

## **Executive Summary**

On December 21, 2018, the Arkansas Department of Environmental Quality (ADEQ) issued an Emergency Order for response actions at the Trafalgar Road Site because emergency conditions exist and the release of potentially hazardous substances may present an imminent and substantial endangerment to the public health, safety or welfare or to the environment.

This Response Action Plan was developed to document site conditions, identify baseline assumptions, and data gaps as currently understood. These data affect decisions on volumes, locations for response actions, and types of response actions. Costs may be significantly impacted by these data. Additional information about the Site is being made available daily which will further refine costs and the response action approach.

Site preparation activities, including the following elements, were identified as common to each alternative:

### **Site Controls**

- Fire Breaks
- Access Road
- Water Supply Line
- Exploratory Trench

### **Storm Water Control/Creek Protection**

- Relocate 36-inch Culvert
- Intermittent Stream Temporary Weir
- Other Surface Water Diversions
- Containment Pond

### **Environmental Monitoring**

- Air Monitoring
- Intermittent Stream and Storm Water Monitoring

### **Health and Safety Monitoring**

- Initial Assessment
- Daily Perimeter Monitoring
- Personnel Monitoring

The civil construction elements would be implemented within 60 days of Notice to Proceed; monitoring elements would be implemented concurrent with fire response.

The following alternatives were reviewed for addressing the fire and managing wastes onsite. These alternatives may be used singly or in combination. Note that disposal options A through D have been identified to manage wastes generated during Alternative 7.

**Fire Management Options**

- 1 Smoke Mitigation
- 2 Infiltration Gallery
- 3 Containment and Flooding
- 4 Smothering
- 5 Controlled Burn
- 6 Targeted Quenching
- 7 Excavate and Quench  
(requires additional disposal options)

**Waste Disposal Options**

- A Onsite Fill and Cover
- B Construction of Onsite Class 4 Landfill
- C Construction of Offsite Class 4 Landfill
- D Offsite Disposal at a Construction Debris Landfill

The preliminary opinion of probable costs for response activities ranges from \$4M to >\$40M.

## **1.0 BASIS FOR RESPONSE**

### **1.1 Emergency Orders**

On December 21, 2018, the Arkansas Department of Environmental Quality (ADEQ) issued an Emergency Order for response actions at the Trafalgar Road Site because emergency conditions exist and the release of potentially hazardous substances may present an imminent and substantial endangerment to the public health, safety or welfare or to the environment.

ADEQ's Emergency Order required emergency response actions at the Trafalgar Road Site, including the following:

- Assessing and formulating a plan to extinguish the fire
- Developing a plan to remove potential hazardous substances, or containerize hazardous substances that exceed risk-based standards, and characterize and dispose of them

The Emergency Order also stipulated specific procedures for characterization, management, and disposal of hazardous substances/wastes; those procedures are included in this Response Action Plan by reference.

On January 2, 2019, the Governor's office issued an Emergency Order suspending regulating statutes and removing impediments to the rapid and orderly remediation of the Trafalgar Road Site.

### **1.2 Data Reviewed**

EnSafe personnel have performed two Site inspections. Multiple conversations with ADEQ personnel, review of available public information, and conversations with local representatives have identified the following Site-specific data:

- Landfilling activities, primarily yard wastes and construction debris, occurred from approximately 2001 through 2016.
- Historical aerial photographs suggest that landfilling activities occurred as wastes were pushed into low areas and ravines.

Aerial photos suggest fill activities beneath the Blue Mountain Storage parking area was filled in 2004-2005; other areas onsite show indications of fill prior to 2003.

- The overall elevation of the Site was raised over time as more wastes were accumulated in layers ("lifts"), probably interspersed with fill soil.
- Prior firefighting efforts attempted to smother the fire added additional soil.
- During Site inspections, some solid wastes and construction debris (concrete, asphalt) were observed. For the purposes of this Response Action Plan, 10% of wastes encountered are assumed to be solid wastes which will require further segregation.
- An unknown quantity of petroleum products, batteries, and other wastes that may contain hazardous substances have also been observed at the Trafalgar Road Site. Contaminants associated with these products may complete human health and ecological exposure pathways. For purposes of this Response Action Plan, 1,000 cubic yards of waste are assumed to be Resource Conservation and Recovery Act (RCRA) hazardous waste that will require characterization, containerization, and offsite disposal.

EnSafe compared contour data from multiple years to develop an understanding of the existing waste volumes. A comparison of 1970 (pre-construction) and 2017 (post-filling) topographic maps indicates that approximately 7 to 8 acres of land were filled (Figure C1.0). Because topographic contour elevation differences on these maps are large, volume estimates are approximate. However, comparison of these two topographic maps suggests between 115,000 and 175,000 cubic yards of waste may be present at the Site. The primary unknown affecting volume estimates is the terminal depth of the Trafalgar Road Site; trenching and/or borings will be required to further revise quantity estimates.

Based on topographic contours, waste thicknesses range from 25 feet (beneath the Blue Mountain Storage parking area) to more than 80 feet in the ravines.

Approximately 25-30% of the waste volume is present beneath the Blue Mountain Storage parking area.

EnSafe has prepared this Response Action Plan based on information available to date; additional information is being made available daily. As a result, alternatives and costs are in flux as a result and should be considered preliminary until data collection efforts are completed. This plan does not address follow-up costs for environmental media (soil, groundwater, sediment, or surface water) investigations which may be required as a result of potential releases of hazardous substances to the environment from the Trafalgar Road Site during the original Site operations, the fire, or response actions.

### **1.3 Data Gaps**

The following data gaps are critical to selecting and designing a response action:

- Location and depth of burn locations within the Trafalgar Road Site; note that smoke vents are not necessarily collocated with fire locations
- Original ground surface elevations (and corresponding waste thicknesses). As noted in conversations with ADEQ, estimates are derived from topographic contours that have 20-foot contour intervals. This introduces significant uncertainty with relief interpolation.
- Volume of other wastes present (e.g., solid and hazardous waste which must be managed separately from yard waste and construction and demolition debris).
- Trafalgar Road Site interior data (temperature, oxygen, carbon monoxide [CO], methane, moisture)

These data affect decisions on volumes, locations for response actions, and types of response actions. Costs may be significantly impacted by these data. As noted above, additional information is being made available daily.

## **2.0 PROJECT MANAGEMENT/ORGANIZATION**

EnSafe is the State's Representative for response actions. EnSafe will be the primary point-of-contact for ADEQ and other state, federal, and local agencies. EnSafe will also perform Site oversight functions and Site safety monitoring. Other primary on-scene personnel will include fire response personnel and excavation contractors. On-scene personnel will be identified and an organization and communications chart will be developed as additional Site data are obtained. ADEQ will perform all reporting and public relations for the Trafalgar Road Site.

### **3.0 CONSTRAINTS**

#### **3.1 Property Access**

Field activities to construct access roads, fire breaks, and other response activities will occur on multiple adjacent and downstream properties. EnSafe understands that ADEQ will obtain all offsite property access.

#### **3.2 Permitting**

##### **3.2.1 Air Permitting**

Under the Governor's and ADEQ's emergency orders, State permitting procedures are waived; however, air quality issues have been discussed with ADEQ during planning calls. Air quality control activities may include:

- Particulate monitoring (PM<sub>2.5</sub>) fire response and any construction activities
- Monitoring for volatile organic compounds (VOCs) using TO-15 at the perimeter of the Trafalgar Road Site to assess whether response actions are functioning as planned

##### **3.2.2 Storm Water Permitting**

Under the Governor's and ADEQ's emergency orders, State permitting procedures are waived; however storm water controls will be implemented (and are described in the response actions below) to minimize the impact to downgradient waterbodies from storm water runoff and active fire response actions within the perimeter of the Trafalgar Road Site on downgradient waterbodies.

A Notice of Intent will be submitted to ADEQ to document storm water activities; however, full plans and specifications are not required given the need for emergency response actions at the Site.

Note that Federal permitting requirements are not waived.

##### **3.2.3 Clean Water Act Section 404 Permitting**

Activities in the intermittent stream are regulated by the U.S. Army Corps of Engineers (USACE), under Nationwide Permit #38 — Cleanup of Hazardous and Toxic Waste. ADEQ conversations with USACE indicate that full permitting is not required at this time given the nature of emergency actions. However, permit application submittal will be required by the USACE for any modifications to the intermittent stream.

### **3.2.4 Bat Habitat**

Bat habitat was observed during the Site walkthrough, and bat populations are assumed present; however, initial Site control activities will occur during winter months (prior to tree roosting season). Clearance activities are not expected to have an adverse impact on bat populations given the number of alternative roosting locations present within 0.5 mile. A desktop review of threatened and endangered species will be performed concurrent with notifications to the U.S. Fish and Wildlife of clearance activities (reviews could not be performed at this time due to the Federal government shutdown).



## **4.0 COMMON ELEMENTS**

Each response action alternative will have multiple common elements. To minimize redundancy, this document summarizes common elements below.

### **4.1 Site Controls**

Prior to any Site activities, Site controls will be implemented to reduce ongoing fire risks.

#### **4.1.1 Fire Breaks**

A 15-foot fire break will be cleared around the perimeter of the Trafalgar Road Site, to minimize the threat of fire spreading to adjacent wooded areas. All vegetation between the Site and the fire break will be removed for site worker safety. This area will also provide a safety zone for any wastes which may slough off the work face during removal operations.

#### **4.1.2 Access Road**

A 15-foot gravel road will be constructed around the perimeter of the Trafalgar Road Site, described above as the fire break (Figure C2.0), to allow for emergency access. The road will also provide access for heavy equipment traffic to operational areas, excavation activities, stockpiling, etc., as discussed in subsequent sections.

#### **4.1.3 Water Supply Line**

A water supply line was installed at the Site on January 11, 2019 to provide water for Site operations and makeup quenching water, as needed.

#### **4.1.4 Exploratory Trench**

An exploratory trench will be installed at the north end of the Trafalgar Road Site (adjacent to the Blue Mountain Storage parking area) to assess the presence/absence of waste, if that material is burning, and depth to native material. If required/feasible, a fire break wall will be constructed to minimize risk of the fire migrating south beneath the parking area.

### **4.2 Storm Water Control/Creek Protection**

As noted in Sections 3.2.2 and 3.2.3, multiple actions will be performed to address storm water controls and discharges to the intermittent stream.

#### **4.2.1 Relocate 36-Inch Culvert**

Storm water from the south side of Trafalgar Road migrates north, through a 36-inch metal culvert beneath the parking lot, into the Trafalgar Road Site. Sloughing and erosion suggest the

pipe discharges directly into the waste, and could potentially be 20-25 deep based on pre-construction and post-construction topographic contour data. The culvert (and slough/erosion feature) are likely sources of air into the Trafalgar Road Site, feeding combustion.

The discharge point for the 36-inch culvert will be identified on the north side of Trafalgar Road and backfilled. A new culverted discharge will be installed to convey storm water east and away from the Trafalgar Road Site, and into the intermittent stream (see Figure C 2.0). One manhole will be installed to redirect the culvert from the northeast to the north.

#### **4.2.2 Intermittent Stream Temporary Weirs**

A temporary weir would be constructed in the intermittent stream to collect make-up water for firefighting on the surface of the Trafalgar Road Site. Water would be collected at this weir location and pumped (as needed) to the top of the Trafalgar Road Site. This location would also be a "last resort" pool to collect water that escapes the containment pond (see Section 4.2.4) and enters the intermittent stream.

#### **4.2.3 Other Surface Water Diversions**

Preliminary conversations between ADEQ and the USACE indicate full permitting is not required at this time given the nature of emergency actions. Drawing submittal will be required by the USACE for any modifications in the intermittent stream. Ultimately, activities performed within the intermittent stream will be permitted under Nationwide Permit #38 — Cleanup of Hazardous and Toxic Waste.

The wet-weather conveyance west of the Trafalgar Road Site will be diverted away from the gully, due to waste in its existing flow path. Pooled surface water would be siphoned downhill to the intermittent stream, to minimize water at the western toe of the Trafalgar Road Site.

The northeast corner of the Trafalgar Road Site has blocked the channel for the intermittent stream. Review of 1970 and 2017 topographic maps and Site observations indicates the intermittent stream flowing underneath the Trafalgar Road Site. One objective of response actions will be to remove waste from the stream channel.

As shown in Figure C3.0, the intermittent stream will be diverted around the northeast end of the Trafalgar Road Site; diversion will occur via temporary pumping until response actions are complete.

#### **4.2.4 Containment Pond**

Containment berms will be constructed around the perimeter of the Trafalgar Road Site (the inner perimeter of the fire break), with storm water and fire water discharge directed to a containment pond at the northern toe of the Trafalgar Road Site. The containment pond will hold storm water and fire water onsite prior to being pumped to the top of the Trafalgar Road Site for reuse in firefighting activities.

### **4.3 Environmental Monitoring**

As noted in the ADEQ Emergency Order there is the potential for hazardous substances within the Trafalgar Road Site. Air and storm water monitoring have been performed at the Site.

Site monitoring will need to consider multiple elements, including the presence of potential hazardous constituents and the potential for unknown constituents. In the event that drums, containers, or other wastes are discovered containing unidentified substances, it may be necessary to isolate these wastes, overpack them and/or secure them in Department of Transportation-approved shipping containers, perform hazardous waste characterization, and arrange for subsequent offsite disposal.

It should be noted that many constituents associated with fires (alkylphenols) have a very low odor threshold, often below human health and ecological risk thresholds and standard detection limits. Therefore, nuisance odors may not correlate with analytical results.

#### **4.3.1 Air Monitoring**

Air quality sampling performed by the United States Environmental Protection Agency in November and December 2018 did not identify hazardous substances above State or Federal screening levels. One location onsite had elevated benzene concentrations; when compared to short-term (sub-chronic) risk screening levels, the United States Environmental Protection Agency determined there was no immediate health concern.

Air monitoring is described in Section 4.5, Health and Safety (H&S) Monitoring.

#### **4.3.2 Intermittent Stream Monitoring**

During Site inspections, burned and charred material were noted in the intermittent stream located at the toe of the Trafalgar Road Site, with charred material present as far as one-quarter mile downstream of the Trafalgar Road Site. Discolored liquids were observed to be seeping out of the toe of the Trafalgar Road Site.

During response actions, storm water and surface water sampling will be performed for VOCs, semi-volatile organic compounds, and metals in the intermittent stream.

#### **4.3.3 Groundwater**

The Trafalgar Road Site appears to be situated within the Boone geologic formation. More specifically the St. Joe limestone member outcrops in close proximity to the Trafalgar Road Site and limestone outcrops are along the creek bed. The St. Joe is a karstic limestone which is highly permeable and is thought to transmit groundwater easily.

Groundwater-surface water interactions are suspected. Groundwater has not been assessed onsite but should be considered when evaluating the use of and ultimate fate of water in the response action. Potential effects on karstic limestone and fate and transport that may need to be considered include: dissolution effects associated with tannic leachate, neutralization effects associated with high calcium, and potential temperature effects associated with ongoing fires.

#### **4.4 Health and Safety Monitoring**

A robust H&S monitoring program will be implemented to monitor conditions for onsite workers and to assess the effectiveness of response actions, which would include both personnel monitoring and ambient air monitoring. EnSafe will perform all onsite monitoring; EnSafe understands offsite residential monitoring will be administered by an independent third party.

The H&S monitoring program will include three primary components:

- Initial Assessment
- Daily Perimeter Monitoring
- Personnel Monitoring

##### **4.4.1 Initial Assessment**

Three days of sampling will be performed during initial field activities to characterize the nature of exposures, focusing on parameters associated with smoke: VOCs (including tentatively identified compounds), polynuclear aromatic hydrocarbons, PM<sub>2.5</sub>, CO, and nitrogen dioxide (NO<sub>2</sub>). PM<sub>2.5</sub>, CO, and NO<sub>2</sub> are National Ambient Air Quality Standard parameters and will be used as indicator parameters. Monitoring will include weather monitoring to log wind direction and speed; 4 samples of each analyte will be collected daily (1 upwind and 3 downwind) covering an approximate 90° arc.

#### **4.4.2 Daily Perimeter Monitoring**

While monitoring will be based on the initial assessment, for planning purposes it is assumed that PM<sub>2.5</sub>, CO, and NO<sub>2</sub> can be used to monitor concentrations during working hours using a remote monitoring system. Monitoring will include weather monitoring to log wind direction and speed; 4 samples of each analyte will be collected each daily (1 upwind and 3 downwind) covering an approximate 90° arc. The following one-hour National Ambient Air Quality Standard will be used as threshold concentrations:

- PM<sub>2.5</sub> = 65 micrograms per cubic meter
- CO = 35 parts per million
- NO<sub>2</sub> = 100 parts per billion

#### **4.4.3 Personnel Monitoring**

While monitoring will be based on the initial assessment, for planning purposes it is assumed that personnel monitoring will include CO and up to 3 specific VOCs. Based on National Institute for Occupational Safety and Health guidelines, assuming a workforce of 25 people, 15 samples will be collected at the following frequency:

- daily for the first week
- if exposures are below occupational exposure limits, collect 15 samples per week for subsequent weeks

## **5.0 ALTERNATIVE 1**

In Alternative 1, the Site would be secured and smoke mitigation measures (such as water cannon) would “knock down” smoke as it is generated from vents across the Site. Alternative 1 is described in more detail below; note that common elements have already been described in Section 4.

### **Common Elements — Alternative 1**

- Site Controls
- Storm Water Controls/Creek Protection
- Environmental Monitoring
- H&S Monitoring

## **5.1 Smoke Mitigation**

Smoke mitigation would be implemented to reduce and/or remove particulate matter (e.g., PM2.5) from the atmosphere. Misting operations include addition of fine water spray to the atmosphere via multiple water distribution points (water cannon and other nozzle devices). Mist would condense on the surface of the Site, drain to the onsite storm water control system, and/or evaporate. Misting operations would operate dawn to dusk.

## **5.2 Advantages**

Alternative 1 could be implemented quickly.

## **5.3 Disadvantages**

Discussions with firefighting experts indicate that misting operations are not technically effective at smoke mitigation. Observations at the Site during rainy/foggy days indicate that smoke is not “knocked down”; rather, rainfall causes an atmospheric inversion — smoke lingers rather than dissipates at the Trafalgar Road Site.

Operation of smoke mitigation equipment requires significant water supply (700-1000 gallons per minute [gpm]) and could generate significant water requiring management as it discharges to the containment pond. Firefighting experts indicate a more effective means of managing smoke is through targeted saturation (with or without surfactant/foam), repacking, and monitoring. These actions can be performed as best management practices during actual excavation and quenching operations (see Sections 6 and 7).

## 6.0 ALTERNATIVE 2

In Alternative 2, the Site would be secured and an infiltration gallery will be installed across the Site to introduce water into the subsurface to extinguish the fire. Alternative 2 is described in more detail below; note that common elements have already been described in Section 4.

### Common Elements — Alternative 2

- Site Controls
- Storm Water Controls/Creek Protection
- Environmental Monitoring
- H&S Monitoring

### 6.1 Infiltration Gallery

As discussed previously, increasing the moisture content greater than 45% enhances cooling. However, multiple studies (see Section 14 for references) suggest that high volumes of water and wetting from the top down is insufficient to completely extinguish combustion activities.

Review of aerial photographs suggests that original Site operations over time resulted in multiple layers of wastes; these wastes may exhibit preferential pathways and varying permeabilities. To deliver water uniformly throughout multiple layers over 60-80 feet deep, a vertical gallery system would be designed and installed using 2- to 4-inch steel pipe with 2- to 5-foot perforated steel screens. Vertical injection intervals would be spaced uniformly throughout the waste, from ground surface to the base of the Trafalgar Road Site; actual intervals would be dependent on the waste profile at each location. Further characterization (e.g., borings) would be required to complete design. The actual design of locations may be optimized (e.g., offset locations and depths) to increase water distribution through the subsurface; alternatively, gauging and valving can be used to optimize water flow.<sup>1</sup>

The gallery will be installed in segments (10-15 injection locations per segment, on approximately 30-40 foot centers) and operated based on areas that have elevated temperatures and/or other landfill gas monitoring indicating active fires. Injection locations would be manifolded to one or more header locations. Water would be introduced under relatively low flow conditions (as opposed to flooding conditions described in Alternative 3) to increase moisture content within the Site.

Probes and monitoring points would be needed to assess Trafalgar Road Site conditions over the long term.

<sup>1</sup> Installation may be complicated by refusal of drill rods/augers on trees, concrete, etc. An alternative approach may be a shallow subsurface gallery.

## **6.2 Advantages**

Alternative 2 controls the Site without disturbing wastes within the Trafalgar Road Site. It allows treatment to be focused on hot spots as identified by Site data. This alternative would be most effective if Site data indicate that subsurface fire activity is limited in areal extent and/or can be easily isolated.

## **6.3 Disadvantages**

Injection techniques have been used but have not been reliable for fully extinguishing subgrade fires. Concerns remain about void space within the Site, and the ability to track heavy equipment across the surface. Water introduced via the gallery may migrate vertically via karst terrain into groundwater; downgradient migration may be difficult to control in karstic limestone. The approach, as described above, is for a phased approach; additional installations may be required over time based on Site data.



## 7.0 ALTERNATIVE 3

In Alternative 3, the Site would be secured and the entire Trafalgar Road Site would be flooded to quench the fire. Alternative 3 is described in more detail below; note that common elements have already been described in Section 4.

### Common Elements — Alternative 3

- Site Controls
- Storm Water Controls/Creek Protection
- Environmental Monitoring
- H&S Monitoring

## 7.1 Containment and Flooding Operations

A structural containment (i.e., dam) would be constructed around the perimeter of the Trafalgar Road Site from natural grade to the top of fill; this could be constructed using a variety of materials (earthen/clay, geotextile, sheet pile). The purpose of the containment would be to contain quenching fluids introduced on the uphill (southern) side; these would be introduced both from ground surface (surface application) as well as subsurface (direct injection).

Preliminary evaluation of dam construction techniques suggests an earthen dam would need to be approximately 95 feet high and require a base approximately 500 feet wide; other designs (e.g., concrete arch dams or buttressed dams) can be explored but would have significantly greater design and construction costs. Geotechnical evaluations have not been performed to assess foundation issues in karstic bedrock. Additional evaluations would need to be performed to determine the safe loading of Trafalgar Road Site wastes (slough) and water on the dam.

Without accounting for leakage or evaporation during quenching, an estimated 30-40 million gallons of water would be required to flood the Trafalgar Road Site. As discussed in Section 4.4.3, the karst geology may present communication pathways to groundwater beneath the Trafalgar Road Site, resulting in significant leakage and subsequent migration of hazardous substances to groundwater. Additional water may be required to maintain saturation within the dam.

Subsurface landfill fires are characterized by conditions where oxygen is present (15-20%); and exposure to air (either through excavation, windy days, or updrafts through channels in the waste pile) fan embers within the landfill and enhance fire activity. Methane concentrations have been depleted and CO concentrations are elevated. Temperatures in active fire areas are generally >200°F; in comparison, in a controlled landfill, biological degradation of materials is typically occurring at temperatures <140°F in a controlled landfill.

Probes and monitoring points would be needed to assess Trafalgar Road Site conditions over the long term.

## **7.2 Advantages**

Alternative 3 controls the Site without disturbing wastes within the Trafalgar Road Site.

## **7.3 Disadvantages**

Significant constructability concerns have been identified; specifically, how to flood approximately 7 acres in karst terrain to a depth of 60-80 feet; and how flooding would impact adjacent properties. The intermittent stream would be significantly impacted by the footprint of the dam. Significant leakage is expected, which may result in incomplete quenching.

Trafalgar Road Site wastes may slough and mobilize following flooding, placing additional stress on the dam; stability under saturated conditions is uncertain. There would likely be an increase in smoke/steam generation during the initial flooding period.

This alternative was determined to be technically infeasible due to dam constructability, size requirements, and hydraulic issues.

## **8.0 ALTERNATIVE 4**

In Alternative 4, the Site would be secured and the entire Trafalgar Road Site would be covered with fill material to smother the fire. Alternative 4 is described in more detail below; note that common elements have already been described in Section 4.

### **Common Elements — Alternative 4**

- Site Controls
- Storm Water Controls/Creek Protection
- Environmental Monitoring
- H&S Monitoring

## **8.1 Smothering Operations**

Smothering operations would increase the moisture content in the wastes to >45% to enhance cooling, and eliminate airflow into the Trafalgar Road Site through placement of 18-24 inches of soil cover (with a permeability less than 1E-05 cm/sec and Unified Soil Classification System soil types SC, ML, CL, or CH), over the top of the Site. Additional cover materials would be placed on the side slopes and would be extended a minimum of 10 feet beyond the perimeter toe of the Trafalgar Road Site. Note that no vegetative cover would be placed until the fire has been completely smothered.

Probes and monitoring points would be needed to assess Trafalgar Road Site conditions over the long term.

## **8.2 Advantages**

Alternative 4 controls the Site without disturbing wastes within the Trafalgar Road Site

## **8.3 Disadvantages**

Significant constructability concerns have been identified; specifically, how to emplace cover on the steep side-slopes of the Trafalgar Road Site. While geomembranes could be evaluated, they may not be feasible while the fire is ongoing due to the risk of direct damage (melting), settlement, and/or sloughing. Additional concerns remain about void space within the Site, and the ability to track heavy equipment across the surface.

Smothering would deprive subsurface fires of oxygen slowly, and it is unclear whether sufficient oxygen sources could be removed to put out all fires. The karst terrain may continue to provide airflow to the base of the Trafalgar Road Site which cannot be sealed. Wastes would remain hot under oxygen-starved conditions, and may pose a re-ignition risk for the long term.

The Bridgeton, Missouri landfill fire continues to smolder after 6 years.

## **9.0 ALTERNATIVE 5**

In Alternative 5, the Site would be secured and actions would be taken to minimize smoke generation and storm water runoff; however, the fire would be managed as a controlled burn with measures implemented to accelerate airflow to the waste for a cleaner, faster burn. Alternative 5 is described in more detail below; note that common elements have already been described in Section 4.

### **Common Elements — Alternative 5**

- Site Controls
- Storm Water Controls/Creek Protection
- Environmental Monitoring
- H&S Monitoring

## **9.1 Controlled Burn**

Alternative 5 would manage the Trafalgar Road Site as a controlled burn. Hot spots would be exposed and/or air introduced into the Site to encourage a cleaner, faster burn. Multiple strategies would be considered depending on the location of hot spots:

- Exposing Site wastes using excavators/trackhoes
- Installing vertical or horizontal vent wells (passive)
- Actively venting (via fans or blowers) the subsurface
- Discharging subsurface vapor through treatment (e.g., particulate scrubbers)

As noted previously, review of aerial photographs suggests that Site operations over time resulted in multiple layers of wastes. These wastes may exhibit preferential pathways and varying permeabilities; variable compaction of wastes will likely impact the potential for uniform combustion.

Probes and monitoring points would be needed to assess Trafalgar Road Site conditions over the long term.

## **9.2 Advantages**

Alternative 5 controls the Site without disturbing wastes within the Trafalgar Road Site. This approach would be most effective if Site data indicate that subsurface fire activity is limited in areal extent and/or can be easily isolated.

## **9.3 Disadvantages**

The Trafalgar Road Site may continue to burn for a long time (months, possibly years); surface activities may not be sufficient to accelerate combustion at depth. Significant constructability concerns have been identified; specifically, how to aerate and manage controlled burns in wastes

burning at depths of 60 to 80 feet deep without risk to site workers. Over the long term, the Trafalgar Road Site would remain highly unstable due to the void spaces caused by combustion.

Surrounding residents may perceive this alternative as high-risk, as the controlled burn process will stimulate additional combustion and may generate additional smoke and odor. ADEQ has indicated that this alternative would be least appealing to citizens. Ash and other products within the Trafalgar Road Site may impact groundwater and/or the intermittent stream over the long term.

## **10.0 ALTERNATIVE 6**

In Alternative 6, the Site would be secured and actions would be taken to minimize smoke generation and storm water runoff. The fire would be attacked using more targeted techniques: burning would be quenched using water and firefighting surfactants (e.g., foams) that improve wettability and penetration. Alternative 6 is described in more detail below; note that common elements have already been described in Section 4.

### **Common Elements — Alternative 6**

- Site Controls
- Storm Water Controls/Creek Protection
- Quench Pond/Dewatering Pads
- Environmental Monitoring
- H&S Monitoring

## **10.1 Targeted Quenching**

In Alternative 6, the fire would be addressed using targeted techniques: hot spots would be quenched using firefighting surfactants (e.g., Class A foams) which improve wettability and penetration. This alternative presumes that firefighting efforts are limited; Site wastes that are not burning will not be excavated unless necessary to prevent the spread of fire.

This approach includes a combination of activities:

- Monitoring subsurface conditions with temperature and other probes; hot spots would be identified as areas exceeding 170°F and/or with variations in indicators (oxygen, CO, methane).
- Exposing Site wastes using excavators/trackhoes.
- Spraying burning wastes with water and/or Class A foams to quench them. Multiple surfactant materials are available, with varying biodegradability. Surfactants would be selected to minimize toxicity to downgradient receptors.
- Temporary excavation of hot-spot wastes, quenching on quench pads (see Section 4.3), and spreading on drip pads to dewater. Excavation would remove burning and smoldering waste, such that a buffer of at least 50 feet is achieved between hot-spot areas and non-combusted areas.
- Prior to returning quenched wastes to the Trafalgar Road Site, all surfaces of the unburned waste will be covered with 12+ inches of soil to prevent the spread of fire.

Surfactants would be selected to reduce the surface tension of the water, absorb more heat, and provide greater penetration into the burning wastes.

Probes and monitoring points would be needed to assess Trafalgar Road Site conditions over the long term.

### **10.2 Advantages**

Alternative 6 provides active quenching in active burning areas while minimizing excavation activities.

### **10.3 Disadvantages**

The Trafalgar Road Site may continue to burn for a long time (months, possibly years). The Trafalgar Road Site may pose a re-ignition risk over the short term (live embers may remain below ground) and long term if burning areas are missed. Targeted, hot-spot quenching techniques may be limited to shallow depths due to equipment and safety limitations. Constructability has not been assessed, given Site wastes are burning at depths of 60 to 80 feet deep; access to hot spots and excavation to depth may not be possible without risk to site workers. Over the long term, the Trafalgar Road Site will remain highly unstable due to the void spaces caused by combustion. Ash and other products within the Trafalgar Road Site may impact the intermittent stream over the long term.

## **11.0 ALTERNATIVE 7**

In Alternative 7, the Site would be secured and actions would be taken to minimize smoke generation and storm water runoff. The Trafalgar Road Site would be excavated. Wastes which are on fire would be quenched using an onsite quenching pond and water recycled onsite. Alternative 7 is described in more detail below; note that common elements have already been described in Section 4.

### **Common Elements — Alternative 7**

- Site Controls
- Storm Water Controls/Creek Protection
- Quench Pond/Dewatering Pads
- Environmental Monitoring
- H&S Monitoring

### **11.1 Excavation and Quenching**

Alternative 7 would excavate Trafalgar Road Site wastes; as noted in Section 1.2, between 115,000 and 175,000 cubic yards of waste are estimated to be present in situ (this estimate is considered approximate, based on the topographic contours). Any wastes on fire would be quenched, through firefighting and an onsite quenching pond. Water will be recycled onsite and potable water added as needed.

Actions will be implemented as discrete cells, beginning at the outside of the Trafalgar Road Site and working toward the interior.

- Excavations would begin around the perimeter using excavators/trackhoes.
- A spotter would identify whether wastes are on fire and require initial quenching (e.g., whether the trackhoe bucket required hosing, whether the exposed excavation face required wetting).
- If wastes are burning, they would be removed to the quench pond
  - Quenching will occur immediately upon excavation (quenching in the excavator bucket).
  - Wet wastes will be placed in an end dump and trucked to the top of the Trafalgar Road Site.
  - Wastes will be quenched a second time in a quench pond.
  - Wastes will be removed from the quench pond and stockpiled to drain.
  - The material would then be staged inside the bermed area pending final disposition. See Section 12 for a discussion of disposal options A through D.



Site soil, sand, and 20-mil or heavier poly sheeting will be used to construct the quench pad and dewatering areas; these areas will be bermed to contain quench liquids/dewatering liquids. Dewatering liquids will be channeled to a temporary sump, then pumped back to the quench pad. As noted previously, make-up water (from the containment pond or from the intermittent stream) will be pumped to the quench pond as needed. Potable water from the new water line will also be used, as needed

During transport of hot wastes, the fire break and access roads will kept wet to prevent ignition from sparks.

- If wastes are determined not to be burning, they will be stockpiled and observed while that portion of the Trafalgar Road Site is excavated.

Once an area has been completely excavated, final disposition would be as outlined in Section 12.

### **11.2 Advantages**

Alternative 7 excavates all Trafalgar Road Site wastes, and identifies and actively quenches burning wastes. Studies (see references in Section 14) have shown that excavation and quenching together provides the highest probability of extinguishing subgrade fires. Excavation and quenching would provide the highest level of probability that the material is extinguished.

### **11.3 Disadvantages**

Fire risks are posed to workers near the cut face. Significant constructability concerns have been identified; specifically, how to excavate wastes 60-80 feet deep without risk to Site workers.

## **12.0 DISPOSITION OPTIONS**

Once all wastes are quenched, they will need to be disposed for the long term. As discussed with ADEQ, four disposition options may be considered; those options (A through D) are presented in Sections 12.1 through 12.4.

### **12.1 A — Onsite (Fill with Cover)**

While it is not clear whether Arkansas regulations would allow quenched wastes to be returned to the land surface, direct placement of quenched wastes onsite would be a viable option, assuming sufficient land is available.

- Fill would be placed in 5-foot lifts, alternating with 1 foot of soil
- A final cover (18 inches of compacted clay, with a 6-inch vegetative layer)
- Cover slopes would not exceed 4:1 (or, if natural slopes exceed this, a 3:1 slope may be considered if terracing is included in the design)

The current Trafalgar Road Site parcel would not contain all Site wastes and be able to maintain the slopes listed above.<sup>2</sup> With acquisition of additional contiguous acreage, this alternative would be viable, or excess volume may need to be managed offsite.

#### **12.1.1 Advantages**

If quenched wastes are returned to the Site, they would be managed long-term as an unpermitted dump site. This alternative provides the simplest materials handling/construction scenario.

#### **12.1.2 Disadvantages**

Returning wastes to the ground surface is not consistent with Arkansas regulations; no liner or other protections against leaching are provided.

### **12.2 B — Class 4 Landfill Construction — Onsite**

Following excavation and quenching activities, wastes would be placed into a Class 4 landfill constructed onsite with the following specifications:

- A base liner (18 inches of compacted clay)
- Fill placed in 5-foot lifts, alternating with 1 foot of soil
- Final cover (18 inches of compacted clay, with a 6-inch vegetative layer)

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<sup>2</sup> The current parcel can only accommodate 30,000 cubic yards of waste.

- Cover slopes would not exceed 4:1 (or, if natural slopes exceed this, a 3:1 slope may be considered if terracing is included in the design)

The current Trafalgar Road Site parcel would not contain all Site wastes and be able to maintain the slopes listed above.<sup>3</sup> With acquisition of additional contiguous acreage, this alternative would be viable, or excess volume may need to be managed offsite.

### **12.2.1 Advantages**

Creating a Class 4 landfill would provide greater long-term stability onsite, and would reduce future leaching of ash and other products from Site wastes over the long term, providing protections for the intermittent stream and groundwater.

### **12.2.2 Disadvantages**

Unless additional acreage is acquired, emplacement of liner materials adjacent to operations areas (e.g., exposed, potentially unstable and smoldering waste slopes 60-80 feet high) will be difficult.

## **12.3 C — Class 4 Landfill Construction — Offsite**

If insufficient space for constructing a Class 4 landfill is available onsite, and adjacent property is not known to be available for acquisition, ADEQ indicated that offsite parcels within 10 miles of the site may be available for construction.

In this event, following excavation and quenching activities, waste would be windrowed allowing dewatering to the extent possible. Dewatered wastes would be hauled to the new Class 4 landfill site, which would be constructed as described below:

- A base liner (18 inches of compacted clay)
- Fill placed in 5-foot lifts, alternating with 1 foot of soil
- Final cover (18 inches of compacted clay, with a 6-inch vegetative layer)
- Cover slopes would not exceed 4:1 (or, if natural slopes exceed this, a 3:1 slope may be considered if terracing is included in the design)

Once all wastes are removed, the former Trafalgar Road Site would be regraded and habitat restored.

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<sup>3</sup> The current parcel can only accommodate 30,000 cubic yards of waste.

### **12.3.1 Advantages**

All Trafalgar Road Site wastes are removed, eliminating ongoing threats to the intermittent stream and groundwater.

### **12.3.2 Disadvantages**

Daily truck traffic on the existing narrow roads in the community increase the risks for traffic accidents and could potentially damage the roadways.

## **12.4 D — Offsite Disposal In C&D Landfill**

Following excavation and quenching activities, waste would be windrowed allowing dewatering to the extent possible. All Bella Vista residential waste is sent to a local transfer station prior to hauling to Lamar, Missouri for final disposal at the Prairie View Regional Waste Landfill, which accepts yard debris and construction debris wastes. For feasibility, this location was used to provide estimated transportation and disposal costs.

Following excavation, the Trafalgar Road Site would be graded and seeded; future land use and ultimate Site restoration plans are have not been determined at this time.

### **12.4.1 Advantages**

All Trafalgar Road Site wastes are removed, eliminating ongoing threats to the intermittent stream and groundwater.

### **12.4.2 Disadvantages**

Daily truck traffic on the existing narrow roads in the community increase the risks of traffic accidents and could potentially damage the roadways.

### **13.0 PRELIMINARY ESTIMATES AND SCHEDULES**

As noted previously, significant data gaps impact accurate cost estimation for Trafalgar Road Site response actions. However, we have provided the following opinion of probable construction costs (OPCC) to assist with ADEQ's evaluation of Site alternative evaluations. The OPCC costs, which will be refined pending additional Site data collection, are shown in Table 1.

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Table 1 Opinion of Probable Construction Costs — Will Be Refined Pending Additional Site Data				
Common Costs				
Site Controls	Fire break, access road, storm water controls 1.1-1.3M			
Alternative Costs				
Alternative	Quenching/Firefighting (Basis and Costs)	Other Control Costs	Waste Disposition Costs	Subtotal
1 — Smoke Mitigation	Assume 30-60 days 0.6-1.3M			
2 — Injection Gallery	None — no active quenching	15-well injection system, operation for 30-60 days \$3-4M	None — waste remains onsite	\$3-4M
3 — Dam	None — no active quenching	Dam construction >\$40M (costs not refined due to technical infeasibility)	None — waste remains onsite	\$>40M (technically infeasible)
4 — Smothering	None — no active quenching	Smother — Clay Cover \$4-5M	None — waste remains onsite	\$4-5M
5 — Controlled Burn	None — no active quenching	Controlled burn Cost is per year of burning \$24M per year	None — waste remains onsite	\$24M/year of burning
6 — Targeted Quenching	Unit cost, \$125/CY 50,000-80,000 CY are quenched \$6.3-10M	None	None – waste remains onsite	\$6.3-10M
7 — Excavation and Quenching	Unit cost, \$125/CY 115,000-175,000 CY are quenched \$15-22M	None	\$15-22M Plus Disposition Options Below	
Disposition Options				
Alternative	Quenching/Firefighting (Basis and Costs)	Disposition-Only Cost		Subtotal
A — Fill/Cap	See Alternative 7 above	\$5.3-6.4M		\$21-29M
B — Onsite Class 4 Cell	See Alternative 7 above	\$5.6-6.7M		\$21-29M
C — Offsite Class 4 Cell	See Alternative 7 above	\$11.3-13.6M		\$26-36M
D — Offsite Landfilling	See Alternative 7 above	\$12.3-15.1M		\$28-37M

## Schedule

The schedule shown in Table 2 has been developed for initial phases of response actions. Quenching/ firefighting operational durations will be dependent on the volume present within the Trafalgar Road Site and the quantity of burning wastes present, as noted previously. This schedule assumes quenching operations, followed by disposition (to be determined).

<b>Table 2</b>	
<b>Preliminary Schedule — Will Be Refined Pending Additional Site Data</b>	
<b>Activity</b>	<b>Duration</b>
Notice To Proceed	1
Site Preparation (Civil Construction Elements)	45-60 days
Excavation/Quenching	TBD (based on waste volumes, assume 150-180 days)
Final Disposition — Landfill Construction or Offsite Disposal	TBD (assume 240-290 days)
Site Restoration	30-60 days

**Note:**

TBD = To be determined

## 14.0 REFERENCES

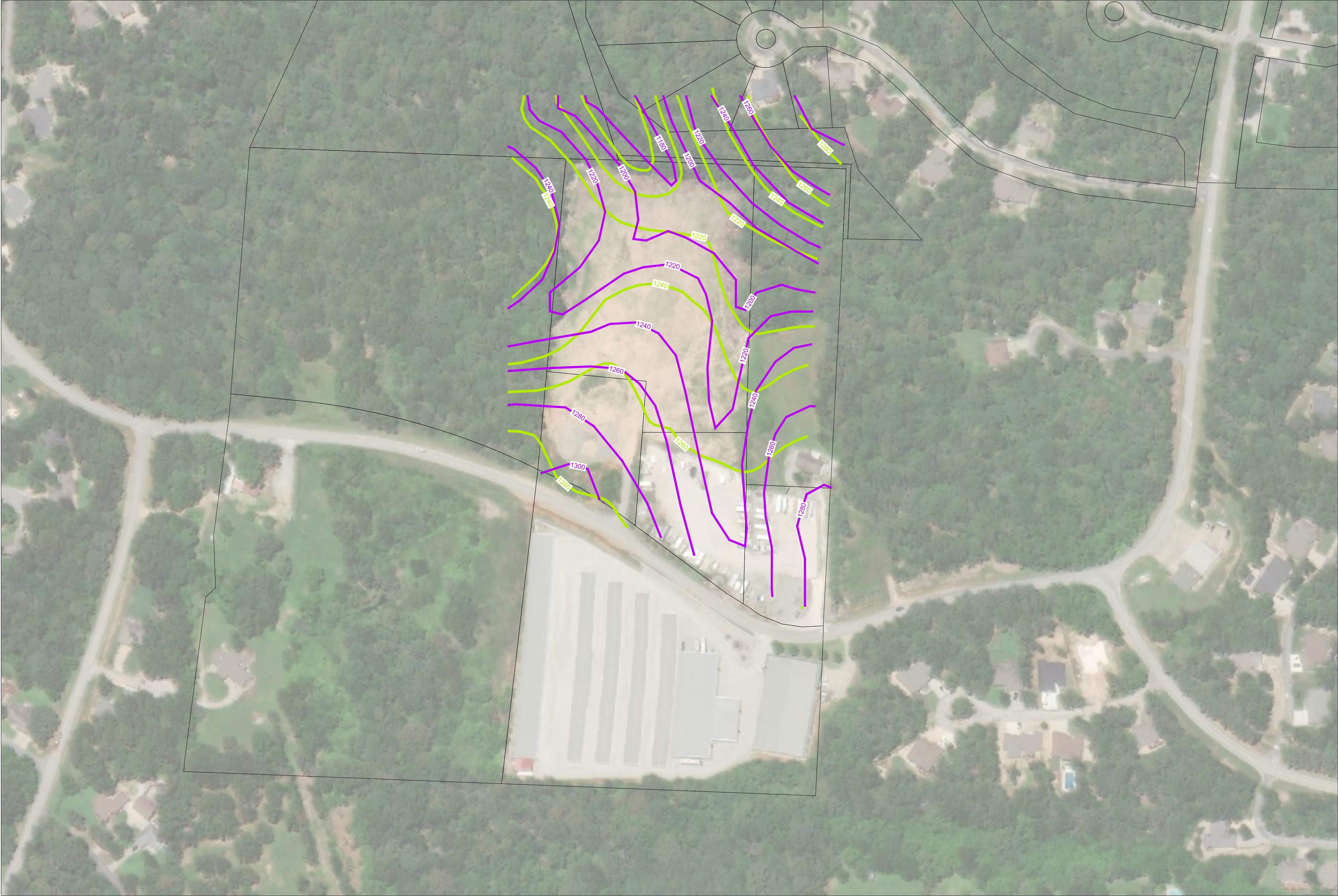
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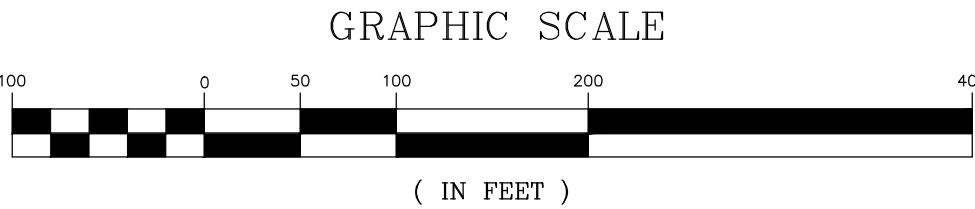
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LEGEND

1970 USGS CONTOURS (DIGITIZED)

2017 USGS CONTOURS (DIGITIZED)



USGS 1970 AND 2017 CONTOURS

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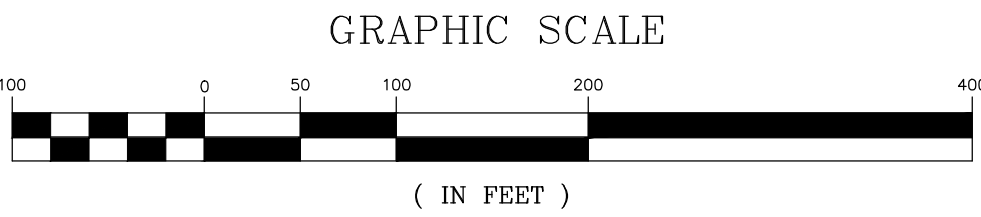
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PHASE 1

**TRAFALGAR ROAD STUMP DUMP FIRE  
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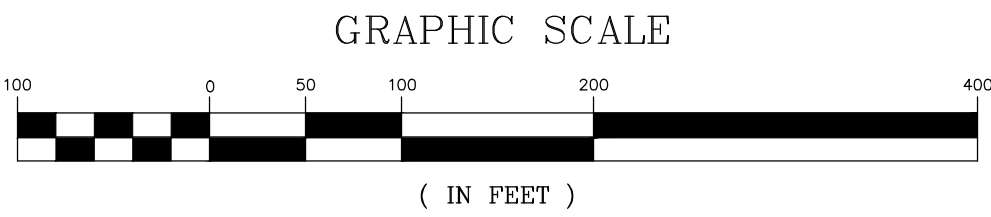
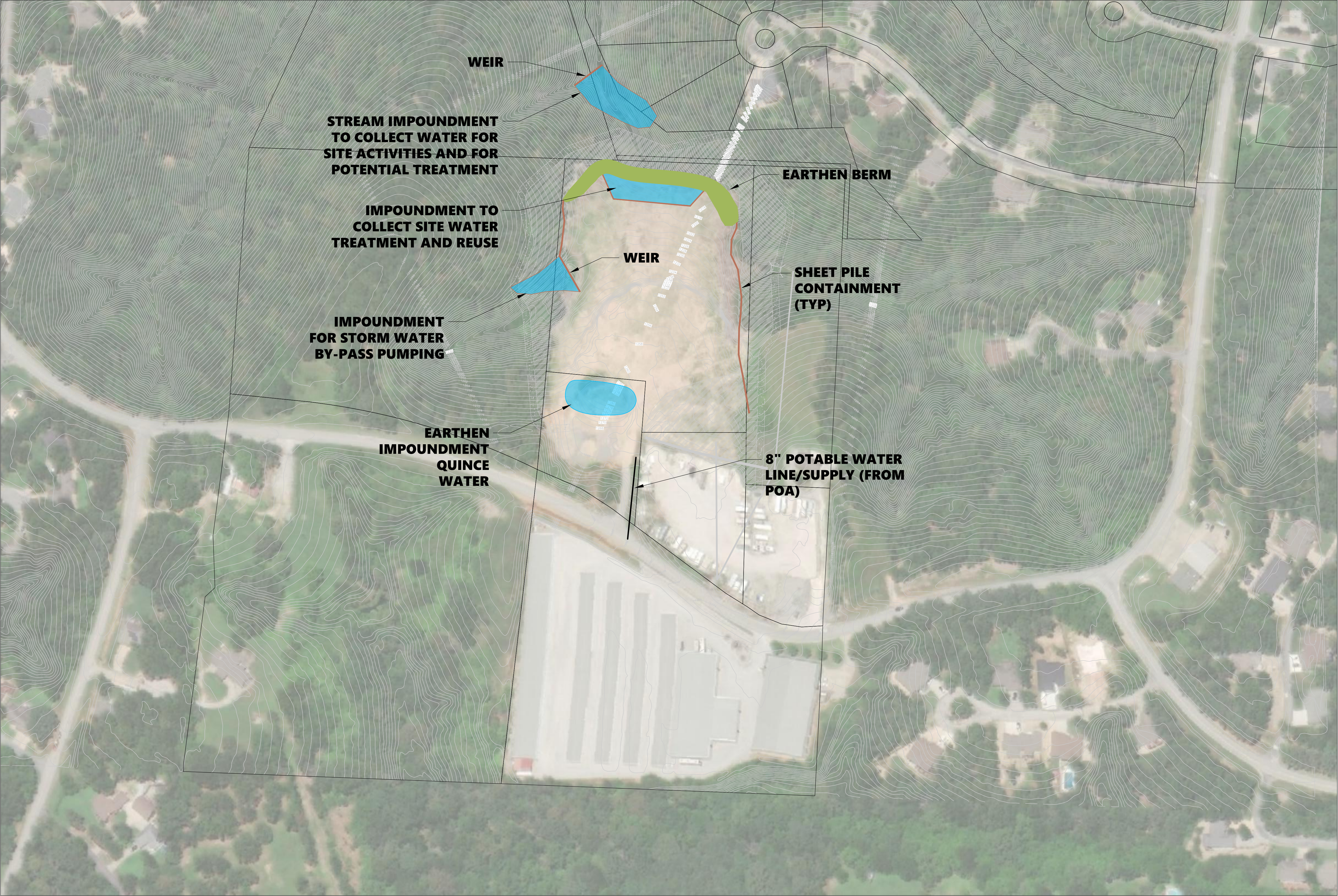
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PHASE 2

**TRAFALGAR ROAD STUMP DUMP FIRE  
RESPONSE  
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