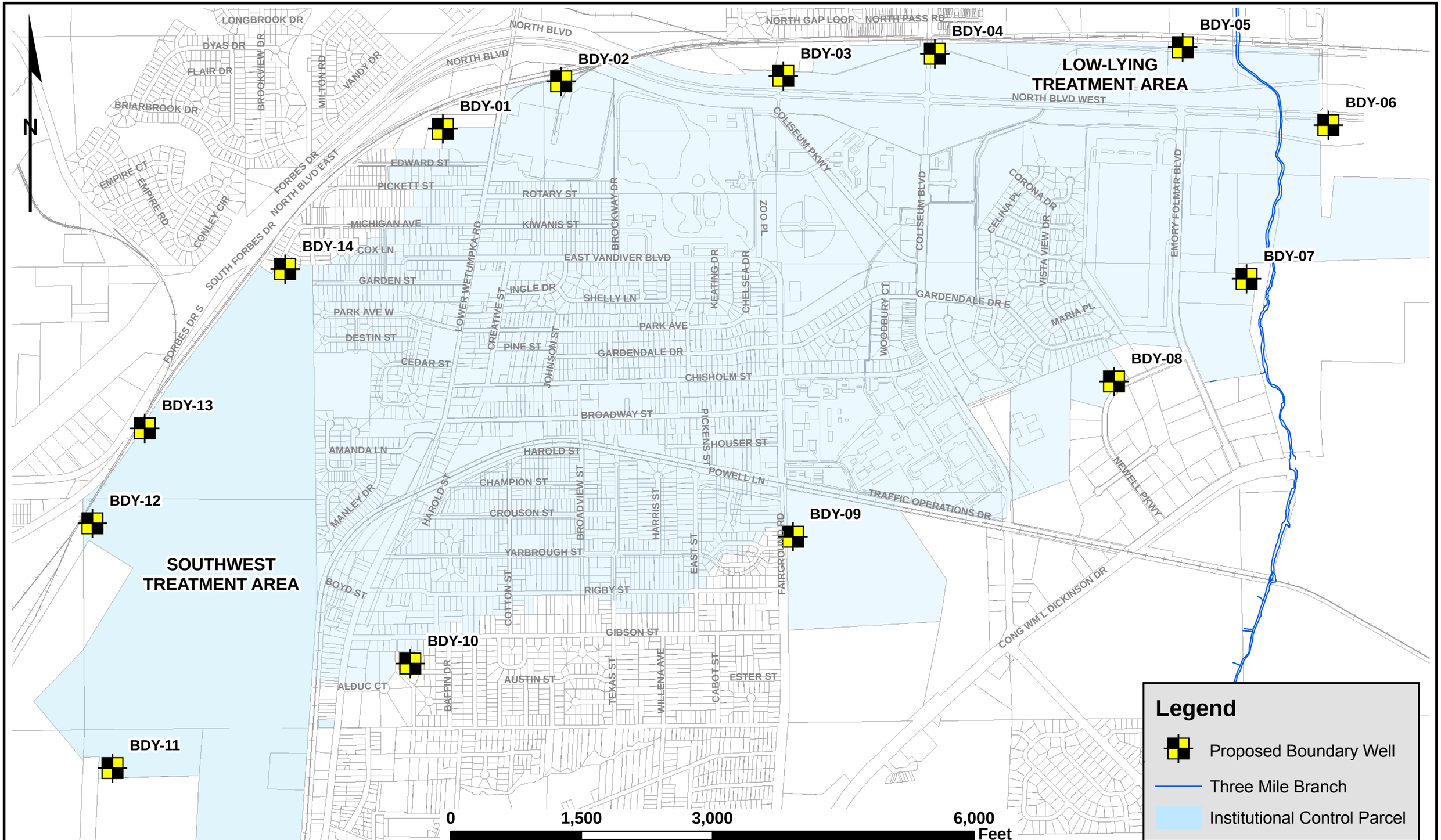
[1] Proposed location. Alabama State Plane East NAD83 (feet) Coordinates. Final locations will be surveyed.

[2] To be determined.

Table 2. Continuous Multichannel Tubing (CMT) well information

WELL NUMBER	WELL TYPE	WELL NORTHING[1]	WELL EASTING[1]	WELL DEPTH	GROUND ELEVATION (ft. MSL)
CMT-1	Continuous Multichannel Tubing	696811.14	519920.13	51.5	219.50
CMT-2	Continuous Multichannel Tubing	696053.53	520128.48	59.8	221.85
CMT-3	Continuous Multichannel Tubing	696447.70	519914.34	58.8	224.60
CMT-4	Continuous Multichannel Tubing	696452.38	520117.47	55.8	223.12
CMT-5	Continuous Multichannel Tubing	697106.65	520288.37	38.0	210.74
CMT-6	Continuous Multichannel Tubing	695960.78	520299.76	52.0	221.35
CMT-7	Continuous Multichannel Tubing	695997.87	520302.22	30.0	221.70

[1] Alabama State Plane East NAD83 (feet) Coordinates.



ALABAMA DEPARTMENT OF TRANSPORTATION
COLISEUM BOULEVARD PLUME

BOUNDARY WELL LOCATIONS

FIGURE 1

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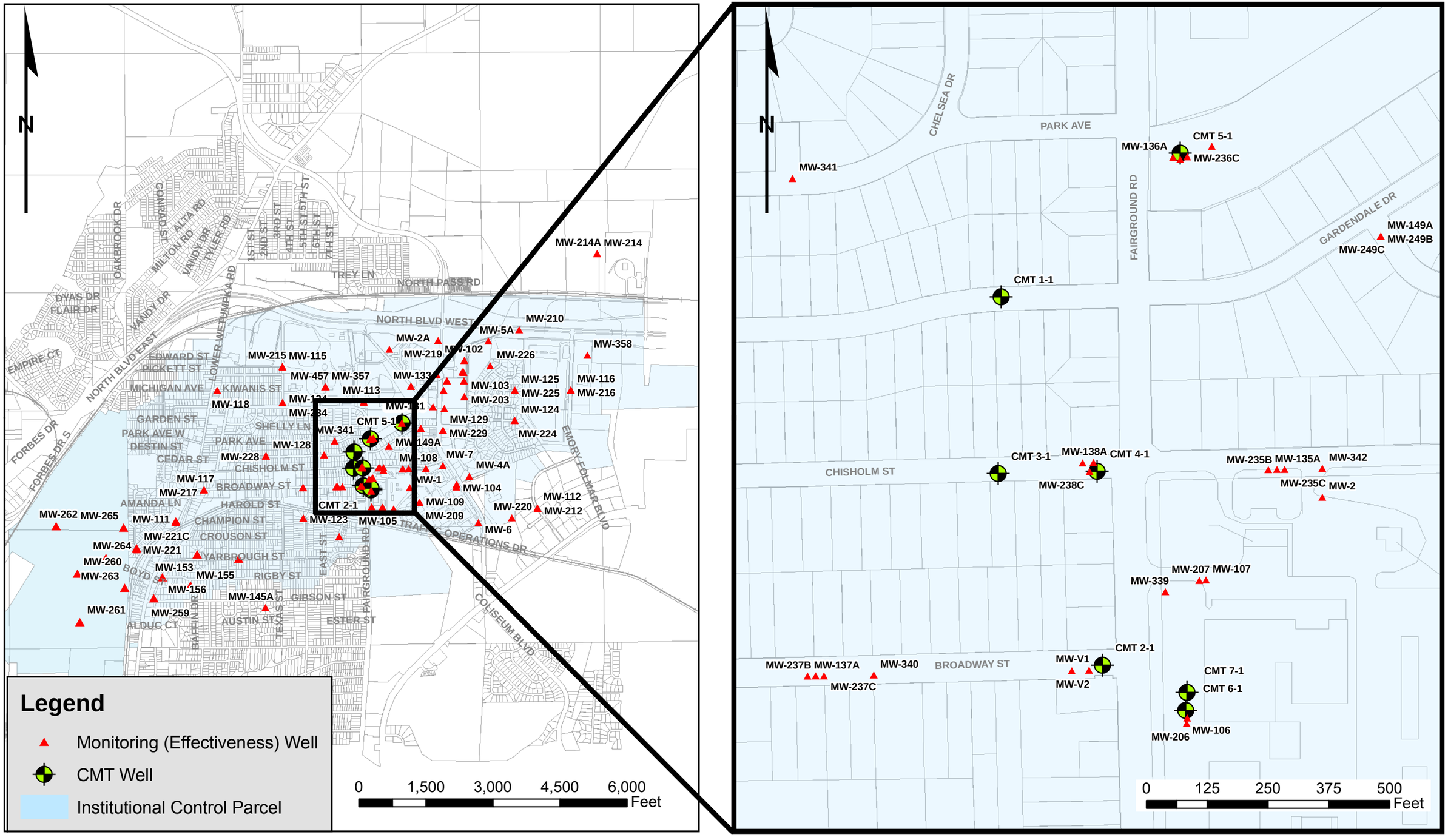

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CMT WELL LOCATIONS

FIGURE 2

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