Draft Proposed Plan

Former Forbes Atlas Missile Site S-5

Lyon County, Kansas

FUDS ID No. B07KS0204-01

DATES TO REMEMBER:

PUBLIC COMMENT PERIOD

- 19 July 2021 through 24 August 2021

The US Army Corps of Engineers (USACE) will accept written comments on the Proposed Plan during the public comment period. Comments should be in writing and submitted to Ms. Calley Havens, at the following mailing or email address:

CENWK-PME-S
601 E. 12th Street Kansas City, MO
64106
calley.w.havens@usace.army.mil

PUBLIC MEETING

- 26 July 2021 at 6:00 pm

The USACE will hold a virtual public meeting to explain the Proposed Plan via the following Webex link:
https://usace1.webex.com/meet/calley.w.havens
Or, join by phone:
+1-844-800-2712 US Toll Free
Access Code: 199-544-3533

ADMINISTRATIVE RECORD

Site related documents for the former Forbes Atlas Missile Site S-5 can be located at:
https://www.nwk.usace.army.mil/Missions/Environmental/Environmental-Projects/Forbes-Atlas-Missile-Site-S-5/

or

Council Grove Public Library
829 West Main Street
Council Grove, Kansas Phone:
620.767.5716
FAX: 620.767.7312
E-mail: cglib@tctelco.net
Hours of Operation:
Mon-Tue: 11 AM-6 PM
Wed-Fri: 11 AM-4 PM

Copies of the Proposed Plan, Public Meeting slideshow, and Fact Sheet are also available for viewing at: https://www.nwk.usace.army.mil/Missions/Environmental/Environmental-Projects/Forbes-Atlas-Missile-Site-S-5/

1.0 INTRODUCTION

This **Proposed Plan** describes the remedial alternatives considered for contaminated **groundwater** at the former Forbes Atlas Missile Site S-5 (the Site) in Lyon County, Kansas (Figure 1) and identifies the **preferred alternative** for remediation.

The US Army, as the lead agency under the **Formerly-Used Defense Sites** (FUDS) Program, on behalf of the Department of Defense (DoD), is issuing this Proposed Plan to solicit public participation as required under Section 117a of the **Comprehensive Environmental Response, Compensation, and Liability Act** (CERCLA), as amended by Superfund Amendments and Reauthorization Act of 1986 and Section 300.430(f)(2) of the National Contingency Plan. The public participation process, as required by CERCLA and the National Contingency Plan, offers the public a reasonable opportunity to submit written or oral comments and to participate in a public meeting during the public comment period.

The U.S. Army Corps of Engineers (USACE) has conducted environmental activities on behalf of the Army, pursuant to the Defense Environmental Restoration Program. Data obtained during the **Remedial Investigation** (USACE, 2018a) identified the **volatile organic compound** (VOC) **trichloroethene** (TCE) as the primary chemical of concern in **groundwater** at the Site. Alternatives to address the groundwater contamination were developed and evaluated during the **Feasibility Study** (USACE, 2020).

This Proposed Plan was developed by USACE with support from the Kansas Department of Health and Environment (KDHE), and the U.S. Environmental Protection Agency (EPA) Region 7. Investigations and evaluation of remedial action alternatives support *in-situ* treatment of contaminated groundwater combined with long-term monitoring and contingent alternate water supply. Other alternatives considered were no further action or long-term monitoring with alternate water supply.

Although the final decision will not be made until after the close of the public comment period in a Decision Document, the remedy described in this Proposed Plan is the preferred alternative for remediation of groundwater at the Site.

USACE, in consultation with KDHE and EPA, may modify the preferred alternative or select another response action presented in this Proposed Plan based on new information or public comments if such a change will result in a more appropriate remedy. Therefore, the public is encouraged to review and comment on all of the alternatives presented in this Proposed Plan.

This Proposed Plan summarizes information that can be found in greater detail in the Remedial Investigation and Feasibility Study reports, which are part of the **Administrative Record** for this Site at the Council Grove Public Library, 829 West Main Street, Council Grove, Kansas. USACE and KDHE encourage the public to review these documents to gain a more comprehensive understanding of activities conducted at the Site.

2.0 SITE BACKGROUND

Site Description and History

The Site is one of nine Atlas "E" missile launch facilities constructed near the former Forbes Air Force Base in Topeka, Kansas. The Site was an operational intercontinental ballistic missile base from 1959 until it was decommissioned in 1965, reported as excess, and subsequently sold. The facility is currently privately owned and is not being used.

The Site is located in Lyon County, Kansas, approximately 8 miles west of Allen, Kansas and approximately 45 miles southwest of Topeka, Kansas (Figure 1). The Site consists of approximately 25 acres within a general rectangular area and is surrounded by agricultural grazing lands (Figure 2). Two offsite private water wells are located within one mile of the Site (Figure 2).

Site features include a missile launch and service building in the south part of the Site (Figure 3). The missile launch and service building was constructed partly underground and included a horizontal missile silo. The horizontal missile silo had a roof located at ground surface which retracted to allow the horizontally-stored missile to be raised to a vertical launch position. Additional features included a launch operations building (also known as the "control building") and a tunnel connecting the launch operations building to the launch and service building, an administration building, a maintenance building, a cooling tower, a water supply building, a septic system, sewage lagoons, a fuel storage system, and a perimeter fence.

During its operational period, activities conducted at the Site, such as missile maintenance and testing, may have contributed to the release of chemical constituents into the environment. If a periodic launch test was conducted at this location, the procedure may have included the missile being fueled with rocket propellant RP (refined petroleum) -1 and liquid oxygen, and raised to erect position. The base of the erect missile was positioned over an opening called the "flame pit," located at the southern end of the horizontal missile silo. Launch exhaust was discharged via this pit to a "flame exhaust tunnel" which led to an outside opening south of the horizontal missile silo. When the alert status was canceled, the missile fuel may have been off-loaded and recycled for later use. The missile fuel tanks and fuel lines were then flushed with TCE to remove residual fuel and prevent accidental explosion. Spilled fuel, TCE, hydraulic fluid, and other wastes may have been washed down to nearby floor drains, which in turn connected to an exterior wastewater sump (the "main sump") at the southwest corner of the horizontal missile silo.

The sliding roof has been removed from the structure, but the horizontal concrete missile silo, underground launch operation rooms, various concrete building slabs, sewage lagoons, and perimeter fence remain at the facility.

Previous Investigations

The following investigations and remedial activities have been conducted at the Site:

1991 USACE Confirmation Study

In 1991, a Confirmation Study at the Site was completed (USACE, 1991). The objective of the Confirmation Study was to provide a preliminary determination of the presence or absence of chemical contamination which may have resulted from DoD activities at the Site. Activities included shallow soil sampling (0 – 1 ft. below ground surface (bgs)), and installation and sampling of two monitoring wells (Figure 3). TCE was

detected in one soil sample at 10 micrograms per kilogram (µg/kg). This concentration is less than the present-day EPA regional screening level for residential soil of 410 µg/kg. TCE concentrations in groundwater were 2 J micrograms per liter (µg/L) in GMW-501 and 85 µg/L in GMW-502. The "J" qualifier indicates an estimated value. TCE in GMW-502 exceeded the maximum contaminant level (MCL) of 5 µg/L.

2007 EPA Preliminary Assessment

In 2007, a Preliminary Assessment was completed by EPA Region 7 to determine whether any threats to human health and the environment existed as a result of releases to soil and groundwater (USEPA, 2007). Activities included soil, sediment, and groundwater sampling. All soil and sediment samples were nondetect for TCE and its degradation product *cis*-1,2-dichloroethene (*cis*-1,2-DCE). Three groundwater samples were collected, two from private wells and one from GMW-502 located east of the missile structure. TCE and *cis*-1,2-DCE were detected in GMW-502 at concentrations of 87 µg/L and 57 µg/L, respectively. TCE in GMW-502 exceeded the MCL of 5 µg/L, but *cis*-1,2-DCE was less than the MCL of 70 µg/L. TCE and *cis*-1,2-DCE were not detected in the two private wells.

2018 USACE Remedial Investigation

In 2018, USACE completed a Remedial Investigation to define the nature and extent of contamination as well as the risks from exposure to contamination at the Site (USACE, 2018a). Activities were performed in two phases and included soil, sediment, and surface water sampling, shallow and deep bedrock well installation, and eight rounds of groundwater sampling. All samples were analyzed for TCE and degradation products *cis*-1,2-DCE and vinyl chloride and screened for adverse human health effects using the EPA regional screening levels and KDHE risk-based standards for Kansas. Access to some potentially impacted areas could not be secured during the investigation. However, sufficient data was collected to allow for an evaluation of remedial alternatives to be made and a preferred alternative be identified.

In soil, all detections of TCE, *cis*-1,2-DCE, and vinyl chloride were less than their respective screening criteria. In sediment, all detections of TCE and *cis*-1,2-DCE were less than their respective screening criteria, but vinyl chloride was detected above screening criteria. In surface water, TCE, *cis*-1,2-DCE, and vinyl chloride exceeded screening criteria. An Interim Remedial Action (USACE, 2018b; see below) was performed to remediate contaminated sediment and water.

In groundwater, TCE was detected in 53 of 112 total samples collected over eight rounds of sampling. TCE exceeded the MCL of 5 µg/L in 30 samples, all from shallow wells. The areal extent of TCE contamination based on the March, 2017 data is shown in Figure 6. All detections of *cis*-1,2-DCE were less than the MCL of 70 µg/L. Vinyl chloride was not detected. The Remedial Investigation concluded that the primary contaminant at the Site is TCE and the contaminated medium at the Site is groundwater.

During the risk assessment, the Remedial Investigation did not identify current significant human health risks from exposure to soil or sediment. However, the TCE concentrations in shallow groundwater present an unacceptable risk to potential future groundwater users. In addition, TCE exceeded the groundwater vapor intrusion screening level, demonstrating the need for USACE to document the potential vapor intrusion risk to the affected property owners in writing as per the DoD Manual 4715.20 (DoD, 2012).

2018 Interim Remedial Action

Based on analytical results from sediment and water samples taken during the Remedial Investigation from the main sump, sediment trap, flame tunnel, and various pits located in and around the missile base structure, it was determined that the main sump and sediment trap were potentially a source of groundwater contamination at the Site. An Interim Remedial Action was performed to remove water and sediments from the sump, sediment trap, and flame pit structures (USACE, 2018b). Field work started in October 2017 and was completed in January 2018. Contaminated water was pumped into a frac-tank, pumped through granular activated carbon to remove VOCs, and placed into another frac-tank for sampling prior to surface discharge. Sediments were removed via a vacuum-truck and placed in a roll-off container for off-site disposal. Following the removal of water and sediments, the sump structures and flame tunnel were power washed to remove any residual sediments. Because the sump system is not actively pumped, the main sumps, the sediment trap at the sump discharge along the south perimeter fence, and the flame pit all filled with water after completion of this work. The interim remedial action was completed as of January 2018 and will be incorporated into the final remedy for the site.

Investigations at the Site have enabled USACE and the regulatory agencies to gain an understanding of the nature and extent of contamination. The preferred alternative described in this Proposed Plan focuses on remediation of TCE-contaminated groundwater at the Site that occurred as a result of DoD-related activities.

3.0 SITE CHARACTERISTICS

A brief description of the physical site characteristics is presented in this section; however, more detailed information can be found in the Remedial Investigation Report (USACE, 2018a) in the Administrative Record File.

The topography at the Site has an elevation difference of approximately 20 ft. across the former DoD property boundary. Surface drainage generally flows from west to east/southeast following surface topography. The drainage empties into an unnamed tributary that parallels Road D and which eventually discharges to Bluff Creek.

Native soils in the vicinity of the Site are dominated by silty clay loam. The soil in the vicinity of the Site is complicated by the historical DoD construction activities for the Atlas Missile Program, which reshaped the area. The overburden soils at the Site are thin, ranging from 1.5 to 15 ft. thick.

The subsurface geology at the Site (Figure 4) is composed of alternating sequences of shale and limestone ranging in depths from 1.5 to 15 ft. bgs. Monitoring wells have been installed in two water-bearing limestone members that are separated by a shale member. The groundwater level in shallow bedrock monitoring wells generally ranged from 11 to 29 ft. bgs during previous Site investigations. Depth to groundwater in the deep bedrock monitoring wells generally ranged from 40 to 51 ft. bgs.

Based on the most recent groundwater elevation data collected in August 2019 (Figure 5), groundwater across the northern and western half of the Site generally flows from the south to the north for both shallow and deep monitoring wells. Groundwater in the southeastern portion of the Site flows east.

Figure 6 shows the concentration of TCE in shallow wells at the Site. TCE was detected at concentrations greater than the EPA MCL of 5 µg/L in five wells (MW-2S, MW-6S, MW-7S, MW-11S, and MW-13S). The deep wells at the Site have not been impacted by contaminants due to an overlying shale layer acting as an effective barrier against the vertical migration of TCE.

4.0 SCOPE AND ROLE OF RESPONSE ACTION

This response action will be the final action for remediation of Site groundwater. This response action builds upon the previous restoration activities at the Site to address source removal during the 2018 Interim Remedial Action. Although groundwater at the Site is not currently used for residential purposes, the goal of the Site response action is to decrease or eliminate the potential for exposure to harmful concentrations of chemicals in groundwater that contribute to unacceptable risks and hazards. The preferred alternative for groundwater remediation focuses on technologies to enhance degradation of the chemicals of concern. The response action will decrease the concentration of harmful contaminants in the groundwater, through natural chemical/biological/physical processes, into nontoxic by-products.

5.0 SUMMARY OF SITE RISKS

A human health risk assessment was performed during the Remedial Investigation to evaluate whether site-related constituents detected pose unacceptable excess lifetime **cancer risks** or non-cancer hazards to current and potential future human receptors. Risks and hazards were characterized for a series of receptor types including trespassers, future residents, and future construction workers. The human health risk assessment resulted in the following conclusions:

- Current and future on-site trespassers: No unacceptable risks or hazards.
- Construction workers: No unacceptable risks or hazards.

- Future residents: The total excess cancer risks fell within the acceptable risk range of 10^{-6} to 10^{-4} as presented in the Defense Environmental Restoration Program Manual, which corresponds to a risk of 1 in 1,000,000 to 1 in 10,000. The total non-cancer **hazard index** for future residents was 21 for an adult and 24 for a child, exceeding the noncancer threshold limit of 1. Non-cancer hazard was driven by inhalation of TCE from residential use of groundwater.
- TCE exceeded EPA's groundwater Vapor Intrusion Screening Level of 0.52 µg/L, demonstrating the potential for unacceptable risks and/or hazards via the vapor intrusion pathway if a residence were to be built at the Site.

The only onsite sediment and surface water is located in deep pits and sumps. Because these areas are not natural habitats nor accessible to wildlife, they were not evaluated for ecological risk considerations. The nearest surface water bodies to the Site are shallow-bedded ephemeral streams and cattle ponds that capture overland flow during precipitation events. These surface water bodies are lower in elevation than the contaminated limestone member, which has been eroded to the East, South, and West of the Site. Groundwater discharging from the limestone to the surface beyond the Site boundaries would flow overland prior to reaching a stream or pond. It is very unlikely that Site-related contamination would reach any stream or pond at concentrations resulting in an unacceptable risk to ecological receptors. Any ecological receptors in nearby surface water bodies are therefore not exposed to any groundwater recharge from the Site. The only medium of potential concern for ecological receptors was soil. However, due to no detections in surface or subsurface soil (0 to 10 ft. bgs), the screening-level ecological risk assessment process was not required.

It is the lead agency's current judgment that the Preferred Alternative identified in this Proposed Plan, or one of the other active measures considered in the Proposed Plan, is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

6.0 REMEDIAL ACTION OBJECTIVE

The **Remedial Action Objective** for the Site focuses on groundwater to mitigate future potential exposure risks to residents. The Remedial Action Objective established for the Site is as follows:

- Prevent resident exposure to potable water from groundwater containing chemicals of concern above their respective groundwater remedial goals.

The preliminary remediation goal is the proposed cleanup level and was set at the Safe Drinking Water Act MCL of 5 µg/L for TCE, which is considered to be an **Applicable or Relevant and Appropriate Requirement** (ARAR) for groundwater at this Site. The preliminary remediation goals for TCE degradation products are set at their respective MCLs of 70 µg/L for *cis*-1,2-DCE, 100 µg/L for *trans*-1,2-DCE, and 2 µg/L for vinyl chloride.

The preliminary remediation goal was applied in screening various technologies and in selection of remedial alternatives for groundwater. The final **remedial goal** for the contaminant at the Site will be determined in the Decision Document.

7.0 SUMMARY OF REMEDIAL ALTERNATIVES

Remedial Action Alternatives developed for the Site include:

- Alternative 1: No Further Action
- Alternative 2: Long-term Monitoring with contingent Alternate Water Supply
- Alternative 3: *In-situ* Treatment with Long-term Monitoring and contingent Alternate Water Supply

Alternative 1 – No Further Action
The no action alternative is a baseline alternative that all other alternatives are measured against. For this alternative, no remedial action is conducted to decrease contaminant concentrations and prevent exposure to groundwater contamination.

Estimated capital cost: $0
Estimated annual operation and maintenance cost: $0
Estimated present worth cost: $0

Alternative 2 – Long-term Monitoring with contingent Alternate Water Supply
Alternative 2 involves monitoring the migration and attenuation of the TCE plume. Alternative 2 would ultimately render the site suitable for Unlimited Use/Unrestricted Exposure when the groundwater reaches the preliminary remediation goals. After the Interim Remedial Action was completed, no known source material remains on Site. The remaining TCE concentrations in groundwater should decrease over time without a source to sustain the plume. Long-term monitoring will provide data to evaluate contaminant concentrations, and additional monitoring wells may be installed to delineate the plume as it changes with time.

Alternative 2 includes provision for a contingent alternate water supply if land use changes to residential. An alternate water supply prevents direct exposure to contaminated groundwater and therefore removes risk to human health. The only institutional control to be implemented by USACE for Alternative 2 is an educational outreach and awareness notice to the property owner(s) regarding the contaminated groundwater. The area will also be periodically monitored both visually and in the KDHE well database to verify that no new wells have been installed near the plume.

Monitoring will continue until remedial action objectives are achieved. The timeframe for groundwater to reach the preliminary remediation goal of 5 µg/L for TCE is estimated at 200 years using SourceDK, a remediation support system model (USACE, 2020). The cost information below assumes annual groundwater monitoring until year 10, followed by groundwater monitoring every 5 years for the lifetime of the remedy. In addition, groundwater optimization resulting in smaller monitoring effort was assumed after year 15.

Estimated capital cost: $308,200
Estimated annual operation and maintenance cost (average): $7,700
Estimated present worth cost: $1,512,400
Estimated time to achieve preliminary remediation goals: Approximately 200 years

Alternative 3 – *In-situ* Treatment with Long-term Monitoring and contingent Alternate Water Supply
Alternative 3 involves destruction of VOC mass in the shallow groundwater by injection of chemicals or substrates to oxidize, reduce, or biodegrade contaminants. The specific *in-situ* treatment technology would be selected during the remedial design, which may choose any of the following: ***in-situ* chemical oxidation**, ***in-situ* chemical reduction**, or **enhanced anaerobic bioremediation**. *In*-situ treatment would occur in the portion of the plume with highest concentrations of groundwater contamination. Performance monitoring after each injection event would provide data to evaluate treatment progress and longevity of the injected chemical or substrate. Alternative 3 includes installation of additional monitoring wells that may be needed for remedial design and/or to delineate the plume as it changes with time.

Alternative 3 also includes provision for a contingent alternate water supply if land use changes to residential. An alternate water supply prevents direct exposure to contaminated groundwater and therefore removes risk to human health. The only institutional control to be implemented by USACE for Alternative 3 is an educational outreach and awareness notice to the property owner(s) regarding the contaminated groundwater. The area will also be periodically monitored both visually and in the KDHE well database to verify that no new wells have been installed near the plume.

Monitoring will continue until remedial action objectives are achieved. The timeframe for groundwater to reach the preliminary remediation goal of 5 µg/L for TCE is estimated at 100 years using SourceDK, a remediation support system model (USACE, 2020). Alternative 3 would ultimately render the site suitable for Unlimited Use/Unrestricted Exposure when the groundwater reaches the preliminary remediation goals. For estimating costs, enhanced anaerobic bioremediation was the assumed treatment technology. The cost information below assumes annual groundwater monitoring until year 10, followed by groundwater monitoring every 5 years for the lifetime of the remedy. In addition, groundwater optimization resulting in smaller monitoring effort was assumed after year 15.

Estimated capital cost: $2,328,000
Estimated annual operation and maintenance cost (average): $9,040
Estimated present worth cost: $3,838,800
Estimated time to achieve preliminary remediation goals: Approximately 100 years

8.0 EVALUATION OF ALTERNATIVES

The three alternatives were evaluated against the nine criteria, found in the National Contingency Plan at 40 Code of Federal Regulations 300.430(e)(9) prior to selection of the preferred alternative. To receive further consideration, each alternative must meet the first two "**threshold criteria**" below, which are: (1) Overall Protection of Human Health and the Environment, and (2) Compliance with **Applicable or Relevant and Appropriate Requirements** (ARARs).

Criteria 3 through 7 below are considered **primary balancing criteria** and are used to comparatively evaluate the alternatives against each other. Criteria 8 and 9 are **modifying criteria** which can only be evaluated following the public comment period, and may modify the proposed alternative. All three alternatives were evaluated against these nine criteria to select the alternative that best addresses the identified Remedial Action Objective.

1. **Overall Protection of Human Health and the Environment.** Alternative 1 is not protective of human health and the environment as no action is performed. Alternative 1 does not comply with criteria 1. Alternatives 2 and 3 would be protective of human health and the environment and would ultimately render the site suitable for Unlimited Use/Unrestricted Exposure when the groundwater reaches the preliminary remediation goals. A policy five-year review will be conducted until Unlimited Use/Unrestricted Exposure is achieved. The monitoring well network in both alternatives would be effective in monitoring remedy performance and groundwater contaminant levels to ensure protection of human health. The contingent alternate water supply in both alternatives would preclude exposure to groundwater, ensuring that the exposure pathway would remain incomplete. Additional information collected for these alternatives would lead to a better understanding of the fate and transport of contamination.
2. **Compliance with ARARs.** Alternative 1 does not comply with ARARs since there is no groundwater monitoring to determine when ARARs (MCLs) are met. Therefore, Alternative 1 does not meet either of the threshold criteria, and was not evaluated further. Alternatives 2 and 3 would comply with ARARs. Groundwater monitoring will continue to determine when ARARs are met.
3. **Long-term Effectiveness and Permanence**. Alternative 2 provides long-term effectiveness and permanence by monitoring the gradual natural degradation of contaminants to ensure potential receptors are not being affected.

   Alternative 3 provides long-term effectiveness and permanence by *in-situ* treatment to decrease contaminant mass, followed by monitoring to ensure potential receptors are not being affected.
4. **Reduction of Toxicity, Mobility, or Volume through Treatment**. Alternative 2 only provides monitoring, and is not considered active treatment. Following source removal during the Interim Remedial Action, contaminant concentrations are expected to decrease over time due to natural attenuation processes such as dispersion and dilution, which act without human intervention.

   Alternative 3 is the only remedial alternative that provides active treatment. *In-situ* treatment can decrease contaminant mass and break down TCE to harmless byproducts, thus decreasing toxicity. Following treatment, contaminant concentrations will continue to decrease due to natural attenuation processes, which act without human intervention. Alternative 3 depends on an injection strategy that could deliver and optimally distribute treatment reagents into the subsurface.
5. **Short-Term Effectiveness**. Alternatives 2 and 3 would be effective in protecting the community, worker health, and environment during the implementation. For both Alternatives 2 and 3, a notice to the landowner(s) will be made to educate the property owner about the contaminated groundwater. The area will also be periodically monitored both visually and by reviewing the KDHE well database to verify that no new wells have been installed near the plume. If Site use changes to residential, these alternatives are

immediately effective due to the connection of an on-Site residence to an alternate water supply. Alternative 3 could also provide a remedial timeframe that is shorter than that for Alternative 2.

6. **Implementability**. Alternative 2 is easily implemented since there is already an existing monitoring well network. Additional wells may be installed to delineate the plume as it changes. Monitoring of the onsite wells would enable long-term trend analysis to confirm the TCE concentrations are decreasing. Administrative activities would not significantly affect the ability and time to implement the alternative.

   Alternative 3 is implementable; however, an injection strategy must be designed to work effectively with the Site geology. A pre-design study to determine the best injection technologies suited for the Site may be required. *In-situ* treatment would likely involve installing injection wells into the aquifer to allow for multiple treatments if required. There is already an existing monitoring well network and additional wells may be installed to delineate the plume as it changes with time.

7. **Cost.** The estimated cost includes the capital and periodic operations and maintenance expenditures over time of a remedial alternative. The present worth cost is the amount needed to be invested at the base year of remediation to assure that funds will be available in the future as they are needed to pay for remediation expenditures assuming certain economic conditions (EPA, 2000). The estimated total costs and the present worth costs for each alternative are summarized as follows:

Remedial Alternative	Estimated Total Cost	Present Worth Cost
1. No Action	$0	$0
2. Alternative 2: Long-term monitoring and contingent alternate water supply	$1,843,700	$1,512,400
3. Alternative 3: *In-situ* treatment with long-term monitoring and contingent alternate water supply	$4,187,200	$3,838,300
During the Feasibility Study, the costing assumptions included annual groundwater monitoring for both Alternative 2 and Alternative 3 with the total costing timeframe abbreviated to 100 years. The cost information presented in this Proposed Plan assumes annual groundwater monitoring until year 10, followed by groundwater monitoring every 5 years for the full estimated duration of both Alternative 2 and Alternative 3. In addition, groundwater optimization resulting in a smaller monitoring effort was assumed after year 15. While these adjustments do not change the outcome of the Cost Effectiveness evaluation, the adjustments result in a more realistic remedial strategy. The total cost for Alternative 2 presented in the FS was $4,017,500 and the total cost for Alternative 3 presented in the FS was $6,360,900		

8. **State Support/Agency Acceptance**. KDHE has informally indicated concurrence with the preferred alternative as presented in this Proposed Plan. Final concurrence of the Proposed Plan will be considered as acceptance of the preferred alternative.
9. **Community Acceptance**. Community acceptance of the preferred alternative will be evaluated after the public comment period ends and will be addressed in the Responsiveness Summary included with the **Decision Document** for the Site.

9.0 THE PREFERRED ALTERNATIVE

Based on the existing data, USACE proposes Alternative 3, *In-situ* Treatment with Long-term Monitoring, and Contingent Alternate Water Supply as the preferred alternative. KDHE has informally indicated support for this alternative. This alternative was selected because it met the Threshold Criteria and provides an appropriate balance among the Balancing Criteria. In addition, Alternative 3 will achieve the Remedial Action

Objective of preventing exposure to potable water from groundwater containing TCE above the groundwater preliminary remediation goals. Alternative 3 will achieve the Remedial Action Objective by treating higher concentration Site groundwater and conducting performance monitoring following treatment. USACE expects the preferred alternative to satisfy the statutory requirements of CERCLA §121(b). It should be noted, though not anticipated, Alternative 3 as the preferred alternative can change in response to public comment or new information. Since there are no current receptors via the vapor intrusion pathway, USACE will document the potential future vapor intrusion risk and provide notice of this potential risk to the affected property owners in writing as per the DoD Manual 4715.20 (DoD, 2012).

10.0 COMMUNITY PARTICIPATION

USACE provides information regarding the investigation of the Site to the public through public meetings, the Administrative Record for the Site, and public notices published in *The Topeka Capital-Journal*. USACE encourages the public to gain a more comprehensive understanding of the Site and the evaluations and assessments that have been conducted.

All pertinent information on the investigation of the Site has been placed in the Administrative Record at the Council Grove Public Library at 829 West Main Street in Council Grove, Kansas. The dates for the public comment period; the date, location, and time of the public meeting; and the location of the Administrative Record are provided on the front page of this Proposed Plan.

After public comment period on this Proposed Plan, a Responsiveness Summary will be prepared documenting the responses to public comment. A Decision Document that includes the Responsiveness Summary and that documents the selection of the Remedial Action will be prepared, signed, and added to the Administrative Record.

As a reminder, all comments must be submitted in writing to Ms. Calley Havens, either at the public meeting or afterwards, but must be postmarked by the end of the public comment period provided on the first page of this Proposed Plan.

For further information on the former Forbes Atlas Missile Site S-5, please contact:

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LIST OF ABBREVIATIONS AND ACRONYMS

ARARs	Applicable or Relevant and Appropriate Requirements
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cis-1,2-DCE	*cis*-1,2-dichloroethene
DoD	Department of Defense
EPA	U.S. Environmental Protection Agency
FUDS	Formerly Used Defense Sites
KDHE	Kansas Department of Health and Environment
MCL	maximum contaminant level
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
TCE	trichloroethene
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound

GLOSSARY OF TERMS

Administrative Record: The body of documents that forms the basis for the selection of a particular response at a site.

Applicable or Relevant and Appropriate Requirements (ARARs):

- Applicable requirements means those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable.
- Relevant and appropriate requirements means those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate.

Cancer Risk: Incremental probability of an individual developing cancer over a lifetime as a result of site-related exposure to potential carcinogens. The Defense Environmental Program Manual considers the acceptable risk range for site-related exposures to be below or within 10^{-6} to 10^{-4} .

Chemical of Concern: A chemical that presents an unacceptable threat to human health or the environment and requires a response action at a site.

***cis*-1,2-dichloroethene (*cis*-1,2-DCE):** A breakdown product of TCE produced by biologically-mediated reductive dechlorination.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): A federal law passed in 1980, also known as Superfund, that created a trust fund to investigate and cleanup abandoned or uncontrolled hazardous substance sites.

Decision Document: A legally binding public document that explains the cleanup alternative that will be used at a site.

Enhanced Anaerobic Bioremediation: Injection of a bioremediation substrate, such as emulsified vegetable oil, lactate, or other substrate, into the subsurface, which provides an electron donor supply for enhancing biological reductive dechlorination under anaerobic conditions.

Feasibility Study: A comprehensive evaluation of potential alternatives for remediating contamination. The Feasibility Study identifies general response actions, screens potentially applicable technologies and process options, assembles alternatives, and evaluates alternatives in detail.

Formerly Used Defense Sites (FUDS): A facility or site (property) that was under the jurisdiction of the Secretary of Defense and owned by, leased to, or otherwise possessed by the United States at the time of actions leading to contamination by hazardous substances. The FUDS program is limited to those real properties that were transferred from DoD control prior to October 17, 1986. Properties must be located within the United States.

Groundwater: Underground water that fills pores in soil or openings in soil or rock to the point of saturation. Groundwater is often used as a source of drinking water via municipal or domestic wells.

Hazard Index: The sum of hazard quotients for chemicals that affect the same target organ or organ system. Because different chemicals can cause similar adverse health effects, combining hazard quotients from

different chemicals is often appropriate. A hazard index (HI) of 1 or lower means chemicals are unlikely to cause adverse noncancer health effects over a lifetime of exposure. However, an HI greater than 1 doesn't necessarily mean adverse effects will occur from exposure, it merely indicates that site-related exposures may present a hazard to human health.

Hazard Quotient: The ratio of the potential exposure to a substance and the level at which no adverse effects are expected (calculated as the exposure divided by the appropriate chronic or acute value). A hazard quotient of 1 or lower means adverse noncancer effects are unlikely, and thus can be considered to have negligible hazard.

***In-situ* Chemical Oxidation:** Injection of a chemical oxidant into the subsurface to contact and chemically convert contamination to nonhazardous or less toxic compounds that are more stable, less mobile, or inert.

***In-situ* Chemical Reduction:** Injection of a chemical reductant into the subsurface to contact and chemically convert contamination to nonhazardous or less toxic compounds that are more stable, less mobile, or inert.

Long-term Monitoring: The practice of observing concentrations of contaminants over an extended period of time. Time period may extend for years to decades depending on various factors.

Maximum Contaminant Level (MCL): MCLs are standards that are set by the EPA for drinking water quality. An MCL is the legal threshold limit on the amount of a substance that is allowed in public water systems under the Safe Drinking Water Act. The limit is usually expressed as a concentration in milligrams or micrograms per liter of water.

Micrograms per Liter (µg/L): Units of concentration corresponding to one microgram per liter of liquid or one part per billion.

Modifying Criteria: The last two of the nine CERCLA criteria used to evaluate remedial alternatives, namely state and community acceptance.

Monitoring Well: A well installed to provide an access point for measuring groundwater levels and to permit collection of groundwater samples that accurately represent *in-situ* groundwater conditions at the specific point of sampling.

Preferred Alternative (Preferred Remedy): The cleanup approach proposed by the lead agency based on the information contained in the Feasibility Study. The preferred alternative is presented in this Proposed Plan and subject to change and/or revision based on public comment.

Present Worth: The current value of future costs or payments when the values are discounted by a rate based on expected interest rates. Used to compare monetary values that exist at different points in time.

Primary Balancing Criteria: Five of the nine CERCLA criteria used to further evaluate remedial alternatives. They are long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost.

Proposed Plan: A document that summarizes key information about the site, presents the preferred remedial action, and provides the rationale for the preferred action. The Proposed Plan is provided to solicit public review and comment on the preferred remedial action.

Remedial Action Objectives: Statements describing the goals to be achieved in protecting human health and the environment.

Remedial Goal: Specific cleanup concentrations or levels based upon federal and state environmental laws and regulations or the health risk on a given site.

Remedial Investigation: The first part of a two-part study that determines how much and what kind of

contamination exists at a site. A Remedial Investigation generally involves collecting and analyzing samples of groundwater, surface water, soil, sediment, and air. The second part of the study is a Feasibility Study.

Threshold Criteria: The first two of the nine CERCLA criteria: (1) overall protection of human health and the environment and (2) compliance with ARARs.

Trichloroethene (TCE): Trichloroethene is a VOC mainly used as a metal degreaser, but can also be used in paint remover and adhesives. TCE is considered a human carcinogen by EPA.

Volatile Organic Compound (VOC): A group of organic compounds that tend to change from liquids to gas easily.

USE THIS SPACE TO WRITE YOUR COMMENTS

Your input on the Proposed Plan for the former Forbes Atlas Missile Site S-5 is important to USACE. Comments provided by the public are valuable in helping USACE select a final remedy for the site.

You may use the space below to write your comments, then fold and mail. Comments must be postmarked by **24 August 2021**. If you have questions about the comment period, please contact Calley Havens, Project Manager, at (816) 509-0250. Those with access to email may submit their comments to USACE at the following address: calley.w.havens@usace.army.mil

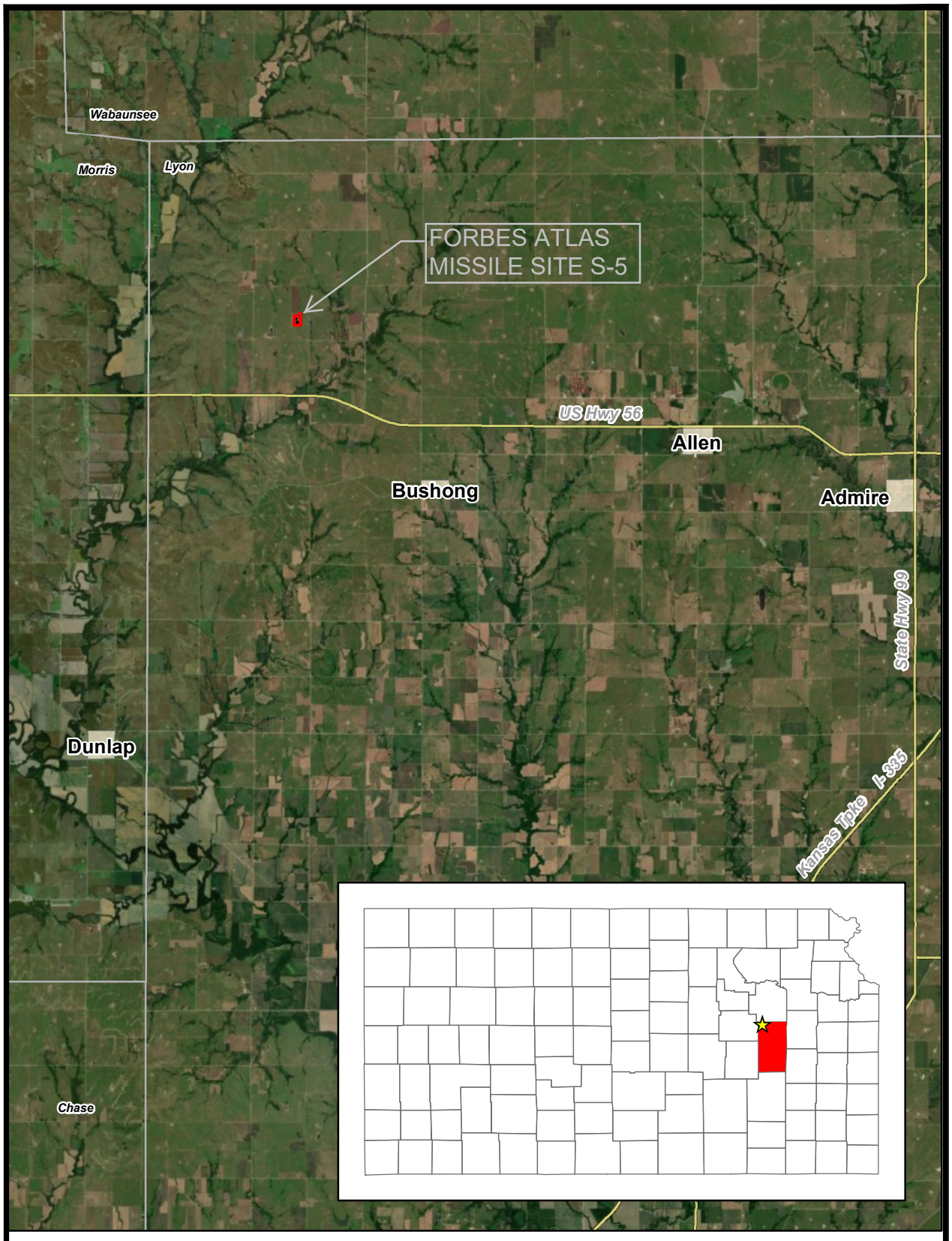
Name:_____

Address:_____

City:_____

State:_____ Zip: _____

Figures



NOTES:

1. IMAGE PROVIDED BY ESRI, DIGITALGLOBE, ET AL
2. FIGURE ADAPTED FROM REMEDIAL INVESTIGATION REPORT (USACE, 2018a)

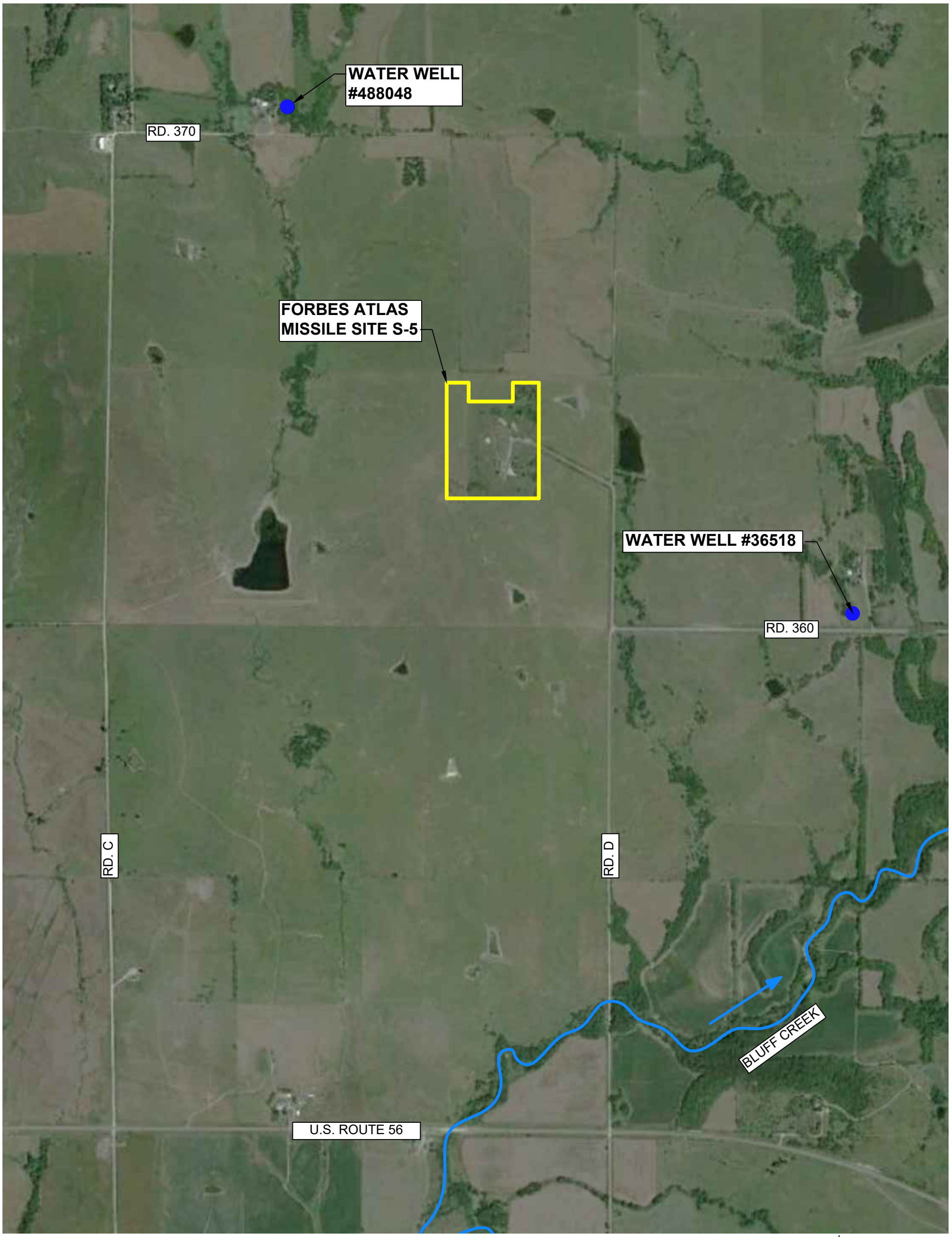
N

0 2 4 6 8 Miles

US Army Corps of Engineers ®
Kansas City District

FIGURE 1

REGIONAL LOCATION MAP
FORBES ATLAS S-5
ALLEN, KANSAS



LEGEND

- WATER WELLS
- RIVER
- FLOW DIRECTION

N

0 1000' 2000'

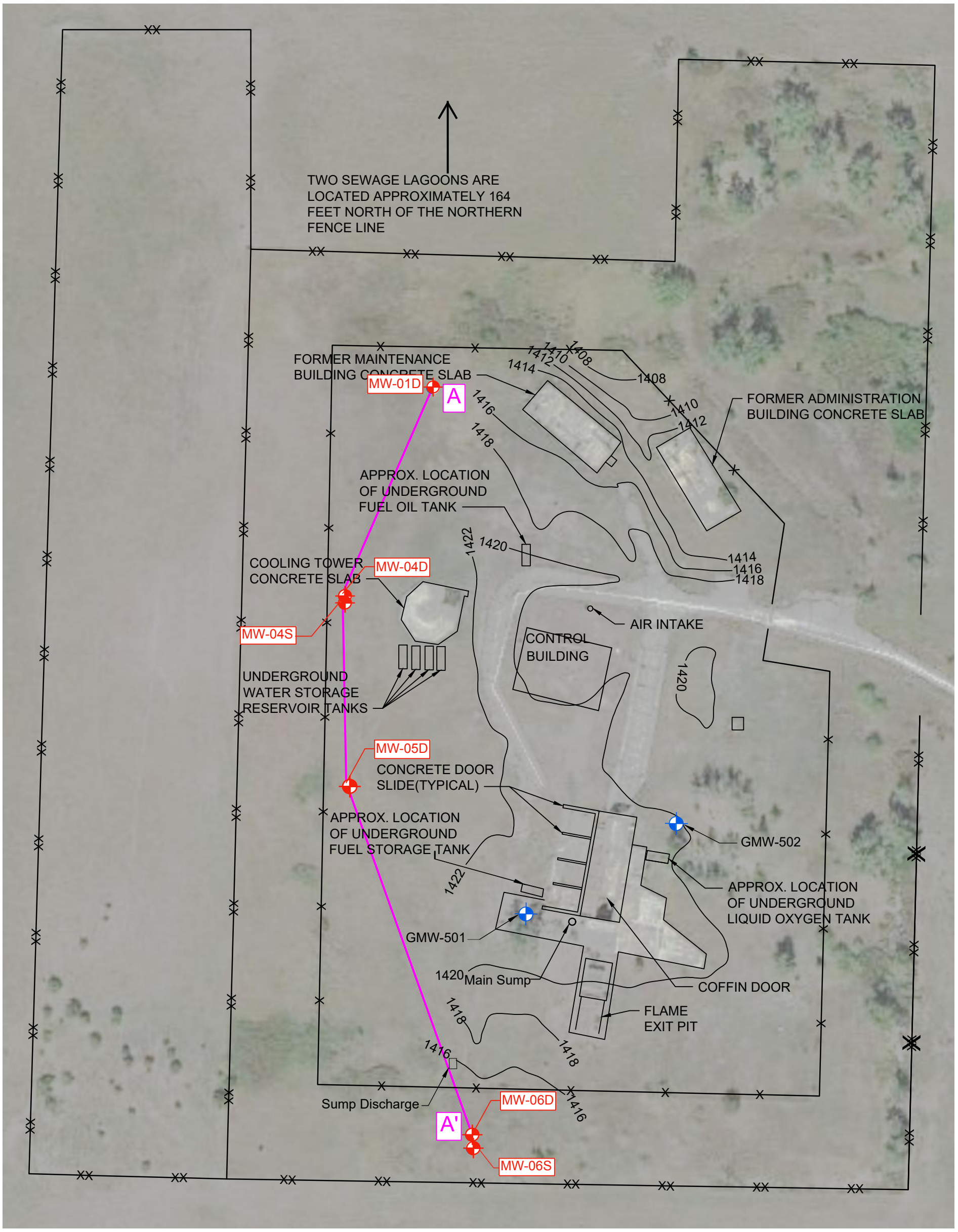
SCALE IN FEET

NOTE:

1. AERIAL IMAGE PROVIDED BY GOOGLE EARTH.

US Army Corps of Engineers ®
Kansas City District

FIGURE 2
OFF SITE KANSAS
WATER WELLS
FORBES ATLAS S-5
ALLEN, KANSAS



LEGEND:

- CHAIN LINK FENCE
- BARB WIRE FENCE
- CONTOUR & ELEVATION (ft AMSL)
- CROSS SECTION A-A'
- HISTORICAL MONITORING WELL
- WELLS IN CROSS SECTION A-A'

N

0 100' 200'

SCALE IN FEET

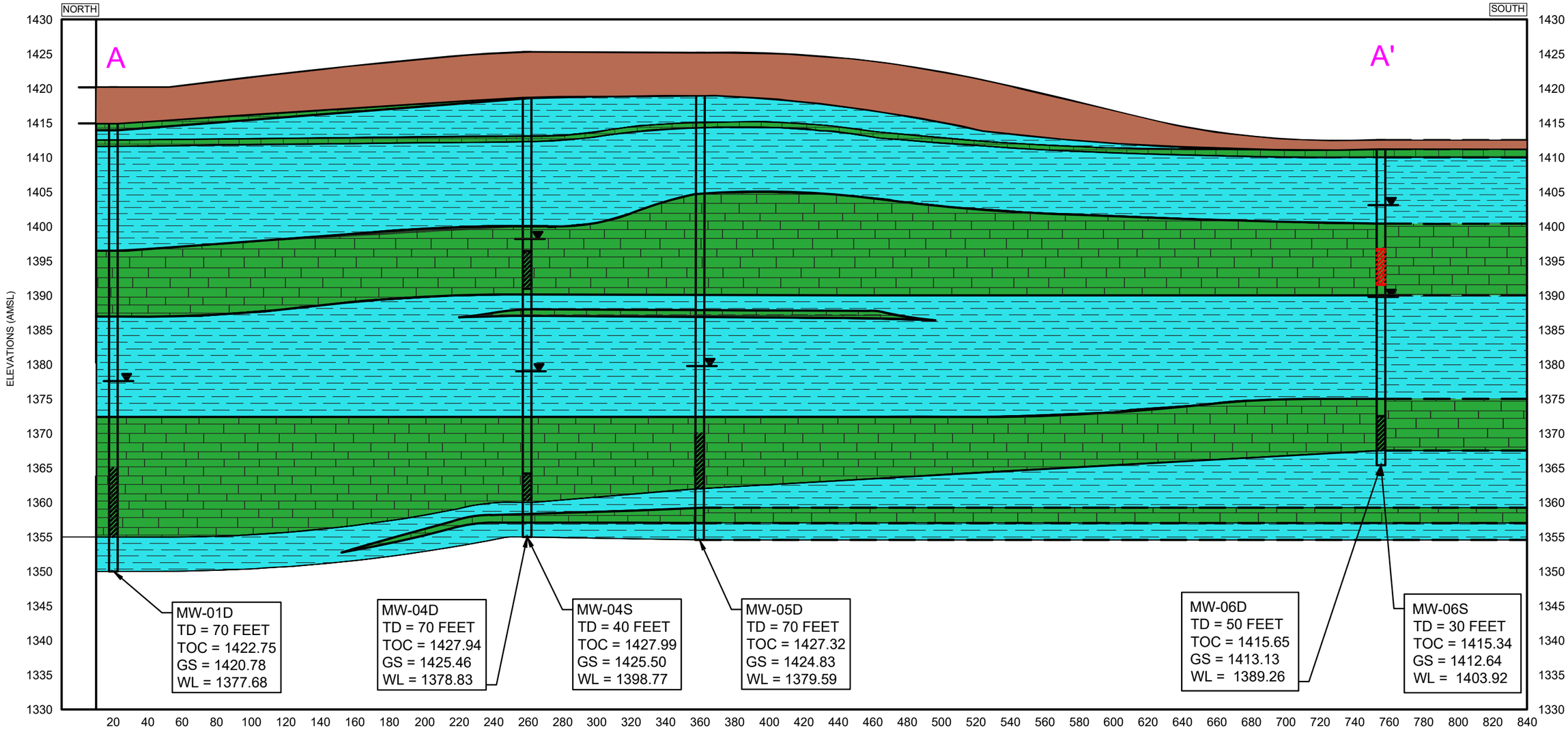
NOTES:

1. SITE PLAN AND ELEVATIONS BASED ON TOPOGRAPHIC SURVEY PERFORMED BY FORGY SURVEYING, ON JULY 13, 1990. FIGURE ADAPTED FROM REMEDIAL INVESTIGATION (USACE, 2018a).
2. AERIAL IMAGE PROVIDED BY GOOGLE EARTH.

US Army Corps of Engineers ®
Kansas City District

FIGURE 3

FORMER SITE LAYOUT
FORBES ATLAS S-5
ALLEN, KANSAS



LEGEND:

CLAY

LIMESTONE

SHALE

SCREENED INTERVAL

SCREENED INTERVAL WITH KNOWN CONTAMINATION

STATIC WATER LEVEL (FT. AMSL). MEASURED MARCH 27, 2017.

TD	TOTAL DEPTH
TOC	TOP OF CASING
GS	GROUND SURFACE
WL	WATER LEVEL

VERTICAL

0 15' 30'

SCALE IN FEET

HORIZONTAL

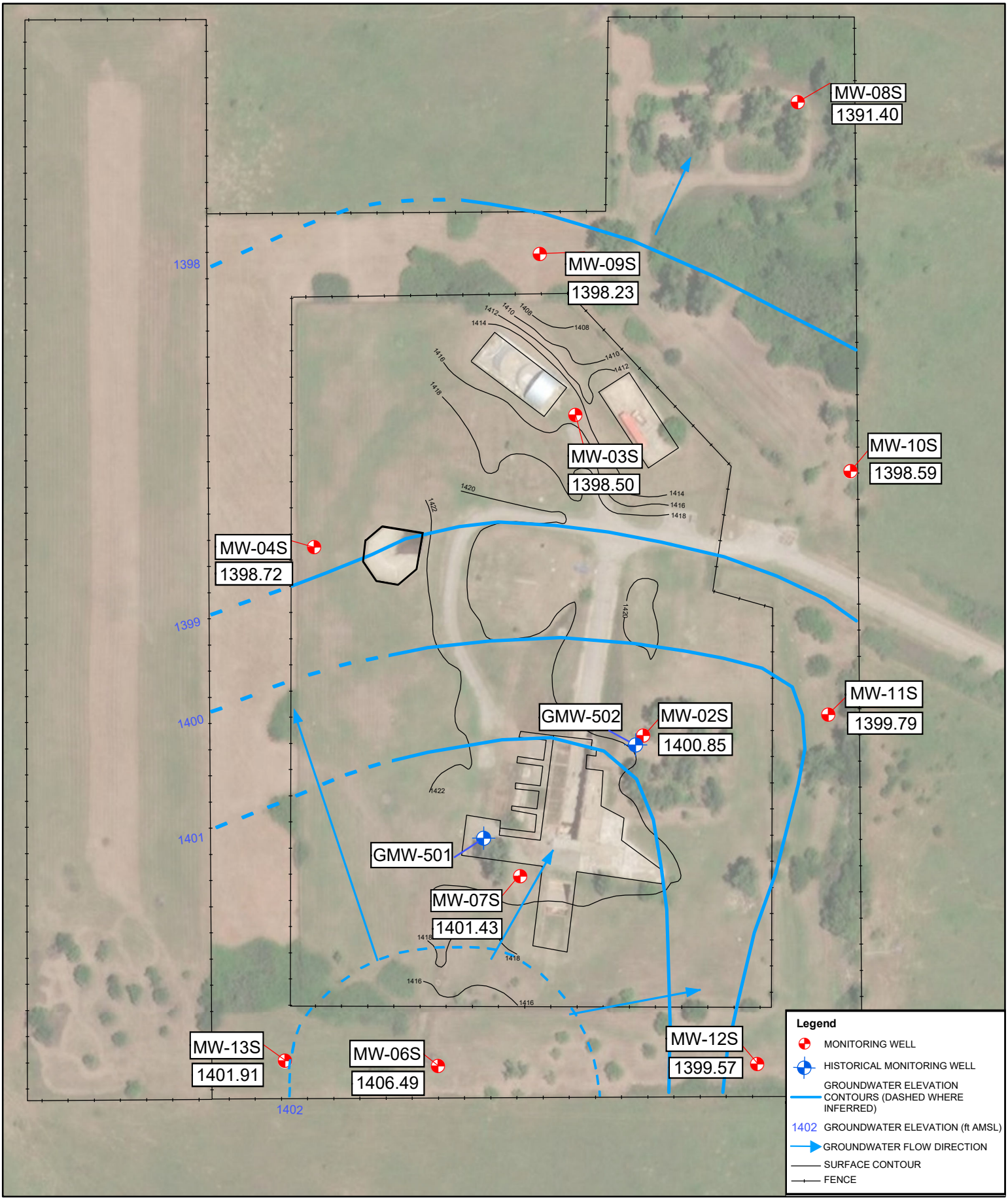
0 60' 120'

SCALE IN FEET

US Army Corps of Engineers ®
Kansas City District

FIGURE 4

GEOLOGICAL CROSS SECTION A-A' FORBES ATLAS S-5 ALLEN, KANSAS



NOTES:

1. AERIAL IMAGE PROVIDED BY ESRI.

2. SITE PLAN AND ELEVATION BASED ON TOPOGRAPHIC SURVEY PERFORMED BY FORGY SURVEYING, ON JULY 13,1990

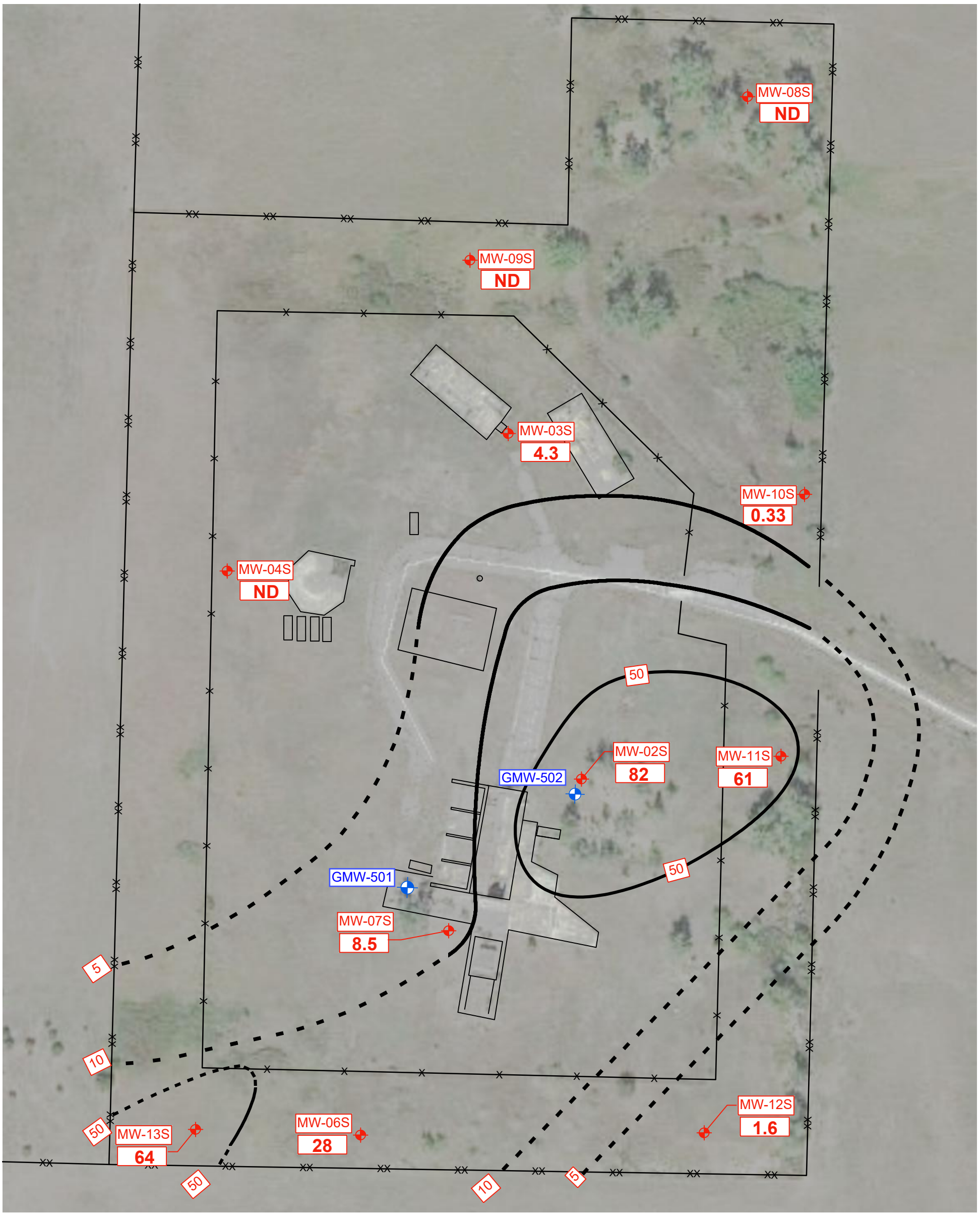
3. MW-06S WAS NOT USED TO DRAW THE GROUNDWATER ELEVATION COUNTOURS FOR THIS FIGURE.

N
W E
S

0 55 110 220 Feet

US Army Corps of Engineers
Kansas City District

FIGURE 5
TYPICAL GROUNDWATER ELEVATION MAP
SHALLOW MONITORING WELL LOCATIONS
FORBES ATLAS S-5
ALLEN, KANSAS
AUGUST 8, 2019



NOTES:

1. AERIAL IMAGE PROVIDED BY GOOGLE EARTH.

2. SITE PLAN AND ELEVATIONS BASED ON TOPOGRAPHICAL SURVEY PERFORMED BY FORGY SURVEYING, ON JULY 13, 1990.

3. SURVEY SITE DATA FROM KAW VALLEY ENGINEERING INC. SURVEY DATES JUNE 12, 2015 AND JUNE 29, 2016.

4. MARCH 2017 TCE ISOCONCENTRATION CONTOURS GENERATED FROM SHALLOW MONITORING WELLS.

5. FIGURE ADAPTED FROM REMEDIAL INVESTIGATION (USACE, 2018a).

N

0 100' 200'

SCALE IN FEET

LEGEND:

- MONITORING WELL
- HISTORICAL MONITORING WELL
- 6.6 ANALYTICAL RESULT (µg/L)
- ND NON-DETECT
- CHAIN LINK FENCE
- BARB WIRE FENCE
- TCE ISOCONCENTRATION CONTOUR (DASHED WHERE INFERRED)

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Kansas City District

FIGURE 6
TCE ISOCONCENTRATION MAP
FORBES ATLAS S-5
ALLEN, KANSAS